Natural Capital Science Report

Vital captial Index and Tool kit for Dairy Agriculture

Andrew Whitman

and

Gabe Clark

Manomet Center for Conservation Sciences
14 Maine Street Suite 305
Brunswick, ME 04011
www.manometmaine.org
contact: gclark@manomet.org
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Introduction

We developed the Vital Capital Index (VCI) and toolkit for Dairy Agriculture to be a practical tool to help dairy farmers identify opportunities for improving agricultural stewardship and to communicate their stewardship to their stakeholders and supply chain. We hope that dairy farmers will apply the VCI to identify improvement opportunities and make improvements appropriate to their farm. Initially, the VCI could be used to "benchmark" conditions on a farm. Over time, a farmer could use the VCI to track their efforts at continuous improvement.

The VCI is made up of 40 field-tested, science-based, practical indicators developed in consultation with dairy farmers. Indicators **provide information abut other unmeasured items and can be used to gauge progress toward a goal**. A draft of the VCI was tested on 31 farms across the U.S. that varied greatly in their size and practices. The VCI is a farm-specific tool; it was not developed to score and compare the stewardship among farms. Dairy farms differ greatly due to their size, location, environment, etc., making it difficult to compare farms. When developing the VCI and toolkit, we recognized that it had to:

(1) be **relevant** to all U.S. dairy farms regardless of region, herd size, or practices (e.g., organic or conventional);

(2) be **useful** for producers;

(3) be **science-based**;

(4) speak to **diverse values**, including those of dairy farmers;

(5) focus on **continuous improvement**, not targets.

The VCI

Dairy farmers can use the VCI with little or no assistance and might take one to two hours to complete the VCI. It is composed of 22 stewardship topics that were identified to be important elements of dairy farm sustainability by dairy farmers and other stakeholders. For each stewardship topic, we included background information, an indicator worksheet, a description of related stewardship practices (including web links), and references.

The VCI uses both outcome-based and practice-based indicators for nearly all stewardship topics. **Outcome-based indicators describe the current condition of a stewardship topic (e.g., nutrient management) and will tell a farmer where their farm is today for that stewardship topic**. We cite reference values for many outcome-based indicators to help producers more easily interpret their results. There is insufficient research to indicate whether these reference values should be considered targets. Outcome-based indicators are akin to knowing the your saving account balance; but like your balance, they say nothing about what you are doing to maintain your balance. They cannot be used to predict the future stewardship of a dairy farm.

Therefore, we also included practice-based indicators that a dairy farmer can use to assess their practices associated with each stewardship topic. **Practice-based indicators describe the character and level of stewardship practices applied on a farm**. They describe what you are doing to maintain or increase the quality of stewardship on your farm. When many stewardship practices are applied, then practice-based indicator scores will be high. When few stewardship practices are applied, then scores will be low. A practice-based indicator score may be low without compromising farm sustainability. For more information about how the VCI was developed, please see Appendix A.

Instructions

1. **Review the VCI:** Please take some time to familiarize yourself with the VCI and its 22 different stewardship topics. This will help you gauge how much time and what resources you may need to complete the VCI. Some stewardship topics may be important to you; others may not be of interest to you or be relevant to your farm operation (for example, recreational access if you are in a remote location). You should also review the VCI Preparation Worksheet so that you can figure out how best to gather information necessary to complete worksheet.

2. **Complete the VCI Preparation Worksheet:** It will take some time to fill in the worksheet but will make it easier to complete the VCI. In some cases, you may have the information at your fingertips but in other cases, you may have to review bills from the previous year. In a few cases, you may have to estimate the numbers that you enter into the worksheet. These numbers will be used to calculate outcome-based indicators in the VCI. The outcome-based indicators were designed so that if their numbers were revealed, they would not disclose any business financial information.

3. **Select relevant stewardship topics:** You should identify stewardship topics that are important to you. Mark the components that you are going to complete. You can skip stewardship topics that are not relevant to your farm operation or important to you. Most dairy farmers are likely to select more than half of the stewardship topics.

4. **Score your farm for your selected stewardship topics:** Each stewardship topic has a section in the VCI that includes background information, an indicator worksheet, indicators, a short description of related stewardship practices (including web links), and references. There are 18 outcome-based indicators which use numerical information from the VCI Preparation Worksheet to calculate a value that describes the condition of a farm stewardship topic. Each stewardship topic also has one practice-based indicator composed of 3 or more questions. The answer to each question has an associated score. For practice-based indicators, the questions about practices that can contribute the most to overall stewardship contribute the most to the practice-based indicator score. The practice-based indicator score is calculated by adding up all of the scores associated with each question. Practice-based indicators can score from 0 to 10, with a 0 indicating that none of the listed practices were applied on the farm operation and a 10 indicating that all practices were applied.

5. Review results: We have included reference values for outcome-based indicators when they were available. Users can compare their indicator values to the reference values to help assess whether any change in farm practices might be desired. Most dairy operations should have a practice-based indicator score >0 (unless the stewardship does not apply to your operation). Operations that apply many stewardship practices will score high. In some cases, some indicator scores may be low without compromising farm sustainability. Typically, scores of most practice-based indicators should be range from 4 to 6.

6. Identify opportunities for continuous improvement: After reviewing your results, identify opportunities for improvement that are consistent with your business model, match your available capital, and are important to you.

Table 1. VCI Preparation Worksheet – This is a list of data needed for completing the VCI. You may wish to keep this page separate because it includes information that you may not want to share with others. Filling out the VCI will go faster if you first pull together these data. This information will be used to calculate values of outcome-based indicators.

Total current assets ($)	$ _____
Total current debts ($)	$ _____
Annual average pay price ($ per cwt.)	$ _____
Average cost of production ($ per cwt.)	$ _____
Number of cows milked annually	_____ cows
Annual electricity use (kWh)	_____ kWh
Number of ownership families in the Farming operation:	_____families
Average SCC (somatic cell count)	_____,000
Cull rate	_____

Annual property taxes ($)	$ _____
Number of FTE (full time equivalent) employees (number of people)	_____ people
Annual total fuel costs ($)	$ _____
Annual fertilizer use on cropped fields (total lbs of N, P, and K)	_____ lbs
Annual water use (gal)	_____ gal
Annual milk production (cwt)	_____ cwt
Number of acres (total including lease, rented and owned)	_____total _____rent/lease
Average Milk Urea Nitrogen (MUN)	_____

Acknowledgements

Foremost, we are grateful for the input and participation in this project of many dairy farmers from across the United States, especially at this economically stressful time. The development of the Vital Capital Index benefits from the input from stakeholders too numerous to list here including volunteers from Landaff, NH, Middlebury, VT, and East Canaan, CT. We are grateful to many reviewers for their time and comments that helped us improve this document, including: Gary Anderson Ph.D. (University of Maine, Orono), Andrea Asch (Ben and Jerry's), Allen Dusault (Sustainable Conservation), Cashion East (University of Arkansas), Bob Foster (dairy Farmer), Chris Galen (National Milk Producers Federation), Rachel Gilker Ph.D. (University of Vermont), Martha Guzman-Aceves (California Rural Legal Assistance Foundation), Jamie Jonker Ph.D. (National Milk Producers Federation), Paul Martin (Western United Dairyman), Marty Matlock Ph.D. (University of Arkansas), Craig Metz (EnSave), Denise Mullinaxn (California Dairy Quality Assurance), Mike Payne DMV Ph.D. (California Dairy Quality Assurance), David Pimentel (Cornell University), Al Rotz Ph.D. (USDA ARS at Pennsylvania State University), Matt Sanderson Ph.D. (USDA ARS at Pennsylvania State University), and Doug Young (dairy farmer). Although we incorporated nearly all of the many thoughtful suggestions made by reviewers in an effort to create a useful and comprehensive Vital Capital Index, we accept responsibility for the limitations of this document. Matt Welch and Erin Fitzgerald (Dairy Management, Inc.) were a continual source of thoughtful advice which was instrumental to the development of this document. Support for this work was provided by Dairy Management, Inc. and Manomet Center for Conservation Sciences.

1. Prosperity: Financial Performance and Management

Regular assessment of financial performance and management can help ensure the economic resiliency and financial strength of a farm business, and livelihood and quality of life for a farm family and employees. Operating a profitable dairy is essential to prosperity, a key component of sustainability. Dairy producers must maintain the cash flow necessary to pay suppliers and employees. Long-term profitability allows producers to invest in their operations, make investments to protect the environment for agricultural production and other ecosystem services, and have a reasonable quality of life.

Financial Performance & Management Indicator Worksheet

Outcome-based Metrics	Value	Why Is This Important
1. Debt-to-Asset Ratio: The debt-to-asset ratio is the total amount of farm business debt divided by your total amount of farm assets. This includes debts from operating and equipment loans and assets such as equipment and real estate. What is your total debt-to-asset ratio?	_____ (ratio)	1. Debt-to-Asset Ratio: The debt-to-asset ratio gives an up-to-date picture of the financial health of a farming business. There is more information about how to manage your debt-to-asset ratios under Metric #3. *Reference values for all US dairies: mean debt-to-asset ratio is 0.40**
2. Profitability: What was the ratio of your average per cwt pay price received divided by your average cost of production over the last 12 months?	_____ Ratio	2. Profitability: Dairy profitability can change dramatically as input costs and milk price on the market change. Therefore, profitability must be evaluated at many points in time to understand profitability trends and to identify if the current profitability level is adequate. Garci, A. 2009. Dairy profitability 101: Milk quality and feed efficiency. South Dakota State University Extension. Brookings, SD. Ex 4042 (available online at: http://agbiopubs.sdstate.edu/articles/ExEx4042.pdf). *Reference values for businesses: >1:1 is profitable, 1:1 is about breakeven, and <1:1 is not profitable.*

Practice-based Metrics	Score	Tools for Continuous Improvement
3. Debt-to-Asset Ratio a. How has your debt-to-asset ratio changed over the last year (increased=0, stayed the same=1, decreased=2)?	_____ (max = 2)	3. Debt-to-Asset Ratio: Low debt levels are always desirable. Dairies that are new or adding significant infrastructure often have financial reasons for having high debt levels. Dairies that rely heavily on leased land or feed from off-farm may have high debt levels and still be financially healthy. High debt levels reduce the resiliency of a dairy by making it vulnerable to downturns and other unpredictable financial challenges. They also can lead to increased routine debt service payments, which can reduce available cash. For more information on managing debt-to-asset ratio, read: Shoemaker, D. 2009. Managing debt to preserve future profitability. Dairy Issues Briefs, OH State University Ext., Wooster, OH, DIB# 11-09, April 2009 (available online at: http://dairy.osu.edu/DIBS/DIBS%2011%20Taking%20on%20additional%20debt.pdf).
b. How has your debt-to-asset ratio changed over the last five years (increased=0, stayed the same=1, decreased=2)?	_____ (max = 2)	

1. Prosperity: Financial Performance and Management (cont.)

Financial Performance & Management Indicator Worksheet

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
4. Financial Review: Do you use information from reviewing and evaluating your financial records and past year's financial performance to improve your business decision making and performance in the coming years (no=0, yes=1)?	____ (max = 1)	4. Financial Review: An evaluation of the last year's financial information can help improve your financial and operational decisions. It helps you use financial records and to improve returns and future financial stability. The following information can help you develop a financial review system: Tranel, L. F. 2002. Managing Dairy Farm Finances. Iowa State University Extension Dairy Field Specialist. Ames, Iowa. LT-105 (available online at: http://www.grassworks.org/Managing%20Dairy%20Finance2.pdf).
5. Profitability: a. How has your profitability changed over the last year, what is today's ratio (Metric 2, above) compared to the same ratio from a year ago (decreased=0, stayed the same=1, increased=2)?	_____ (max = 2)	5. Profitability: There are many spreadsheets available to help dairy producers do financial planning. Most leading agriculture universities have tools. For more about using cost of production information, read: Bolton, K. and G. Frank. 2009. Cost of production vs. cost of production and then there is cost of production! University of Wisconsin, Madison, WI. Center for Dairy Profitability, September 2009 (available online at: http://cdp.wisc.edu/pdf/Cost%20of%20ProductionIIIFinal.pdf).
b. How has your profitability changed over the last five years, what is today's ratio (Metric 2, above) compared to the same ratio from five years ago (decreased=0, stayed the same=1, increased=2)?	_____ (max = 2)	
6. Cash Flow: Did your dairy business "cash flow" or make enough income to pay all expenses in at least 3 of the last 5 years (no=0, yes=1)?	_____ (max = 1)	6. Cash Flow: All dairies must have sufficient regular income to meet expenses and stay in business. For more on managing cash flow, read: Michigan State University Dairy Team. 2006. Dollars and sense: About the dairy cash flow budget spreadsheet. MI State University Dairy Team. East Lansing, MI (available online at: http://dollarsandsense.anr.msu.edu/Portals/dollars/Files/PDF/dairy%20cash%20flow%20budget.pdf).
Performance and Financial Practice Score (add metric scores)	____ (max = 10)	

Other Resources:

Dhuyvetter, K.C. and T. L. Kastens. 2006. Factors impacting dairy profitability in 2007. Department of Agricultural Economics, KS State University, Manhattan, KS (available online at: http://www.agmanager.info/livestock/budgets/production/dairy/2007_Profit_Outlook%20(Dec2006).pdf).

Hadley, G. 2005. Comparing High Profit, Medium Profit and Low Profit 2003 Wisconsin AgFA Farms. AgStar Scholars Program, University of Wisconsin-River Falls, Center for Dairy Profitability (available online at: http://cdp.wisc.edu/pdf/FarmComparison05.pdf).

*Jones, B. 1999. Growth in Dairy Farms: The Consequences of Taking Big Steps or Small Ones When Expanding. University of Wisconsin, Madison. Center for Dairy Profitability (available online at: http://cdp.wisc.edu/pdf/expallv12.pdf).

Willett, G. S. 1993. How much debt can a dairy cow carry? Washington State University, Pullman, WA. Extension Economist, Department of Agricultural Economics. EB1752 (available on line at: http://cru.cahe.wsu.edu/CEPublications/eb1762/eb1762.html).

2. Prosperity: Successional Transfer

Successional transfer involves planning for, and the management of, passing a dairy on to future generations. This ensures the local heritage of dairy production is maintained for generations to come. For many producers, this means planning to pass their operation on to their children, but it can also mean transferring their operation to non-family members.

Successional Transfer Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Successional Transfer: Are you planning to transfer your farm to a future generation (does not have to be a transfer within your family) (no=0, unknown=2, yes=5)?	____ (max = 5)	1-2. Successional Transfer and Planning: Historically, dairy producers passed their dairies on to family members of the next generation or sold to new owners who kept the land in agricultural production. Recent generations have found it increasingly difficult to transfer dairies to the next generation and have the land stay in production. In many areas, pressures from rising retirement costs/needs, rising taxes, and sprawl are resulting in non-agriculture transfers that lead to development. Moreover, new employment expectations and opportunities are reducing the number of family members who seek to continue the family tradition of dairying. Planning for successional transfer is the first step to ensure a dairy will stay in production and is essential if this is an important producer goal. For many communities, planned transfers continue dairy production and help maintain important community values, such as farming heritage and open space. Transfer planning involves legal considerations that vary from state to state and often require assistance from local legal experts. The following reports provide general Information on successional transfer planning: Hachfeld, G. A., et al. 2009. Transferring the farm, Series #1 to #10. University of Minn. Coop. Ext., St. Paul, MN (available online at: http://www.extension.umn.edu/distribution/businessmanagement/components/M1177.pdf).
2. Successional Planning: Do you have a formal plan (a written document or contract) to transfer your farm to a future generation (does not have to be a transfer within your family) (no=0, informal plan [verbal agreement]=2, yes=5)?	____ (max = 5)	
Successional Transfer Practice Score (add metric scores)	____ (max = 10)	

Other Resources:

American Farmland Trust. 2008. Farm transfer and estate planning. Farmland Information Center, Fact Sheet. Northampton, MA (available online at: http://www.farmlandinfo.org/documents/27981/estate_planning__07-2008.pdf).

Cropp. R. K. and J. Kirkpatrick. 2007. Farm succession assessment tool. University of Wisconsin Center for Dairy Profitability. Madison, WI (available online at: http://www.uwex.edu/ces/farmsuccession/resources/planning/communicationtools/documents/FarmSuccessionAssessmentTooldraft4landscape.pdf).

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3. Prosperity: Energy Use

Efficient use of energy reduces farm costs and improves resource use of dairies. Many producers have made significant strides in this area. Producer ingenuity and recent technological advancements have resulted in tools that can be used to increase energy efficiency on dairies.

Energy Use Indicator Worksheet

Outcome-based Metrics	Value	Why is this important?
1. Electricity Efficiency: How much total electricity do you use in your dairy operation per year per milking cow, and cwt (total KwH used in the farming operation, not including the owner's residence, but including employee housing if provided by the dairy)?	____ KwH/cow ____ KwH/cwt	1. Electricity Efficiency: Dairy electricity costs are significant and come from lighting, fans, pumps, and cooling milk. Knowing your total electricity usage is necessary for evaluating profitable changes that reduce use. The following is a good example of an energy management guide: Ludington, D., E. Johnson, J. Kowalski, and A. Mage. 2004. Dairy farm energy management guide: California. Southern CA Edison (available online at: http://www.sce.com/NR/rdonlyres/60CC09E0-2EE1-4087-B46F-51527CC0906D/0/CompleteGuide_102005REV.pdf. *Reference values from all US dairies*: Average: 330KwH/cow* (high: 531Kwh/cow, low: 182KwH/cow).

Practice-based Metrics	Score	Tools for Continuous Improvement
2. Energy Audit: When was your last energy audit (never had one=0, ≥5 years ago=1, <5 years ago =2)?	____ (max = 2)	2. Energy Audit: Energy audits are used to asses how energy is used and options for reducing use. Some states provide audits or cost share programs for audits. Private companies and agricultural organizations may also provide audit services. Programs vary by state so check with your local cooperative extension office. For an audit report example, read: EnSave. 2009. EnSave sample energy audit report. Ensave, Inc. Richmond, Vt. (available online at: http://www.ensave.com/assets/files/Sample%20Dairy%20Audit%2012.09.pdf).
3. Energy Conservation: a. How much of your lighting uses energy efficient light bulbs (traditional light bulbs and <50% efficient light bulbs=0, 50-85% efficient light bulbs=0.5, >85% efficient light bulbs=1)?	____ (max = 1)	3. Energy Conservation: New lighting, cooling, and pumping systems can use less energy. Energy-efficient lights, such as compact fluorescent lights (CFL) and light emitting diodes (LED), are examples of energy-saving lighting. Efficient barn ventilation systems can include using barn designs that increase air flow, efficient ventilation fan motors, or high volume low speed (HVLS) fans. Variable speed pumps and plate-type milk coolers are also tools for reducing energy use in the milking parlor. For more, read: EnSave. 2010. California Dairy Energy Efficiency Program, EnSave, Inc., Richmond, VT (available online at: http://www.ensave.com/energy-efficiency.html).
b. Do you have barn ventilation and, if so, what percentage of your fans are energy efficient fans (traditional fans=0, >50% efficiency fans=0.5, >85% efficiency fans or you do not need barn ventilation=1)?	____ (max = 1)	
c. Do you use a variable speed vacuum pump (no=0, yes=1)?	____ (max = 1)	
d. Do you use a plate-type milk cooler (no=0, yes=1)?	____ (max = 1)	

3. Prosperity: Energy Use (cont.)

Energy Use Indicator Worksheet

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
4. Do you use an irrigation pump and, if so, what kind (no pump=2, variable speed electric=1.5, electric=1, propane=0.5, diesel=0)?	____ (max = 2)	4. Pumping irrigation water has many variables that determine energy used to move water. Key variables include: the amount of water pumped, the lift required, the pressure required, and pump efficiency. Energy costs can be minimized by maintaining the pump in good condition, selecting the most efficient pump for the location, and the most appropriate power source for the pump. More information about the selection and use of irrigation pumps can be found at: Morris, M. and V. Lynne. 2006. Energy saving tips for irrigators. NCAT Energy Specialists. ATTRA. IP278, Slot278, Version071806 (available online at: http://attra.ncat.org/attra-pub/PDF/energytips_irrig.pdf).
5. Renewable Energy Use: Do you produce energy from solar, wind, wood, digester or another renewable energy source on your farm (no=0, yes=2?	____ (max = 2)	5. Renewable Energy Use: On-farm energy production is an emerging opportunity on many dairies across the country. Properly planned and implemented, energy production systems can be a great benefit to dairies that utilize them. Energy produced on farm can either be used there or sold into the power grid, lowering costs or increasing income. The following primer related to on-farm energy production gives more details: Sawyer, S. 2005. On-farm energy production: A Vermont Primer. Vermont Sustainable Agriculture Council. Montpelier, VT. November 2005 (available online at: http://www.vsjf.org/biofuels/documents/On-Farm_Energy_Production_05.pdf).
Energy Use Practice Score (add metric scores)	_____ (max = 10)	

Other Resources:

Innovation Center for U.S. Dairy. 2009. Energy audit supports sustainability commitment at cost-conscious Maryland dairy. Case Study-Variable speed drive, ventilation, lighting, motor. Farm Energy Audit Program (FEAP). U.S. Dairy Sustainability Commitment, Innovation Center for U.S. Dairy (available online at: http://www.usdairy.com/sustainability/BestPractices/Documents/Palmyra%20Farm%2012-3-09.pdf).

Ludington, D. and G. A. Keoleian. 2003. Dairy farm energy audit summary report. Prepared for New York State Energy Research and Development Authority. Ithaca, New York. Pp. 1-25 (available online at: http://www.nyserda.org/publications/dairyfarmenergysummary.pdf).

*Trimble, D. 2009. Report of pilot energy benchmarking project 2007/2008. Agriculture and Rural Development, UK (available online at: http://www.ruralni.gov.uk/dairy_energy_report.pdf).

Wisconsin Department of Agriculture. 2005 Dairy farm energy management handbook. Wisconsin Department of Agriculture, Trade and Consumer Protection, Madison, WI (available online at: http://www.datcp.state.wi.us/fs/environment/dfeh/index.jsp).

4. Prosperity: Local Economy

Local economic infrastructure provides labor, supplies, and services that are critical for dairy production. Many dairies rely on specific local businesses for goods and services essential to feeding, milking, and caring for dairy cattle. Dairies can also be critical for providing the customer base necessary for maintaining these local suppliers and service providers, which may support other agriculture and business sectors. Managing employees successfully on many modern dairies is vital to ensuring the dairy is running smoothly. Owners and managers of dairies have found labor to be a recent area of focus as production systems continue to change and greater dependence is placed on capable, quality employees.

Local Economy Indicator Worksheet

Outcome-based Metrics	Value	Why Is This Important?
1. How much do you pay in local property taxes per member of the dairy ownership family?	$_____ ($ amount)	1. Dairy producers support local economies by paying taxes and providing jobs. Property taxes for agricultural lands often well exceed the cost of service burden they place on local communities. Agriculture can often be the largest business sector or have the largest businesses (in gross receipts or employment) in rural communities. *Reference values for US households (in 2008): average household property taxes was $1432*.*
2. Labor: How many cows per full-time equivalent (FTE) employee does your dairy have (include family members in your number of employees)?	_____ (ratio)	2. Labor: Labor on dairy farms includes family members as well as paid employees. Jobs are one of the most significant contributions that dairies make to local communities. Moreover, key jobs in dairies may be more reliable than jobs in other sectors during economic downturns because dairy labor needs fluctuate little. *Reference values for US dairies: typical for tie-stall barns - 30 -35 cows per FTE employee, typical for free-stall barns- 40 to 45 cows per FTE employee.***
Practice-based Metrics	**Score**	**Tools for Continuous Improvement**
3. Wages: What is the average wage for employees who are not a part of management and are not apart of your family. (< $8/hr=0, $8.01 to $10.99 /hr=2, >$11/hr=4)?	_____ (max = 4)	3. Wages: Employee wage management is becoming recognized as a key management tool for improving production and quality on dairies. This includes managing wages and job benefits to keep dairy jobs competitive with other local jobs. For more information about dairy wages, read: Harrison, J., S. Lloyd, and T. O'Kane. 2009. Changing hands: Hired labor on Wisconsin dairy farms. Dairy works in Wisconsin: Tasks, shifts, wages, and benefits. University of WI Coop. Ext., Madison, Wisconsin. Briefing no. 3 (available online at: www.pats.wisc.edu/pubs/pdf.ashx?pubsID=100).

4. Prosperity: Local Economy (cont.)

Local Economy Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score
4. Support for Local Agricultural Infrastructure: a. What percent of your equipment purchases are made within 50 miles of your farm (<50%=0, >50%=1, >75%=2, >90%=3)?	_____ (max = 3)
b. What percent of your farming supply purchases are made within 100 miles of your farm (<50%=0, >50%=1, >75%=2, >90%=3)?	_____ (max=3)
Local Economy Practice Score (add metric scores)	____ (max = 10)

Tools for Continuous Improvement

4. Support for Local Agricultural Infrastructure: Key local infrastructure for dairy production can include equipment and supply dealers that add to sustainability of the broader agricultural community. Clusters of dairy producers can attract and support large-animal veterinarians, feed mills, vendors of specialized products, and even processing facilities for retail products. Maintaining the critical mass of producers and suppliers is influenced by the number of local producers and cows, and whether producers purchase locally or look for savings by making purchases from discount suppliers elsewhere. The following publication gives more information about local infrastructural supports and agricultural production.

Warner, M., D. Kahan, and S. Lehel. 2008. Market-oriented agricultural infrastructure: appraisal of public-private partnerships. Agricultural management, marketing and finance occasional paper, FAO, United Nations, Rome, 2008 (available online at: ftp://ftp.fao.org/docrep/fao/011/i0465e/i0465e00.pdf).

Other Resources:

Mill, H. 1998. Fact sheet: 1998 Agricultural economic development. American Farmland Trust. Farmland Information Center (available online at: http://www.farmlandinfo.org/documents/29476/FS_AED_9-98.pdf.

Stup, R. E. 2006. Special research report: Human resource management and dairy employee organizational commitment. Pennsylvania State University. Department of dairy and animal science. College of Agricultural Science. University Park, PA. 2006 (available online at: http://www.cnr.berkeley.edu/ucce50/ag-labor/7research/Stup06.pdf).

Hogan, M. 1997. Compensating Farm Employees. Ohio State University Fact Sheet, Columbus, OH. Agricultural Economics. HRM-2-97 (available online at: http://ohioline.osu.edu/hrm-fact/0002.html).

Keown, J. F. 2005. Managing dairy labor. University of Nebraska-Lincoln Ext., Institute of Agriculture and Natural Resources, Lincoln, NB. G1584 October (available online at: http://agecon.uwyo.edu/riskmgt/humanrisk/Managingdairylabor.pdf).

**Marrison, D. 2009. Dairy Issue Briefs; July 2009. Ohio State University Extension. Columbus, OH. DIB#24-09 (available online at: http://dairy.osu.edu/DIBS/DIB%2024%20Pounds%20of%20milk%20sold%20per%20worker.pdf).

*U.S. Census Bureau

5. People: Dairy Producer Quality of Life

Dairy producers' quality of life is an essential component if dairy farms are to be sustainable. Quality of life includes economic standard of living, as well as job satisfaction; personal health; time for family, friends, and leisure; and achieving life goals.

Dairy Producer Quality of Life Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Life Satisfaction: Score your response to the following three statements (strongly disagree or disagree=0, you neither agree nor=1 disagree, agree=2, strongly agree=2.5): a. Dairy farming provides me with a quality financial return adequate for my needs. b. Dairy farming provides me with an opportunity to work towards my full potential and a work environment I appreciate. c. Through dairy farming I contribute in a meaningful way to my community and the well-being of others.	_____ (max = 2 ½) _____ (max = 2 ½) _____ (max = 2 ½) _____ (max =7 ½)	1. Life Satisfaction: These three questions focus on key parts of life satisfaction and personal sustainability: reasonable financial return, job satisfaction, and a contribution to society. Like all independent business operators, dairy farmers have the challenge of relying upon themselves to manage their operation so that it provides life satisfaction. Achieving a desired quality of life requires careful planning to avoid becoming overwhelmed by regular business challenges. To learn more about the importance of life satisfaction for dairy producers, see the following publication: Lloyd, S., M. Bell, T. Kriegl, and S. Stevenson. 2007. Milking more than profit: life satisfaction on Wisconsin dairy farms. University of Wisconsin-Madison, Center for Integrated Agricultural Systems, Madison, WI (available online at: http://www.cias.wisc.edu/wp-content/uploads/2008/07/qol707final.pdf).
2. Vacation Time: How many days of vacation did you take last year (< 3=0, 3 to 7= ¾ , > 7=1¼)?	_____ (max =1 ¼)	2. Vacation Time: Many dairy producers take few, if any, vacation days from their job. It is important for individuals or the farm family to take vacations, especially as dairy routinely has long work hours. Vacations allow producers a break from routine, time to focus on family and friends, possibly visit and learn from other dairy producers, and opportunity to re-charge and regain perspective about their business and life goals.
3. Work Hours: How many hours a day on average do you work (>14 hours=0, 10-14 hours= ¾, <10 hours=1¼)?	_____ (max =1 ¼)	3. Work Hours: Managing daily work hours is an important part of any job and helps maintain a perspective on work. It also helps one avoid being over tired, which reduces quality of life and increases likelihood of injury.
Dairy producer Quality of Life Practice Score (add metric scores)	_____ (max = 10)	

Other Resources:

Brannstrom, A. 2006. "Wisconsin Dairy Modernization Survey, 2006." Center for Dairy Profitability. University of Wisconsin. Madison, WI. September 2006 (available online at: http://www.cdp.wisc.edu/pdf/Dairy%20Modernization%20Survey%202006.pdf).

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6. People: Farm Employees

Managing farm employees to ensure their rights are respected and the work environment is kept safe assists in promoting quality dairy production and supports a high quality work place.

Farm Employees Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Safety Training: Do you provide worker safety training (once a year verbally=0, two or more times a year=0.5, two or more times a year, plus there is a written safety document distributed to employees=1)?	____ (max = 1)	1. Safety Training: Worker safety training helps ensure employee safety and correct use of equipment. It also reduces costly injuries, lost time, and equipment damage. For more information about safety training, read: Keown, J.F. 2005. Managing dairy labor. G1584. University of NB-Lincoln Extension, Institute of Ag. and Nat. Resources. G1584 (available online at: http://www.ianrpubs.unl.edu/epublic/live/g1584/build/g1584.pdf?redirected=true).
2. Employment Verification: Do you have a document verification program for non-local employees (no=0, yes=1)?	____ (max = 1)	2. Employment Verification: To ensure stable labor, a dairy's hiring practices must follow local and federal laws, including completing appropriate documentation on all employees. More information is available at: Gordon, J., K. Higgs, J. Krahn, A. Sandeen. 2009. Labor management. Northwest Sustainable Dairies (available online at: http://www.northwestsustainabledairies.com/assets/pdfs/labor_management.pdf).
3. Sanitation Facilities: Do you provide access to the following sanitation facilities (access to fewer than two of the following=0, access to two=0.5, access to three or more=1): Bathroom, washroom with supplies, shower, and/or laundry?	____ (max = 1)	3. Sanitation Facilities: Employees require access to certain sanitation facilities depending on what activities are required in their jobs. Not all dairies may need all of the sanitation facilities mentioned, although a minimum level is required in many states.
4. Youth Labor: (add score from (a) and (b). a. Do you employ laborers < 18 years old (yes=1, no=2) (if yes answer (b), if no, skip (b)? b. If yes, do you require that they: do not work during school hours, have specialized training, and have parental consent, or follow local regulations for minor employees (no=0, yes=1)?	____ (max = 2)	4. Youth Labor: Dairies can provide a key shaping work experience for youth that encourage initiative and work ethic. Employing youth is common in dairy, though special work/ safety legal requirements must be addressed. Youth labor laws vary by state, so you can check with your state agriculture agency for information. For information on employing youth, read: Uchtmann, D. and C. Parr. 2001 Child labor laws. University of IL, Champaign, IL (available online at: http://www.farmdoc.illinois.edu/legal/pdfs/childLabor_law.pdf).

6. People: Farm Employees (cont.)

Farm Employees Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score
5. Employee Benefits: a. Does the farm business provide healthcare for the owners (no=0, yes=1)?	(max = 1)
b. Do you make a healthcare plan available to employees (no healthcare option=0; yes, but no employer contribution=0.5; yes, with employer contribution=1)?	(max = 1)
c. Do employees receive benefits such as housing, paid vacation, overtime pay, 401k [or like], and/or on-farm produced products (no benefits=0, 1 benefit=0.5, 2 benefits=1, ≥3 benefits=2)?	_____ (max = 2)
6. Employee turnover: What is your average annual employee turnover rate (>25% annually=0, 10% to 25% annually=0.5, <10% annually=1)?	_____ (max = 1)
Farm Employee Practice Score (add metric scores)	____ (max = 10)

Tools for Continuous Improvement
5. Employee Benefits: Managing wages and job benefits to keep dairy jobs competitive with other sources of local jobs is challenging. Attracting and retaining quality employees is essential for productivity. More information about hired labor can be found in: Harrison, J., S. Lloyd, and T. O'Kane. 2009. Changing hands: Hired labor on Wisconsin dairy farms. Dairy works in Wisconsin: Tasks, shifts, wages, and benefits. University of WI Coop. Ext., Madison, WI. Briefing No. 3 available online at: www.pats.wisc.edu/pubs/pdf.ashx?pubsID=100).
6. Employee Turnover: Controlling employee turnover reduces the amount of time spent in employee training and allows you to build a group of experienced employees.

Other Resources:

Garcia, A. 2006. Hiring and managing Spanish-speaking employees. South Dakota State University Cooperative Extension. Brookings, SD. Ex 4034 (available online at: http://agbiopubs.sdstate.edu/articles/ExEx4034.pdf).

Hogan, M. 1997. Compensating Farm Employees. Ohio State University Fact Sheet, Columbus, OH. Agricultural Economics. HRM-2-97 (available online at: http://ohioline.osu.edu/hrm-fact/0002.html).

Keown, J. F., E. Marotz. 1995. How to write a dairy job description. University of Nebraska Cooperative Extension. Lincoln, NE. G95-1224-A (available online at: http://agecon.uwyo.edu/riskmgt/humanrisk/HowtoWriteaDairyJobDescriptpdf.pdf).

Stup, R. E. 2006. Special research report: Human resource management and dairy employee organizational commitment. Pennsylvania State University. Department of dairy and animal science. College of Agricultural Science. University Park, PA. 2006 (available online at: http://www.cnr.berkeley.edu/ucce50/ag-labor/7research/Stup06.pdf).

7. People: Food Production and Safety

The production of safe, high quality milk by dairy producers is vital to the future of the dairy industry. Consumers expect that the dairy industry will provide a consistent, safe and nutritious product and this continues to be an important hallmark and marketing angle for domestic dairy products.

Food Safety and Quality Indicator Worksheet

Outcome-based Metrics	Value	Why is This Important?
1. Milk Production: What is your annual milk production (cwt)?	_____ (cwt)	1. Milk Production: The greatest contribution of dairy farms to people and society is the production of safe, natural, and nutritious food.
2. Milk Production Efficiency: What was your average annual production per lactating cow (lbs)(rolling herd average)?	_____ (lbs)	2. Milk Production Efficiency: All dairy cows have nutritional requirements they need to live healthily, nutrients they use above and beyond that are used to make milk. Increasing the milk produced per cow can reduce the percentage of nutrients used to meet maintenance requirements and increase the nutrients used to produce milk.

Practice-based Metrics	Score	Tools for Continuous Improvement
3. Farm Visitors: Do you have a system for monitoring farm visitors (no=0, signage or sign-in=1, signage and sign-in=2)?	_____ (max =2)	3. Farm Visitors: Tracking visitors is a key part of reducing the likelihood of deliberate contamination by strangers, controlling biohazards, and maintaining farm and product safety. The following document reviews key farm safety procedures: Wallace, R. L. 2003. Practical and sensible dairy farm biosecurity. Proceeding of the 6th Western Dairy Management Conference. March 12-14th, 2003, Reno, NV-201 (available online at: http://www.dairyfarmingtoday.org/NR/rdonlyres/6FAEA599-6650-4E8C-88A9-385EE4BFFB63/0/DFTFarmSecurityPDF.pdf).
4. Tracking Hazardous Chemicals: Is access to all medicines, pesticides, herbicides and other potentially hazardous materials limited to appropriate employees (no=0, yes=1)?	_____ (max = 1)	4. Tracking Hazardous Chemicals: Securing hazardous materials on a dairy reduces safety risk due to employee error and contamination by disgruntled persons. The following article gives further biosecurity steps: Castillo A. R. 2006. Dairy industry and biosecurity (planning ahead). University of California Cooperative Extension. Merced and Stanislaus. Agribusiness Dairyman 25(8):12 (available online at: http://cemerced.ucdavis.edu/files/28380.pdf).

7. People: Food Safety and Quality (cont.)

Food Safety and Quality Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
5. Managing Animal Health: a. Do you have a system for tracking medical treatments in the lactating herd (none=0, written tracking of tagged animals and/or visual [marked treated animals with leg band or paint]=1)?	_____ (max = 1)	5. Managing Animal Health: Medical treatments in your lactating herd should be tracked so that all cattle-handling employees can readily identify treated animals, know their health needs, and appropriately withhold milk from treated cows. Special treatment areas for sick cattle can make it easier to treat sick animals and reduce spread of disease. More information about managing animal well-being can be found in: Principles and guidelines for dairy animal well-being. National Dairy Animal Well-Being Initiative. 2008 (available online at: www.dairywellbeing.org/pdfs/NDAWI%20Principles%20&%20Guidelines.pdf).
b. Do you have a system, such as hospital pens, to separate cattle needing special treatment (no=0, yes=1)?	_____ (max = 1)	
6. Veterinarian Input: Do you annually consult with a veterinarian for legal prohibitions and withdrawal times for drugs and other animal treatments (including drugs used off label) (no = 0, yes = 1)?	_____ (max = 1)	6. Veterinarian Input: Veterinarian input can help improve your dairy operation decision making process and set up herd health protocols that can improve animal health and yield financial benefits. The following publication identifies key measures that improve cow comfort. Croney, C., J. Gordon, K. Higgs, J. Krahn, A. Sandeen and M. Wustenberg. 2009. Northwest sustainable dairies: Animal care and welfare (available online at: http://www.northwestsustainabledairies.com/assets/pdfs/animal_care-and-welfare.pdf).
7. Employee Food Safety Communication: Are instructions for medical treatments, milking procedures, and cleaning procedures available in all employees' primary language (no=0, verbal=1, written=2)?	_____ (max = 2)	7. Employee Food Safety Communication: Employees should receive instructions about medicating livestock, and milking and cleaning procedures so that they understand the importance of food safety, know where to find instructions if the manager is unavailable, and know standard operating procedures for ensuring food safety. These instructions must be in a language and format that can be understood by employees. Ensuring clean milking systems can help keep high milk quality, and help lead to gaining maximum premiums for milk quality. For a review of standard operating procedures for milking system cleaning, read:: Tikofsky, L. 2009. Milking system cleaning SOPs, annual evaluation are premium. Eastern Dairy Business, November 2009 p. 30-31 (available online at: http://qmps.vet.cornell.edu/QM1109.pdf).

7. People: Food Safety and Quality (cont.)

Food Safety and Quality Indicator Worksheet (cont.)	Score	Tools for Continuous Improvement
Practice-based Metrics (cont.) 8. Milking Procedures: How many of the following techniques do you use in your milking procedure: Predipping, wiping, fore stripping, post dipping (<3=0, 3=1, 4=2)?	_____ (max = 2)	8. Milking Procedures: Practicing proper milking procedures can result in high quality milk and lead to additional premiums based on milk quality. The following publication identifies good procedures for both parlors and pipelines. For a review of standard milking procedures, read: Ruegg, P. L. 2005. Standard Milking Procedures. Resource Milk Money. University of Wisconsin Cooperative Extension. 3-13 (available online at: http://www.uwex.edu/MilkQuality/PDF/Vol_3_pdf/Pg_3-13-14_standard_ops.pdf).
Food Safety and Quality Practice Score (add metric scores)	____ (max = 10)	

Other Resources:

Capper, J. 2009. More production per cow, not less, is the most environmentally friendly strategy. Western Dairy News. Fort Collins, CO. Vol 9, No. 2. (available online at: http://www.cvmbs.colostate.edu/ilm/proinfo/wdn/2009/March%20WDN.pdf).

Carlson, K. R., C. Johnston, and D. Bals. 2004. Caring for dairy animals: Technical reference guide and on the dairy self evaluation guide. National Milk Producers Federation. DACc80-4EG (available online at: http://www.nmpf.org/publications/dairy_caring).

Dairy Management Inc. 2005. Dairy farm security fact sheet. Dairy Management Inc., Chicago, IL (available online at: http://www.dairyfarmingtoday.org/NR/rdonlyres/6FAEA599-6650-4E8C-88A9-385EE4BFFB63/0/DFTFarmSecurityPDF.pdf.

Moore, D. A. 2006. Guarding against the "trojan horse": practical biosecurity measures for dairy farms. School of Veterinary Medicine, University of California Davis, CA (available online at: http://www.vetmed.ucdavis.edu/vetext/INF-DI/trojanhorse-biosecurity.pdf).

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8. People: Community Relations and Activities

Being a good neighbor and having good relationships with regulators can help maintain and build local support for dairy agriculture and help sustain local communities. Minimizing what neighbors perceive as nuisances can foster good neighbor relationships. Adhering to regulatory requirements can help avoid frustrating conflicts with regulators. The community also benefits from charitable contributions and volunteering of producers.

Community Relations & Activities Indicator Worksheet

Outcome-based Metrics	Value	Why Is This important?
1. Community Benefits: a. For how many local and regional non-profit organizations do you volunteer?	_____ (number)	1. Community Benefits: Dairy producers are often actively involved in local communities. Involvement ranges from school groups and local fire departments to charitable organizations and resource preservation associations and can be vital to sustaining local communities. Reid, J. N. 2000. Community participation: How people power brings sustainable benefits to communities. USDA Rural Development Office of Community Development. June 2000 (available online at: http://www.rurdev.usda.gov/rbs/ezec/Pubs/commparticrept.pdf).
b. How many hours did you spend last calendar year working with these organizations?	_____ (hours)	
c. How many charitable organizations did you donate to last year, and what was the total amount donated?	_____ (number) _____ ($ amount)	
d. How many groups or organizations (e.g., school groups, civic organizations) visited your farm last year?	_____ (number)	
e. How many people made educational visits to your farm last year?	_____ (number)	

8. People: Community Relations and Activities (cont.)

Community Relations & Activities Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
2. Potential Nuisances for Neighbors: a. Do you apply practices to minimize the effect of manure spreading on your neighbors (no=0, yes=1)?	_____ (max = 1)	2. Potential Nuisances for Neighbors: Dairy producers can apply a number of practices to reduce nuisances to neighbors. Managing manure with techniques appropriate to your region and climate can eliminate many manure odor issues. Controlling fly breeding habitat around manure, silage storage, and other areas can minimize fly issues. Keeping livestock facilities clean and managing for cow comfort can minimize complaints and benefit animal health and milk production. Applying cropping practices that minimize soil loss, and efficiently use nutrients, energy, and water, can improve crop production, while limiting neighbors' concerns about your practices. For more about good neighbor strategies, read: Kelsey, T. W. and C. W. Abdalla. 2008. Finding the common ground: Good neighbor relations, advice and tips from farmers. PA State University College of Agricultural Sciences, Agricultural Research and Cooperative Extension. State College, PA. UA309 (available online at: http://pubs.cas.psu.edu/FreePubs/pdfs/ua309.pdf).
b. Do you apply practices to minimize the effect of fly populations on your neighbors (no=0, yes=1)?	_____ (max = 1)	
c. Have you had any complaints related to manure spreading or storage over the last five years (>3 complaints=0, 1-3 complaints=1, no complaints=2)?	_____ (max = 2)	
d. Have you had any complaints related to animal housing or condition over the last five years (>3 complaints=0, 1-3 complaints=1, no complaints=2)?	_____ (max = 2)	
e. Have you had any complaints related to cropping practices over the last five years (>3 complaints=0, 1-3 complaints=1, no complaints=2)?	_____ (max = 2)	
3. Regulatory Matters: Have you had any regulatory violations related to cropping practices and/or manure management in the last five years (two or more violations=0, one violation=1, no violations=2)?	_____ (max = 2)	3. Regulatory Matters: Adhering to regulations demonstrates willingness to be a good neighbor and avoids conflicts with regulatory staff. For more on regulations, read: Manure management for environmental protection. PA Department of Environmental Protection. Harrisburg, PA. Doc Number: Nov 15, 2001. 361-0300-001 (available online at: http://panutrientmgmt.cas.psu.edu/pdf/rp_manure_mgmt.pdf).
Community Relations and Activities Practice Score (add metric scores)	____ (max = 10)	

Other Resources:

Bellows, B.C., J. Wright, L. Telega, and C. Crispell. 2009. Managing good farm-neighbor-relations: an essential component of manure management. Cornell Cooperative Extension, Ithaca, NY (available online at: http://www.p2pays.org/ref/21/20009.htm).

Outlaw, J. L., R. D. Knutson, and R. B. Schwart Jr. 1995. Dairy waste management regulatory policy. Dairy Markets and Policy-Issues and Options, Cornell University. Ithaca, NY. P-17. September 1995 (available online at: http://www.cpdmp.cornell.edu/CPDMP/Pages/Publications/Pubs/P17.pdf).

Wylie, P., and D.D. Jones. 2007. Best environmental management practices. Building good neighbor relationships. Michigan State University Extension. East Lansing, MI. ID-305, E-2818 (available online at: http://www.ces.purdue.edu/extmedia/ID/ID-307.pdf).

9. People: Agricultural Heritage and Resource Conservation

Dairy operations help indirectly and directly to conserve the agricultural heritage in many communities. Dairy producers can help conserve their agricultural heritage by supporting conservation of farmlands, passing their farm on to the next generation, and making working agriculture visible.

Ag. Heritage & Resource Conservation Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Farmland Conservation: a. Do you own any land with conservation easements on it (no=0, yes=1)?	____ (max = 1)	1. Farmland Conservation: Conservation easements are a tool to help protect farmland from development, generate onetime income for a farm, and re-set the agricultural land value so that the economic value of its potential agricultural production. They are often used to purchase the development rights as a means of protecting land from development. They do not work for all dairies or producers. More about conservation easements, read: American Farmland Trust. 2004. Fact sheet: Agricultural conservation easements. American Farmland Trust, Farmland Information Center. Northampton, MA (available online at: http://www.farmlandinfo.org/documents/27762/ACE_1-04.pdf).
b. Do you farm any leased or rented land with conservation easements on it (no=0, yes=1)?	____ (max = 1)	
c. Are you actively supporting or involved with an agricultural land conservation organization (no=0, yes=1)?	____ (max = 1)	
2. Cultural Heritage: a. How many generations has your dairy been in your family (one generation=0, two generations=1, > two generations=2)?	____ (max = 2)	2. Cultural Heritage: Dairies with > 1 generation active in daily operations or living on the premises transmit local and regional heritage across generations and to non-farming community members. For more about family dairies and successional transfer, read: Bastian C., A. Nagler, J. Hewlett, and R. Weigel. 2006. Risk management for Ag families: An extension model for improving family business success. American Agricultural Economics Association Annual Meeting, Long Beach, CA. July 23-26, 2006 (available online at: http://ageconsearch.umn.edu/bitstream/21352/1/sp06ba10.pdf).
b. How many generations live or work on your dairy (two generations or fewer=0, more than two generations=1)?	____ (max = 1)	
3. Rural Landscapes: a. Does your operation have farm buildings > 60 years old (no=0, yes=1)?	____ (max = 1)	3. Rural Landscapes: The appearance of a dairy affects how it is perceived by a community. Communities often appreciate well-maintained, older farm buildings for reasons ranging from aesthetic to historical preservation to conservation of past building methods. Well-kept, older buildings also visually remind local communities of their agricultural heritage and may encourage support for agriculture. Maintaining the appearance of your dairy will also encourage respect and support for your operation. For more about rural landscapes and your farm's appearance, read: Kelsey, T. and C. Abdalla. 2008. Finding the common ground: Good neighbor relations, advice and tips from farmers. Pennsylvania State University College of Agricultural Sciences, Agricultural Research and Cooperative Extension. University Park, PA. UA309 (available online at: http://pubs.cas.psu.edu/FreePubs/pdfs/ua309.pdf).
b. Do you make your farming enterprise more visible to your local community with any of the following (one point each, maximum of 3 points): cropping in visible areas, pasturing along roadsides, newly sided or painted building (visible from road) in the last 10 years, landscaped farm entrance, or a visible farm sign?	_____ (max = 3)	

9. People: Agricultural Heritage and Resource Conservation (cont.)

Ag. Heritage & Resource Conservation Indicator Worksheet (cont.)	
Practice-based Metrics (cont.)	**Score**
Agricultural Heritage and Resource Conservation Practice Score (add metric scores)	____ (max = 10)

Other Resources:

University of Wisconsin-Extension. 2002. Conservation easements. University of Wisconsin-Extension, Madison, WI. DNR PUB-WT-549 2002 (available online at: http://runoffinfo.uwex.edu/pdf/easement_brochure.pdf.

10. People: Recreational Access

Recreational access to dairy farm lands can provide important recreational opportunities, amenity values, health benefits and nature-based tourism opportunities for local communities. This can enhance the quality of life and economies of local communities.

Recreational Access Indicator Worksheet

Outcome-based Metrics	Score
1. Number of Recreational Users: How many recreational users access your property annually per acre (total recreation users divided by acres managed) (acres managed include owned and rented land that is actively managed for dairy production)?	____ (ratio)

Practice-based Metrics	Score
2. Public Access: What level of public access do you provide onto your property for recreational activities (no access is allowed=0, written or verbal permission is needed to access part or all of my land=1, anyone can access part or all of my land=3)?	____ (max = 3)
3. User Activities: How many of the following activities take place on your property (one point each): Hunting, fishing, trapping, winter trail use, summer trail use, boating, bird watching, photography, painting, picnicking, other?	_____ (total/2) (max = 5)
4. Public Facilities: Do you have any established public facilities (trails, boat ramps, water access, etc.) on your property used for recreational purposes (no=0, yes=2)?	____ (max = 2)
Recreational Access Practice Score (add metric scores)	____ (max = 10)

Why Is This important?
1. Number of Recreational Users: Private lands are a key source of recreational lands in the U.S. In some areas, recreation access to private lands is a significant driver of the local economy. Users of agricultural lands may also have a greater respect for the agricultural activities.

Tools for Continuous Improvement
2-4. Recreational access onto agricultural land can provide significant support to a rural economy. Providing access to local neighbors or community members for recreational purposes can support quality neighbor relations. Providing open space in many areas is a valued role that agriculture plays in a community. Open space has more significance in communities than just recreational uses; it also provides scenery that many communities value. The following report from the USDA gives information about farmland recreational access: Brown, D. M., R.J. Reeder. 2007. Farm-based recreation: A statistical profile. USDA Economic Research Service. Economic Research Report Number 53, December 2007 (available online at: http://www.ers.usda.gov/publications/err53/err53.pdf).

10. People: Recreational Access (cont.)

Other Resources:

Brown, M. D. and R. J. Reeder. 2007 Farm-based Recreation: A statistical profile. USDA Economic Research Service. Washington DC. Economic Research Report No. 53 (available online at: http://www.ers.usda.gov/publications/err53/err53.pdf).

11. Planet: Nutrient Management

The efficient management of nutrients including use of manure can reduce costs and environmental impact. Manure management needs to be carefully planned and managed to meet crop needs within soil limitations while avoiding liabilities from over-application or nutrient loss from runoff.

Nutrient Management Indicator Worksheet

Outcome-based Metrics	Score	Why is this Important?
1. Nutrient Use Efficiency: How many pounds of chemical (total lbs of N, P, and K) fertilizer do you apply per acre (total pounds of chemical fertilizer divided by total cropped acres)?	____ (lbs/acre)	1. Nutrient Use Efficiency: Efficient use of chemical fertilizers is essential to controlling production costs and minimizing potential negative impacts. Efficient use can greatly improve crop production efficiency, reduce other crop inputs, and improve harvesting efficiency. This indicator can show how change in fertilizer use over time increases your ability to meet productivity demands.

Practice-based Metrics	Score	Tools for Continuous Improvement
2. Nutrient Management Plan: Do you have a nutrient management plan (no=0, yes=1) (NRCS practice: Nutrient Management (code: 590)?	_____ (max = 1)	2. Nutrient Management Plan: Proper management of soil nutrients on a dairy can minimize costs, help maintain high production efficiency, and avoid negative environmental impacts. Consultants, local NRCS staff, or university experts can help you develop a nutrient management plan that works for you . Although requirements vary by state, the following reference provides a useful framework for nutrient management plans: Mallarino, A., J. Sawyer, B. Stewart, and J. Creswell. 2002. Nutrient Management Plan. IA State University Ext., Ames, IA (available online at: http://www.extension.iastate.edu/publications/nmep8.pdf).
3. Manure Storage: a. Do you have a manure storage system (no=0, yes=1) (NRCS Practice: Waste Storage Facility [code: 313])?	_____ (max = 1)	3. Manure Storage: Manure storage is an essential part of any nutrient management plan. It allows manure to be stored until it can be best used during the spring or summer to improve crop production. Manure storage systems should have adequate volume suitable to herd size and storage period. For information on manure storage, you can contact your local NRCS or cooperative extension office. For general information, read: Harrison, J., and D. Smith. 2004. Manure storage selection: Process improvements for animal feeding operation. UT State University Ext., Ag. Environ. Management Systems. Logan, UT. AG/AWM-01-3 (available online at: http://extension.usu.edu/files/factsheets/AG-AWM-01-3.pdf).
b. Does your manure storage system meet your needs for your cow numbers and the storage period (no=0, yes=1/2)?	_____ (max = 1/2)	
c. Does your manure storage system comply with regulatory requirements for capacity and construction design (no=0, yes=1/2)?	_____ (max = 1/2)	

11. Planet: Nutrient Management (cont.)

Nutrient Management Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
4. Alternative Manure Management Systems: a. Do you compost manure (no=0, yes=1/2) (NRCS Practice: Composting Facility [code: 317])?	_____ (max = ½)	4. Alternative Manure Management Systems: Digesting and composting manure are alternative management systems that can increase the value of manure. They can reduce odor, generate energy, and stabilize nutrients. The following publication can help you evaluate digester options: Burke D. A. 2001. Dairy waste anaerobic digestion handbook: Options for recovering beneficial products form dairy manure. Environmental Energy Company, Olympia, WA (available online at: http://www.makingenergy.com/Dairy%20Waste%20Handbook.pdf).
b. Do you have a manure digester (no=0, yes=1/2) (NRCS Practice: Anaerobic Digester, Ambient Temp [code: 365]; Anaerobic Digester, Controlled Temp [code: 366])?	_____ (max = ½)	
5. Nutrient Application Levels: a. Do you test your manure for N, P, and K levels before spreading and/or irrigating (no=0, yes=1)?	_____ (max = 1)	5. Manure Application Management: Managing the application of manure is about applying manure to balance with the nutrient requirements of crop and forage production. When well managed, an application can add to your financial bottom line without affecting the environment. It is essential to balance the primary nutrients of manure (nitrogen, phosphorous and potassium) with soil/crop requirements. This will reduce the need for chemical fertilizer and the cost of crop production. One challenge is to have a land base that is sufficiently large enough to handle all of the manure produced by a dairy without over application. Dairies can use their land base or leased land, or export their manure to other crop production operations that need manure. For many dairies, their manure is not sufficient for meeting all of their nutrient needs and they need to purchase chemical fertilizers. For further information on applying nutrients, read: Downing, T. 2000. Calculating dairy manure nutrient application rates. OR State University, Ext. Services. Tillamook, OR. EM8768 (available online at: http://extension.oregonstate.edu/catalog/pdf/em/em8768.pdf). Powell, M., Q. Ketterings. 2004. Whole-farm nutrient management on dairy farms to improve profitability and reduce environmental impacts. Cornell University Crop and Soil Science Research Series. Ithaca. NY. R04-1 (available online at: http://www.dfrc.wisc.edu/powell/final%20report.pdf).
b. Are your nutrient applications based on a nitrogen balance or a phosphorous balance (neither=0, nitrogen=1/2, phosphorous=1)?	_____ (max = 1)	
c. Do you use calibrations for your manure spreader(s) so that you know your application rate (no=0, yes=1)?	_____ (max = 1)	
d. Do you have access to adequate acreage to spread your manure, based on crop nutrient needs and/or regulatory requirements (no=0, yes=1/2)?	_____ (max = ½)	
e. Upon which do you base your manure application rates (neither =0, soil tests or crop needs =1/2, soil tests and crop needs =1)?	_____ (max = 1)	
f. Upon which do you base your chemical fertilizer application rates (neither=0, soil tests or crop needs=1/2, soil test and crop needs=1)?	_____ (max = 1)	
g. Do you take a legume nitrogen credit when you plow down legumes in a crop rotation (no=0, yes=1/2)?	_____ (max = ½)	

11. Planet: Nutrient Management (cont.)

Nutrient Management Indicator Worksheet (cont.)	
Practice-based Metrics (cont.)	**Score**
Nutrient Management Practices Score (add metric scores)	_____ (Max = 10)

Other Resources:

Bruulsema, T. W. and Q. Ketterings. 2008. Fertilizer BMPs-Best management for fertilizers on northeastern dairy farms. International Plant Nutrition Institute. Norcross, GA. Ref# 08052 (available online at: http://www.ipni.net/ipniweb/portal.nsf/0/9bbc50427c6469ae852574f200162796/$FILE/Dairy%20BMP.pdf).

Dairy Nutrient Management Program. 2009. Washington State Department of Agriculture. Olympia, WA. AGR PUB 430-268 (N/8/09) (available online at: http://agr.wa.gov/FoodAnimal/Livestock-Nutrient/Docs/RecordkeepingFactSheet082109.pdf).

US EPA. 2003. Dairies and Environmental Stewardship. United States Environmental Protection Agency. Washington, DC. EPA 205-F-03-003 (online at: http://www.epa.gov/oecaagct/dairy.pdf).

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12. Planet: Crop Management

Crop management is the use of different cropping methods for enhancing crop productivity while conserving soil quality. Quality cropping management is the first step to high quality feed production and healthy productive cows.

Crop Management Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Crop Rotation: Crop rotation is the planting of different annual and/or perennial crops on the same field over a series of years. Do you apply a crop rotation system on fields where you plant annual crops (no = 0, < 50% of fields = 1, > 50% of fields = 2, > 90% of fields = 3) (NRCS practice: Conservation Crop Rotation [code328])?	____ (max = 3)	1. Crop Rotation: Using crop rotations can maintain or improve soil quality, increase nutrient availability, and reduce weed and pest problems. Because conditions and landowner objectives vary, you can get the best information for selecting a system from your local cooperative extension specialist or NRCS office. For information on crop rotations and an evaluation tool, read: Roth, G., J. Harper, and R. Kyper 1997 Crop Rotations for Dairy Farms. Pennsylvania State University, University Park, PA. Agronomy Facts 57 (available online at: http://cornandsoybeans.psu.edu/pdfs/agfact57.pdf).
2. Use of Annual Crops: How many consecutive years do you plant annual crops (corn, soybeans, cereal grain, etc.) in your crop rotation (>4 years = 0, 3 to 4 years = 1, ≤ 2 years = 2) (NRCS practice: Cover Crop [code 340])?	____ (max = 2)	2. Use of Annual Crops: Alternating use of annual and perennial crops in a crop rotation can reduce disease, insect, and weed problems. Using legumes as a perennial crop in a crop rotation can also fix nitrogen and reduce fertilizer needs the following year. For more information about crop rotations, read: Zylstra, J. 2008. Crop rotations and direct seeding. Agriculture and Rural Development, Alberta. Canada. Agdex519-28 (available online at: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex3479).
3. Tillage Systems: a. Crop Rotation: What percent of your tillable acreage is in crop rotation or a permanent perennial crop (< 50% = 0, 50 to 79% = 1, ≥ 80% = 2)?	____ (max = 2)	3. Tillage Systems: No-till and minimum-till planting techniques can reduce costs and improve soil conditions. Regional differences in soil structure and type, crop species, and crop rotations can determine which (if any) no-till and minimum-till planting systems are likely to work for you. To evaluate whether no-till will work for you, read: Watson, S. 1999. The Kansas no-till handbook. KS State University Ag. Exp. Station and Cooperative Extension Service. S-126 (available online at: http://www.ksre.ksu.edu/library/crpsl2/s126.pdf.).
b. Reduced Tillage Systems: What percent of your tillable acreage is under no-till or minimum-till planting techniques (<50% = 0, 50% to 79% = 1, ≥ 80% = 2) (NRCS practice code 345, 329, 346)?	____ (max = 2)	
4. Forage Quality: Do you use forage quality tests to evaluate the crops that you grow (score: no = 0, yes = 1)?	____ (max = 1)	4. Forage Quality: An evaluation of forage quality can help you assess your crop production and ensure forages/grains produced on the farm are balanced for optimizing milk production. To better understand how forage quality can affect milk production, read: Hutjens, M. 2002. Assessing forage quality. University of IL Coop. Ext., Urbana, IL (available online at: http://www.livestocktrail.uiuc.edu/dairynet/paperDisplay.cfm?ContentID=631).

12. Planet: Crop Management (cont.)

Crop Management Indicator Worksheet Practice-based Metrics	Score	Tools for Continuous Improvement
Crop Management Practices Score (add metric score)	____ (max = 10)	

Other Resources:

National Milk Producers Federation. 2009. Dairy environmental handbook: Best management practices for dairy producers. National Milk Producers Federation, Arlington, VA (available online at: http://www.nmpf.org/publications/dairy_handbook).

Wiederholt, R., D. Franzen, and B. Johnson. 2005. Livestock manure utilization in no-till cropping systems. North Dakota State University Extension Service. Fargo, ND. NM-1292 (available online at: http://www.ag.ndsu.edu/pubs/ansci/waste/nm1292.pdf).

Pennington, Jodie. 2009. Feeding quality forages to improve profits with dairy cattle. University of Arkansas Division of Agriculture, Cooperative Extension Service. Little Rock, AR (available online at: http://www.uaex.edu/Other_Areas/publications/PDF/FSA-4010.pdf).

13. Planet: Grazing Management

Grazing in dairy production can be used as a low-cost form of providing a portion of a cow's diet from land that may not be suitable for crop production. Grazing management can improve pasture use while avoiding the degradation of natural resources.

Grazing Management Indicator Worksheet

Practice-based Metrics	Score
1. Grazing System a. Do you graze your lactating cows (no grazing=0, continuous grazing=1, rotate pastures weekly=1.5, rotate pastures daily=2)?	_____ (max = 2)
b. Do you graze your dry cows (no grazing=0, grazing=1)?	_____ (max = 1)
c. Do you graze your heifers (no grazing=0, grazing=1)?	_____ (max = 1)
2. Pasture Management a. Do you have any soil erosion sites in your pastures (eq. gully erosion or trailing) (no=1, yes=0)?	_____ (max = 1)
b. Do you provide piped water to your cattle on pasture (no=0, yes=2)?	_____ (max = 2)
c. Do you soil test your pastures (no=0, yes=1)?	_____ (max = 1)
d. Do you regularly measure forage production and forage residuals on pasture as part of forage budgeting management (no=0, yes=1)?	_____ (max = 1)
e. Do you limit access to streams and provide buffer areas to prevent water quality problems (no=0, yes=1)?	_____ (max = 1)
Grazing Management Practices Score (add metric scores)	_____ (max = 10)

Tools for Continuous Improvement

1. Grazing System: Grazing is a production technique used to provide a portion of a cows diet during the growing season. Grazing systems vary in set up costs and management requirements, but can result in improved production from grazed forage. Well-managed intensive grazing rotation systems can produce higher forage quality than long rotation systems with little management. With any grazing systems, herd activity is one of the keys to optimizing production. For more on grazing system planning, read:
   Blanchet, K., H. Moechnig and J. Dejong-Hughes. 2003. Grazing systems planning guide. University of Minnesota Extension Service. St. Paul, MN. BU – 07606 – S. (available online at: http://www.extension.umn.edu/distribution/livestocksystems/components/DI7606.pdf).
2. Pasture Management: Pasture management is the close management of each pasture area. With any grazing systems, pasture management is one key to optimizing production. Tools for improving pasture production and minimizing environmental impact include: controlling potential erosion problems, providing adequate water quality and availability for cattle, and monitoring pasture soil quality. For more on managing pasture, read:
   Eldridge, S. and J. Read. 2004. Soil management for dairy and beef cattle grazing. New South Wales, Agricultural Department. Orange, NSW (available online at: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/167028/soil-dairy-beef.pdf).

Other Resources:

Cannon, L. E., M. J. Gamroth, and A. C. Buyerie. 2004. Managing dairy grazing for better grass and more milk. Oregon State University Extension Service. Corvallis, OR. EM 8412-E. (available online at: http://extension.oregonstate.edu/catalog/pdf/em/em8412-e.pdf).

14. Planet: Soil Health

Soil health is a key component of any dairy that produces forage and feed on the farm. Soil quality can significantly affect your ability to produce high-quality forage and feeds and effectively use and manage manure.

Soil Health Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Soil Nutrient Testing: How often do you test the soil in your fields (> every 5 years=0, every 4 to 5 years=1, every 2 to 3 years=2, every year=3)?	_____ (max = 3)	1. Soil Nutrient Testing: Soil testing is a key tool for evaluating and managing soil nutrient levels. Frequent soil testing can help you maintain nutrients and soil organic matter for efficient crop production and grow high-quality forage and feeds, as well as effectively manage manure. Learn more about testing soils in: Daniels, M., J. Langston, S. Chapman, K. Combs, K. VanDevender, J. Jennings. 2005. Soil testing for manure management. University of AK, Div. of Ag. Coop. Ext. Serv. Little Rock AK. FSA1035-2.5M-9-05RV (online at: http://www.uaex.edu/Other_Areas/publications/PDF/FSA1035.pdf).
2. Cover Cropping: What percentage of field acres planted to annual crops has cover cropping over the winter (less then 30%=0, over 30%=1, over 50%=2, over 80%=3) (NRCS practice: Cover Crop [code 340])?	_____ (max = 3)	2. Cover Cropping: Late-summer or fall cover crops on fields that have been used to grow annual crops have many benefits. They can reduce soil erosion, maintain or increase soil organic matter, help stabilize or reduce nutrient loss, and can build up soil nitrogen levels, as discussed in detail in: Ketterings, Q., S. Swink, S. Duiker, K. Czymmek, D. Beegle and B. Cox. 2008. Nitrogen benefits of winter cover crops. Cornell University Coop. Ext., Ithaca, NY. Fact Sheet 43 (available online at: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet43.pdf).
3. Field Records: Do you keep records of crop yields, pasture rotations, manure and fertilizer application rates, and soil tests for each field (no=0, yes=2)?	_____ (max = 2)	3. Field Records: Keeping field records on cropping practices and yields will help you manage your fields and manure, and grow high-quality feed/forage. They will also help you maintain cropping systems and control weeds and pests. Examples of field record keeping can be found in: Wilson, M. L. and L. M. Risse. 2009. Record keeping for dairy operations in Georgia. University of GA, Coop. Ext. Athens, GA. Circular 978 (available online at: http://pubs.caes.uga.edu/caespubs/pubs/PDF/C978.pdf).
4. Soil Erosion Control: Do you apply farming techniques when needed to minimize erosion (no=0, yes=2)?	_____ (max = 2)	4. Soil Erosion Control: Erosion can pose a problem for nearly all crop systems. It can reduce fertility, production, and water quality. Key erosion control techniques include: filter strips, buffers, crop rotation, and cover cropping. For more about erosion control read: Sanders, F.S. 2000. Dairy Production Best Management Practices. LA State University Ag Center Res. and Ext. Baton Rouge, LA (available online at: http://www.lsuagcenter.com/NR/rdonlyres/0E64A9BF-BA23-449E-8636-8D8971111357/3112/pub2823dairy6.pdf).

14. Planet: Soil Health (cont.)

Soil Health Indicator Worksheet (cont.)	Score
Practice-based Metrics (cont.)	
Soil Health Practice Score (add metric scores)	____ (max = 10)

Other Resources:

Clark, A. 2007. Managing Cover Crops Profitably. USDA-SARE. Sustainable Agriculture Network, Beltsville, MD (available online at: http://www.sare.org/publications/covercrops/covercrops.pdf).

15. Planet: Pest Management

Pest management includes managing insect and weed pests of forage and feed crops as well as pest control around barns and other facilities. Pest control around barns is essential so that pests do not compromise animal health and milk production. Pest control in fields is aimed at keeping weeds and crop pest-levels low enough to avoid compromising crop and forage production. When carefully managed, pest management will not compromise animal welfare, employee health, or have deleterious impacts on wildlife or the environment.

Pest Management Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Best Management Practices (BMPs): a. Do you follow BMPs for all chemical applications (no=0, yes=2/3)?	_____ (max = 2/3)	1. Best Management Practices: Following BMPs for herbicide and pesticide application makes for a safer work environment for employees and reduces risk of environmental damage. Key BMPs include: following manufactures' recommendations, record keeping, and following state-level guidelines. For more information about BMP's see: Sanders, F.S. 2000. Dairy production best management practices. LA State University Ag Center Research and Extension. Baton Rouge, LA (available online at: http://www.lsuagcenter.com/NR/rdonlyres/0E64A9BF-BA23-449E-8636-8D8971111357/3112/pub2823dairy6.pdf).
b. Do you follow the manufactures recommendations for all chemical applications (no=0, yes=1/3)?	_____ (max = 1/3)	
c. Do you keep records of all chemical applications by field, crop and year (no=0, yes=1/3)?	_____ (max = 1/3)	
d. Do you only use pesticides, herbicides and/or fungicides registered for use within your state (no=0, yes=1/3)?	_____ (max = 1/3)	
2. Rodent and Fly Control: a. Do you first use cultural methods (i.e., trapping, draining standing water, composting manure) to control flies before using chemical control methods (no=0, yes=1/3)?	_____ (max = 1/3)	2. Rodent and Fly Control: Pest control in barns is often necessary so that pest populations do not affect animal performance and health. To control pests, you can limit the amount of pest habitat, including: minimizing standing water, securing buildings and grain storage areas to keep out rodents, and keeping facilities clean. For more information on pest control, read: Rutz, D., C. Geden, and C. Pitts. 2000. Pest management recommendations for dairy cattle. Cornell and PA Coop. Ext. Ithaca, NY. 10M493 (available online at: http://pubs.cas.psu.edu/FreePubs/pdfs/ue056.pdf).
b. Do you first use cultural methods (i.e., trapping and barriers) to control rodents and birds before using chemical methods of control (no=0, yes=1/3)?	_____ (max = 1/3)	
3. Chemical Selection: a. Do you select pesticides, herbicides and/or fungicides to target specific pests or weeds (no=0, yes=2/3)?	_____ (max = 2/3)	3. Chemical Selection: Proper chemical selection to control crop pests is an essential for reaching crop production goals. It can control targeted weeds and pests, minimize environment impact, and hinder the development of chemical resistance. No one chemical will always work, due to the pest adaptability and varying conditions. You can check your state cooperative extension service or state NRCS about selecting chemicals. For more about chemical selection, read: Cornell University Cooperative Ext. 2009. Integrated pest management for field crops. Cornell University Coop. Ext.. Ithaca, NY (available online at: http://ipmguidelines.org/FieldCrops/content/CH02/default-14.asp).
b. Do you select pesticides, herbicides, and/or fungicides with low risk of developing resistance by pests or weeds and avoid those with known pest-resistance problems (no=0, yes=1/3)?	_____ (max = 1/3)	
c. Do you select pesticides, herbicides, and/or fungicides with the lowest toxicity, potential environmental impact, and/or least potential negative impact to beneficial organisms (no=0, yes=1/3)?	_____ (max = 1/3)	

15. Planet: Pest Management (cont.)

Pest Management Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
4. Chemical Applications: a. When you apply pesticides, herbicides, and/or fungicides, what size buffer do you leave (do not leave a buffer=0, leave the minimum buffer required by law if less than 100 feet= 1/3, leave at least a 100 foot buffer around all waterways or I do not apply pesticides, herbicides, or fungicides= 2/3)?	_____ (max = 2/3)	4. Chemical Applications: Using proper application methods with crop pest management chemicals can increase their effectiveness, reduce costs, and reduce potential environmental impacts. Knowing your local regulations about buffer widths required for waterways assists in planning chemical applications. Scouting fields before application gives key information about weed types, weed population densities, soil conditions and spay timing needs. Crops in different fields may not need the same chemical applications at the same time. Chemical application should be timed to be most effective in controlling pests and minimizing negative environmental impacts. Planning applications for time periods during which weather conditions are most conducive to supporting the pest management strategy will also improve the effectiveness of applications while potentially minimizing costs and environmental impact. You can check your state or local cooperative extension service or state NRCS for information about how to best apply chemicals for your needs. For general information about managing chemical applications, read: Curran, W. S., D. D. Lingenfelter, D. D. Calvin, and J. F. Tooker. 2009. Field crop pest management 2009-2010, section 1, pest management. Agronomy Guide 2009-2010. PA State University, University Park, PA. (available online at: http://agguide.agronomy.psu.edu/pm/sec1/sec1toc.cfm).
b. When and how do you control weed problems in fields (apply herbicides on a regular schedule=0, scout fields and only spray fields that are in need=1/3, scout fields and spot spray=2/3, use cultivation or I do not apply herbicides =1)?	_____ (max = 1)	
c. When and how do you control insect pests in fields (apply insecticides on a regular schedule=0, scout fields and only spray fields that are in need=1/3, scout fields and spot spray=2/3, I do not apply insecticides =1)?	_____ (max = 1)	
d. When and how do you control smuts, rusts, and other fungi in fields (apply fungicides on a regular schedule=0, scout fields and only spray fields that are in need=1/3, scout fields and spot spray=2/3, use cultivation or I do not apply fungicides =1)?	_____ (max = 1)	
e. When you spray fields, what level of weather monitoring is conducted (weather is not monitored=0, low- to no-wind periods are targeted for applications=1/3, spaying is done only in no- to low-wind periods=2/3, spaying is done only in low- to no-wind periods with drop nozzles=1)?	_____ (max = 1)	
f. How often do you calibrate your sprayer (less than once a year=0, once a year=1/3, more then once a year=2/3) ?	_____ (max = 2/3)	
5. Chemical Waste Disposal: Do you dispose of all chemical-contaminated materials in a way that meets legal requirements (no=0, yes=1/3)?	_____ (max = 1/3)	5. Chemical Waste Disposal: Agricultural chemical containers and contaminated materials should be properly disposed to avoid environmental contamination. Disposal requirements vary from state to state, so you should check with your state agriculture agency to learn about your requirements. For general information about disposal, read: Hirrel, S. and B. Majors. 2007. Pesticide storage, safety and disposal. University of AK. Coop. Ext. Serv., Ag. and Nat. Res. FSA9522 (available online at: http://www.uaex.edu/Other_Areas/publications/PDF/FSA-9522.pdf).

15. Planet: Pest Management (cont.)

Pest Management Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
6. Employee Pest Management Training: Do you provide continuing education for all employees who come in contact with chemicals that require safety training (no=0, yes=2/3)?	_____ (max = 2/3)	6. Employee Pest Management Training: Knowledge about application techniques and managing pest chemicals is constantly changing. Continuing education for application employees can increase their ability to effectively and safely control pests, and to protect people, livestock, and the environment. You can contact your state cooperative extension service or state agriculture agency staff to learn more about employee training opportunities. For more on pest management training, read: Buhler, W. 2009. Pesticide applicator certification and licensing. NC State University Cooperative Extension. Raleigh, NC. AG-714W (available online at: http://ipm.ncsu.edu/pesticidesafety/AG714W.pdf).
Pest Management Practices Score (add metric scores)	_____ (Max = 10)	

Other Resources:

Greer, H. A. L. 2002. Guide to effective weed control. Oklahoma State University Cooperative Extension Service. Stillwater, OK. PSS-2750. (available online at: http://www.okrangelandswest.okstate.edu/files/invasive%20species%20pdfs/PSS-2750.pdf).

Hoffman, L. 2004. Crop profile for field corn in Pennsylvania. PA State University, Department of Agronomy. University Park, PA (available online at: http://www.ipmcenters.org/cropprofiles/docs/PAcorn.html).

Roberson, G. T. 2010. Chemical application equipment. North Carolina State University Cooperative Extension. Raleigh, NC (available online at: http://ipm.ncsu.edu/agchem/2-toc.pdf)

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16. Planet: Wildlife and Biodiversity

Wildlife and biodiversity are critical components of a sustainable environment. Farmlands can potentially provide habitat for a diverse array of wildlife and plant species, though farms will vary in the amount and quality of habitat they provide.

Wildlife and Biodiversity Indicator Worksheet

Outcome-based Metrics	Score
1. Habitat for Wildlife and Biodiversity: What percentage of your total acreage is made up of land that is managed primarily for wildlife benefits or is not managed for agriculture and is suitable for wildlife habitat?	_____ (number)
2. Wildlife Travel Corridors: Along the largest river/stream that passes through your property, what percentage has at least a 35-foot wide buffer of natural vegetation on both sides?	_____ (percent)

Practice-based Metrics	Score
3. Game Species: Do you manage any non-cropped acreage for game species (no=0, yes=2) (NRCS practices [code]): Early Successional Habitat Development/Management [647], Hedgerow Planting [422], Upland Wildlife Habitat Management [645])?	_____ (max = 2)
4. Other Wildlife Species: Do you manage any non-cropped acreage for other wildlife species (no=0, yes=2) (NRCS practices (code): Early Successional Habitat Development/Management (647), Hedgerow Planting: (422), Upland Wildlife Habitat Management (645)	_____ (max = 2)
5. Aquatic Species: Do you manage any land for aquatic species (no=0, yes=2) (NRCS practices [code]: Riparian Forest Buffer [391], Riparian herbaceous Cover [390], Streambank and Shoreline Protection [580], Stream Habitat Improvement and Management [395], Wetland Creation [658], Wetland Enhancement [659], Wetland Restoration [657], Wetland Wildlife Habitat Management [644])?	_____ (max = 2)
6. Threatened or Endangered Species: Do you manage any land for threatened or endangered species (no=0; yes or there are no threatened or endangered species on my dairy area=4) (NRCS practices: Early Successional Habitat Development/Management (code: 647) (code: 643)?	_____ (max = 4)

Why is this important?
1. Habitat for Wildlife and Biodiversity: Biodiversity and healthy wildlife populations are essential to landscape sustainability. The benefits of conserving wildlife and biodiversity include natural predators for pest species, crop pollinators, and wildlife viewing opportunities. Wildlife conservation can also provide fishing and hunting opportunities and more resilient ecosystems. Wildlife viewing opportunities can add to the quality of life and create eco-tourism opportunities for local communities.
2. Wildlife Travel Corridors: Wildlife corridors provide habitat that allows wildlife to move easily around the landscape, allowing young animals to find and colonize new habitats. Vegetated buffers with natural vegetation provide the best corridor habitat.

Tools for Continuous Improvement
3-6. Habitat for Wildlife and Biodiversity: Management options can include money making techniques (e.g., forest management for timber and wildlife) and options that include NRCS cost-share programs. Some common techniques include vegetation strips, stream buffers, fallow land, and managed timberlands. Appropriate techniques for conserving wildlife and biodiversity will vary with farm conditions and landowner objectives, especially if nuisance wildlife is a problem. Information for your farm is available from NRCS state offices, cooperative extension offices, state fish and wildlife agencies, and state university extension staff. For general information about enhancing habitat for wildlife, see: Bakermans, M. H. and A. D. Rodewald. 2002. Enhancing wildlife habitat on farmlands. Ohio State University Extension, Columbus, OH. W-14-2002 (available online at: http://ohioline.osu.edu/w-fact/pdf/0014.pdf).

16. Planet: Wildlife and Biodiversity (cont.)

Wildlife and Biodiversity Indicator Worksheet (cont.)	
Practice-based Metrics (cont.)	**Score**
Wildlife and Biodiversity Practice Score (add metric scores)	____ (max = 10)

Other Resources:

Eastern Canada Soil and Water Conservation Center. 2008. Enhancing Wildlife and Biodiversity. Eastern Canada Soil and Water Conservation Center. Ottawa, Ontario (available online at: http://www4.agr.gc.ca/resources/prod/doc/pfra/pdf/enhancing%20wildlife-e.pdf).

Knutson, M. G. 2002. The many faces of a farm pond. Upper Midwest Environmental Science Center. La Crosse, WI (available online at: http://www.umesc.usgs.gov/documents/reports/2002/farmpondposter_page2.pdf).

17. Planet: Water Quality

High quality water is essential for local communities, healthy livestock, and healthy natural ecosystems. Many producers recognize the importance of keeping water clean and work hard to achieve this goal by adopting effective nutrient, cropping, and stock management practices.

Water Quality Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Regulatory Requirements: a. Do you know your local, state and federal regulatory requirements for water quality (no=0, yes=2)	____ (max = 2)	1. Regulatory Requirements: Dairies often face local, state, and/or federal regulatory requirements aimed at protecting water quality. These requirements focus on riparian areas, ground water use, and avoiding water contamination. To learn about the regulations in your area, contact your state agriculture agency staff or local extension service office. Eastridge, M. L., and S. Steel. 2003. Questions pertaining to large dairy enterprises in Ohio: regulations. Extension Factsheet. Ohio State University Extension. Columbus, OH. AS-8-03. (Available online at: http://ohioline.osu.edu/as-fact/pdf/0008.pdf)
b. Are you in compliance with local, state and federal regulatory requirements for water quality (no=0, yes=2)?	____ (max = 2)	
2. Riparian Buffers: Do you maintain a minimum of a 35-ft riparian buffer along all water bodies in crop fields and pastures (no=0, yes=4)?	____ (max = 4)	2. Riparian Buffers: Vegetated riparian buffers can keep excessive nutrients, soil, and chemicals from flowing into water bodies. Effective buffers vary in width depending on slope, soil type, and precipitation levels, though 35-ft. buffers can often be sufficient. For more about designing buffers, read: Dosskey, M., D. Schultz, and T. Isenhart. 1997. How to design a riparian buffer for agricultural land. USDA Forest Service, Rocky Mtn. Stn. AF Note-4 (available online at: http://www.unl.edu/nac/agroforestrynotes/an04rfb03.pdf).
3. Water Quality Practices: Do you address potential water quality issues created by agricultural cropping activities by uniformly adopting across your fields farming techniques to minimize nutrient run off(no=0, yes=2)?	____ (max = 2)	3. Water Quality Practices: Many cropping and livestock management practices that minimize the likelihood of water contamination are commonly adopted by dairy producers, including: strip cropping, contour farming, cover cropping, and buffers for application of manure and agricultural chemicals. For more information such practices, read: Sanders, F.S. 2000. Dairy production best management practices. LA State University Ag Center Research and Ext. Baton Rouge, LA (available online at: http://www.lsuagcenter.com/NR/rdonlyres/0E64A9BF-BA23-449E-8636-8D8971111357/3112/pub2823dairy6.pdf).
Water Quality Practices Score (add metric scores)	____ (max = 10)	

17. Planet: Water Quality (cont.)

Other Resources:

Olexa, M. T., L. D'lsernia, L. Minton, D. Miller, and S. Corbett. 2005. Handbook of Florida water regulation: Water management districts. University of FL IFAS Extension. Gainesville, FL. FE594a (available online at: http://sogweb.sog.unc.edu/Water/images/c/c3/FE59400.pdf).

18. Planet: Water Use

Water is a critical resource for humans, agriculture, and natural ecosystems. Efficient use of this resource allows dairy agriculture to use its fair share for milk production and without compromising the needs of other vital users.

Water Use Indicator Worksheet

Outcome-based Metrics	Amount	Why Is This important?
1. Water use efficiency (total annual gallons used per total annual cwt):	_____ (gal/cwt)	1. Water Use Efficiency: More water is used for agricultural irrigation than for any other use in the U.S. Although water costs vary regionally, efficient water use reduces purchasing and energy (pumping) costs. It also reduces the drought vulnerability of dairies in all regions. Monitoring water use and evaluating opportunities to increase use efficiency can save money, strengthen a dairy business, and reduce environmental impact.

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Water Use Monitoring: Do you measure your water use (no=0, yes=2)?	____ (max = 2)	2. Water Use Monitoring: Monitoring water use can help producers identify where use might be reduced. This includes monitoring water use in milking facilities, crop irrigation, drinking water, dust control, and other areas. Milking parlor water use can be reduced by recycling and using more efficient cleaning systems. For more information on measuring use, read: Martin, E. C. 2009. Measuring water flow and rate on the farm. University of AZ, AZ Coop. Ext., Tucson, AZ. Arizona Water Series No. 24 (available online at: http://ag.arizona.edu/pubs/water/az1130.pdf).
2. Irrigation and Soil Moisture Management: What technique do you use to monitor soil moisture (not monitored or irrigations are on schedule=0, visual inspection=1, soil moisture is monitored by moisture sensors or probes in fields or irrigation is not used=2)?	_____ (max = 2)	3. Irrigation and Soil Moisture Management: Irrigation is an essential tool for dairy in many regions for crop production. Managing the timing of irrigation requires careful tracking of soil moisture and weather. Soil moisture monitoring is a key tool for minimizing irrigation and accurately meeting crop needs. For more on measuring soil moisture, read: Werner, H. 2002. Measuring soil moisture for irrigation water management. SD State University, Coop. Ext. Serv.. Brookings, SD. FS 876 (available online at: http://agbiopubs.sdstate.edu/articles/FS876.pdf).
2. Water Use Reduction Techniques: a. Do you recycle water (no=0, yes=2)?	_____ (max =2)	4. Water Use Reduction Techniques: Reducing water use will increase your water use efficiency. A common approach is to establish a water recycling system for irrigation water and milk room wash water. New irrigation water technologies also increase use efficiency. For more on reducing irrigation water use, read: Morris, M, and V. Lynne. 2006. Measuring and conserving irrigation water. National Sustainable Ag. Inform. Serv. (available online at: http://attra.ncat.org/attra-pub/PDF/irrigation_water.pdf).
b. How many of the following techniques do you use to increase the efficiency of your irrigation systems: Laser leveling, drip nozzles, gated pipe, recycling water system, drop nozzles (one point each, up to four points)?	_____ (max = 4)	

18. Planet: Water Use (cont.)

Water Use Indicator Worksheet (cont.)		
Practice-based Metrics (cont.)	**Score**	
Water Use Practices Score (add metric scores)	____ (max = 10)	

Other Resources:

Isher, V. 2001. Estimating water use for dairy operations. Pennsylvania State University, Penn State Dairy Alliance, University Park, PA (available online at: http://resources.cas.psu.edu/WaterResources/pdfs/dairywateruse1.xls).

Looper, M., and D. Waldner. 2007. Water for dairy cattle. New Mexico State University Cooperative Extension Service. Las Cruces, NM. Guide D-107 (available online at: http://aces.nmsu.edu/pubs/_d/D-107.pdf).

19. Planet: Air Quality

Managing air quality on a dairy can include minimizing dust, odors, equipment emissions, or other air quality issues. Air quality management in dairy production improves the environment on the dairy as well as for the surrounding areas.

Air Quality Indicator Worksheet

Practice-based Metrics	Score
1. Air Quality Regulations: a. Do you know your local air quality regulations (no=0, yes=1)?	_____ (max = 1)
b. Compliance: Are you in compliance with local air quality regulations (no=0, yes=1)?	_____ (max = 1)
c. Violations: Have you had any violations of air quality requirements in the last five years (no=2, yes=0)?	_____ (max = 2)
2. Air Quality Management a. Have you had any air quality complaints in the last five years related to manure spreading (either through irrigation or direct manure spreading) (no=1, yes=0)?	_____ (max = 1)
b. Have you had any air quality complaints in the last five years related to on-farm odors (no=1, yes=0)?	_____ (max – 1)
c. Have you had any air quality complaints in the last five years related to dust (no=1, yes=0)?	_____ (max = 1)
d. Are you applying any practices (e.g., dust control, improved manure application systems, diet manipulation, or others) on your dairy to address air quality issues (one point each, up to three points) (NRCS practice code 370)?	_____ (max = 3)
Air Quality Practices Score (add metric scores)	____ (max = 10)

Tools for Continuous Improvement
1. Air Quality Regulations: Air quality rules and regulations are becoming more widespread for all agriculture, especially livestock production. Some dairy regions have unique air quality-related concerns while other concerns are industry wide. For more information about how to address specific requirements or regulations in your area contact your local cooperative extension office or NRCS. For general information, read: Rieck-Hinz, A., J. Lorimor, W. Powers, and H. Xin. 2003. Air quality and animal agriculture. IA State University Ext., Ames IA. EDC 162H (available online at: http://www.extension.iastate.edu/Publications/EDC162H.pdf).
2. Air Quality Management: The most important air quality impacts are related to manure, odors and dust. Methane is an emerging national air quality issue. Managing air quality on dairy farms can be integrated into management practices for pens, manure, cropping, and feeding. The best information for understanding and addressing local air quality issues can be obtained from your local cooperative extension staff or NRCS field office. For general information about dairy air quality issues, read: Powers, W. 2004 Practices to reduce odor from livestock operations. Department of Animal Science, Iowa State University, Ames IA. PM 1970a (available online at: www.extension.iastate.edu/Publications/PM1970a.pdf.).

Other Resources:

Zhao, L., T. L. Combs, J. N. Rausch, R. Manuzon, R. Brugger, G. Arnold, and E. Imerman. 2008. Air quality in new free-stall dairy facilities. OH State University Extension. Columbus, OH. AEX-732-08 (available online at: http://ohioline.osu.edu/aex-fact/pdf/0732.pdf).

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20. Planet: Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions are an important social and environmental issue. Dairies can reduce GHG emissions by adopting new practices that reduce energy use, improve crop management, and reduce emissions from manure and cows, many of which will also improve milk production and reduce costs.

Greenhouse Gas Emissions Indicator Worksheet

Outcome-based Metrics	Score	Why Is This Important?
1. Fossil Fuel Use Efficiency (total cost of fuel and oil used annually, per cwt):	_____ ($/cwt)	1. Fossil Fuel Use Efficiency: Efficient use of fossil fuels can reduce production costs, air pollution, and GHG emissions. Some widely used strategies for reducing fossil fuel use include: more fuel-efficient tractors, passive water heating systems, and reduced tillage cropping.

Practice-based Metrics	Score	Tools for Continuous Improvement
2. Soil Fertility Management: a. Do you use nutrient management techniques that allow you to minimize use of chemical nitrogen fertilizers (no=0, yes=1) (NRCS practice: Nutrient Management [code 590])?	_____ (max = 1)	2. Soil Fertility Management: Using manure to meet crop nutrient needs before using chemical fertilizers can greatly reduce your costs and environmental impact. For more information about the value of manure as a fertilizer, see: Pennington, J., K. VanDevender, and J. Jennings. 2009. Nutrient and fertilizer value of dairy manure. University of AK, Div. of Ag., Coop. Ext. FSA4017 (available online at: http://www.uaex.edu/Other_Areas/publications/PDF/FSA-4017.pdf).
b. Do you use manure as the primary source of NPK to meet soil nutrient needs before using commercial fertilizer (no=0, yes=1) (NRCS practice: Nutrient Management [code 590])?	_____ (max = 1)	
c. Do you use manure to meet all of your nutrient needs (no=0, yes=2) (NRCS practice: Nutrient Management [code 590])?	_____ (max = 2)	
3. Precision-guided Farming: Do you use any precision-guided farming technologies (e.g., GPS-guided tillage equipment, GPS-guided spray equipment, GPS-guided fertilizer equipment) (no=0, yes=1)?	_____ (max = 1)	3. Precision-guided Farming: Precision-guided farming can increase farm efficiencies by reducing fuel, fertilizer, and chemical use, and improving yields. It is not suitable for all fields but many fields could benefit from precision-guided spraying and fertilizing. For more information, see: Franzen, D. 2009. Economics and the environment: Site-specific farming. ND State University Ext. Serv., Fargo, ND. SF-1176-4(revised) (available online at: http://www.ag.ndsu.edu/pubs/plantsci/soilfert/sf1176-4.pdf).
4. Feeding Strategies: Do you apply feeding strategies to increase productivity or decrease GHG releases (no=0, yes=1)?	_____ (max = 1)	4. Feeding Strategies: Enteric methane from cows is a major source of GHG emissions on a dairy. Researchers are developing feeding strategies that can reduce cow enteric methane production. The following article provides information about feeding strategies: Ishler, V. 2008. Carbon, methane emission and the dairy cow. PA State University, College of Animal Science. University Park, PA. DAS 08-127 (available online at: http://www.das.psu.edu/research-xtension/dairy/pdf/carbonanddairy.pdf).

20. Planet: Green House Gas Emissions (cont.)

Greenhouse Gas Emissions Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
5. Soil Carbon: Do you apply farming techniques to increase soil carbon and soil organic matter levels (e.g., no-till planting, using cover crops and perennial grassland) (no=0, yes=2)?	_____ (max = 2)	5. Soil Carbon: Soils can store much carbon and the farming techniques for storing carbon are rapidly evolving. You can contact a local cooperative extension office or university program for information for your area. For an introduction, read: Sundermeier, A., R. Reeder, and R. Lal. 2005. Soil carbon sequestration-fundamental. OH State University Ext., Columbus, OH. AEX 510-05 (available online at: http://ohioline.osu.edu/aex-fact/pdf/0510.pdf).
6. Are you applying a practice or tool to limit methane production from your manure (eq. covered manure with burn off, manure additive) (no=0, yes=2)	_____ (max = 2)	6.
GHG Emissions Practice Score (add metric scores)	____ (max = 10)	

Other Resources:

Min, D. and R. Leep. 2005. Carbon Sequestration, what is it in dairy forage systems? Michigan Dairy Review, Michigan State University. East Lansing, MI (available online at: https://www.msu.edu/~mdr/reprints/Oct04/MDR_reprint_oct04_carbon.pdf).

21. Planet: Waste Management

Waste management applies to routine farm trash, bale and bunker plastic, packaging for medicine and other supplies, equipment fluids, silage leachate, human waste, unneeded equipment, leftover cropping chemicals, expired chemicals, and milk room waste. Some waste can be re-used (e.g., waste motor oil for heating) or recycled (e.g., some plastics). Managing waste well can protect the environment, groundwater, and your dairy.

Waste Management Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Waste Management Plan: Do you have a waste management plan that addresses non-manure waste in the production area (sometimes is part of manure management plans) (no=0, yes but not in a written form= 1, yes there is a written plan=3)?	_____ (max = 3)	1. Waste Management Plan: A management plan for non-manure waste can help avoid environmental impacts from materials not disposed of properly. The following reference provides a good checklist for non-manure waste and describes how to create a dairy non-manure waste management plan: Department of Agriculture and Rural Development. 2005. Agri-environment scheme management plan: Farm waste management. Dept. of Ag. and Rural Development. Northern Ireland (available online at: http://www.ruralni.gov.uk/ae_man_whole_1_4_cmb.pdf).
2. Silage Leachate Capture: Do you have a silage leachate capture system (no=0, planning for one but not within the next year=1, one is planned for installation within one year=2, yes or do not need one due to not utilizing silage silos=3)?	_____ (max = 3)	2. Silage Leachate Capture: Silage leachate runoff can greatly reduce water quality of nearby waterways. In many states, it must be part of a nutrient management plan. You can find information on leachate management through your state NRCS office. For general information, read: Mitchell, R., D. Bolinger, and N. Rector. 2002. Controlling silage leachate. MI State University Ext., East Lansing, MI (available online at: http://www.michfb.com/files/maeap/farmstead/tools/Silage%20Leachate%20Management.pdf).
3. Milk Room Waste: Do you have a milk room waste capture system (no=0, planning for one but not within the next year=1, one is planed for instillation within one years=2, yes=3)?	_____ (max = 3)	3. Milk Room Waste: Milk room waste often contains high phosphorous levels that come from chemicals used to clean milking equipment. Careful management of this waste can avoid undesirable impacts. It is usually handled by routing it to a manure holding system or a milk room septic system. You can learn about good management practices from your local NRCS office. For key points about managing this waste, read: Kleinman, P., L. Geohring and T. Steenhuis. 2005. Milkhouse filters. USDA-ARS, University Park, PA and Cornell University, Ithaca, NY. SERA-17 (available online at: http://www.sera17.ext.vt.edu/Documents/BMP_milkhouse_filters.pdf).

21. Planet: Waste Management (cont.)

Waste Management Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
4. Disposal of Used Equipment Fluids: Do you recycle motor oils and hydraulic fluids (no=0, yes=1)?	_____ (max = 1)	4. Disposal of Used Equipment Fluids: Farm equipment can generate many gallons of used motor oil and hydraulic fluids under routine use. Recycling these fluids can avoid significant environmental impacts. To learn more about recycling used equipment fluids, read: South Carolina Dept. of Health and Environ. 2009. Recycle used motor oil. SC Dept. of Health and Environ. Control, Office of Solid Waste Reduction and Recycling. Columbia, SC. OR-0776 (online at: http://www.scdhec.gov/environment/lwm/recycle/pubs/dyp_recycle_oil.pdf).
Waste Management Practices Score (add metric scores)	____ (max = 10)	

Other Resources:

Cornell University. 2010. Recycling dairy plastics. 2010 Recycling Ag Plastics Project: Life cycle stewardship of agricultural plastics. Cornell University. Ithaca, NY (available online at: http://cwmi.css.cornell.edu/Recycling%20Dairy%20Plastics.pdf)

22. Planet: Ethical Animal Care

Well-cared-for livestock are essential to the success and sustainability of dairy agriculture, a point well appreciated by dairy producers. Most dairy producers work hard to maintain the comfort and health of their cattle because they care about their animals, and want to ensure milk quality and sustainable production.

Ethical Animal Care Indicator Worksheet

Practice-based Metrics	Score	Tools for Continuous Improvement
1. Herd Health Protocols: Do you have herd health protocols developed with a veterinarian or consultant (no=0, yes=2/3)?	_____ (max = 2/3)	1. Herd Health Protocols: Producers can stay on top of herd health issues by developing herd health protocols and management plans. Outside experts can provide current information to improve protocols. Protocols for tracking each cow's medical history can best help you manage herd health. For an example of a herd health protocol, read: Stokka, G., J. Smith, J. Dunham, and T. Van Anne. 1996. Dairy preventive herd health program (PHHP). KS State University Ag. Exper. Stn. and Coop. Ext. Serv.. MF2101 (available online at: http://www.ksre.ksu.edu/library/lvstk2/mf2101.pdf).
2. Medications: a. Are all medications only used in prescribed doses and cases (no=0, yes=1/3)?	_____ (max = 1/3)	2. Medications: Medications can be important tools for treating sick cows. They require careful use and tracking of sick cows to ensure their effectiveness. For more about managing medications, read: Kirk, J. 2000. Prudent drug use on dairies. University of California Davis, Veterinary Medicine Extension. Tulare, CA (available online at: http://www.vetmed.ucdavis.edu/vetext/INF-DA/INF-DA_PrudentDrugUse.html).
b. Do you track all medication doses and reasons for treatment (no=0, yes=1/3)?	_____ (max = 1/3)	
3. Animal Health Monitoring: a. Are your animals individually identified (no=0, yes=1/3)?	_____ (max = 2/3)	3. Animal Health Monitoring: Monitoring body condition scores (BCS) and lameness in a dairy herd will track trends in herd health. Condition scores can vary depending on herd stage of lactation, although cows with very low or very high BCS can be managed with a feeding system that can meet your herd's needs. Herd lameness is also an indicator of herd health. For more about BCS, read: Heinrichs, A. and V. Ishler. 1989 Body condition scoring as a tool for dairy herd management. PA State University College of Ag. Coop. Ext. University Park, PA. Extension Circular 363 (available online at: http://www.das.psu.edu/research-extension/dairy/nutrition/pdf/body-condition-scoring.pdf).
b. Is individual animal health tracked on paper or by computer (no=0, yes=1/3)?	_____ (max = 1/3)	
c. Do you regularly monitor body condition scores (BCSs) (no=0, yes=1/3)?	_____ (max = 1/3)	
d. Do you regularly monitor lame animals (no=0, yes=1/3)?	_____ (max = 1/3)	

22. Planet: Ethical Animal Care (cont.)

Ethical Animal Care Indicator Worksheet (cont.)

Practice-based Metrics (cont.)	Score	Tools for Continuous Improvement
4. Employee Training: a. Are your employees given formal training in animal handling (no=0, yes or I have no employees=1/3)?	_____ (max = 1/3)	4. Employee Training: Training employees in proper animal handling helps ensure animal care. Proper handling reduces stress and the likelihood of injury to employees and animals. Understanding handling protocols also eliminates the need for electric cattle prods. For more information, read: Agriculture Canada. 2009. Code of practice for the care and handling of dairy cattle. Nat'l. Farm Care Council. Agriculture and Agri-Food Canada (available online at: http://nfacc.ca/Documents/Document-Item.aspx?id=112.).
b. Are electric prods only used when they will reduce the risk of harm to cattle or humans (no=0, yes=1/3)?	_____ (max = 1/3)	
5. Tail Docking: Is tail docking performed on the dairy (no=1/3, yes=0)?	_____ (max = 1/3)	5. Tail Docking: Tail docking is often used to enhance worker health and udder cleanliness. Recent research indicates that the negative effects of docking may exceed benefits. For a scientific assessment of docking, read: Am. Vet. Med. Assoc. 2006. Welfare implications of tail docking of dairy cattle. Am. Vet. Med. Assoc. Schaumburg, IL (online at: http://www.avma.org/reference/backgrounders/tail_docking_cattle_bgnd.pdf).
6. Cow Space Requirements: a. How much space do you provide for lactating cows (≥1.2 cows/stall for free stall, < 75 sq ft/cow for bedded pack, or <500 sq ft/cow dry lot=0, <1.2 cows/per stall for free stall, > 75 sq ft/cow for bedded pack, > 500 sq ft/cow for dry lot, or use a tie stall barn=1/3)?	_____ (max = 1/3)	6. Cow Space Requirements: Space standards for cattle in free stall barns, bedded packs and dry lot systems have been established to help keep cows comfortable and healthy. For more on space requirements, read: Graves, R. D. McFarland and J. Tyson. 2009. Designing and building dairy cattle free stalls. PA State University College of Ag. Sci. and Coop. Ext. G 76 (available online at: http://www.abe.psu.edu/extension/factsheets/g/G76.pdf). NRCS. 2007. Composted bedded pack dairy barns. Manure Management Information Sheet USDA NRCS, Manure Mgt. Technology Develop. Team, East Nat'l. Tech. Support Ctr. No. 3 (available online at: http://www.or.nrcs.usda.gov/technical/engineering/environmental_engineering/Compost_Netmeeting/Compost_Bedded_Pack_Barn_Info_Sheet.pdf). Stokes, S. and M. Gamroth. 1999. Freestall dairy facilities in central Texas. TX A&M AgriLIFE Extension. College Station, TX. L-5311 (available online at: http://animalscience.tamu.edu/images/pdf/dairy/dairy-freestall-dairy-facilities-in-central-texas.pdf).
b. How much space do you provide for dry cows (≥1.2 cows/ stall for free stall, ≤75 sq ft/cow for bedded pack, ≤500 sq ft/cow for dry lot=0; <1.2 cows/stall for free stall, >75 sq ft/cow for bedded pack, > 500 sq ft/cow for dry lot, or use a tie stall barn =1/3)?	_____ (max = 1/3)	
c. How much space do you provide for heifers (≥1.2 heifers/stall in free stall, ≤75 sq ft/heifer for bedded pack, ≤500 sq ft/cow in dry lot=0, <1.2 heifer/stall in free stall, >60 sq ft/heifer for bedded pack, >500 sq ft/cow for dry lot, or use a tie stall barn =1/3)?	_____ (max = 1/3)	

22. Planet: Ethical Animal Care (cont.)

Ethical Animal Care Indicator Worksheet (cont.)

Practice Based Metrics (cont.)	Score	Tools for Continuous Improvement
7. Heat Stress Avoidance: If you use a dry lot do you provide shade (less then 50% of the cows have shad access=0, more then 50% of the cows have shade=1/3, all pens have shade or I do not use a dry lot=2/3)?	_____ (max = 2/3)	7. Heat Stress Avoidance: Managing heat stress for cattle in dry lot situations improves animal comfort and can improve production. For more on shade requirements, read: Robinson, P. 1998 Managing to prevent heat stress in dairy cows during hot dry weather. University of CA Coop. Ext., Davis, CA (available online at: http://animalscience.ucdavis.edu/faculty/robinson/Articles/FullText/PDF/heat1.pdf).
8. Feed Bunk Space Adequacy: a. How many feet of bunk space do you provide for your lactating cows (<18 inches/cow=0, > or = to 18 inches/cow=2/3)?	_____ (max = 2/3)	8. Feed Bunk Space Adequacy: Adequate feed bunk space ensures all animals have sufficient access to high quality feed and can help ensure herd health and milk production. For more information on feed bunk space, read: Bernard, J. K. and M. J. Montgomery. 1997. Managing intake of lactating dairy cows. University of Tennessee Agricultural Extension Service. Knoxville, TN. PB 1598 (available online at: http://www.utextension.utk.edu/publications/pbfiles/pb1598.pdf).
b. How many feet of bunk space do you provide for your dry cows (<18 inches/cow=0, > or = to18 inches/cow=2/3)?	_____ (max = 1/3)	
c. How many feet of bunk space do you provide for your heifers < 12 inches/cow=0, > or = to 12 inches/cow=2/3)?	_____ (max = 1/3)	
d. Do you feed lactating herd a ration balanced for optimal nutrition (no=0, yes=2/3)	_____ (max = 2/3)	
e. Do you feed your heifers and dry cows a balanced diet for optimal nutrition (no=0, yes=2/3)	_____ (max = 2/3)	
9. Cull Rate: What is your average annual cull rate (cull rate over 35%=0, cull rate between 25% to 35%=1/3, cull rate is under 25%=2/3)?	_____ (max = 2/3)	9. Managing cull rates can reduce herd replacement costs and be a sign of high quality cow care that is leading to a longer productive life. At times there can be good reasons for higher cull rates due to unique circumstance.
10. Somatic Cell Counts: What is your average Somatic Cell Count (SCC) (SCC is over 350,000=0, SCC is between 150,000 and 350,000=1/3, SCC is under 150,000=2/3)?	_____ (max = 2/3)	10. Somatic Cell Counts: Adopting strategies to minimize SCCs can help keep your cows healthy, maintain high milk quality, and increase milk quality premiums. For more about how to reduce SCCs, read: Bagley, C. 2000. Helping dairy producers reduce the SCC. Animal Health Fact Sheet. UT State Univ. Ext.. Logan, UT. AH/Dairy/05 (available online at: http://extension.usu.edu/files/publications/factsheet/AH_Dairy_05.pdf)
11. Milk Urea Nitrogen Levels: What is your average Milk Urea Nitrogen (MUN) level (MUN level is over 16=0, MUN level is under 16=1/3)?	_____ (max = 1/3)	11. Milk Urea Nitrogen Levels: You can use the MUN levels to identify nutritional issues in your herd. High MUN levels can indicate excess protein in the diet. For more about managing MUN levels, read: Amaral-Phillips, D. M. 2001. Tools for diagnosing nutritional problems in dairy herds. University of KY Ext.. Lexington, KY (available online at: http://www.uky.edu/Ag/AnimalSciences/dairy/extension/nut00025.pdf)

22. Planet: Ethical Animal Care (cont.)

Ethical Animal Care Indicator Worksheet (cont.)	
Practice Based Metrics (cont.)	**Score**
Ethical Animal Practices Score (add metric scores)	_____ (max = 10)

Other Resources:

Karszes, J. 1998. Culling rates and profit: Is there a management issue? Cornell University Department of Agriculture, Resource, and Management Economics. Ithaca, NY (available online at: http://www.ansci.cornell.edu/pdfs/culling.pdf).

National Milk Producers Federation. 2009. National dairy FARM animal care manual: Farmers assuring responsible management. Arlington, VA. (available online at: http://www.nationaldairyfarm.com/sites/default/files/NatlDairyFarm_Manual_online.pdf).

National Dairy Animal Well-Being Initiative. 2008. Principles and guidelines for dairy animal well-being. National Dairy Animal Well-Being Initiative, Madison, WI (available online at: www.dairywellbeing.org/pdfs/NDAWI%20Principles%20&%20Guidelines.pdf).

APPENDIX A: A short summary of how the VCI was developed

The VCI was developed using three steps[1]. A key consideration when selecting indicators was to make sure that each indicator is socially relevant to a broad base of stakeholders. Relevant indicators help ensure that the VCI can be used to communicate sustainability considerations among farmers, farm organizations, environmental organizations, retailers, and consumers.

Step 1: The first step was to identify the important stewardship topics of dairy agriculture sustainability, "the things that count," at the farm level. We relied heavily upon input from dairy producers and stakeholders to generate a list of sustainability stewardship topics. This bottom-up approach was essential to ensure that the values and concerns of producers, local communities, and other stakeholder groups were embedded in the VCI.

We used the triple bottom line framework to help guide this work. The triple bottom line framework considers three pillars of sustainability: prosperity (economic), people (social), and planet (environmental) elements. When working with stakeholders, we used the triple bottom line framework to remind them to think broadly about all aspects of dairy agriculture sustainability. We recognize that sustainability is truly about meeting the triple bottom line, of which the financial bottom line is essential.

We used stakeholder meetings at the community level (n=3)[2], regional level (n=1, New England), and national level (n=1) and a focus group composed of over 40 dairy producers (with herd sizes ranging from 80 to > 1,000 cows, including organic and conventional) to generate a list of key stewardship topics. Stakeholders included non-agriculture landowners, agriculture land conservation organizations, land use planners, citizens, environmental organizations, labor organizations, producer co-ops, agriculture scientists, state agency staff, and dairy industry. We also tracked recent agriculture and non-agriculture sustainability efforts (including consumer survey information) to ensure that the VCI included key sustainability topics and could contribute to the greater dairy agriculture sustainability conversation. This was important because the definition of sustainability is rapidly evolving.

Step 2: The second step was to select and test high-quality candidate indicators for each stewardship topic. There were five criteria for selecting indicators for testing: breadth (ability to indicate other elements of the farm system), scientific merit (support from scientific literature), utility (usefulness of the indicator to farmers), practicality (ease with which the indicator can be measured), and social relevance [3]. We selected 175 candidate indicators, which were further reviewed by agricultural scientists, sociologists, environmentalists, agriculture extension staff, producers, and representatives of the dairy industry. We then field tested the candidate metrics by applying them to 31 farms from 11 states: California, Connecticut, Florida, Maine, Massachusetts, New Hampshire, New Mexico, New York, Vermont, Washington, and Wisconsin. This allowed the metrics to be tested with nearly the full diversity of dairy operations in the U.S. This effort was used to increase producer approval, improve practicality, minimize technical flaws, and to statistically identify the fewest number of metrics necessary to accurately assess dairy stewardship and sustainability.

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[1] Hagan, J., and A. Whitman. 2006. Biodiversity Indicators for Sustainable Forestry: Simplifying Complexity. J. Forestry (2006): 203-210.

[2] The three communities represented the diversity of communities with dairy agriculture: agriculture was a small part of the economy in one (Landaff, NH), it was an important land use in another (East Canaan, CT), and it was a major part of the economy and an important land use in the third (Addison Co., VT).

[3] Hagan and Whitman (2006).

Step 3: The third step was to winnow the long list of indicators into a short list of indicators while still adhering to our criteria of breadth, scientific merit, utility, practicality, and social relevance. We did this by incorporating producer responses to the metrics, statistical evaluation, and technical review input from state and national technical teams[4]. It was of paramount importance to make the VCI practical for producers by limiting the VCI to relatively few, easy-to-understand indicators.

[4] California Dairy Quality Assurance Program, National Milk Producers Federation, United Western Dairymen, EnSave, Inc.

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Manomet's mission is to conserve natural resources for the benefit of wildlife and human populations. Through research and collaboration, Manomet builds science-based, cooperative solutions to improve sustainability.

Natural Capital, or ecosystem services, includes all goods and services that we get from nature, such as clean water and air, food, carbon, biodiversity, and wood products. The Natural Capital Initiative at Manomet is helping people conserve functional ecosystems to sustain the well-being, environment, and prosperity of current and future generations.