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Environmental Impacts - Sustainability Indicators of the Dairy Stewardship Alliance
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Section 2. Designing more sustainable LFS and food chains

Sustainable indicators resulting from farmer self assessments completed 2005 through 2009. A joint project with Center for Sustainable Agriculture at the University of Vermont, St. Alban's Cooperative Creamery, Ben & Jerry's Homemade, Inc., Vermont Farmers, University of Vermont Extension, Vermont Agency of Agriculture, Food and Markets with funding from USDA - Sustainable Agriculture Research and Education.

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1. Abstract

Which sustainable practices contribute to increasing environmental stewardship on dairy farms? The Dairy Stewardship Alliance (Alliance) study has developed and vetted sustainability indicators for dairy farming. To be sustainable, practices guided by the indicators must enhance the natural environment and herd health, support profitability and improve the quality of life for farmers and their communities.

The Alliance's Self-Assessment provides measurable indicators for continuous improvement in farming practices. Assessment of agricultural practices is often a reaction to market demand and administrated by external systems which focus on single products. Many farmers are independently interested is assessing and improving the sustainability for their entire farm.

Working with participant farmers, the Alliance's sustainability indicators include modules with a focus on biodiversity, animal husbandry, community health, on-farm energy, soil health, water quality, pest and nutrient management as well as a farm financial inventory. The Alliance is a collaborative effort between dairy farmers, the University of Vermont, Ben & Jerry's Inc., St. Albans Cooperative Creamery and Vermont's Agency of Agriculture.

For farms that have used these indicators to guide management decisions, there have been significant improvements in stewardship practices which reduce environmental impacts. Support is provided for farmers to develop a better understanding of their production practices, explore alternatives and implement changes to improve the sustainability of their farm operations.

The Alliance has enhanced the self-assessment by coordinating similar efforts with farmers in the EU to develop an on-line self assessment. Researchers are examining measures for continuous improvement that might create financial opportunities for dairy farmers and create product value for their co-ops.

The opportunity of using these indicators to develop baseline measurements for carbon credits has lead to the organization of a Northeast Dairy Sustainability Collaborative of dairy cooperatives, processors, researchers and farmers. As a group, we have become involved in an industry wide effort to identify ways to reduce Green House Gas (GHG) emissions and carbon footprints throughout the dairy production and distribution system (Value Chain). A recent focus has been to develop a "low carbon farming" matrix to measure improvements. Future research is necessary to identify technologies and/or innovative approaches to decrease atmospheric concentrations of GHG by increasing carbon sequestration and/or by reducing GHG emissions from agricultural operations.

2. Needs and Challenges

The Dairy Stewardship Alliance helps farmers to conduct a careful analysis of their production practices as they move toward greater stewardship in the areas of water quality, soil, pest and nutrient management; biodiversity, and animal husbandry. The farms also assess their financial stability, energy efficiency and community interactions.

The Alliance has identified a set of sustainability indicators separated into ten (10) modules. These modules were tested and refined with an original group of 52 farmers who voluntarily agreed to be a part of the research. Prior to a second assessment, these farms identified and implemented changes in their production or management practices. These farms then completed the post-test 2nd assessment which documented the areas where changes were and identified needs for further technical assistance.

The Alliance's sustainability indicators have gained a great deal of interest and momentum. St. Alban's Co-op, Ben & Jerry's and Unilever are now considering the expansion and the availability of the on-line version of the assessment as the "Caring Dairy" program to all 520 members of the co-op.

Originally conceived as a hard copy set of ten modules, the 90 page manual is extremely costly to reproduce and to assess results. With the support of Ben & Jerry's/ Unilever, we are moving forward to develop an on-line version of the sustainability indicators as an electronic on-line self-assessment that can be completed and submitted electronically.

3. Objectives/ Performance Targets

Objective: Of 520 farms in the dairy co-op, 52 will participate in the Dairy Stewardship Self Assessment and 40 (76%) of these will each improve at least two identified sustainable production practices in the areas of animal husbandry, biodiversity, community health, energy efficiency, farm financials, nutrient management, organic practices, pest management, soil health management, and water management.

Result: Over a four year trial, 51 (93%) of the Alliance's farms completed the self assessment and received pre-test summary reports. As of 9/30/09, 37 farmers (72.5%) completed the assessment a second time after having implemented changes to increase stewardship practices on their farms.

Objectives/Outcomes:

1. Farmers complete a self assessment of sustainability indicators for ten modules of sustainable dairy practices, receive summary reports and identify additional sustainable practices to implement.

2. During this research, 76% of participating farms improve sustainable farming practices and utilize the self assessment to guide them in meeting Accepted Agricultural Practices (AAPs) and Concentrated Animal Farm Operation (LFO/ MFO) certification requirements.

3. The Dairy Stewardship Alliance and University Extension will identify future areas for technical assistance as identified through the research summary results.

4. The final edited version of the Dairy Stewardship Sustainability Indicators is published and distributed with recommendations for on-going development and application throughout the Northeast Region.

4. Accomplishments

Milestones

Milestone 1: 520 farmers and dairy specialists receive detailed background information concerning On-Farm Self Assessment for Sustainable Practices.

Initial information on the Dairy Stewardship Alliance (DSA) was distributed to all members of the St. Alban's Co-op through their membership coordinator and Co-op newsletter. While the DSA was originally directed at the 520 members of St. Alban's Co-op, participation expanded to any interested dairy farmers in Vermont. As a result, farmers from two other Co-ops, Agri-Mark and Organic Valley also participated. The Secretary of the Board of St' Alban's Coop participated in the research, as did all farmer advisory board members of the "Young Cooperators" advisory board members. Throughout the project, 5 different farmers served on our DSA advisory task force.

Milestone 2: 52 farms are identified for participation by Extension, NRCS, VT Pasture Network, and Agency of Agriculture. During the Mid-Phase, these farmers complete the Dairy Stewardship Self Assessment and help to refine the tool kit.

During the course of this project, 55 farmers volunteered to participate in the assessment and received their own copies of the Self Assessment Tool Kit. Of these, 51 farmers enrolled and completed the first assessment (Pre-test). The original 12 farms served as a group of advisors who helped to revise and edit the text of the manuals. In addition, as each of the other farmers completed their assessment, their input was gathered by researchers for the final editing of the manual, which was then tested with the final group of farmers.

As of the end of the project period, Ben & Jerry's/Unilever was working to update an on-line version based on the Dairy Stewardship Alliance's self assessment, combined with the format used by "Caring Dairy" project in The Netherlands.

Milestone 3: Self-Assessment Modules are revised and pre- and post-assessments are completed by 40 farms for planning and decision making concerning new practices to implement and technical assistance needs.

Over the full length of this project, we continued to collect edits in order to make the modules more farmer friendly and to be able to standardize results. 72.5% (37)of the farms who completed the assessment a first time (Pre-test) moved forward to identify changes and complete the assessment a second time (Post-test) after their changes had been made.

> The final report for the Dairy Stewardship Alliance (USDA-NESARE LNE06-243) which documents the sustainable indicators and changes implemented for all farms is available at http://www.uvm.edu/sustainableagriculture in their publications section
> The modules and self assessments are available on-line at http://www.benandjerrys.com/activism/inside-the-pint/more-about-milk/dsa/

5. Outcomes/ Impacts

Farmers and advisors involved in the Alliance assessments have made at least 30 educational presentations on the value of this experience to a wide variety of farm and community groups, and many have written numerous articles on the Alliance. (Sample article is attached in Appendix 6.4)

> Over the course of this four year research project, 51 farmers complete baseline pre-test assessments of their "Indicators for Sustainability" for all modules of their dairy farming practices. Within two years, 72.5% (37) of these farms identified additional sustainable practices to implement, and documented their changes by completing the 2nd assessment (Post-test). Farmers identified sustainable farming practices that they could consider implementing and

utilized the self-assessment to guide them in meeting the state required Accepted Animal Practices (AAPs) and Large Farm Operations (LFO)/ Medium Farm Operations (MFO) certification requirements.

Through farmer scores on the assessments, the Dairy Stewardship Alliance identified biodiversity, energy enhancement, water quality and farm safety as the most immediate areas for needed technical assistance.

The modules were edited and the final edited version of the Dairy Stewardship Self Assessment is accessible through the Internet.

Our findings were presented to over 1,200 individuals to conferences such as the Northeast Dairy Conference Forum, the VT Grass Farmers Association, and the European Association for Animal Production annual meetings.

Ben & Jerry's/Unilever continues partnering with representatives of Wageningen University, CONO-Co-op/ Beemester and their "Caring Dairy" project in the Netherlands, to develop and on-line version of the "Sustainability Indicators" for dairy farms. CONO Coop, makers of Beemster Cheese, have already implemented the process with its 500 Dairy Co-op members, and there are expectations that St. Alban's Co-op may be able to implement the process with its 500+ members within the next year.

6. Summary Background

In 2003, Ben & Jerry's joined forces with the University of Vermont's Center for Sustainable Agriculture and the St. Albans Cooperative Creamery, Inc. to form the Dairy Stewardship Alliance. The Alliance's primary goals were:

To provide an on-farm self-assessment of sustainability indicators designed to help dairy farmers measure & evaluate the environmental, social and economic aspects of their farm operations

To provide information about sustainable indicators for dairy farming practices

To provide a foundation for further research and development of programs promoting sustainability in agriculture

To date the group's efforts have focused on testing and evaluation of the on-farm self-assessment formally known as the Dairy Farm Sustainability Toolkit (or "Toolkit" for short). Originally developed for Ben & Jerry's by graduate students from the Corporate Environmental Management Program at the University of Michigan, the Toolkit is a comprehensive set of 10 Educational Modules, each corresponding to one of ten key indicators for sustainable dairy farming in Vermont, against which farmers can self-assess their farm management practices and performance over time.

Purpose

The purposes of this initiative to:

Provide an on-farm assessment tool for sustainability indicators for dairy farms

Educate and communicate information on sustainable dairy farming practices

Create a foundation for ongoing work in sustainable agriculture.

The Dairy Stewardship Alliance's creation of a self-assessment tool helps the farm to assess farm management strategies which include environmental, social and economic goals.

7. Methodology

The self-assessment tool has 10 modules encompassing social, environmental and economic indicators:

ANIMAL HUSBANDRY	NUTRIENT MANAGEMENT
BIODIVERSITY	ORGANIC (included only for informational purposes)
COMMUNITY HEALTH	PEST MANAGEMENT
ENERGY	FARM FINANCIALS
SOIL QUALITY	WATER MANAGEMENT

Brief Explanation of Modules:

Animal Husbandry:
Focus on areas such as: herd nutrition, overall health, health of incoming and outgoing animals, milk quality, lactation management and cull rates, housing and handling areas, stalls, pasturing and milking equipment, parlor, and calf raising conditions.

Biodiversity:
This refers to all plants, animals, and microorganisms existing and interacting within an ecosystem. In an agriculture setting, this can be viewed in layers: microorganisms and worms living in the soil; native plants, crops, and trees growing on top of the soil; and insects, birds, and animals inhabiting the plants, crops, and trees.

Community Health:
Community health is defined as the strength of the community in which a farmer operates. Strong community relations and respect for agriculture can lead to a better quality of life for farmers. Research shows that the support received from a community can significantly impact a farmer's job satisfaction. Consequently, this module evaluates a farmer's working environment through two main criteria: community relations and protection of labor supply.

Energy:
There are two main types of energy: renewable and non-renewable described in this module. Non-renewable energy is an energy resource that is not replaced or is replaced only very slowly by natural processes. Primary examples of non-renewable energy resources are the fossil fuels—oil, natural gas, and coal. Renewable energy is any energy resource that is naturally regenerated over a short time scale and derived either directly or indirectly from the sun, or from other natural movements and mechanisms of the environment. Examples of renewable energy are things such as: thermal, photochemical, photoelectric, wind, hydropower, photosynthetic, geothermal and tidal energy. In order to gain maximum farmer participation in adopting best management practices, it is necessary to outline how the dairy farmer benefits from managing their energy use.

Farm Financials:
Farm Financials is a module designed to assess the financial performance of a farm enterprise. Through the use of key ratios, and the quality of life the farmer leads, this section describes the merits of monitoring financial performance of the farms. Monitoring financial performance can help farmers control their costs for managing and perhaps even growing their businesses.

Nutrient Management:
Nutrients are needed to sustain healthy animals and crops. Adopting best practices for nutrient management is important to maintaining ground water that is safe for drinking and surface waters that can support healthy aquatic ecosystems, function as industrial and commercial water supplies, and provide recreational enjoyment.

Organics:
Note: This module is not used in the ranking and provides information and a summary of the regulations rather than certification questions.
Organic farms are those certified under the USDA National Organic Program. The USDA National Organic Program is defined in the United States Federal code and is the only legally recognized standard for organic products in the United States. Because only an accredited organization can certify a farm as organic under the requirements of the USDA National Organic Program.

Pest Management:
Since the 1940's, chemical pesticides such as herbicides, insecticides, fungicides, rodenticides, and plant growth regulators have been the dominant approach to controlling and eliminating pests. There is a growing concern regarding the use of pesticides as they have the potential to cause harm to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms. These concerns led to an alternative approach called Integrated Pest Management (IPM), that is a pest management strategy that focuses on long-term prevention or suppression of pest problems through a combination of techniques such as monitoring for pest presence and establishing treatment threshold levels, using non-chemical practices to make the habitat less conducive to pest development, improving sanitation, and employing mechanical and physical controls. Elements of the IPM are integrated into this module.

Soil Health:
This module focuses on best management practices to maximize soil quality and health in order to maximize production and minimize erosion and pollution to water or air. Recommended areas of management include monitoring overall quality, minimizing erosion, maximizing organic content and preventing soil compaction.

Water Management:
This module will focus on best management practices dairy farmers can use to minimize and prevent water pollution and, to a lesser extent, to promote appropriate water use. General areas to be covered include preventing pollution from livestock yards, storage areas and milk house waste, general land management strategies and management of water use.

Rank Scoring

After completing the first assessment, participating farmers each receive a report with detailed charts showing how they scored in each of the different topic areas of the modules. Their first chart shows their individual farm results and the second chart presents their scores in comparison to the overall averages for all farms for each module area. In this way the farmer can see how they've scored in relation to all the other farms completing the self assessment. (See Appendix)

The scoring is done based on a 'red', 'yellow' and 'green' color coding, in a sort of "traffic light" system where 'green' indicates that sustainable practices are being used. 'Yellow', indicates that some level of sustainable practices are being used, however additional attention could be added to improve them. Finally, a 'red' score shows areas within an evaluation which are in need of improvements to be corrected in order to be more sustainable overall. The organic module is included for informational purposes and there are no specific questions for this area.

Table 7-1 Scoring System for Module Total Scores

Module	Green			Yellow		Red	
	Maximum	High	Low	High	Low	High	Low
Animal Husbandry	41	41	35	34	25	24	9
Biodiversity	26	26	21	20	16	16	6
Community Health	28	28	23	22	19	18	12
Energy	20	20	16	15	13	12	6
Farm Financials	33	33	28	27	20	19	6
Nutrient Management	25	25	21	20	16	15	7
Pest Management	30	30	26	25	18	17	5
Soil Health	24	24	21	20	15	14	6
Water Management	32	32	27	26	20	19	7

Design and Process

From July 2005 until June 2009 assessments gauging a variety of indicator criteria related to sustainability were conducted on dairy farms throughout the state of Vermont. During this time, fifty-five (55) farms volunteered to become involved in the research being conducted by the Dairy Stewardship Alliance. Fifty-one (51) farms successfully completed a ten module self assessment inventory composed of 67 ranked questions on sustainability of their farming practices. Farmers then received a report ranking their results, identifying and providing a comparison of their results against all other farms completing the assessment. Seventy-two percent (72%) or 37 of those farms identified changes or improvements in their farming practices. These farms then documented the changes made by completing the self assessment a second time. Farmers were provided a final report identifying the results of their first assessment versus their second assessment for all modules, as well as a report of their ranked scores and changes compared to all other farms completing the final assessment.

The initial time a farm filled out the assessment it was referred to by researchers as 'assessment one' or the 'Pre assessment' and correspondingly, the second time a farm fill out the assessment, the document was referred to by researchers as 'assessment two' or 'Post- assessment'. With a time gap of 12-24 months between the first and second assessment, researchers were able to document a number of changed conditions/practices being reported on these farms. When taken in sum, an analysis of these findings indicates an increase in sustainability related practices/indicators has occurred during the project period. Data from these assessments tell an interesting story about practices on dairy farms and selected findings are presented below.

The assessment tool contained nine distinct modules (or categories) to be ranked as indicators, plus a tenth information module on organic farming practices to consider. The indicator modules were Animal Husbandry, Biodiversity, Community Health, Energy, Farm Financials, Nutrient Management, Pest Management, Soil Healn.th, and Water Management. Each module contained a series of 6-9 questions related to the module theme. Some of these questions were quantitative in nature and others more qualitative. When assessments were collected from farms, answers to each of the 67 questions were ranked and assigned a quantitative value then weighted. When added together the values of these answers helped to create Module Index Scores (MIS) for each farm. A more comprehensive indicator score, Total Index Score (TIS) was created for each farm which consisted of the sum of a farm's nine individual MIS scores.

Database Methodology

Scalability and Inferential Integrity

Initially, all data was entered into an EXCEL spreadsheet. Reproducing the reports for farmers, and accessing information details proved to be difficult and time consuming. During 2007 all data collected from the Dairy Stewardship Alliance has been migrated into Microsoft Access 2007. This system established a structured data base structure that provided relationships and inferential integrity between different tables (see figure 4.1). This system ensures scalability while maintaining flexibility in the development to meet future growth and complexity requirements.

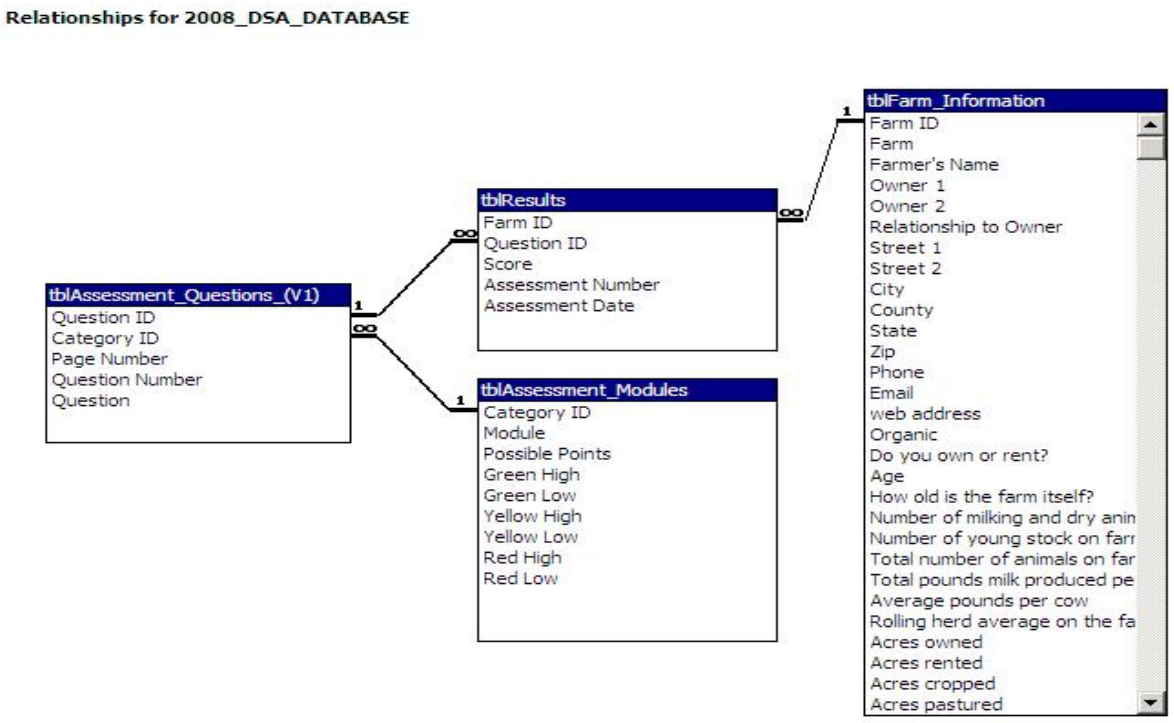


Figure 7-2 Inferential Integrity in the DSA Database

Prior to 2007 all of the data existed in Microsoft Excel. While Excel provides strong presentation and shorter development time, benefits of migration to Microsoft Access include increased performance as the data storage of Access is faster than Excel. In addition data extraction is streamlined through Access reports, integration with Microsoft Excel, or third-party applications such as Crystal Reports. Finally, the migration to Access will give the researchers the ability to upscale to SQL Server for web based data entry, collection and reports.

Transparency of Analytical Processes

Users can audit the database to see named ranges, formulas, and macros that are creating the interlocking system of calculations, linked cells, and formatted summaries that work together as an intricate system to create a final analysis. This ensures there are no hidden steps in the analysis.

Separation of Data and Presentation

ACCESS separates the analytical data into components: tables, queries, and reports. These components are less sensitive to changes and create an environment where changes to the database can easily be implemented and custom analysis can be created at request without destroying previous analyses.

8. Findings/Results

Post-test Results: Interpreting the values from the 2nd Assessments

When added together the value of the scores from each question within an individual DSA Module determines the module score. The value of these answers helped to create Module Index Scores (MIS) for each farm, which was shared with each farmer so they could see how they ranked themselves. As a more comprehensive indicator score, the Total Index Score (TIS) was created for each farm which consisted of the sum of a farm's nine individual MIS scores, allowing them to compare their overall results with those of all other farms involved.

Across the farms making changes and completing the second assessment, researchers saw a 12.2 average increase/improvement in TIS between the first assessment and second assessment (186.5 and 198.7 respectively). The average total MIS for all farms increased by 1.35, however the level of change did deviate between different farms and across different modules. When looking at the average MIS, all of the modules except the Farm Financial module showed an increase in sustainability related indicators. Farmers were more reluctant to share the specifics of their farm financial information. Therefore, the final edit of assessment changed the format of the Financial module to include a series of positive or negative responses to their record-keeping and financial analysis, rather than asking for specific financial indicators.

The most significant changes in conditions/practices were all quantitatively positive and were seen in the Animal Husbandry (+2.59), Water Management (+1.86), Soil Health (+1.81), and Community Health (+1.71) modules.

Chart 1 below outlines the average MIS for each assessment and the observed change between assessments for all farms. Chart 2 plots the average change between the MIS recorded during the first and second assessment for all farms. Chart 3 graphs the MIS average scores recorded during the first(pre-test) and second (post-test) assessments for all farms making changes and completing the assessment twice.

Module	1st Assessment Average	2nd Assessment Average	Average Change
Animal Husbandry	31.13	33.72	2.59
Water Management	23.28	25.14	1.86
Soil Health	17.26	19.07	1.81
Community Health	18.61	20.32	1.71
Pest Management	20.93	22.41	1.48
Biodiversity	17.17	18.59	1.41
Nutrient Management	20.25	21.43	1.18
Energy	13.57	13.89	0.32
Farm Financials	24.38	24.15	-0.23

Chart 1: Comparison of Average Module Index Scores across all Farms

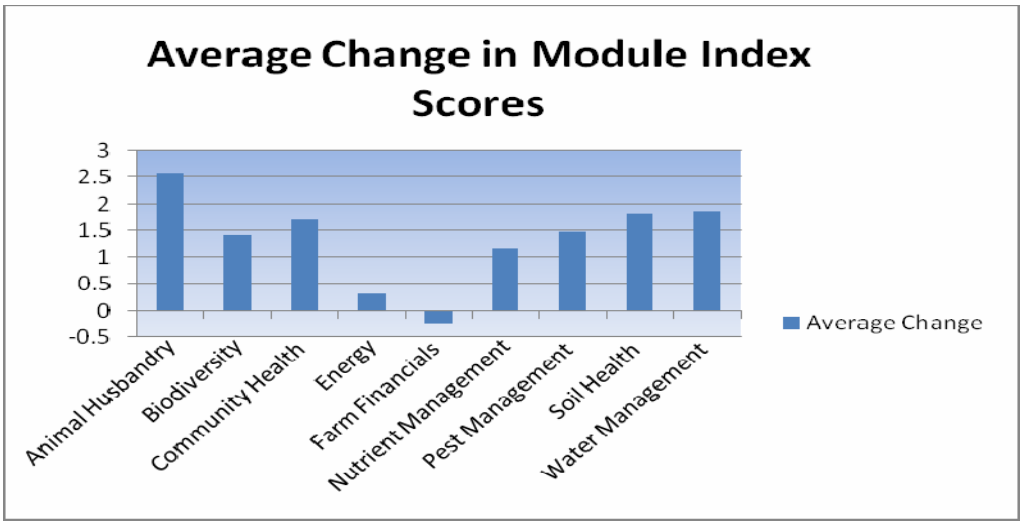


Chart 2: Average Change in Module Index Scores for all Farms

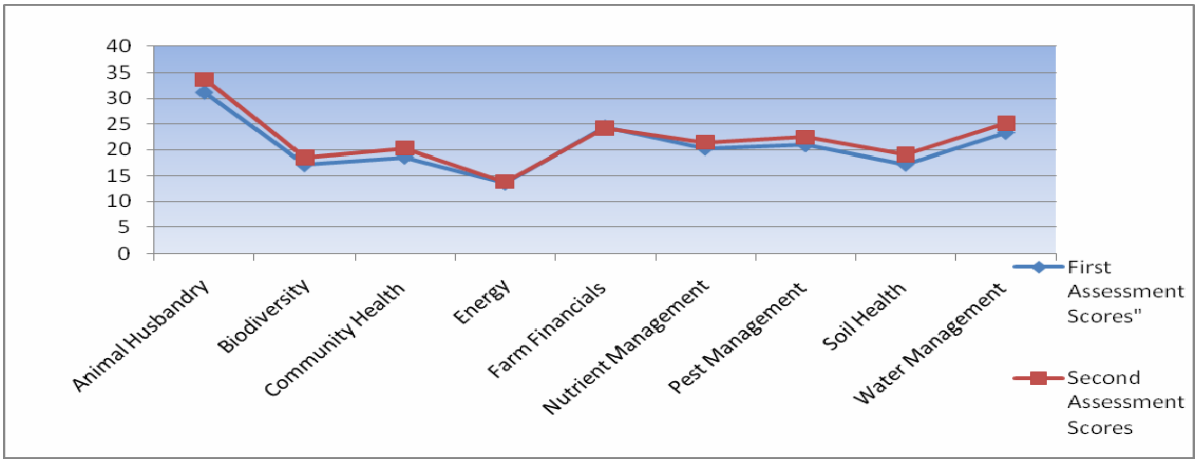


Chart 3: Average Module Index Scores for first and second assessments.

Although the TIS and MIS do help convey a great deal of information, in and of themselves these scores do not shed light on specific on farm practices/indicators identified within each module. In order to glean detailed information regarding specific indicators for changes in farming practices, an analysis of the data which of the specifically ranked indicators within the MIS and TIS scores was conducted. This process included the development of an average score for each of the 67 questions answered by farmers on both the first and second assessments. Fifty-eight of these average scores were then placed on a spectrum ranking level-of-change (because of the changes made in the final version, the questions related to Farm Financials were not included). This ranking ordered scores from those that changed the most to those that changed the least.

The greatest change in practice observed was found within the Soil Health Module, specifically an increase use of cover crops on farms. The second greatest change observed was part of the Animal Husbandry module. Particularly, a greater number of

farms have been working to improve the health status of incoming and outgoing animals by the use of practices such as examining animals, washing animals, and/or requiring visitors to wear booties before entering barns. The third greatest change in practices observed was within the Nutrient Management module. Researchers detected an increased use of, adherence to, and documentation of nutrient management plans.

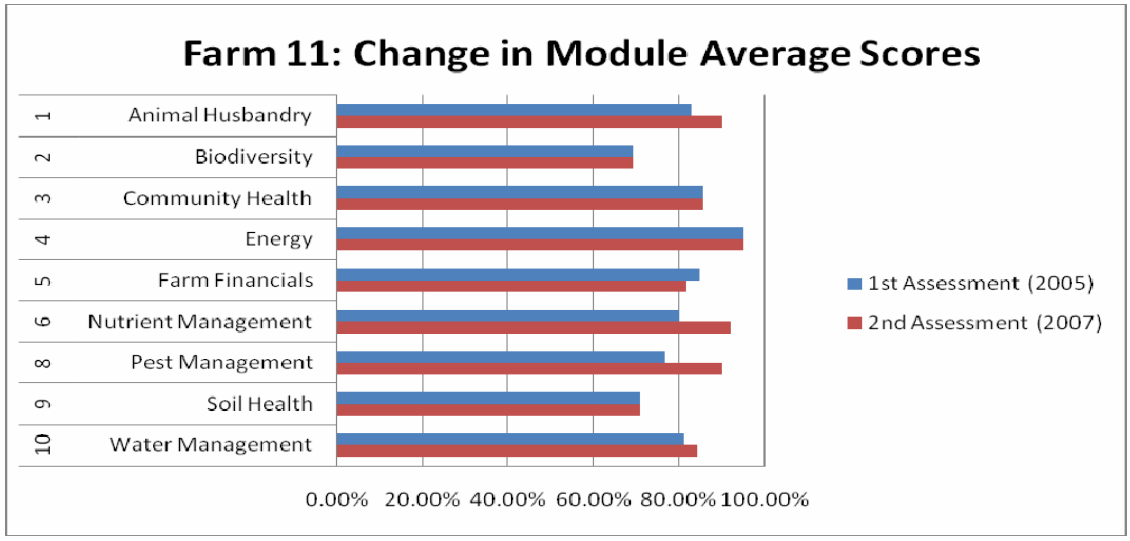
Looking further at this data, we see the five greatest specific changes in practices/indicators occurred across five different modules. The top ten changes in practices/conditions were distributed between seven of the nine modules. This may indicates farmers are receptive to making changes related to sustainability rankings across multiple facets of their operations. The graph below (Chart 4) outlines the top ten changes in practices which were observed.

CHART 4: Top Ten Changes in Practices

Individual Farm Results: Charts and Summary

EXAMPLE FARM # 11:

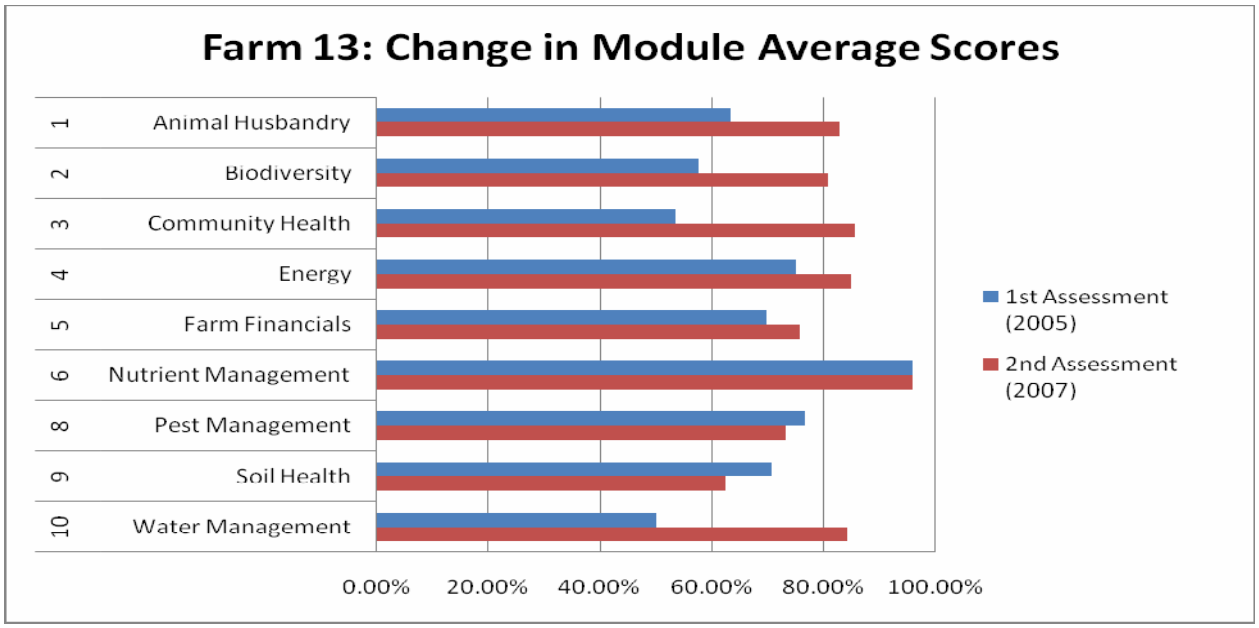
To protect their confidentiality, all participating farms received an identifying code number. The chart below indicates that "Farm #11" showed marked improvement between the first and second assessments in several key areas, and has remained constant in others. Areas of improvement include animal husbandry, as well as nutrient, pest, and water management. Significant strides were made in nutrient and pest management. Their results show a focus on trying to improve crop management. While making improvements in several areas, the farm was able to maintain the same level of sustainability in other areas, which indicates that the new management practices that employed have smoothly integrated into the whole farm practices and are not so labor intensive that they detract from other areas of the farm. Farm financials was the one area in which this farm scored a lower percentile on the second assessment as compared to the first. There are many possible reasons for this including the drastic drop in milk prices in 2006 and again in 2009. Financial indicators are affected by farm management and by the variable economy, and farmers can expect the financial module scores to fluctuate more than some of the other modules.



Comparison of Results of Pre- vs. Post Assessments for Farm #11

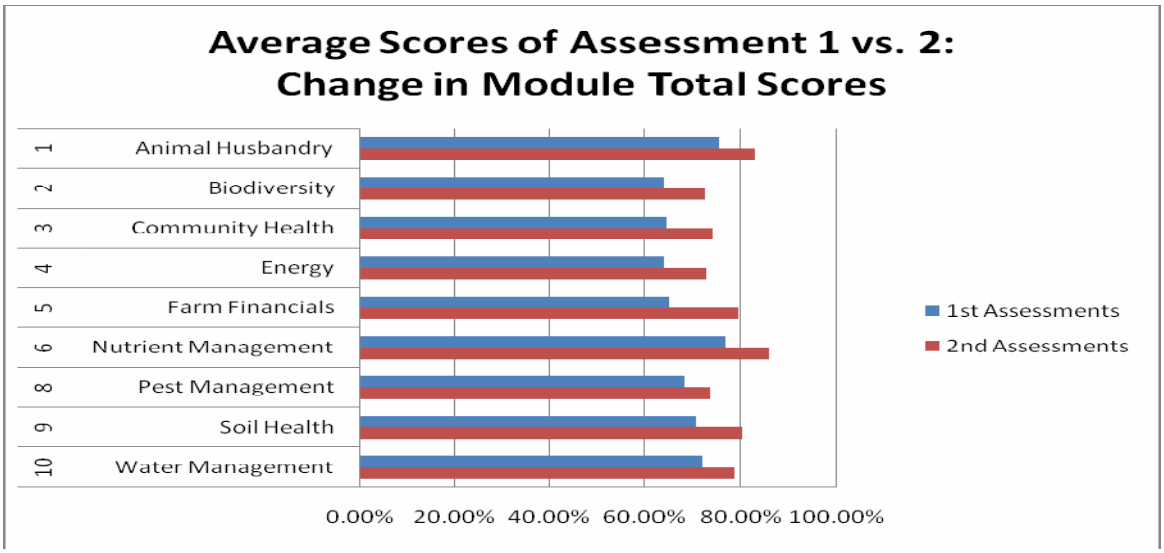
Example Farm #13: Charts and Summary

Farm 13 really focused and made great progress in many of the areas including scoring 34% higher in water management, 32% higher in community health, and 23% higher in biodiversity. This intense honing of management practices in certain areas took a small toll on other aspects on the farm with both soil health and pest management going down by 3.3% and 8.3% respectively. This may mean that the new practices adopted by the farm are too time consuming, or that implementing them at first proved to be a challenge so that other areas of the farm were not as closely managed as usual. However, the two modules that did go down did not go down that much, so hopefully farm 13 will become more adept at executing a more sustainable management plan. Eventually, it is expected that they will be able to bring up the other modules to the original level of sustainability, if not higher. Another possibility is that the questions in those modules were unclear so the farmer systematically marked the practice with a lower score when unsure exactly where the farmer's practices fell under. Not having a technical assistant available for guidance or consultation, was a problem observed in these earlier self assessments. Over time, as the modules were edited, using famer input, each module section gained clarity, and the result was less confusion by the farmers involved.



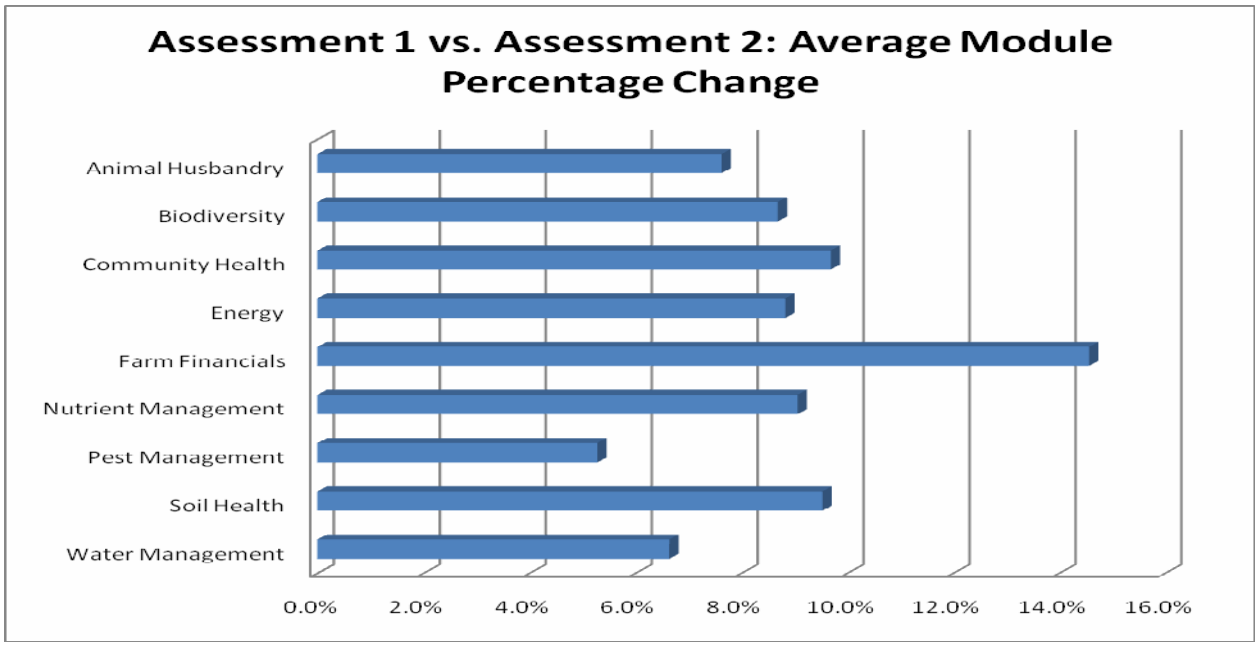
Comparison of Results of Pre- vs. Post Assessments for Farm 13

Comparison of 1st and 2nd Assessments across all Farms



	Module	Avg 1st	Avg 2nd	Possible Points	AvgOf1 as %	AvgOf2 as %	% change
1	Animal Husbandry	30.87	34.00	41.00	75.30%	82.93%	7.6%
2	Biodiversity	16.56	18.82	26.00	63.71%	72.40%	8.7%
3	Community Health	18.05	20.76	28.00	64.47%	74.16%	9.7%
4	Energy	12.76	14.53	20.00	63.82%	72.65%	8.8%
5	Farm Financials	21.46	26.27	33.00	65.03%	79.60%	14.6%
6	Nutrient Management	19.21	21.47	25.00	76.82%	85.88%	9.1%
7	Pest Management	20.47	22.06	30.00	68.25%	73.53%	5.3%
8	Soil Health	16.95	19.24	24.00	70.61%	80.15%	9.5%
9	Water Management	23.05	25.18	32.00	72.04%	78.68%	6.6%

Overall Increase in Sustainability Rankings across all Farms



Overall, there were measureable positive changes in the scores for all modules between the pre and post-tests. Providing up to date information and education on sustainable practices for dairy farms was a secondary, underlining objective when designing the Diary Stewardship Self Assessment. It was extremely encouraging to see positive change over time in all areas of the assessment.

Sustainability Indicators - Interpretation of Results

Our initial experience after interviewing the first 12 famers involved, indicated that that we needed to make a few changes in the phrasing of the individual questions being scored and to use terminology that the farmers they themselves suggested. For example, a confinement operation, not growing their own crops, may not respond accurately to the questions in that section, because some of the questions did not seem applicable to their farm. Or, an organic farm, not using chemical pesticides, may leave some of the questions blank, based on their interpretation of the questions. This meant that the assessment or particular modules in the assessment had to be revised for a second printing before proceeding with Phase II farms after the first year of research.

Overall, the farms that participated were able to implement new sustainable measures in certain areas without neglecting other parts of the farm. This is very important because this assessment is only pertinent if it can help farmers not only identify parts of their farms that could become more sustainable but also suggest solutions that are able to be integrated into their overall management. Individual farms seem to be implementing a focused approach to tackling improved sustainability.

The areas within a module which received the lowest rankings, were identified in a report to the farmer. Farmers were encouraged to implement whichever changes seem the most feasible to them, while continuing to manage farm in a similar way as before the assessment. This seemed to be a very effective method because farmers were able to make significant steps toward sustainability without completely overhauling their farming practices or becoming burnt out.

Both the Caring Dairy and the Dairy Stewardship Alliance models encourage a farm focus on two or three modules a year, and to make changes at a reasonable pace. Eventually, they will be able to obtain additional technical assistance and education in each of the Sustainability Indicators. This makes implementing changes toward sustainability a systematic and successful ongoing process.