

SECTION: PLANET

VITAL CAPITAL INDEX FOR DAIRY AGRICULTURE, VERSION 3.0 (DRAFT BETA 3 FOR PEER REVIEW)

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INTRODUCTION AND PURPOSE

Manomet, in collaboration with Agri-Mark/Cabot Creamery Cooperative (Agri-Mark), conceived of the **Vital Capital Index for Dairy Agriculture** (VCI) as a tool to help dairy farmers assess, benchmark, and manage the sustainability performance of their farms. Equally important, the VCI provides results that dairy farmers can use to communicate efforts of continuous improvement with a variety of stakeholders. The VCI is composed of practical, field-tested, science-based indicators developed to address a wide range of sustainability topics. This document is a beta version of VCI 3.0 that is currently under review by selected dairy farmers from the northeastern U.S. Two prior versions of the VCI have been developed and field tested.

Vital Capital refers to the five key capitals that are essential for human well-being and sustainability:

- *Natural Capital* is any stock or flow of energy and material that produces goods and services and is synonymous with ecosystem services (e.g., resources, processes).
- *Human Capital* consists of people's health, knowledge, skills and motivation which are vital to productive work.
- *Social Capital* consists of the institutions that help us maintain and develop human capital
- *Built or Manufactured Capital* is composed of material goods or fixed assets which contribute to infrastructure and the production process.
- *Financial Capital* is the money which plays a key role in our economy, enabling the other capitals to be owned and traded.

BACKGROUND

In 2013, Manomet, in partnership with Agri-Mark, launched version 3.0 of the online Vital Capital Index (VCI) to aid dairy farmers with benchmarking their sustainability and managing twelve key topics of stewardship (Table 1). With support from the Innovation Center for Dairy Agriculture, Manomet developed a beta VCI through discussions with dairy farmers and by reviewing dozens of leading farm sustainability frameworks, and then synthesizing those findings with review from industry experts. Version 3.0 is a confidential tool that begins with 12 questions of “Awareness” on key sustainability topics, and then will drill deeper on a topic-by-topic basis into three additional modules. The VCI’s four modules together are identified as M.A.P.P.S. – for the *Manomet Awareness, Practice, Performance and Sustainability* process. [Please note: VCI Module 1, the Awareness level, is “live”; the other sections are currently in development]. The VCI uses a go-at-your-own-pace approach, including the ability to easily enter and exit the tool. Ultimately, the VCI provides a snapshot of a farm’s sustainability story as well as a roadmap for a farm’s stewardship opportunities. The VCI takes a triple-bottom-line approach by covering economic, social and environmental components of sustainability. It takes dairy farmers about 15 minutes to complete Module 1 of the VCI. This document contains draft indicators for modules 2, 3, and 4 for review. A draft of the complete VCI has already been reviewed in the field on four pilot farms.

Pressing environmental and social issues related to dairy agriculture are occupying more and more of dairy farmers' time. The VCI was designed to help dairy farmers tackle these challenges by addressing a dozen core sustainability topics ranging from farm management to food safety to water stewardship. Farmers can use it as a benchmarking tool to track their continuous improvement. The results can help farmers communicate their sustainability story to supply chains and neighbors alike. Most importantly it allows farmers to be comprehensive and develop sensible strategies for tackling these challenges while enhancing the viability and stewardship of their operations.

Table 1. The triple bottom lines and twelve sustainability topics in the Vital Capital Index for Dairy Agriculture, beta v.3.0.

Triple Bottom Lines	Related Twelve Topics
Prosperity	Business Oversight and Strategy
	Farm Management
	Review of Farm Operations
People	Farm Family Well-being
	Consumer Well-being
	Employee Well-being
	Local Community Well-being
Planet	Animal Care and Well-being
	Land Stewardship
	Ecosystem Conservation
	Energy, Waste, and Greenhouse Gas Emissions
	Water

DESCRIPTION OF MODULES 1, 2, 3, AND 4

The VCI has four modules that provide the platform upon which farmers can take a business-based approach to sustainability (Figure 1). The underlying indicators were field-tested and are practical and science-based.

MODULE 1: AWARENESS

A farmer can use Module 1 to identify their awareness and engagement on key sustainability topics. In Module 1, each indicator question has four possible responses. The user selects the one response that best describes the degree with which a key sustainability practice has been applied on their farm. The four possible responses are scored between 0 and 0.8 points per topic, with a total maximum of 10 points across the entire module (including 0.4 points for participating). A higher score indicates that a user has a high level of awareness of these key farm sustainability topics.

MODULE 2: PRACTICE

Module 2 is composed of indicators to identify the various sustainability practices a dairy farmer might apply to their farm. Each indicator is a question regarding use of a list of related practices. Each practice has a weighed score based on the extent to which it might improve outcomes relevant to a specific topic. For each topic in Module 2, the scores of all responses to an indicator question are summed up. Total scores for each topic can range from 0 to 10 depending on which practices have been identified. A farmer can use Module 2 to benchmark practices and self-assess which additional ones might be considered in order to enhance their operations. A high score simply indicates that a user identified many sustainability practices in place on their dairy.

MODULE 3: PERFORMANCE

Module 3 is composed of two types of performance indicators: (1) *Key Management Indicators* which describe the performance or level of the management around a specific topic, and (2) *Key Performance Indicators* describing the performance regarding a specific topic. *Key Management Indicators* score from 0 to 10. A “0” indicates no management practices are in place with regard to the topic; a “10” indicates strong management practices are in place to manage dairy farm risks. The *Key Management Indicators* are intended to capture key, holistic synergies among practices that can enhance the sustainability of a dairy. High scores indicate that a strong system is in place for managing a specific topic.

Key Performance Indicators have their own units and will include benchmarks from other sources in the future. Many of the *Key Performance Indicators* are widely in use in dairy agriculture already. Although the levels of both types of indicators are directional, what is sustainable is undefined as this could vary among dairy farms. A farmer can use Module 3 to assess and track continuous improvement on their farm performance over time.

MODULE 4: SUSTAINABILITY

Using a context-based approach¹, Module 4 allows farmers to see if they are sustainable for key topics. These indicators measure farm or business performance in terms of impacts on vital capitals, relative to current

¹ McElroy and van Engelen 2012.

standards or norms (legal or broad-based social) in order to ensure stakeholder well-being². We include context-based metrics for sub-topics wherein farmers may have obligations or responsibilities to themselves and/or other stakeholders (e.g., suppliers, employees, neighbors, consumers, et al.), typically following legal requirements and based on our interpretation of strongly prevailing social norms. For some topics, we determined that farmers do not currently have legal requirements or clear responsibilities and so did not include a context-based metric.

Figure 1: The four modules of the Vital Capital Index for Dairy Agriculture, beta v.3.0. Each of the 12 topics have indicators in each module.



² McElroy and van Engelen 2012.
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PLANET

The planet refers to various aspects of the environment and natural world that provide essential benefits to support all living things. Agriculture will no doubt come under increasing scrutiny with regard to its environmental impacts unless farmers can show that they are already acting in environmentally responsible ways⁵⁶. This can help avoid regulatory burdens and be used to explain to customers and consumers how dairy farmers are land stewards. Key topics include animal care and well-being, biodiversity (including wildlife), land stewardship, energy, waste, and greenhouse gas emissions, and water (both quantity and quality).

TOPIC #8 - ANIMAL CARE AND WELL-BEING

Dairy farmers focus many of their efforts on maintaining the health of their cows because well-cared-for cows produce high-quality milk. They maintain their herd health by providing nutritious diets, good living conditions and good medical care. Most farmers participate in animal care programs to help demonstrate that they have a caring relationship with their animals. Farmers that don't provide adequate care for their cows can undermine the reputation of the industry and viable markets for dairy products.

8.1 AWARENESS INDICATOR

Dairy farms rely on healthy, productive cows. Participation in animal care programs sends a clear signal to buyers, processors, and consumers about the importance of animal care. Widely recognized programs include: American Humane Certified™, Animal Welfare Approved, Certified Humane Certification Program, Food Alliance, Global Animal Partnership's 5-Step Program, Humane Farm Animal Care, Milk and Dairy Beef Quality Assurance Program, National Milk Producers Federation FARM Program, New York State Cattle Health Assurance Program (NYS CHAP), and Northwest Sustainable Dairies. By sustaining healthy cows, farmers are able to maintain their reputation for animal care and maximize milk production on their farms.

8.1.1 Does your farm currently participate in a widely recognized animal well-being program (0.8 pt)?⁵⁷

- a. Hardly or Not at All (0 pt)
- b. Somewhat (0.2 pt)
- c. Mostly (0.5 pt)
- d. Yes (0.8 pt)

8.2 PRACTICE INDICATORS⁵⁸

8.2.1 Health Management: Management includes having a Herd Health Plan, standard operating procedures (SOPS), employee/family worker training, and record keeping. Which of the following herd management BMPs do you apply on your farm (1.5 pts)?

- a. The dairy has a documented Veterinarian/Client/Patient Relationship (0.5 pt).⁵⁹

⁵⁶ Aigner et al. 2003

⁵⁷ Farm Indicator 1.1: Animal Care Guidelines (Innovation Center for U.S. Dairy 2014).

⁵⁸ Includes major BMPs from the NMPF FARM Program (National Milk Producers Federation 2013).

⁵⁹ Farm Indicator 1.2: Veterinary Care (Innovation Center for U.S. Dairy 2014).

- b. Documentation exists of training for new and existing animal caretakers at least on an annual basis (0.2 pt).
- c. Written SOPs are readily available, and in many cases posted, in the native languages of personnel assigned animal care responsibilities and cover Herd Health Plan, newborn management, feed and nutrition management, and non-ambulatory animal management (0.2 pt)
- d. Emergency contact information is readily available to address animal care needs arising from unique circumstances such as a fire or natural disaster, equipment failures and power failures (0.2 pt).
- e. Each animal is permanently identified and an effective record-keeping system is employed for animal care and management decision making (0.2 pt).⁶⁰
- f. A specific milking routine, procedures and actions are followed to ensure cow comfort and well-being (0.2 pt).

8.2.2 Calf Care: To thrive, calves require special attention to diet, including colostrum intake which entails adequately training employees/family workers for their care. Which of the following calf care BMPs do you apply on your farm (1.2 pts)?

- a. All calves receive colostrum or colostrum replacer soon after birth, even if immediately transported off the farm (0.2 pt).
- b. Calves receive a volume and quality of milk or milk replacer to maintain health, growth and vigor until weaned or marketed (0.2 pt).
- c. Calves have access to palatable, clean, fresh water as necessary to maintain proper hydration (0.2 pt).
- d. Calves are offered fresh, palatable starter feed (0.2 pt).
- e. Identified animal caretakers are trained in calf care nutritional requirements, including use of esophageal tube feeders and other feeding mechanisms (0.2 pt).
- f. Tail docking is planned to be phased out or does not occur (0.2 pt).

8.2.3 Nutrition: Animals require a routine of adequate feed and water to provide sufficient nutrition to live and be highly productive. Which of the following nutrition BMPs do you apply on your farm (1.5 pts)?

- a. All animals have access to clean, fresh water as necessary to maintain proper hydration (0.3 pt).
- b. Rations provide the required nutrients for maintenance, growth, health and lactation for the appropriate physiological life stage (0.3 pt).
- c. Feed equipment is washed and disinfected after being used for non-feed purposes (0.3 pt).
- d. Sufficient feed bunk space is provided that allows all animals to feed at the same time or sufficient quantities of feed are available for all animals during a 24-hour period (0.3 pt).
- e. Employees/family workers who feed are formally trained in preparing and dispensing feed (0.3 pt).

8.2.4 Animal Health: A Herd Health Plan can create a platform for ensuring appropriate nutrition, housing, and disease prevention and detection, along with treatment that helps maintain herd health. Which of the following animal health BMPs do you apply on your farm (1.7 pts)?

- a. The dairy has a written Herd Health Plan, developed in consultation with the herd veterinarian, to prevent common diseases or conditions such as mastitis, lameness, metritis, metabolic diseases, displaced abomasum, pneumonia and infectious diarrhea (0.5 pt).
- b. The Herd Health Plan is reviewed and updated annually (0.1 pt).
- c. Navels are dipped in an effective antiseptic solution as soon as possible (0.1 pt).
- d. Calves are disbudded at eight weeks of age or earlier and with appropriate use of analgesics and/or anesthetics (0.1 pt).

⁶⁰ Standard TI.a (Assurance Food Safety 2014).

- e. All other planned medical procedures are performed at the earliest age possible and with appropriate use of analgesics and/or anesthetics (0.1 pt).
- f. Ninety percent or more of all animals in all pens score 2 or less on the NDFP Hygiene Scorecard (1 is clean, 4 is dirty) (0.1 pt).
- g. Ninety-five percent of the lactating and dry dairy herd scores a 2 or less on the NDFP Locomotion Scorecard (1 is sound, 2 is moderately lame, 3 is severely lame) (0.1 pt).
- h. The dairy farmer is taking action to improve animals with severe lameness (0.1 pt).
- i. A lameness prevention protocol is in place (0.1 pt).
- j. Ninety-nine percent of all classes of animals score a body condition score of 2 or more on the NDFP Body Condition Score Scorecard (1 is thin, 5 is fat) (0.1 pt).
- k. The dairy farmer is taking action to improve animals with body condition scores less than 2 (0.1 pt).
- l. Ninety-five percent or more of lactating and dry dairy herd score a 2 or less on the NDFP Hock and Knee Lesion Scorecard (1 is no hair loss/ swelling, 2 is some hair loss; no swelling, 3 is severe swelling and/or abrasion through hide) (0.1 pt).
- m. Medications are only used following manufacturer- and veterinarian-prescribed label directions and withdrawal times (0.1 pt).

8.2.5 Environment and Facilities: Proper management of the cow's environment can protect them from weather extremes and ensure their safety and care. Which of the following facilities BMPs do you apply on your farm (1.2 pts)?

- a. Protection from heat and cold are provided for all age classes; using shade, fans, water cooling, and/or windbreaks (0.2 pt).
- b. Protocols are in place to minimize airborne particles as a way to reduce odors and dust (0.2 pt).
- c. Housing allows cattle to easily stand up, lie down, adopt normal resting postures and have visual contact with other cattle (0.2 pt).
- d. Cattle have a bed that provides comfort, insulation, warmth, dryness and traction (0.2 pt).
- e. The dairy farmer monitors and takes action for slips and falls (0.2 pt).
- f. A clean, dry, well-lit, well-ventilated calving area is used (0.2 pt).

8.2.6 Handling, Movement, and Transportation: Which of the following handling BMPs do you apply on your farm (1.4 pts)?

- a. Animal caretakers working in animal movement are trained on the principles of flight zones and flight distances to know the importance of controlling the animal movement in lanes, alleyways and other parts of the complex (0.2 pt).
- b. Animal caretakers have signed a cow care agreement written in their primary language (0.4 pt).
- c. The dairy uses the "Top 10 Considerations for Culling and Transporting Dairy Animals" in handling and transportation decision making (0.2 pt).
- d. Animal caretakers are trained to handle and restrain calves with a minimum of stress to the animal (0.2 pt).
- e. Calves are moved by lifting, walking or mechanical conveyance (0.2 pt).
- f. Transport devices used to move calves are clean, and properly designed and maintained (0.2 pt).

8.2.7 Special-Needs Animals: Being prepared for special-needs animals is a key step for successfully managing these cows and minimizing stress to the cow and employees/family workers. Which of the following special needs BMPs do you apply on your farm (1.5 pts)?

- a. Special-needs animals are not restricted from feed and water for more than four hours (0.2 pt).

- b. The Herd Health Plan addresses non-ambulatory animal management and includes specific protocols for euthanasia consistent with recommendations from the American Association of Bovine Practitioners and the American Veterinary Medical Association (0.3 pt).
- d. Facilities are provided to segregate sick or injured animals; these facilities provide protection from weather (0.2 pt).
- e. Self-locking stalls provide an emergency release for a non-ambulatory situation (0.2 pt).
- f. Timely and prompt marketing of animals is part of the management plan (0.2 pt).
- g. Designated animal caretakers have been trained and proper equipment is available to move non-ambulatory animals. Special equipment for injured or non-ambulatory animals is available (0.2 pt).
- h. Trained animal caretakers are available when sick, injured, non-ambulatory or dead animals must be moved (0.2 pt).

8.3 PERFORMANCE INDICATORS

KEY MANAGEMENT INDICATOR

9.3.1 **Animal care and well-being:** Which of the following best described the level of animal care management on your farm (10 pts)?⁶¹

- The dairy participates in a widely recognized animal well-being program, has a written Herd Health Plan, and has a documented Veterinarian/Client/Patient Relationship. Appropriate measures are applied to support good health, exhibition of normal behavior, adequate feedings, and adequate space for cows. The dairy also takes proactive action to ensure animal well-being (e.g., employee training) (5 pts).
- The dairy participates in a widely recognized animal well-being program, has a written Herd Health Plan, and has a documented Veterinarian/Client/Patient Relationship. Appropriate measures are applied to support good health, exhibition of normal behavior, adequate feedings, and adequate space for cows (4 pts).
- The dairy participates in a widely recognized animal well-being program, has a written Herd Health Plan, and has a documented Veterinarian/Client/Patient Relationship. No actual harm to cows is identified, but only minimum measures necessary to promote good health, exhibition of normal behavior, adequate feedings, and/or adequate space (3 pts).
- The dairy participates in a widely recognized animal well-being program and has a Herd Health Plan that is not written down. It lacks a documented Veterinarian/Client/Patient Relationship. Only minimum measures necessary to mitigate adverse impacts to animal well-being are implemented in response to impacts to animal well-being (1 pts).
- The dairy does not currently participate in a widely recognized animal well-being program, and lacks a Herd Health Plan and a documented Veterinarian/Client/Patient Relationship. No measures to mitigate adverse impacts to animal well-being are implemented (0 pts).

KEY PERFORMANCE INDICATORS

9.3.2 **Milk Quality:** The Somatic Cell Count (SCC) is a key indicator of milk quality. Most somatic cells are white blood cells which can increase in numbers in milk as an immune response to a mastitis-causing pathogen. Farmers are financially rewarded for low herd SCCs and penalized for high ones, because cell counts reflect the quality of the milk produced. A low SCC indicates better animal health. As the number of somatic cells increases, milk production is likely to fall, primarily due to mastitis pathogens.

⁶¹ Based on National Milk Producers Federation (2013), Veissier et al. (2011), and Fontes et al. (2014).

a. Average Somatic Cell Count: [standard laboratory procedure]

9.3.3 **Herd Nutrient Balance:** Milk urea nitrogen is the fraction of milk protein that is derived from blood urea nitrogen (MUN). It can become abnormal with changes in ration balancing, feeding management and nutrient balance. It may be a useful test for diagnosing herd problems and identifying opportunities to improve protein supply in feed though other additional is necessary to ensure optimal diets.

a. Average Milk Urea Nitrogen Level: [standard laboratory procedure]

9.3.4 **Cull Rate:** Farmers cull dairy cows to remove unhealthy and less productive cows from the herd. Excessive cull rates can increase expenses and increase the relative environmental impact, including emissions of greenhouse gases.

a. Average Annual Cull Rate = Number of cows removed due to poor health or low productivity / Herd size

8.4 SUSTAINABILITY INDICATOR

8.4.1 **Animal Care:** People differ widely in their assessment of animal care on dairy farms. Animal care programs are well-established and are advised by scientists and veterinarians to ensure that they are science-based. They are used to provide a reference or benchmark for farms regarding animals care. Meeting or exceeding the standards of these programs indicates that a farmer is providing sufficient care for his/her cows. (sustainable would be "C" or better)

a. Animal Care Program Participation: Do you meet or exceed the standards of an animal care program ("c" is considered sustainable) (10 pts)?

- a. Currently doesn't participate or mostly does not meet
- b. Mostly compliant with OR mostly compliant and undergoing corrective action response (1 pt)
- c. Always compliant with OR currently compliant with and have fulfilled corrective action plans for compliance failures (5 pts)
- d. Always compliant with and Mostly Exceed (7 pts)
- e. Always compliant with and Far Exceed (10 pts)

TOPICS #9 - LAND STEWARDSHIP

Land stewardship is the responsible use of natural resources to maintain productivity of lands for present and future generations. In agriculture, the focus is primarily on the productivity and management of agricultural lands though conservation of wildlife and their habitats can also be a consideration.

9.1 AWARENESS INDICATOR

9.1.1. **Nutrient Management Plan:** A nutrient management plan helps ensure the effective and efficient use of manure and other nutrients on a farm. Does your farm currently have a written nutrient management plan that is approved by state agencies or the NRCS in your state (1 pt)⁶²?

- a. Hardly or Not at All (0 pt)
- b. Somewhat (0.2 pt)
- c. Mostly (0.5 pt)
- D. Yes (0.8 pt)

9.2 PRACTICE INDICATORS

Land stewardship is managing land responsibly for your benefit and for the benefit of future generations. It entails appropriate management of croplands, pasture, pests, and soils, including management of their nutrients.

NUTRIENT MANAGEMENT (4 PTS)

Nutrient management is the system used by farmers to manage the amount, form, placement, and timing of the application of nutrients to plants. In dairy agriculture, it also includes the management and use of manure. Careful nutrient management can improve productivity and profitability, and reduce excess nutrients, and reduce their loss to the environment.

NUTRIENT MANAGEMENT PLANNING (2 PTS)⁶³

9.2.1. **Updating Your Nutrient Management Plan:** How often is the nutrient management plan for your farm updated (0.5 pt)?

- a. Every 5 years or less often (0 pt)
- b. Every 3 years (0.25 pt)
- c. Every year (0.5 pt)

9.2.2. **Setbacks:** Which of the following best describes your setback practices on your farm to keep nutrients from getting into surface water (0.5 pt)?

- a. I don't use setbacks when storing manure and applying nutrients (0 pt)
- b. I follow state-level setbacks for storing manure away from water bodies (0.25 pt)
- c. I follow state-level setbacks when applying nutrients near water bodies and flowing water (0.45 pt)

⁶² Any nutrient management plan that includes the minimum specific elements of the NRCS Comprehensive Nutrient Management Plan (CNMP) can be considered.

⁶³ Incorporates portions of Unilever Sustainable Agriculture Code, Section 2.3, Nutrient Management (King et al. 2010).

- d. I exceed state-level setbacks when applying nutrients near water bodies and flowing water (0.5 pt)

9.2.3. Feed Management: Which of the following practices are used to control nutrient levels in animals diets (1 pt)

- a. Diets are formulated to meet the requirements of the animals by a nutritionist, feed company, or software (0.14 pt)
- b. Animals are feed by groups (high producers, low producers, dry cows, close-up cows, heifer groups) (0.14 pt)
- c. There is a system for evaluating diet dry matter on the farm (0.12 pt)
- d. Diets are adjusted daily to weekly for changes in dry matter (0.12 pt)
- e. Dry matter intake is determined daily to monthly (0.12 pt)
- f. Heifer diets are tracked by monthly Average Daily Gain and/or month of first calving (0.12 pt)
- g. Diets are routinely analyzed for nutrients (e.g., N, P, K, NDF, CP, ADF) (0.12 pt)
- h. Manage for optimal protein levels in feed by groups (0.12 pt)

MANURE STORAGE (1 PT)

9.2.4. Manure Storage: Which of the following best describes your manure storage system (select one) (0.5 pt)?

- a. I don't have a manure storage system (0 pts)
- b. Meets your needs for your herd size and the storage period (0.3 pts)
- c. Complies with regulatory requirements for capacity and construction design (0.45 pts)
- c. Exceeds with regulatory requirements for capacity and construction design (0.5 pts)

9.2.5. Alternative Manure Management Systems: Which of the following alternative manure management systems do you use to improve nutrient management (select all that apply) (0.5 pt)?

- a. None (0 pt)
- b. Compost manure (0.1 pt) (includes conformity with NRCS Practice code 317)
- c. Manure digester (0.1 pt) (includes conformity with NRCS Practice codes: 365 and 366)
- d. Whole farm nutrient management which considers the import and losses of nutrients on the farm and export of milk, meat, crops, or manure (0.3 pt).

MANURE AND FERTILIZER APPLICATION (1 PT)

9.2.6. Frequency of Soil Testing: How often do you typically test the soil for nutrients in your fields and pastures (0.5 pt)?

- a. Every 6 years or less often (0 pt)
- b. Every 3 to 5 years or as yields dictate (0.25 pt)
- c. Every 1 to 2 years (0.5 pt)

9.2.7. Nutrient Application Levels: Which of the following practices do you apply to manage nutrient levels when applying manure and other fertilizers (check all that apply) (0.5 pt)?

- a. Test your manure for N, P, and K levels before spreading and/or irrigating (0.08 pt)
- b. Set nutrient applications based on a nitrogen balance (0.04 pt)
- c. Set nutrient applications based on a phosphorous balance (0.08 pt.)
- d. Calibrate your manure spreader(s) so that you know your application rate (0.08 pt)

- e. Spread your manure over wide enough acreage to address regulatory requirements and/or avoid excessive levels of nutrients in soils (can include distribution off farm) (0.06 pt.)
- f. Set your manure and fertilizer application rates based on crop needs (0.08 pt.)
- g. Take a legume nitrogen credit when you plow down legumes in a crop rotation (0.02 pt.)
- h. Regularly measure nutrient value of grown feed, forage, and pasture as part of forage management (0.06 pt)
- i. use other materials for nutrients (e.g., biosolids, wood ash)

SOIL, CROPLAND, AND PASTURE STEWARDSHIP (3 PTS)

The stewardship of farmland and its soils is essential to ensuring sustainable production of feed and forage for your farm's dairy herd. It can take considerable investment but can lead to reduced feed costs and impacts to the environment.

9.2.8. Field Records: Which of the following records do you keep for each field and use it their management (check all that apply) (1 pt)?⁶⁴

- a. Crop yields (0.09 pt)
- b. Pasture rotations (0.03 pt)
- c. Manure application rates (0.09 pt)
- d. Fertilizer application rates (0.09 pt)
- e. Soil tests (0.2 pts)

9.2.9. Soil Conservation: Which of following soil conservation BMPs do you apply as needed to minimize erosion and compaction (1 pt)?⁶⁵

- a. The risk of soil erosion and loss is routinely assessed and managed **OR** soil erosion does not occur on my farm (0.34 pt)
- b. The risk of soil erosion from fields is seasonally assessed and managed (e.g. erosion control, riparian buffer strips, drain design) **OR** soil erosion does not occur on my farm (0.33 pt)
- c. The risk of soil compaction is annually assessed and managed **OR** soil compaction does not occur on my farm (0.33 pt)

9.2.10. Crop and Pasture Stewardship: Which of following crop and pasture stewardship BMPs do you apply as needed to maintain soil health minimize erosion and compaction (1 pt)?

- a. Apply crop rotation that includes a perennial crop (0.3 pt)
- b. Limit the number of consecutive years of planting annual crops (e.g., corn, soybeans, cereal grain) in your crop rotation (0.25 pt)?
- c. Apply no-till or minimum-till planting techniques (includes conformity with NRCS Practice codes 345, 329, 346) (0.25 pt.)
- d. Use cover cropping at least one winter in five (0.2 pt)

PEST MANAGEMENT (3 PTS)⁶⁶

⁶⁴ Incorporates portions of Unilever Sustainable Agriculture Code, Section 3.3, Soil Management (King 2010).

⁶⁵ Incorporates portions of Unilever Sustainable Agriculture Code, Section 3.3, Soil Management (King 2010).

⁶⁶ Incorporates portions of Unilever Sustainable Agriculture Code, Section 2.4 Pest Management (King et al. 2010).

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 in fields reduces crop losses and associated costs and increases the efficiency of your operations. Pest control in barns reduces feed losses and maintains herd health. When well-managed, pest management reduces losses and does not compromise animal welfare, employee/family worker health, or the environment. Careful planning and management of pesticides can ensure that you are able to achieve your pest control goals at a low cost.

9.1.2. Integrated Pest and Weed Management (IPM) Plan: An IPM plan focuses on effective control of pest outbreaks in the barn, on cropland, in forage or elsewhere to minimize damage and costs. It incorporates pest monitoring, safety, and proper application of chemicals. Does your farm currently have an Integrated Pest and Weed Management plan (1 pt)?⁶⁷

- a. Hardly or not at all (0 pts)
- b. Somewhat (0.2 pt)
- c. Mostly (0.7 pt)
- d. Yes (1 pt)

9.2.11. Application Best Management Practices (BMPs): Which of the following practices do you or your pesticide applicator apply on your farm (0.5 pts)⁶⁸?

- a. Do not use pesticides, herbicides and fungicides on your farm (0.5 pts)
- b. Have a pesticide licensed employee, family worker, and/or contractor to apply pesticides, herbicides and/or fungicides on your farm (0.2 pt)
- c. Keep records of all chemical applications by field, crop and year (0.05 point)
- d. Only use pesticides, herbicides and/or fungicides registered for use within your state (0.15 pt)
- e. Use cultural control to prevent build-up or survival of weed seeds and pest eggs and larvae (0.1 pt)

9.2.12. Pesticide selection: Which of the following factors do you consider when selecting pesticides, herbicides, and/or fungicides (select all that apply) (0.5 pts)?

- a. Chemicals to target specific pests or weeds (0.3 pt)?
- b. Chemicals with the lowest toxicity, potential environmental impact, and/or least potential negative impact to beneficial organisms (0.15 pt)?
- c. Chemicals with low risk of developing resistance by pests or weeds and avoid those with known pest-resistance problems (0.05 pt)?

PESTICIDE APPLICATION (1 PTS)

Careful application of pesticides can help minimize application costs, maximize the effectiveness of pesticides in reducing losses, and protect you, your employee, family workers, and environment.

9.2.13. Pre-application practices: Which of the following practices do you employ when scouting and applying pesticides, herbicides, and/or fungicides (select only one) (0.45 pts)?

- a. apply them without scouting fields (0 pts)
- b. scout fields and only spray fields that are in need (0.3 pt)
- c. scout fields and spot spray affected areas of fields (0.45 pts)

⁶⁷ Follows WWF (2015) - F. Pollution, Waste, and Greenhouse Gas Emissions Indicator 51

⁶⁸ Follows WWF (2015) - F. Pollution, Waste, and Greenhouse Gas Emissions Indicators 53 and 54,

9.2.14. Application practices: Which of the following practices do you use when applying pesticides, herbicides, and/or fungicides (check all that apply) (0.45 pts)?

- a. maintain legally required spray buffers around water bodies (0.15 pt)
- b. dispose of all chemical-contaminated materials in a way that meets legal requirements (0.1 pt)
- c. check application equipment and calibrate your sprayer more than once a year (0.05 pt)
- d. conduct annual training to employees/family workers who come in contact with chemicals that require safety training (0.15 pt)

9.2.15. Rodent and Fly Control: Which of the following practices do you usually apply first to control flies and small animals (birds and rodents) (select all only one) (0.1 pt)?

- a. Cultural methods (i.e., trapping, barriers, draining standing water, composting manure) (0.1 pt)
- b. Cultural methods plus chemical control (0.07 pt)
- c. Chemical control (0.01 pt)

9.2.16. Weather factors during application: How does weather factor into your application of pesticides, herbicides, and/or fungicides (check one of the following) (0.3 pt)?

- a. weather does not factor into application **AND/OR** I apply at any time (0 pt)
- b. apply only in no- to low-wind periods (0.15 pt)
- c. apply only in low- to no-wind periods using drop nozzles (0.3 pt)

9.3: PERFORMANCE INDICATORS

KEY MANAGEMENT INDICATOR

9.3.1 **Nutrient Management**: Which of the following best described the level of nutrient management on your farm (10 pts)?⁶⁹

- a. The dairy follows a written nutrient management plan that is approved by a state agency or NRCS, and relies on the advice of a crop consultant for determining levels of nutrient application. Appropriate measures are applied to minimize nutrient loss and optimize nutrient use and avoid unnecessary pesticide impacts while maintaining productivity, protecting ground and surface water quality, maintaining soil health, and benefiting farm financial returns. The farm also takes many proactive actions to nutrient and pest management (e.g., employee training, annual soil sampling, use of precision ag.) so that significant negative impacts are avoided (10 pts).
- b. The dairy follows a written nutrient management plan that is approved by a state agency or NRCS, and relies on the advice of a crop consultant for determining levels of nutrient application. Appropriate measures are applied to minimize nutrient loss and optimize nutrient use and avoid unnecessary pesticide impacts while maintaining productivity, protecting ground and surface water quality, maintaining soil health and benefiting farm financial returns (8 pts).
- c. The dairy follows a written nutrient management plan that is approved by a state agency or NRCS and uses IPM. No actual harm to soil health or water quality is noted, but dairy only applies minimum measures necessary to minimize nutrient loss and optimize nutrient use and avoid unnecessary pesticide impacts while maintaining productivity, protecting ground and surface water quality, maintaining soil health, and benefiting farm financial returns (5 pts).

⁶⁹ NRCS, NHCP 2011. Nutrient management. Natural resources conservation service conservation practice standard. 590-1
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- d. The farm has a written nutrient management plan and IPM that is haphazardly followed. Minimum measures necessary to mitigate adverse impacts are only implemented when there are large impacts to soil health and ground and surface water quality (2 pts).
- e. The dairy lacks a written nutrient management plan and IPM. No measures to mitigate adverse impacts to soil health and ground and surface water quality are implemented (0 pts).

KEY PERFORMANCE INDICATORS

NUTRIENT MANAGEMENT

9.3.2 **Manure use:** Percentage of manure generated that is managed according to a nutrient management plan.

9.3.3 **Nitrogen recovery rate:** Ratio of the amount of nitrogen in the harvested crop to the amount of nitrogen applied⁷⁰. Typically these data are identified in a nutrient management plan.

SOIL CONSERVATION

9.3.4 **Conservation Tillage:** Percent of planted acres leaving > 30 percent residue (mulch, ridge, and/or no-till).

9.3.5 **Cover crop coverage:** Percent of cultivated areas where cover crops are used.

PESTICIDE USE:

9.3.6 **Pesticide use:** Pounds of active ingredient of pesticides, herbicides, and fungicides applied / acre of crop land, pasture, and forage area (pounds/acre). Active ingredient amounts are reported on the label.

9.3.7 **Use of low risk pesticides:** Percent of active ingredient of pesticides, herbicides, and fungicides applied that don't require buffers near waterbodies / total pounds of active ingredient of pesticides, herbicides, and fungicides applied (percent). Similar to Chemical Use metric in the Unilever Sustainable Agriculture Code - Appendix 1.

9.4 SUSTAINABILITY INDICATORS

9.4.1. **Soil erosion (%):** Percent of cropland, forage land, and pasture where the ratio of annual soil loss (tons/acre) is less than the annual soil formation (tons/acre). If 100% then a farm operation should be sustainable.

7.4.2. **Pesticide use:** Many regulations governing the use of chemicals including pesticide in agriculture were developed to protect public health. These can include local, state, and federal regulations concerning air and water quality and application and management of farm chemicals. When a farm has had no regulatory actions in the last year OR is compliant with corrective action plans then the dairy is considered sustainable. Which of the following best describes the compliance of your dairy farm with local, state, and federal regulations concerning pesticides and management of farm chemicals ("c" or better is sustainable)?

- a. Mostly doesn't not achieve compliance with regulations related to the application and management of pesticides

⁷⁰ Similar to Nitrogen Balance metric in Unilever Sustainable Agriculture Code - Appendix 1.

- b. Mostly compliant with regulations OR mostly compliant and undergoing corrective action response (1 pt)
- c. Always compliant with regulations OR currently compliant with and have fulfilled corrective action plans for compliance failures (5 pts)
- d. Always compliant with regulations and mostly exceed regulations (7 pts)
- e. Always compliant with regulations and far exceed regulations(10 pts)

CONFIDENTIAL

TOPIC #10. ECOSYSTEM CONSERVATION⁷¹

An ecosystem is a complex set of relationships among species and their chemical and physical environment in an area. It takes in biodiversity, the vast diversity of life and includes wildlife. It also includes natural capital which are the key natural benefits provide by nature to farmers and surrounding communities, such as game, fish, fire wood, lumber, wild nuts, fruits, and berries, recreation, flood control, climate regulation, and clean water.

10.1 AWARENESS INDICATORS

9.1.3. Ecosystem Management Plan: Many different farm plans take into account ecosystem conservation. Does your farm currently have an ecosystem conservation plan that is approved by state agencies, NRCS in your state or is part of an easement? This can include nutrient management plan, an NRCS conservation or soil conservation plan, participation in an NRCS program, easements, or a forest management plan Yes (0.8 pt)⁷²?

- a. Hardly or Not at All (0 pt)
- b. Somewhat (0.2 pt)
- c. Mostly (0.5 pt)
- D. Yes (0.8 pt)

10.2 PRACTICE INDICATORS

CONSERVATION PLAN (2 PT)

10.2.1. Conservation Plan: Do you have a conservation or wildlife plan for your farm or do you participate in any of the following conservation programs (select all that apply) (2 pt)?

- a. No (0 pt)
- b. I have my own conservation and/or wildlife plan (0.02 pt)
- c. NRCS Conservation Programs (ACEP, EQIP, WHIP, CSP, GLCI, AMA, Other) (0.03 pt)
- d. State or regional conservation program (0.03 pt)
- e. Farmland conservation easement (0.03 pt)
- f. Land conservation easement (0.03 pt)
- g. Forest management plan (0.03 pt)
- h. Other programs or tools used (please provide the name) (e.g., high conservation value assessments) (0.03 pt) _____

HABITAT MANAGEMENT (8 POINT)

10.2.2. Habitat Management: Which of the following habitat types do you manage for conservation values? (0.5 pt)

- a. or NA Forests (0.1 pt if Yes or NA)

⁷¹ Includes draft Wildlife indicators from the Innovation Center for U.S. Dairy (2014). Incorporates portions of Unilever Sustainable Agriculture Code, Section 5.3 Biodiversity Protection and Enhancement (King et al. 2010).

⁷² Nutrient management plan includes addressing the minimum specific elements of the NRCS Comprehensive Nutrient Management Plan (CNMP).

- b. or NA Grasslands (0.1 pt if Yes or NA)
- c. or NA Wetlands (0.1 pt if Yes or NA)
- d. or NA Marginal lands (0.1 pt if Yes or NA)
- e. or NA Waterbodies (0.1 pt if Yes or NA)
- f. or NA Other (list) (0.1 pt if Yes or NA) _____

10.2.3. Wildlife-friendly management techniques for fields and cropland: Which of the following practices do you apply to fields and/or croplands that benefit wildlife (check NA if not applicable to your farm) (0.5 pt)?

- a. or NA Crop rotation (0.04 pt)
- b. or NA Buffer strips (0.09 pt)
- c. or NA Grass waterways (0.04 pt)
- d. or NA Contour farming (0.07 pt)
- e. or NA Restricted livestock access to water bodies (0.09 pt)
- f. or NA Residue left in field (0.04 pt)
- g. or NA Other conservation Practices (please list): _____ (0.04 pt)
- h. or NA Other conservation Practices (please list): _____ (0.04 pt)

10.2.5. Rare species and habitats: Every state has a natural heritage program which can provide information about state or federally listed species and state-listed natural habitats (S1 and S2, G1, and G2) on your land. Has your land been evaluated for the occurrence of state/ federally listed species and/or state-listed natural habitats (S1 and S2, G1, and G2) and, if present, is there a conservation plan in place (maybe local, state, or federal) and/or have you applied conservation practices to maintain them on your land?

State and/or federally listed species	<input type="checkbox"/> a. occurrence not evaluated	<input type="checkbox"/> b. occurrence evaluated	<input type="checkbox"/> c. Conservation plan in place and/or maintained on land
State-listed habitats (S1 and S2, G1 and G2)	<input type="checkbox"/> d. occurrence not evaluated	<input type="checkbox"/> e. occurrence evaluated	<input type="checkbox"/> f. Conservation plan in place and/or maintained on land

10.2.6. Riparian Area Management: Conserved riparian areas provide habitat for riparian and aquatic species and help protect water quality of aquatic ecosystems. Which of the following practices are applied on your farm land next to water bodies (streams, rivers, lakes, and ponds) and wetlands (select all that apply)(1 pt)?

- a. Mostly maintain a vegetated buffer wider than 30 feet
- b. Apply water quality BMPs for farm road (0.04 pt)
- b. Restrict livestock access to water bodies (0.06 pt)
- c. Stream and water body bank protected from erosion (0.1 pt)

10.3: PERFORMANCE INDICATORS

KEY MANAGEMENT INDICATOR

10.3.1 **Ecosystem Management:** Which of the following best described the level of ecosystem management on your farm?

- a. Risks and impacts on environmental health are regularly monitored. Appropriate measures to prevent and mitigate adverse impacts to biodiversity in non-cropped areas and water quality are applied. The dairy follows a written conservation or forest management plan that is approved by a state agency or NRCS. The farmer(s) knows whether Federally-listed threatened/ endangered species are present and regulations governing endangered species and water quality. They also take proactive action to maintain environmental health, biodiversity, and water quality (10 pts).

- b. Risks and impacts on environmental health are regularly monitored. Appropriate measures to prevent and mitigate adverse impacts to biodiversity non-cropped areas and water quality are implemented (8 pts).
- c. Risks and impacts on environmental health are regularly monitored. No actual damage to water quality or biodiversity is identified but only minimum measures necessary to prevent adverse impact to environmental health, biodiversity, and water quality are implemented (5 pts).
- d. Neither risks nor impacts on environmental health are regularly monitored. Minimum measures are only applied when there is adverse impacts to environmental health, biodiversity, and water quality (2 pts).
- e. Neither risks nor impacts on environmental health are regularly monitored. Measures to mitigate adverse impacts to environmental health, biodiversity, and water quality are not applied (0 pts).

KEY PERFORMANCE INDICATORS

10.3.2 **Wildlife Travel Corridors (%)**: Percentage of the largest river/stream that passes through your property that has at least a 35-foot wide buffer of natural vegetation on both sides? If rivers and/or streams are not present then not applicable.

10.3.3 **Rare species (%)**: Percent of state or federally listed species on your property that have populations managed with a local, state, and/or federal conservation plan or maintained on your land. If state or federally listed species are not present then not applicable.

10.3.4 **Rare habitats (%)**: Percent of state-listed habitats (S1 and S2) on your land that are managed by a conservation plan or maintained on your land. This could be part of a forest management plan. If state-listed habitats are not present then not applicable.

OTHER OUTCOMES

10.3.5 **Working lands and open space**: Working lands and open space provide key ecosystem benefits to farmers and surrounding communities beyond the food produced.⁷³⁷⁴

a. Working lands (%): Percent of directly owned lands that are working lands include pasture, cropping acres, and land occupied by barns, parlors, and storage areas.

b. Semi-natural Lands (%): Percentage of directly owned lands in land that does not directly contribute to food production but is too altered by management to be considered natural, including field margins, hedgerows, planted riparian areas, forest plantations, reforested areas, old fields, altered wetlands, non-native grasslands not used in dairy production, etc.

c. Natural wildlife habitat (%): Percentage of directly owned lands in natural forest, natural wetland, and/or natural grasslands. Natural habitats are largely unaltered habitats that include the original, native, dominate tree, wetland, or grass species.⁷⁵

⁷³ Farm Indicator 3.4: Total Acres of working land and open space and Farm Indicator 2.3: Dairy Working Lands and Open Space (Innovation Center for U.S. Dairy 2014).

⁷⁴ Follows using broad habitat categories, a commonly used currency for biodiversity offsets (Quétier and Lavorel 2011).

⁷⁵ Similar to Protect and Improve Habitats for Biodiversity metric in the Unilever Sustainable Agriculture Code - Appendix 1.

10.4 SUSTAINABILITY INDICATORS

WILDLIFE AND BIODIVERSITY

Do you have any natural habitats on your properties? Natural habitats are habitats that have not ever been converted to other uses. Forest land that was once cropland or pastures would NOT be a natural habitat.

If **NO** then skip 10.4.1

Are you going to convert land? If **NO** then skip question 10.4.1

10.4.1. Natural Habitat Maintenance: Do you conserve natural habitats on your land which contribute to regional conservation (Y/N)? Globally, it is estimate that 10% of habitats will need to be conserved if we are to avoid losing species. When regional efforts conserve $\geq 10\%$ of different natural habitats, then species may be adequately conserved. At lower level of conservation, landowners can help avoid the loss of biodiversity by conserving specie son their own lands.

a. Is at least 10% of natural forest, wetlands, and/or grasslands conserved within your ecoregion [*a pop-up window will be available so that farmers can determine conservation levels in their ecoregion*]? If so then skip Indicator 10.4.1 as it is non-applicable.

OR

b. If $< 10\%$ of natural forest, wetlands, and/or grasslands is not conserved within your ecoregion, then determine how much natural forest, wetlands, and/or grasslands are conserved within your ecoregion. A landowner should consider conserving up to 10% of his/her natural forest, wetlands, and grasslands if these major habitats occur on his/her farm. Conserved lands can include (1) land sold and held fee for conservation in perpetuity, (2) and protected by easements conversion to other habitat types (including development), and (3) forest lands with modest levels of timber management, including forest lands enrolled under Current Use Taxation programs.

10.4.2. Rare species (%): Percent of state and federal listed species on your land which have populations on your farm that are being maintained.

10.4.3. Rare habitats (%): Percent of acres of state-listed habitats (S1 and S2) on your land which are being maintained on your farm.

TOPIC #11 - ENERGY, WASTE, AND GREENHOUSE GAS EMISSIONS

Proper management of energy, waste, and greenhouse gas (GHG) emissions can provide an opportunity to reduce costs and resource use. Because fossil fuel use is central to farm operations and emits CO₂, energy conservation can save money and reduce GHG emissions.

11.1 AWARENESS INDICATOR

The best way to reduce waste and pollution is to save money avoiding their production.

11.1.1. In the last five years or as long as you have owned your farm (whichever is shorter), have you applied practices that save energy, reduce or recycle solid waste, and/or reduce your greenhouse gas emissions each year (0.8 pt)?

- a. Hardly or not at all (0 pts)
- b. Somewhat (0.2 pt)
- c. Mostly (0.5 pt)
- d. Yes (0.8 pt)

11.2 PRACTICE INDICATORS

When well-coordinated, practices reducing farm energy use, waste, and emissions can help reduce production costs, the environmental footprint of your farm, and enhance your reputation in your community. Energy from fossils fuels can contribute to environmental impacts associated with extraction and processing and their combustion.

ENERGY MANAGEMENT (4 PTS)

Energy conservation and appropriate use of renewable energy can reduce energy use, costs, and vulnerability to price spikes and increase the energy efficiency of production.

11.2.1. Energy conservation: What energy conservation measures or upgrades have you applied in the last five years (check all that apply)(2 pts)

- a. None (0 pts)
- b. Energy audit (0.4 pt)
- c. purchase Energy Star equipment when available (0.1 pt)⁷⁶

High-efficiency lighting (check one only) (0.2 pt)⁷⁷

- c. 50-85% efficient light bulbs (0.1)
- d. >85% efficient light bulbs (0.2 pt)

High efficiency barn fans (check one only) (0.2 pt)

⁷⁶ Austin Green Business Leaders Program (2015)

⁷⁷ Austin Green Business Leaders Program (2015)

- e. >50% efficiency fans (0.1 pt)
- f. >85% efficiency fans or you do not need barn ventilation (0.2 pt)

Milk room (check all that apply) (0.3 pt)⁷⁸

- g. Pre-heaters (0.1 pt)
- h. Variable speed vacuum pumps (0.1 pt)
- i. Plate-type milk cooler (0.1 pt)

Field practices (check all that apply) (1 pt)

- j. No/reduced tillage practices (0.6 pt)
- k. Employed other practices that reduce number of passes across a field (0.2 pt)
- l. Fuel switching (from fuel oil or diesel to natural gas or propane) (0.1 pt)
- m. Upgraded to fuel efficient equipment (0.1 pt)

Irrigation pump (check one only) (0.2 pt)

- n. no pump or don't use irrigation (0.2 pt)
- o. variable speed electric (0.15 pt)
- p. electric (0.1 pt)
- q. propane (0.04 pt)

11.2.2. Renewable Energy Use: Which of the following alternative energy sources have you added to your farm operations in the five year (check all that apply) (2 pts)?⁷⁹

- a. Windmills (0.2 pt)
- b. Solar photovoltaic (0.15 pt)
- c. Solar hot water (0.3 pt)
- d. Outdoor wood boiler (0.3 pt)
- e. Other wood energy (0.2 pt)
- f. Geothermal (0.3 pt)
- g. Anaerobic digester (0.4 pt)
- h. Fuel switching (diesel to biodiesel)(0.1 pt)
- i. Plate cooler (0.05 pt)

WASTE MANAGEMENT (3 PTS)

Appropriate waste management can reduce exposure of you, family workers, employees, and animals to dangerous chemicals, the threat of regulatory enforcement actions, and environmental impacts and help maintain the reputation of your operations. Some recycling and re-use strategies can reduce disposal fees or even generate income.

11.2.3. Waste Management: Do you apply the following waste BMPS for waste on your farm?(2 pt)

- a. For Haz-mat chemical spills, a plan and spill kit (includes absorbent material; clamps, plugs, and catch basin for leaks, shovel; and tarps to protect soil during field repair jobs) (0.7 pt)⁸⁰
- b. Store fluorescent lamps in a central, safe storage area, box them to avoid breakage, and send them annually to a consolidation or recycling facility (0.3 pt)
- c. Properly store and dispose of animal pharmaceutical waste (0.3 pt)

⁷⁸ Austin Green Business Leaders Program (2015)

⁷⁹ Austin Green Business Leaders Program (2015)

⁸⁰ Austin Green Business Leaders Program (2015)

- d. Properly store and dispose of hazardous waste (e.g., old oil, pesticides, disinfectants) (0.7 pt)⁸¹

11.2.4. Waste Recycling and Re-use: Which of the following types of waste are regularly recycled and/or re-used on your farm? (1 pt)

- a. Tires (0.1 pt)
- b. Beverage bottles (0.05 pt)
- c. Pesticide containers (0.2 pt)
- d. Silage and hay bale plastic wrap (0.2 pt)
- e. Office paper (0.05 pt)
- f. Cardboard (0.05 pt)
- g. Pallets (0.05 pt)
- h. Metal (0.1 pt)
- i. Motor oil (0.1 pt)
- j. Hydraulic fluids (0.1 pt)

GREENHOUSE GAS (GHG) EMISSIONS AND AIR QUALITY (3 PTS)

GHG emissions can pollute the air and contribute to climate change. Many GHG reduction strategies can be used to improve farm efficiency and reduce costs and enhance the reputation of your operations. Major sources of GHG emissions from dairy agriculture include N₂O emissions from fertilizers, soil tillage, and manure, methane (CH₄ from the digestive system of livestock and manure management), carbon dioxide (CO₂) from burning fossil fuels and conversion of forests and native grasslands to crop land or grassland. In some areas, farms can contribute to air pollution which can affect the health of family, workers, and neighbors⁸².

11.2.5. Nitrogen emissions: Which of the following nutrient application practices do you apply (1 pt)⁸³

- a. Techniques that minimize use of chemical nitrogen fertilizers (includes conformity with NRCS Practice code 590))(0.19 pt)
- b. Use manure as the primary source of NPK to meet soil nutrient needs before using commercial fertilizer (includes conformity with NRCS Practice code 590))(0.19 pt)
- c. Use precision-guided farming technologies (e.g., GPS-guided tillage equipment, GPS-guided spray and/or fertilizer equipment) (0.18 pt)
- d. Injection into root zone (0.24 pt)
- e. Manure and fertilizer are applied at rates to meet crop needs and optimize yield (0.15 pt)
- f. Band placement of fertilizer and/or manure near, below and to side of seed row (0.05 pt)

11.2.6. Methane and other air emissions: Which of the following manure management practices do you apply that limit methane production from your manure (1 pt)?

- a. covered manure and flare methane gas (0.2 pt)
- b. compost manure (0.2 pt)

⁸¹ Follows WWF (2015) - F. Pollution, Waste, and Greenhouse Gas Emissions Indicator 55

⁸² Follows WWF (2015) - F. Pollution, Waste, and Greenhouse Gas Emissions Indicator 58

⁸³ Incorporates portions of Unilever Sustainable Agriculture Code, Section 2.3, Nutrient Management (King et al. 2010).

- c. manure additive (0.2 pt)
- d. anaerobic digestion (0.2 pt)
- e. slurry injection (0.2 pt)

11.2.7. Soil carbon: Which of the following cropping practices do you apply that increase soil carbon sequestration (0.4 pt)?

- a. Used cover cropping (0.14 pt)
- b. No-till planting (0.14 pt)
- c. Use manure and/or compost to fertilize cropland, forage crops, and/or pasture (0.7 pt)
- d. Other (list) (0.05 pt): _____

11.2.8. Other GHG reduction practices: Have you applied any of the following non-crop practices to your farm (0.4 pt)?⁸⁴

- a. Use feeding and breeding strategies to increase productivity/efficiency or decrease GHG releases (0.2 pt)
- b. Re-forested riparian buffers in last 10 years (0.09 pt)
- c. Converted cropland to permanent pasture or forage in last 10 years (0.09 pt)
- d. Added a permanent conservation easement that excludes development in last 10 years (0.02 pt)
- e. Converted unproductive upland to forest in the last 10 years (0.1 pt)

11.2.9. Air Quality: Dairies can be significant sources of dust and emissions that affect air quality. Which of the following BMPs do you apply to control dust and air emissions (0.2 pt)?

- a. Modifications to diet to reduce dust (0.07 pt)
- b. Landscaping using trees and shrubs to absorb dust and emissions (0.07 pt)
- c. Other (please list): _____ (0.06 pt)

11.3 PERFORMANCE INDICATORS

KEY MANAGEMENT INDICATOR

12.3.1 **Energy, Waste, and GHG Emissions Management**: Which of the following best described the level of energy, waste, and GHG emissions management on your farm (10 pts)?

- a. Risks and impacts of energy costs are annually monitored. Cost effective measures to reduce GHG emissions, waste, and impacts to air quality (can include dust control) are applied. The dairy has had an energy audit within the last five years and has a current, approved nutrient management plan. The farmers knows regulations governing waste and water quality. The farm owners also take proactive actions each year to reduce energy use, solid waste, and/or GHG emissions (10 pts).
- b. Risks and impacts of energy costs are monitored annually. Cost effective measures to reduce GHG emissions, waste, and impacts to air quality (can include dust control) are applied. The dairy has an approved nutrient management plan. The farmer knows regulations governing waste and water quality. Many materials are re-used or recycled (8 pts).

⁸⁴ USDA NRCS. 2015. GHG and Carbon Sequestration Ranking Tool (accessed at <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/air/?cid=stelprdb1044982>).

- c. Risks and impacts of energy costs are monitored most years. No actual adverse impacts from waste have been identified, but no or only minimum measures necessary to prevent adverse waste impacts are applied. Many materials are re-used or recycled (5 pts).
- d. Neither risks nor impacts of energy costs are regularly monitored. Only minimum measures necessary to reduce energy use, solid waste, and/or GHG emissions are applied (2 pts).
- e. Neither risks nor impacts of energy costs are monitored. No measures necessary to reduce energy use, solid waste, and/or GHG emissions are applied (0 pts).

11.3.1. Energy Use:

a. Energy Intensity: Energy use / CWT of milk production (FPCM) (KWH/CWT)⁸⁵

b. Renewable Electrical Energy Use: Percent of energy used from renewable energy sources = [energy used from renewable energy sources] / [energy used from all energy sources]. If purchased electricity costs, KWH, and location are entered, an estimate of percent of energy used from renewable energy sources will be calculated based on the renewable use profile of the electricity supplier. The farmer will be able to edit the auto-populated estimate using their own data.

11.3.2. Waste:

a. Waste Intensity: Tons of waste / CWT of milk production (FPCM) **OR** tons of waste/gross sales.

11.3.3. Greenhouse Gas Emissions: GHG emissions from dairy farming includes N₂O from soils, fertilizer use and fossil fuels combustion CO₂ and CH₄ from cows, manure, and fossil fuel combustions, each weighted by their global warming potential⁸⁶.

a. Total GHG Emissions⁸⁷ - If herd size and location are entered, an estimate of total GHG emissions will be estimated. The farmer will be able to edit the auto-populated estimate using their own data and will be encouraged to use Farm Smart⁸⁸ or the Cool Farm Tool⁸⁹ to estimate GHG emissions.

b. Greenhouse Gas Emissions Intensity (tons CO₂e emissions /CWT milk production) = [sum of CO₂ emitted x 1 + sum of N₂O emitted x 298 + sum of CH₄ emitted x 25] / CWT of milk production (FPCM)⁹⁰

11.4 SUSTAINABILITY INDICATORS

11.4.1. **Greenhouse Gas Emissions:** Ratio of Total Greenhouse Gas Emissions to GHG Emissions allowed based on contribution to GDP. This will be auto-populated and estimated based on herd size. Farmers will be able to modify these estimates based on their own work.

7.4.3. **Management and Disposal of Solid and Hazardous Waste:** When managed and disposed of inappropriately, solid and hazardous waste can pose a threat to public health. Local, state, and federal regulations concerning appropriate management and disposal of solid and hazardous waste can apply to dairy farms. When a farm has had no regulatory actions in the last year OR is compliant with corrective action plans then the dairy is considered sustainable. Which of the following best describes the compliance

⁸⁵ Farm Indicator 1.2: Energy Intensity (Innovation Center for U.S. Dairy 2014).

⁸⁶ Based on Global Warming Potentials from the IPCC Fourth Assessment Report (2007).

⁸⁷ Follows WWF (2015) - F. Pollution, Waste, and Greenhouse Gas Emissions Indicator 57

⁸⁸ An online dairy farm GHG emissions calculator create by the Innovation Center for Dairy which can be found at:

<https://farmsmartqa01.usdairy.com/Account/Login?ReturnUrl=%2Fdefault.aspx>

⁸⁹ An online farm GHG emissions calculator create by the Cool Farm Alliance which can be found at: <http://www.coolfarmtool.org/>

⁹⁰ Farm Indicator 2.2: GHG Intensity (Innovation Center for U.S. Dairy 2014) and similar to Crop greenhouse gas footprint metric

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of your dairy farm with local, state, and federal regulations concerning appropriate management and disposal of solid and hazardous waste (“c” or better is sustainable)(10 pts)?

- a. Mostly doesn't not meet regulatory compliance
- b. Mostly compliant with regulations OR mostly compliant and undergoing corrective action response (1 pt)
- c. Always compliant with regulations OR currently compliant with and have fulfilled corrective action plans for compliance failures (5 pts)
- d. Always compliant with regulations and mostly exceed regulations (7 pts)
- e. Always compliant with regulations and far exceed regulations(10 pts)

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TOPIC #12 – WATER

The key water issues for agriculture are its impacts on water availability (principally irrigation) and water quality. Water is used for animal consumption, milk cooling, cleaning and sanitizing equipment, cow cooling, irrigating crops, moving manure and cleaning the barns via flush systems. Agriculture is a major user of water, especially in areas with limited water. Maintaining efficient use of water is important, as it is a resource where availability is becoming more limited in some areas.⁹¹ Dairy agriculture can also pose risks to water quality when poorly managed. Hence, supply chains are concerned about impacts to water supply and quality and how these impacts might limit the availability of dairy products.

12.1 AWARENESS INDICATOR

Checking farm water use and potential impacts can help maintain clean supplies of local water.

12.1.1 Do you check for water leaks, water usage, sufficient availability of water, and/or water quality impacts on at least a monthly basis (0.8pt)?

- a. Hardly or not at all (0 pts)
- b. Somewhat (0.2 pt)
- c. Mostly (0.5 pt)
- d. Yes (0.8 pt)

12.2 PRACTICE INDICATORS

By applying best management practices and using water efficiently, farmers can reduce costs and the risk of water pollution by systematically managing water resources on the farm.⁹²

WATER USE (5 PTS)

A reliable, high quality water supply is essential to dairy farms. Although irrigation accounts for much of the water used by agriculture, farms without irrigation can use about 4.5 gallons of water to produce one gallon of milk. Through careful water conservation and management, producers can reduce water and energy costs and ensure the adequacy of their water supplies.

12.2.1. Water Management: What practices do you apply to help ensure farm access to water (2.3 pts)?

- a. Monitor farm water use (0.5 pt)
- b. Assessed use and recharge rates of farm water sources to verify source sustainability (0.5 pt)
- c. Seasonally check and repair water leaks (0.4 pt)⁹³
- d. Know your farm water rights (0.2 pt)
- e. Know the stability of farm water from your well and/or your other sources of water (0.3 pt)
- f. Have a plan to meet water needs during drought by reducing use or getting water elsewhere (0.1 pt)
- g. Knowledge of government programs to address drought impacts on farm (0.1 pt)
- h. Evaluate farm for fire risk (0.1 pt)
- i. Participate in a regional or local water management program (0.1 pt)

12.2.2. Water Conservation: Which of the following water use reduction techniques do you apply on your farm (0.2 pt)?

- a. Re-using plate cooler water for livestock watering or other uses (0.07 pt)

⁹¹ Risk Mitigation Best Management Practices for Washington State Dairy Producers (2009)

⁹² Risk Mitigation Best Management Practices for Washington State Dairy Producers (2009)

⁹³ Austin Green Business Leaders Program (2015)

- b. Reduce irrigation of landscaping during drought (0.02 pt)
- c. Recycle or reuse water on you farm (0.1 pt)
- d. have low flow toilets/urinals and aerators on faucets and shower heads (0.01 pt)⁹⁴

My farm does not use irrigation (2.5 pts) (skip questions 12.2.3 and 12.2.4)

12.2.3. Irrigation Systems: Which of the following water use reduction techniques do you apply on your farm (select all that apply) (1.5 pt)?

- a. Monitor the timing and application of irrigation water (1 pt)
- b. Water recycling system (0.3 pt)
- c. Have a laser leveled irrigation system (0.2 pt)
- d. Use drip irrigation nozzles (0.2 pt)
- e. Use gated pipe irrigation (0.2 pt)
- f. Use drop nozzle irrigation (0.2 pt)
- g. Enclosed irrigation ditch lines in pipes (0.2 pt)
- h. Converted rill irrigation to more efficient systems (0.2 pt)

12.2.4. Irrigation and Soil Moisture Management: What technique do you use to monitor soil moisture (select one only)? (1 pt)

- a. Irrigation is not monitored or irrigations are on a fixed schedule (0 pt)
- b. Visual inspection (0.5 pt)
- c. Soil moisture is monitored by field moisture sensors or probes (1 pt)

WATER QUALITY (5 PTS)

Nitrogen, phosphorus, and pathogens from dairy farms can pose a risk to water sources used for drinking and to healthy aquatic ecosystems. Water protection measures can improve nutrient use efficiency and reduce costs and risks to reputation while safeguarding water supplies, human health, and aquatic ecosystems.

12.2.5. Water Quality Practices: Which of the following water protection practices have been applied on your farm (select all that apply) (5 pt)?⁹⁵

- a. Understand state and federal regulatory requirements for farms concerning water quality (1 pt)
- b. Riparian buffers of perennial vegetation that are ≥ 35 ft. wide (1 pt)
- c. Control of livestock access to water bodies (1 pt)
- d. A nutrient management plan covering for pastures, forage, and crop land (1 pt)
- e. An state-approved integrated pest management plan (0.6 pt)
- e. The risk of sedimentation of water bodies with soil from fields is seasonally assessed and managed (e.g. erosion control, riparian buffer strips, drain design) **OR** sedimentation does not occur on my farm (0.2 pt)
- f. Seasonal scouting for eutrophication (e.g., algae build up, other visual indicators) in water bodies on or downstream to farm (0.2 pt)

⁹⁴ Austin Green Business Leaders Program (2015)

⁹⁵ Farm Indicator 3.6: Prevention of Impacts on Water Quality (Innovation Center for U.S. Dairy 2014)

12.3 PERFORMANCE INDICATORS

KEY MANAGEMENT INDICATOR

12.3.2 **Water Management:** Which of the following best described the level of water management on your farm (10 pts)?

- a. Risks and impacts on water quality are regularly monitored. Appropriate measures to prevent and mitigate adverse impact to water quality and water availability (e.g., conservation) are applied. The dairy follows a written water management plan that is approved by a state agency or NRCS. The farmer knows regulations governing water quality and water withdrawals. The farmer also takes proactive action to improve water conservation and water quality (10 pts).
- b. Risks and impacts on water quality are regularly monitored. Appropriate measures to prevent and mitigate adverse impact to water availability (e.g., conservation) and water quality are applied (8 pts).
- c. Risks and impacts on water quality are regularly monitored. No actual damage to water quality or water availability is identified, but either no or only minimum measures necessary to prevent adverse impact to improve water availability or water quality are applied (5 pts).
- d. Neither risks nor impacts on water quality are regularly monitored. Only minimum measures necessary to mitigate adverse impact to improve water availability or water quality are applied in response to actual damage (2 pts).
- e. Neither risks nor impacts on water quality are regularly monitored. No measures to mitigate actual damage to improve water availability or water quality and water quality are applied (0 pts).

KEY PERFORMANCE INDICATORS

12.3.3 Water Use:

a. Water Use Intensity: Water use intensity (gallons/ FPCM CWT)⁹⁶. Water use intensity will be estimated and auto-populated based on herd size and milk production though a farmer will be able to edit auto-populated estimates using other sources of information.

b. Water Conservation: Percent of cropped area using the following water conservation strategies:

b.1 Rain water farming: Where crop production is dependent on rain water.

b.2 Dryland farming: A systematic method of growing crops and managing soil moisture in low rainfall areas without irrigation.

b.3 Scheduled irrigation: Scheduled irrigation is where water is only applied when necessary to maintain soil moisture levels necessary for crop production. Soils are monitored to determine when irrigation should occur.

12.3.4 Water Quality:

a. Water Quality 1: Water buffers >35 ft. wide along waterbodies (% of water body miles).

12.4 SUSTAINABILITY INDICATORS

⁹⁶ Similar to Farm Indicator 3.2: Water Efficiency (Innovation Center for U.S. Dairy 2014).

12.4.1. **Water Use:** Ratio of Total Farm Water Use to water use allowed based on contribution to GDP at the watershed level⁹⁷. Water use will be estimated and auto-populated based on herd size and milk production though a farmer will be able to edit auto-populated estimates using other sources of information.

12.4.2. **Water Quality:**

a. Water Quality Regulation Compliance: Water quality regulations for agriculture were developed to protect public health and aquatic ecosystems. When a dairy has had no regulatory actions in the last year OR is compliant with corrective action plans then the dairy is considered sustainable. Which of the following best describes the compliance of your dairy farm with local, state, and federal regulations concerning water quality, waste management, application of farm chemicals, driving record, and manure and nutrient management (“b” or better is sustainable)?

- a. Mostly doesn't not achieve regulatory compliance
- b. Mostly compliant with regulations OR mostly compliant and undergoing corrective action response (1 pt)
- c. Always compliant with regulations OR currently compliant with and have fulfilled corrective action plans for compliance failures (5 pts)
- d. Always compliant with regulations and mostly exceed regulations (7 pts)
- e. Always compliant with regulations and far exceed regulations(10 pts)

⁹⁷ Similar to Farm Indicator 3.3: Relative Stress on Water Sources by Withdrawal (Innovation Center for U.S. Dairy 2014)
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