Striving to protect the natural resources (such as soil, water, and air) needed for current and future food production is not a new endeavor, although the present-day pressures on all of Earth’s resources have generated widespread interest in this important effort. The core aspects of sustainability have always been an integral part of dairy farmers’ personal values and daily on-farm practices.

Understanding Sustainability

What is sustainability? While there was some degree of discussion of sustainability in the 1970s, it wasn’t until the 1980s that a specific characterization for sustainability in agriculture was developed. The U.S. Government, in the 1990 Farm Bill, defined it as follows—a definition that was adopted by the U.S. Department of Agriculture (USDA) and many others:

Sustainable Agriculture is an integrated system of plant and animal production practices having a site-specific application that over the long term will:

- Satisfy human food and fiber needs;
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends;
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- Sustain the economic viability of farm operations; and
- Enhance the quality of life for farmers and society as a whole.

Sustainable farms must meet all five elements of the USDA definition. For instance, a farm that stresses environmental quality while not being economically viable is not sustainable. Likewise, one that focuses on short-term profits without making the most efficient use of nonrenewable resources would not fit the definition.

Today’s consumer is making a connection between sustainability and their overall health and wellness, which demonstrates how sustainability connects to personal benefits and values. In fact, food and home items that have a direct personal benefit on health and well-being are often the gateway for U.S. consumers to begin purchasing sustainable products and are seeking ways “to vote for responsibility.” Consumers currently perceive products with these sorts of claims as being sustainable: local, fresh, natural, organic, safe and even fair trade.

Feeding a Hungry World

- In 1961, the U.S. population was about 184 million people. In 2006, it was about 300 million, a 63 percent increase. If agriculture today was no more productive than it was in 1961, it would require expanding land in farms by 63 percent, or the food supply per person would be 63 percent smaller.
- It took an average of almost 0.6 acres per person to produce enough feed for U.S. meat, dairy and poultry production in 1961. In 2005, it dropped to about 0.27 acres - so today it takes less than half as much land on a per person basis to produce our meat, dairy and poultry supply than about 45 years ago. Increases in agricultural productivity are what make this possible.
- Farming—production agriculture—is also about feeding the...
world. According to U.S. Census Bureau data, the world population in 1961 was about 3 billion; today it exceeds 6.9 billion people. By 2050, it is estimated that more than 9 billion people will inhabit the planet.7

**Today’s Sustainable Farming Practices**

- American farmers are providing consumers with more and better quality food than ever before. In fact, one farmer now supplies food for more than 150 people in the United States and abroad compared with just 25.8 people in 1960 and on less land every year.8 Production of food worldwide rose in the past half century, with the World Bank estimating that between 70 and 90 percent of the increase resulted from modern farming practices rather than more acres cultivated.9 Efficiency is one of the core elements of sustainability.

- The vast majority of farmers strive for sustainability, whether they choose to use the latest technology and practices, or follow organic guidelines. One reason is that most U.S. dairy farms are family owned. In fact, data from the USDA show that more than 98 percent of all dairy farms are owned by families.10 Furthermore, 91 percent are considered by the USDA to be “small family farms,” with $250,000 a year or less in income.11

- Combining scientific advancements and on-farm sensibilities, dairy farmers continually look for ways to be sustainable in all phases of their operations. Examples of sustainable farming practices include crop rotation to mitigate weeds and improve soil quality, the introduction of beneficial insects to control harmful pests, the practice of no-tillage or reduced tillage techniques for soil and fuel conservation, and the use of new products with enhanced environmental benefits.12 Of the crop land in production, approximately 41 percent is cultivated using conservation tillage techniques that leave at least 30 percent of the previous crop residue after planting. This reduces erosion, retains soil moisture, and conserves fuel needed to cultivate.13

- Dairy farmers have improved the amount of milk each cow produces, thereby reducing the amount of feed, water and space needed per gallon of milk and resulting in less manure. According to USDA statistics, U.S. dairy farmers today are producing almost three times more milk with about half the number of cows compared to dairy farmers in 1960.

- Dairy farming and processing have great impacts beyond the farm and processing plant gates. Their contribution, especially in rural communities, can be essential to the health of a local economy. The U.S. Commerce Department’s Bureau of Economic Analysis (BEA) output multipliers are a way to consider local impact from dairy farming (output multipliers show how much the economy’s output is increased by an additional dollar of sales from an industry). BEA’s Output Multiplier shows that dairy has a multiplier of 3.99. For example, if an average dairy farm in the U.S. sold an additional $1,000 of milk, it would boost the local economy by $3,995. Another figure of interest is the employment impact of an industry. BEA’s Employment Multiplier calculates the number of jobs created by increasing annual industry sales. The average U.S. dairy employment multiplier is 34.16; meaning that $1 million in dairy farm sales would, on average in the U.S., create an additional 34 jobs.14

**Carbon Footprint and Greenhouse Gases (GHG)**

Greenhouse gases are an environmental concern because they can deplete the Earth’s ozone layer, which results in higher temperatures. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide and ozone. According to the U.S. Environmental Protection Agency’s U.S. Inventory of Greenhouse Gas Emission Report, the agricultural sector was responsible for 9 percent of total U.S. greenhouse gas emissions in 2006.15

In July 2010, the Innovation Center for U.S. Dairy completed the first national carbon footprint study of fluid milk. This study was conducted by the Applied Sustainability Center of the University of Arkansas, one of the nation’s leading agricultural Life Cycle Analysis (LCA) research groups. This LCA measures Greenhouse gas emissions for fluid milk from crop production through disposal of the container by the consumer. This unprecedented effort gathered data from more than 500 farms and 50 processing plants across the United States, while analyzing 210,000 round trips transporting milk from farm to processor.
Based on data from 2007-2008, the carbon footprint of a gallon of milk, from farm to table, is 17.6 pounds of carbon dioxide equivalents (CO2e) per gallon of milk consumed (or 2.05 kg CO2e per kg of milk consumed) with a range from 15.3 to 20.7 pounds CO2e due to natural variability and uncertainty in input parameter values. The total fluid milk carbon footprint is approximately 35 million metric tons, with a 95 percent confidence range from 30 to 45 million metric tons. The study, along with data from other resources, validates that total U.S. dairy GHG emissions are approximately 2 percent of total U.S. emissions. 16

According to the study, the use of best management practices, rather than the size or location of the farm or processing facility, makes the biggest difference in reducing GHG emissions—and these best practices also deliver economic benefits.

Additional information shows that producing a pound of milk takes three times less methane than it did in 1924 because of the many efficiencies practiced by dairy farmers. Reducing methane emissions even further requires feeding grains and high-quality forage while continuing to use other tools such as genetic improvement and management, according to the researchers. 17

**On-Farm Strategies for Reducing Dairy’s Carbon Footprint**

- The University of Arkansas carbon footprint study identifies opportunities to be more efficient and further reduce GHG emissions along the entire dairy supply chain. On dairy farms, feed efficiency (how effectively a cow’s diet helps her produce milk) and manure management (manure storage) represent the greatest opportunities.

- One technology is the use of bovine somatotropin (rbST), which helps cows make more milk in a scientifically-proven safe manner. This increased efficiency reduces environmental impact, according to a Cornell University study published in the Proceedings of the National Academy of Science. For every one million cows receiving rbST, the reduction in the carbon footprint is equivalent to removing approximately 400,000 family cars from the road or planting 300 million trees. 18

- The absorption potential of agricultural soils could contribute significantly to constraining growth in greenhouse gas emissions while also contributing to improvements in soil quality in some areas, a recent European Union report concluded. The Intergovernmental Panel on Climate Change in 1996 clearly identified carbon sequestration in soils as one of the possible greenhouse gas mitigation measures for agriculture. 20

- Several reports show that organic milk production is between 15 percent and 25 percent lower compared to conventional herds that do not use recombinant bovine somatotropin (which is used to increase milk production on some dairies). Some of the factors that contribute to the lower production are nutrition, lack of feed additives, longer time to recover from diseases, lower genetics and higher retention of low-producing cows due to higher organic milk prices. It is unproven whether the prohibited use of antibiotics to treat mastitis (an infection in the udder) is a significant factor in this lower production. 21

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Manure is an excellent material for composting. The benefits of compost include replacement of chemical fertilizers (implying avoidance of greenhouse gases related to their production), reduced use of pesticides (avoiding emissions associated with their production), improved tilth and workability (less consumption of fuels), and greater odor management. The majority of animal manure is spread, sprayed, or applied in other ways to agricultural land. Manure is also useful in water conservation because it increases the water-holding capacity of soil by 20 percent, resulting in reduced groundwater needed to grow crops.  

Also refer to Midwest Dairy Association “Dairy Farms and the Environment” and “Local Foods” fact sheets.

This fact sheet was reviewed by John Fetrow, VMD, MBA; Mike Hutjens, PhD; Lloyd Metzger, PhD; JW Schroeder, PhD; and Leo Timms, PhD, in November 2011 for its content and accuracy.