The Dairy Community’s Contributions to Sustainable Nutrition
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WHAT SUSTAINABLE NUTRITION MEANS TO THE DAIRY COMMUNITY

Sustainable nutrition is the ongoing science-based pursuit for solutions that provide affordable, accessible, nutrient-rich foods that can nourish the world’s growing global population, while also protecting environmental resources.

“If we want to draw the line in the sand and say, ‘this and no more,’ then we need to freeze the footprint of food. And we will have to find ways to produce more with less—more nutrition with less land, water and other inputs.”

Jason Clay, Senior Vice President, Food and Markets, World Wildlife Fund, Inc.

“Meeting the challenges of the food and agriculture sectors sustainably could unlock 14 major business opportunities worth U.S. $2.3 trillion annually by 2030.”

Business and Sustainable Development Commission
The Sustainable Development Goals (SDGs) – launched by the United Nations in 2015 – are a transformative declaration to improve all lives around the world, while also fostering environmental stewardship. The SDGs recognize the interconnected dimensions of sustainable development: Economic, Social and Environmental.

The dairy community works to support efforts to make the SDGs vision for the future a reality by

- investing in global dairy communities
- tracking global sustainability commitments through the Dairy Sustainability Framework and Rotterdam Declaration
- advancing research that supports dairy’s role in addressing the SDGs

Dairy Embraces the 5 Ps of Sustainable Development

**PEOPLE**
Dairy foods and ingredients help nourish people across the lifespan around the world.

- ~815 million people around the world are undernourished
- ~1 in 3 people globally are suffering from some form of malnutrition (overweight, underweight, micronutrient deficiencies)
- Malnutrition is 2x as likely among children living in low-income countries with conflict, compared to children in stable, low-income countries

**PLANET**
Dairy’s ongoing commitment to environmental stewardship fulfills sustainable food systems to the SDGs.

- 7% of the total land on earth is used for feeding dairy animals
- 25% reduction by 2020 – U.S. dairy community’s voluntary greenhouse gas emissions reduction goal for fluid milk
- U.S. dairy cows generate lowest greenhouse gas emissions per gallon of milk

**PROSPERITY**
Strengthening global dairy communities can empower prosperous and fulfilling lives.

- 365 days of income to dairy communities
- One billion people globally have livelihoods connected to dairy

**PEACE**
Conflict can exacerbate food insecurity and dairy acknowledges that sustainable food systems go hand-in-hand with peaceful societies.

- Dairy can be a key contributor to employment and global food security. In doing so, it can help play an important role in supporting resilient, nourished communities

**PARTNERSHIPS**
Cooperatives and collaboration are at the heart of the dairy community.

- 37 million dairy farms are led by women globally
- Dairy provides 365 days of income to dairy communities

**SUSTAINABLE DEVELOPMENT GOALS**

- 365 days

Key Issues Snapshot

- Global estimated increase of people at risk of undernourishment by 2050 due to climate change

Source: National Dairy Council
I. Summary: Why Sustainable Nutrition Matters To The Dairy Community

Nutrition has a central role in the global agenda for sustainable development.⁴

Between 2009-2050, the global population is expected to increase by one-third.⁵ Sustainable nutrition solutions will need to meet nutritional, environmental, economic and consumer demands while also increasing food production by 70 percent by 2050 (from 2005-2007).⁵ This requires science and insights, thoughtful explanation, broad collaboration and coordinated efforts from all stakeholders.

Coordination is underway at the global level. In 2015, 193 world leaders gathered to adopt the United Nations (U.N.) Sustainable Development Goals (SDGs).⁶ All U.N. member countries agreed to put food security, health and the protection of the planet at the forefront. The following spring, the U.N. declared 2016-2025 as the Decade of Action on Nutrition, reflecting nutrition’s central role in sustainable development. Good nutrition is highly relevant to 12 of the 17 SDGs.⁴

The food and agriculture sectors have the opportunity to serve primary roles in global sustainable development efforts. As an integral part of these sectors, the dairy community has a unique opportunity to contribute to the SDGs and assume a leadership role to shape the future of sustainable nutrition.

This paper is intended to provide an overview of the global sustainable nutrition landscape and the U.S. dairy community’s role and vision for sustainable nutrition.
THE DAIRY COMMUNITY’S COMMITMENT TO SUSTAINABLE NUTRITION

The dairy community has made multiple public commitments to a more sustainable future.

Together with the Food and Agriculture Organization of the U.N. (FAO), the International Dairy Federation (IDF) signed the Dairy Declaration of Rotterdam in 2016 as part of the IDF World Dairy Summit. The declaration committed the global dairy community to sustainable development for the benefit of people and the planet.

The U.S. dairy community demonstrates its continuous commitment to sustainability through the Dairy Sustainability Framework (DSF), a common global platform to advance sustainability across the dairy value chain. It acknowledges dairy’s role and quantifies its contributions and impacts, while setting overarching sustainability goals for the global sector. The Innovation Center for U.S. Dairy®, powered by research-based guidance from National Dairy Council, serves a governance role as the regional affiliate for the U.S. dairy value chain.

These activities are just the beginning. Creating sustainable nutrition solutions that help us all thrive will require our best ideas – and our boldest collaborative efforts.

Each of the following chapters covers key aspects of sustainable nutrition, including the triple burden of malnutrition, building sustainable food systems, agriculture’s role in economic development and dietary guidance landscape. The chapters describe key challenges, opportunities and dairy’s role in addressing both global and U.S. issues.

The dairy community is prepared to be part of the solution. We invite you to join us.
II. The Triple Burden Of Malnutrition

**Challenge**

The triple burden of malnutrition (i.e., undernutrition, micronutrient deficiency and overweight and obesity) is a universal challenge felt locally and globally. Malnutrition affects nearly one in three people worldwide.10,11

**Opportunity**

Dairy foods, like milk, cheese and yogurt, can provide important nutrients – including calcium, phosphorus, vitamin B12, pantothenic acid (B5) and high-quality protein – required for good health.12,13,14

Malnutrition occurs in some form in every country in the world. The triple burden of malnutrition is one of the greatest challenges of our time. Even in the 21st century, poor diet remains a leading cause of disease.15

Proper nutrition and basic food security underpin peace and prosperity; thus, malnutrition can have negative long-term consequences.15

Undernutrition increases the risk of disease and death, drives up health care costs, burdens families and communities, limits educational potential and impedes economic progress.16,17

“Numerous studies suggest that every dollar invested in well-targeted interventions to reduce undernourishment and micronutrient deficiencies can yield from five times to over 20 times as much in benefits.”

– Food and Agriculture Organization of the United Nations9
The triple burden of malnutrition – undernutrition (underweight, stunted or wasted), micronutrient deficiency, and overweight and obesity (weight that is higher than healthy for height) – is the greatest contributor to disease globally and affects every country.1

The United Nations’ Sustainable Development Goals (SDGs) boldly call for an end to malnutrition in all its forms by 2030.13

Malnutrition within the Sustainable Development Goals

The United Nations’ Sustainable Development Goals (SDGs) boldly call for an end to malnutrition in all its forms by 2030.13

Sustainable Development Goal #2
End hunger, achieve food security, improve nutrition and promote sustainable agriculture14

U.S. Snapshot
Across the U.S., malnutrition – particularly in the forms of micronutrient deficiency, overweight and obesity – is a reality for adults and children:

- 31% of Americans (ages 9+) may be at risk of at least one vitamin deficiency or anemia*15
- Over 70% of U.S. adults (ages 20+) are obese or overweight16
- About 10% of U.S. children ages 2-5 years are obese17
- Overweight and obesity is a risk factor for cardiovascular diseases, including hypertension, coronary heart disease and type 2 diabetes18

The triple burden of malnutrition is a universal challenge. Achieving SDG 2 – ending malnutrition in all its forms – demands a response of unprecedented scale. Learn more at nationaldairycouncil.org

For sources cited here, please visit https://dairygood.org/content/2018/the-triple-burden-of-global-malnutrition

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Undernutrition And Micronutrient Deficiencies

**CHALLENGE**

815 million people around the world are unable to get enough food (2016).11

**OPPORTUNITY**

Dairy foods contribute essential nutrients (such as vitamin A and protein) important for nutrient adequacy in undernourished populations worldwide.15

**GLOBAL IMPACTS**

How will we nourish more people? The U.N. projects the global population will grow to nearly 10 billion by 2050.19 A growing population, combined with economic growth, is expected to increase food demand from 2005-2007 levels by about two-thirds.5 One-third of this increased demand will be driven by the growing world population,5 most of which is expected to come from developing nations.20

Undernutrition affects the youngest and poorest disproportionately. Globally, about 45 percent of the deaths for children under age five are tied to undernutrition – mostly in low- and middle-income countries.21 Rates of childhood undernutrition vary by region. Childhood undernutrition is felt by 60 low- and middle-income countries, where fewer than one-third of infants meet minimum dietary diversity standards to ensure proper growth and development.22 Low-income populations often suffer because they lack access to a variety of nutrient-dense foods, including dairy.23

Micronutrient deficiencies are also particularly hard-hitting in poor and developing nations. Over two billion people are anemic, largely due to iron deficiency.24 Vitamin A and iodine micronutrient deficiencies are also micronutrient deficiencies of great public health concern globally. Vitamin D, B12, folate, calcium and zinc are also important deficiencies.15
U.S. IMPACTS
Some people in the U.S. are food insecure, meaning they do not have “access at all times to enough food for an active healthy life.” In 2016, over 41 million Americans were living in food-insecure households. Furthermore, about three-fourths of Americans do not meet the dietary recommendations for fruits, vegetables, whole grains and dairy in the 2015-2020 Dietary Guidelines for Americans (DGA), meaning they may be missing out on nutrients important for supporting health. An estimated 31 percent of Americans over the age of nine may be at risk of one vitamin deficiency or anemia.

On any given day, a young child in the U.S. is more likely to get sweets or sugar-sweetened beverages than a serving of fruit or a vegetable. Eleven percent of American toddlers don’t meet the recommended dietary allowance for calcium, on average.

PROGRESS AND OPPORTUNITIES
Addressing malnutrition is a central priority for numerous global initiatives. For example, public and private sectors have made significant progress toward achieving the U.N.’s Millennium Development Goals – the predecessors to the SDGs – of reducing poverty and hunger. Between 1990 and 2015, the number of undernourished people in developing countries not affected by conflict declined by nearly 50 percent.

There are additional goals and efforts underway. One of the World Health Organization’s (WHO) top nutrition goals for 2025 is to reduce childhood stunting. The World Food Programme (WFP) focuses on the first 1,000 days, a critical period of human development, which encompasses conception through the first two years of life. The WFP is working to ensure that mothers and children have access to nutritious food to help prevent malnutrition and promote healthy development.

WHO’S 2025 GLOBAL NUTRITION TARGETS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>STUNTING</td>
<td>40% reduction in the number of children under-5 who are stunted</td>
</tr>
<tr>
<td>ANAEMIA</td>
<td>50% reduction of anaemia in women of reproductive age</td>
</tr>
<tr>
<td>LOW BIRTH WEIGHT</td>
<td>30% reduction in low birth weight</td>
</tr>
<tr>
<td>CHILDHOOD OVERWEIGHT</td>
<td>No increase in childhood weight</td>
</tr>
<tr>
<td>BREASTFEEDING</td>
<td>Increase the rate of exclusive breastfeeding in the first 6 months up to at least 50%</td>
</tr>
<tr>
<td>WASTING</td>
<td>Reduce and maintain childhood wasting to less than 5%</td>
</tr>
</tbody>
</table>

i. This statistic is based on NHANES 2003-2006 data.
Separately, various types of fortification initiatives offer opportunities to improve nutrition. Micronutrient fortification of ready-to-use therapeutic foods (RUTF) can improve nutrition for vulnerable populations. Growers can boost crop nutrition through agronomic practices, selective breeding and biotechnology.\textsuperscript{35} These advances in biotechnology applications could benefit the world’s underprivileged, with biofortified staple crops such as rice, maize and wheat under development.\textsuperscript{35}

As an example, while millions of people depend on rice as a dietary staple, this grain lacks vitamin A, a nutrient essential for healthy vision. To address this, golden rice has been developed using biotechnology to increase its beta-carotene content to help people meet vitamin A requirements.\textsuperscript{36} Another example of a biofortified crop is cassava, a dietary staple for many in sub-Saharan Africa. It is also being fortified to help prevent vitamin A deficiencies in a project known as BioCassava Plus.\textsuperscript{37}

Innovations in agriculture, food science, technology and other sectors may be key solutions to help end poverty and malnutrition.
Dairy’s Role

Dairy production, as well as the consumption of nutrient-rich dairy foods like milk, cheese and yogurt, can help alleviate some of the issues related to global malnutrition. Dairy production has significant poverty-reduction implications, especially for women in developing countries, and can contribute to household livelihood, food security and nutrition. Milk supplies essential nutrients, including high-quality protein as well as vitamins and minerals required for growth and development throughout childhood.

The dairy community has the opportunity to help meet demand in developing countries – and contribute nutrients that are important for children recovering from acute malnutrition – by expanding its capacity to produce and deliver safe, high-quality, nutrient-rich dairy products. For example, dairy manufacturers can scale their operations to supply wider geographic areas with their products, sharing best practices for everything from plant design and equipment to operator training, distribution methods and retailing practices. Dairy exporters can also extend their global marketing and distribution efforts to meet demand.

A 2014 network survey of Feeding America food banks revealed that milk is one of the most requested and least donated items for food banks. As of 2014, these food banks received an average of just one gallon of milk per person each year, compared to the 68 gallons they need to meet the recommendations of the DGA. Some in the dairy community, including processors and retailers, are addressing this need by donating and distributing surplus milk through the Great American Milk Drive and other community and nonprofit initiatives.

Healthy eating patterns, which include low-fat or fat-free dairy foods, are linked to reduced risk of certain chronic diseases, including cardiovascular disease (strong evidence) and type 2 diabetes (moderate evidence). Dairy food consumption is also associated with better bone health, especially among children and adolescents. In the U.S., milk is the number one food source for three of the four nutrients of public health concern identified by the 2015-2020 DGA – calcium, vitamin D and potassium – for Americans over the age of two. It can be difficult to match the nutrients in dairy foods with other non-dairy, calcium-equivalent foods in a healthy eating pattern because of dairy’s unique nutrient profile.

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ii. The 2015-2020 DGA recommends three servings (cup-equivalents) of dairy foods per day for those nine years and older as part of the Healthy U.S.-Style Eating Pattern and the Healthy Vegetarian Eating Pattern. Recommended dairy foods include low-fat or fat-free milk, cheese and yogurt. To convert the three servings per day recommendation to gallons of milk per year:

1 cup = 1 serving of milk
3 cups/d * 7 d/wk = 21 cups/wk
21 cups/wk * 52 wk/yr = 1,0902 cups/yr
(1,0902 cups/yr)/(16 cups/gal) = ~68 gallons/year needed to meet DGA recommendations for dairy food intake
The Dietary Guidelines for Americans recommends three servings of dairy products each day.*

Milk’s essential nutrients can be difficult to replace in a healthy dietary pattern. Three 8-ounce cups provide as much of each nutrient as:

- **PROTEIN**
  - 50% DV
  - 4 large (50 g) hardboiled eggs

- **CALCIUM**
  - 70% DV
  - 38 cups of raw kale

- **PHOSPHORUS**
  - 60% DV
  - approx. 3 cups of cooked red kidney beans

- **VITAMIN D**
  - 45% DV
  - 6.5 oz of sardines (approx. 15 sardines)

- **NIACIN (B3)**
  - 35% DV
  - approx. six large white mushrooms

- **VITAMIN B12**
  - 140% DV
  - approx. 1 lb pork chops

- **RIBOFLAVIN (B2)**
  - 100% DV
  - 0.8 cups of whole almonds

- **PANTOTHENIC ACID (B5)**
  - 50% DV
  - approx. 5 cups of chopped broccoli

- **VITAMIN A**
  - 45% DV
  - approx. 1.8 cups of fortified ready-to-eat cereal

- **VITAMIN B6**
  - 45% DV
  - 6.5 oz of sardines (approx. 15 sardines)

- **PHOSPHORUS**
  - 60% DV
  - approx. 3 cups of cooked red kidney beans

- **MILK DELIVERS A UNIQUE NUTRIENT PACKAGE**

The Triple Burden Of Malnutrition

*The 2015-2020 Dietary Guidelines for Americans recommends three servings of low-fat or fat-free dairy foods (milk, cheese, yogurt) for Americans 2 years and older.

Source: U.S. Department of Agriculture, Agricultural Research Service, Nutrient Data Laboratory, USDA National Nutrient Database for Standard Reference. Release 28, revised May 2016. Calculations based on low-fat milk (USDA database #01082). Some milk may be a good source of selenium and/or zinc. Other foods used: eggs (#1129); kale (#11233); kidney beans (#16031); pork chops (#10058); almonds (#12061); fortified ready-to-eat cereal (#08508); sardines (#15088); mushrooms (#11260); broccoli (#11090).

©2018 National Dairy Council®

Source: National Dairy Council®

The Triple Burden of Malnutrition 13
Overnutrition: Overweight and Obesity

**CHALLENGE**
Overweight and obesity raise risk of morbidity from numerous conditions, including hypertension, type 2 diabetes, coronary heart disease and stroke.\(^{49}\)

**OPPORTUNITY**
Healthy eating patterns, which include low-fat and fat-free dairy foods, are associated with reduced risk for several chronic diseases, including cardiovascular disease (strong evidence) and type 2 diabetes (moderate evidence).\(^{43}\)

**GLOBAL IMPACTS**
Malnutrition also takes the form of overnutrition through overweight and obesity.\(^{15}\) Globally, in 2016, there were over 1.9 billion adults over the age of 18 who were overweight, and more than 650 million adults had obesity.\(^{50}\)

Rates of overweight, obesity and other diet-related chronic diseases – such as type 2 diabetes and hypertension – are growing in nearly every region.\(^{50}\) Nearly half of the children worldwide under the age of five with overweight or obesity live in Asia (2016 data).\(^{50}\) In Africa, the number of overweight children under the age of five has increased by nearly 50 percent since 2000.\(^{50}\)

Although economic development usually increases a country’s food supply, the FAO concludes that it doesn’t always improve nutritional adequacy.\(^{51}\) When traditional diets are displaced by calorie-rich, nutrient-poor foods, people in developing countries may suffer the consequences, such as excess calories consumed and growing rates of obesity.\(^{52,53}\)

Obesity puts people at risk for more than 30 associated chronic health conditions.\(^{49}\) By 2020, the WHO projects that the number of global deaths attributable to chronic conditions such as heart disease and diabetes will reach 44 million, an increase of 15 percent globally between 2010 and 2020.\(^{52}\)
II. The Triple Burden of Malnutrition

U.S. IMPACTS
The average American’s eating habits – too many calories, too few nutrients – is related to the nation’s high rates of obesity and other associated chronic diseases. Beyond their significant health impact, obesity and associated chronic diseases also have an economic impact. In the U.S., five chronic conditions cost our nation nearly $347 billion (2010). This is 30 percent of total health spending. The annual loss of economic productivity due to obesity alone is projected to total between $390 and $580 billion by 2030.

PROGRESS AND OPPORTUNITIES
New tools are emerging each day that boost awareness and education about good eating habits, improved access to nutrient-rich foods and the importance of regular physical activity to help reduce rates of obesity and related non-communicable diseases. For example, people are adopting technology-driven tools to help them make good food and lifestyle choices. Increasingly intelligent and adaptive technology is being developed to enable better evaluation of personal nutrition and health variables – and more personalized, precise guidance for users.

Progressive consumers want information that is uniquely tailored to their own individual needs – and many are finding data-driven guidance in app-connected wearables that allow them to customize their experience.

Self-monitoring apps and websites, such as MyFitnessPal, help people track food and calorie intake. Other apps assist those with chronic disease management, such as blood-sugar or blood-pressure monitoring.

Nutrition and health-coaching apps are connecting people with nutrition counseling through smart phones or websites. Nutrition guidance provided by these tools and technologies can be used to offer the best available science-based information, including guidance on consuming adequate nutrients within calorie limits by choosing nutrient-dense foods like low-fat or fat-free milk, cheese and yogurt.

DAIRY’S ROLE
Milk, cheese and yogurt provide nutrients like calcium and protein essential to normal growth and development that make them an important part of healthy eating patterns for children and adults. Moderate- to high-quality evidence indicates that total dairy intake is associated with reduced risk of stroke, hypertension, metabolic syndrome, and type 2 diabetes, according to a 2016 systematic review. A 2016 analysis of prospective studies indicated that each daily serving of dairy foods was linked to a 13 percent reduced risk of childhood overweight and obesity. More research is needed to evaluate the link between dairy foods and body weight. By maintaining a dialogue with the health and wellness sector regarding nutrition, product and environmental research – as well as the nutritional value of dairy foods – the dairy community can encourage healthy eating patterns and lifestyle choices.
II. The Triple Burden of Malnutrition

Dairy Can Help

Dairy foods and ingredients can be a bridge to the Sustainable Development Goals (SDGs) – helping connect secure and sustainable food systems to the health, economic, environmental, and social challenges presented by malnutrition.

- Up to 1 billion people and their livelihoods depend on dairy.
- 4 billion servings of dairy are projected to be consumed by 2050.

Eating nutrient-rich dairy foods like milk, cheese, and yogurt can help alleviate some of the causes of global malnutrition.

- Milk supplies essential nutrients, including calcium, vitamin D, and sodium, all of which are crucial for proper growth and development of children.
- Consumption of high-quality dairy products can help in lowering the number of overweight and obese children.
- A 2016 analysis of prospective studies found that eating 300g of dairy a day reduced the risk of childhood overweight or obesity by 12%.

U.S. Snapshot

- Milk is the number one food source of calcium, vitamin D, and potassium, which are crucial for bone health and growth.
- Milk is among the most respected infant and child food bank items in the U.S.
- 1 gallon of milk amount received by U.S. food banks per person per year = 0.38 gallons of milk amount needed to meet USDA recommended per person per year.

The triple burden of malnutrition is a universal challenge. Achieving SDG 2 – ending hunger and malnutrition in all its forms – demands a response of unprecedented scale. The dairy community is prepared to be part of this response.
III. Building Sustainable Food Systems

**CHALLENGE**
Between 2009 and 2050, the global population is projected to grow by one-third, requiring a 70 percent increase in food production (from 2005-2007 levels) – in the face of fewer natural resources and climate change.

**OPPORTUNITY**
Dairy cows and farmers around the world can help enable the sustainable food systems of the future.

Human activities use resources and impact the environment. Agriculture requires inputs and resources like land, water and fertilizers that support the production of food for the population. At the same time, agriculture and its associated activities can also generate negative outputs, such as greenhouse gases (GHGs) and pollutants. Agriculture affects and is affected by climate and the biological interactions between coexisting plants and animals (e.g., pollinators).

Since the food and agriculture sectors depend on natural resources, their commitment to environmental stewardship – and sustainable food systems – amounts to self-preservation.

Nourishing a growing world population while reducing environmental impacts will require food and agriculture systems to integrate their conservation and efficiency efforts. These sectors will also need to collaborate closely to document impacts, while working to continuously improve their environmental footprint.

The linkages between dairy, its societal benefits and the environment are complex. The potential for improvement and change is recognized within the global dairy community through the establishment of a common global platform to advance sustainability across the dairy value chain.

“We need to figure out how to feed the world without depleting our natural resources.”
José Graziano da Silva, Director-General of the Food and Agriculture Organization of the United Nations
The DSF was established for dairy organizations worldwide to map and connect their sustainability activities in a credible and consistent manner. Recognizing that there is no single, “best” way to produce dairy that fits every circumstance and location, the DSF enables regional setting of priorities and measures and the quantification of progress. In the U.S. market, the Innovation Center for U.S. Dairy® convened a multi-stakeholder group to develop the U.S. Dairy Stewardship and Sustainability Framework (U.S. Dairy Framework), which aligns with the DSF and provides the national platform for global reporting.

**The Stewardship and Sustainability Framework for U.S. Dairy**

The U.S. Dairy Framework was developed by the Innovation Center for U.S. Dairy® with input from a multi-stakeholder group of Dairy Sustainability Alliance® members to support dairy cooperatives, processors, manufacturers and milk marketing organizations that choose to voluntarily track and communicate sustainability progress. The U.S. Dairy Framework defines indicators and metrics that enable the dairy community to track, measure, and communicate social responsibility and continuous improvement. Metrics are based on U.S. industry-aligned measurement and reporting tools, particularly the National Dairy Farmers Assuring Responsible Management (FARM) Program and a Dairy Processor Handbook jointly developed with the International Dairy Foods Association (IDFA).

The U.S. Dairy Framework metrics are used at the international level for DSF global reporting. Dairy processors and cooperatives formally recognized as DSF members are those who participate in the Innovation Center for U.S. Dairy®, are members of the Dairy Sustainability Alliance® and are enrolled in or source only from FARM program-enrolled dairy farms. DSF in turn maps to the SDGs, providing U.S. dairy with a local-to-global platform to communicate U.S. dairy’s essential role in sustainable 21st century food systems.

![Nutrients from manure applied to crops](source: Innovation Center for U.S. Dairy® 67)
Greenhouse Gases and Climate Change

**CHALLENGE**
Agriculture, forestry and other land use contributed 24 percent of total GHG emissions in 2010.68

**OPPORTUNITY**
Agriculture and dairy can be part of the solution to climate change.

**GLOBAL IMPACTS**
Agricultural practices release GHGs into the environment, which trap heat. Their accumulation in the Earth’s atmosphere is linked to global warming and more extreme weather events associated with climate change.69 A recent model predicts a 95 percent chance that the global climate will warm by at least two degrees Celsius by 2100.70 Global animal agriculture (poultry, cattle, pigs, sheep, buffalo and others) contributes 14.5 percent of total GHG emissions related to human activity.71
U.S. Impacts

Sectors like transportation and industry have higher GHG footprints than agriculture alone. Agriculture contributes nine percent to total U.S. GHG emissions (2016). Roughly two-thirds of this is the result of livestock production, with cropland agriculture, including grains like rice, contributing most of the rest.

Food accounts for 10-30 percent of a U.S. household’s carbon footprint. Other aspects of lifestyle, including travel and housing, make up a larger percentage of an individual’s GHG footprint (i.e., 35-70 percent). Food waste and loss as well as overconsumption accounted for about 34 percent of an average American’s food-related carbon impact in 2010. Managing portion control and eliminating food waste would reduce the average American’s total carbon footprint.

Progress and Opportunities

While agriculture contributes significantly to GHG production, it can also be part of the solution to climate change.

The Intergovernmental Panel on Climate Change (IPCC) notes that until now, most of the climate change focus has been on mitigation, carbon capture and storage and reforestation – with more research needed to determine agriculture’s potential.

Scientists estimate that on a global scale, agriculture could reduce carbon dioxide concentrations in the atmosphere by storing it in plant biomass and soils, contributing to a climate change solution. In turn, the increased soil carbon enriches the soil, potentially increasing crop yields and enhancing food security. According to a 2010 USDA publication, changing farming practices could play a significant role in reducing GHG emissions from agriculture.

One initiative exploring this possibility is the “4 per 1000” project, which states that if soil carbon was increased worldwide by 0.4 percent (or 4 parts per thousand) annually, it would stop the increase in atmospheric carbon. More carbon is stored in the soil than in living plants and animals combined, and effective soil management could be a powerful weapon in the fight against climate change.

Global agriculture could contribute to a climate change solution.

Effective soil management could be a powerful weapon in the fight against climate change.
In 2008, the dairy community prioritized the reduction of GHG emissions. It began conducting lifecycle assessments (LCAs) as a way to measure carbon impact and establish an accurate baseline for fluid milk and other dairy products.

The assessments showed that production of all dairy products in the U.S. accounts for approximately two percent of the nation’s total GHG emissions (2010). Globally, milk production, processing and transportation contribute 2.7 percent of total GHGs (2010).

Dairy cows’ GHG emissions come from enteric fermentation, part of their digestive process, as well as manure storage and management. Methane, the GHG that contributes the most to the global warming impact of milk production, has a global warming potential over a 100-year period about 28 times higher than that of carbon dioxide.

The dairy community is taking active measures to reduce methane emissions. Research efforts are directed at dairy feed composition, delivery, processing and supplementation, as well as plant breeding and dairy cow health and breeding. The dairy community is also evaluating a wide variety of technologies to collect, handle, process and store dairy manure.
Milk in North America is produced with fewer carbon emissions per gallon than anywhere else in the world, making the U.S. a global leader in efficient dairy production.\(^\text{84, 87}\)

In addition, the dairy community’s improved breeding practices, advanced management practices and innovative technology have helped mitigate its environmental impact. Today, North American and European dairy cows are remarkably efficient, producing four times more milk than the world’s average cow – while generating the lowest GHG emissions per gallon.\(^\text{84}\)

From 1944 to 2007, the U.S. dairy community reduced its carbon footprint by nearly 65 percent,\(^\text{88}\) and much of that progress happened before the dairy community began carbon accounting. At the time, many of these carbon reduction measures were considered good farming business decisions and production improvements.

The U.S. dairy community is continuing to make strides to reduce its carbon footprint. In 2012, it voluntarily committed to a carbon reduction goal of 25 percent by 2020.

As rising global demand for protein\(^\text{58}\) could lead to increased worldwide dairy consumption, production and development, the global dairy community has an opportunity to reduce its environmental footprint by investing in better management practices and adopting best practices in technology. The global adoption of yield improvements and feed efficiencies, as well as how manure and human food byproducts are used, will also contribute to more resilient food systems. These efficiencies are attainable by dairy as well as other agricultural sectors.
Land Use

**CHALLENGE**
Land is one of the most important resources in the food and agriculture sector, yet only about one-third of our total land mass may be suitable for farming.\(^9\)

**OPPORTUNITY**
Animals can efficiently provide nutrition from lands that cannot sustain crops. Animals eat a variety of crops and coproducts, converting many foods people can’t or won’t eat into more nutrient-rich foods to help nourish people.\(^{90, 91}\)

**GLOBAL IMPACTS**
Land is one of the most important resources in the food and agriculture sector, yet only about one-third of the world’s total land mass may be suitable for farming. Meanwhile, the growing population, increased development and agriculture are all competing for land use. As a result, there are more opportunities to impact the land in unintended ways, especially in the process of land transformation and occupation. In developing countries, deforestation occurs as farmers clear forests to make land available for cultivation.\(^{92}\) At the same time, cities are converting valuable farm and ranch land for human occupation.\(^{93}\)

As of 2015, 11 percent of the world’s total land surface was used in crop production. This is about one-third of the land that potentially could be used for farming. Not all of the remaining land is available for agriculture, as some is already in use, is protected or is not ideal for productive farming.\(^9\)

Raising animals on land that cannot sustain crops is an important part of the food system, since less than half of the Earth’s surface area can be used for farming. Many lands are not suitable for crop production due to weather or soil conditions. But these areas may be suitable for grazing animals, extending the productivity of marginal land for food production. This makes it essential to optimize yields on land that is already being farmed.\(^9\)
U.S. IMPACTS
In the U.S., farmlands are essential to our future food security. Just over 40 percent of our available land is under the stewardship of farmers as of 2012, but we lose 175 acres of farmland every hour to development and urban sprawl. And in North America, arable land declined by two percent annually from 1961-1963 to 2006-2007.

PROGRESS AND OPPORTUNITIES
Farmers have always worked to improve yields. Today, there is an added impetus to boost nutritional yields more sustainably, from every arable acre. Applying precision agriculture techniques – including precise applications of fertilizer and irrigation – is one way farmers are producing more food efficiently while mitigating environmental impacts.

Today’s agriculture is also addressing its impact on soil health, the foundation of the food system. Erosion from conventional tillage and cropping practices can deplete soil health and water retention capacity. By reintroducing organic matter, such as manure, into the soil, farmers can improve soil structure, drainage and aeration, increase water and nutrient storage capacity and increase the activity and number of soil microorganisms, which further improves soil structure.

Farmers are exploring a wide variety of innovative alternative food production methods, such as hydroponics, aquaponics, aeroponic and vertical farming, which are practices that can be applied in urban environments. Algae also shows promise, with potential for multiple uses, including as a human food.
Much of dairy’s effective land use can be credited to the efficiency and stewardship of dairy farmers. The U.S. dairy community has worked to improve the efficient conversion of animal feed, which is digested by the cow’s unique four-chambered stomach and turned into nutrient-rich milk. The land area required to produce feed crops for dairy cows is only 3.7 percent of total U.S. farmland and 8.4 percent of U.S. cropland (2008).67

On a global scale, the primary milk-producing animals (i.e., dairy cows, sheep, goats and buffaloes) require about one billion hectares of land, equal to seven percent of total land on earth.104 Most land used for livestock feed production is grassland.105

Some people believe animal feed production competes with human food production for renewable and nonrenewable resources, including land. Since the most productive and easily arable land is limited, these groups argue that animal agriculture occupies land that could be better used to grow plant-based foods that feed people directly.105

These arguments fail to consider that farm animals eat a variety of crops and coproducts, converting many foods people can’t or won’t eat into more nutrient-rich foods to help nourish people. In fact, 80 percent of what cows eat can’t be digested by people.90

Cows eat coproducts and byproducts from edible human foods such as pulp, peels, pits and seeds from fruits and vegetables, as well as hulls from almonds.90 Cows are able to unlock nutrition from plants, which may have little protein of varying quality, and turn it into milk, which contains high-quality protein and eight other essential nutrients to help nourish people. In many ways, dairy cows are nature’s recyclers.

Using these coproducts and byproducts in animal feed is an economically and environmentally sustainable way of repurposing them so they don’t go to landfills.

The dairy community works to continuously improve efficiency in sustainable farming practices – combined with the dairy cow’s inherent nutrient recycling capabilities – to help mitigate the competition between feeding dairy cows and feeding people, one of several overarching environmental concerns.
Water Use, Quality and Scarcity

**CHALLENGE**
Every continent is now experiencing the effects of water scarcity.106

**OPPORTUNITY**
In times of drought, dairy farmers can switch to less water-intensive feed crops and safely reuse water for various farming needs.

**GLOBAL IMPACTS**
As global population growth and economic development increases competition for water, access to adequate water is becoming a growing concern for agriculture stakeholders around the world.107 Climate change is likely to alter both water availability and consumption as warming conditions increase people’s and animals’ need for water.107, 108, 110, 111, 112, 113, 114
U.S. IMPACTS
Water scarcity is a growing concern in the U.S., where rates of groundwater withdrawal are greater than its natural replenishment in some areas. Agriculture accounts for about 80-90 percent of the consumptive water use in the U.S., which means water actually consumed by crop plants. Almost all rain and snow that falls in the contiguous United States falls first on private lands, a large portion of which is farmland. Well-managed farm and ranch lands filter this water for streams, estuaries and aquifers.

PROGRESS AND OPPORTUNITIES
While there is enough freshwater on the planet for seven billion people, it is distributed unevenly – and too much of it is wasted, polluted or unsustainably managed.

Because agriculture is dependent on consistent water supplies, farmers can play an important role in water resource management. Approximately 70 percent of all the water used in the world is managed by farmers and ranchers. Many resources regarding water management and conservation best practices are available to farmers.

DAIRY’S ROLE
While dairy production uses a small fraction of total water – just over five percent of total U.S. water withdrawal – the dairy community is dedicated to responsible water use.

Conservation practices extend to how feed is grown for cows, where most water (i.e., 93.5 percent) is used in dairy farming, and to other necessary on-farm activities that require water (i.e., 3.6 percent).

In times of drought, dairy farmers can switch to less water-intensive feed crops. Many farmers also safely reuse water for various farming needs by using specialized technologies and processes to recycle water.

Dairy farmers can reuse water as many as five or six times. For example, water used to clean milking parlors can be reused to clean production areas and then to irrigate fields. Modern dairy farms also often use heat exchangers, a technology that uses water to aid in more efficient cooling of milk. Then, that water can be used again for other farming needs.

To protect water quality, farmers can use precision farming and climate-smart agriculture techniques that allow them to apply products like fertilizers more selectively and sparingly, reducing crop inputs while minimizing runoff.

Investing in precision agriculture best practices and technologies, high-efficiency irrigation and the development of drought-tolerant varieties of crops are critically important steps to help ensure sustainable food systems.
IV. Agriculture’s Role in Economic Development

CHALLENGE
Around the world, the livelihoods of 2.5 billion people in developing nations depend on agriculture.122

OPPORTUNITY
The dairy value chain offers unique economic stability. Dairy farming can produce marketable food 365 days of the year.

When agriculture grows, economies grow.123 Today, with the expected population boom and increase in global trade, the agriculture sector has the opportunity to help transform economies and sustain economic growth.

Agricultural development will need to reflect each nation’s food policies, values and modes of farming and production – while also accommodating global food sources and trade, if regional supplies are threatened by natural events or limited natural resources. Increasingly volatile and extreme weather patterns – and the resulting price fluctuations – will continue to alter the economic landscape of countries, reinforcing the need to invest in agriculture and food resiliency in the coming decades.124

GLOBAL IMPACTS
In many developing economies, agriculture, in the form of small farms, is the most effective way for individuals to provide for themselves and their families. Their ability to weather the challenges of climate change will be key to continued economic growth.122

In these regions, livestock are used to pull farm implements, like plows, and as a regular source of food and income for farmers.104 They are also among the most popular assets for rural women, as livestock is more easily acquired than land and other financial assets, making it important to the empowerment of women in developing countries.104, 125

“... ere long, the most valuable of all arts will be the art of deriving a comfortable subsistence from the smallest area of soil.”
Abraham Lincoln121
U.S. IMPACTS

America’s food and agriculture sectors are the nation’s twin engines, propelling the economy and fueling the nation. It all starts with the land.

There are over two million farms and ranches on U.S. soil in 2012, creating livelihoods for generations of families from coast to coast. Food and beverage companies and retailers complete the value chain to get the food to the public. The dairy value chain provides high-quality nutrition for people to enjoy in their homes as well as in restaurants where more than 14 million Americans work.

Over the years, agriculture has become increasingly efficient, helping keep food costs in the U.S. low. Americans spent an average of 11.4 percent of their disposable household income on food in 2014.

The food and agriculture sectors will continue to play an integral role in economic growth and standard of living.

PROGRESS AND OPPORTUNITIES

The next 40 years will be unprecedented in the history of agriculture. Each growing season, farmers around the world will be called to increase their knowledge and ingenuity to optimize production of nutrient-rich foods.

They will also be challenged by the stark reality of unpredictable climate conditions and volatile global trade, which are factors that affect pricing, and consequently, food access and nutrition security. In recent decades, U.S. agriculture has made tremendous improvements in yields. Now, with an understanding of carbon impacts from farming and introduction of precision agriculture, farmers can consider yields, inputs and soil in the context of the environment. Instead of only focusing on yield, sustainable agriculture is driven by the need to optimize for both yield and environmental impact.

DAIRY’S ROLE

Dairy generates employment opportunities throughout its value chain. Globally, up to one billion people derive their livelihoods from dairy, including traditionally disadvantaged segments of society, from small landholders to laborers and women. In 2013, approximately 150,418 employees worked on American dairy farms – with an average of 5.1 workers per farm.

The year-round income from dairy farming allows for savings and diversification of crops. The dairy community and the nutrient-rich milk and dairy foods they provide can help nourish the global food economy – now and for generations to come.
V. Dietary Guidance Landscape

**CHALLENGE**
Food-based dietary guidelines (FBDG) recommend foods that will help meet nutrient needs and promote health. Increasingly, guidelines are being called on to reduce environmental impact and provide sustainable solutions to the triple burden of malnutrition.15

**OPPORTUNITY**
Developing healthy eating patterns and sustainable food systems requires holistic solutions that account for environmental, social and economic aspects of sustainability. Dairy foods can be part of healthy and sustainable eating patterns.

Many countries rely on FBDG, such as the Dietary Guidelines for Americans (DGA) in the U.S., to define healthy eating patterns. Ideally, these guidelines use best practices and science to identify eating patterns that meet nutrient and calorie recommendations, support growth and maintenance of health at all life stages and reduce the risk of chronic, non-communicable diseases. Recently, adding sustainability concepts to FBDG has been proposed; if these proposals are implemented, integration of nutrition and sustainability may require new definitions and approaches.

In 2010, FAO defined the concept of sustainable diets including multiple characteristics of eating patterns that address sustainability priorities. FAO defines sustainable diets as “those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.” FAO, however, does not define the foods that fit into a “sustainable diet.”
In 2014, the FAO and WHO jointly organized the Second International Conference on Nutrition (ICN2) “to address the multiple challenges of malnutrition in all its forms and identify opportunities for tackling them in the next decades.” The resulting Rome Declaration on Nutrition recognized and described the importance of both healthy diets and sustainable food systems in this context, as follows:

- Nutrition improvement requires healthy, balanced, diversified diets, including traditional diets where appropriate, meeting nutrient requirements of all age groups, and all groups with special nutrition needs, while avoiding the excessive intake of saturated fat, sugars and salt/sodium, and virtually eliminating trans-fat, among others;
- Food systems should provide year-round access to foods that cover people’s nutrient needs and promote healthy dietary practices;
- Food systems, including all components of production, processing and distribution, should be sustainable, resilient and efficient in providing more diverse foods in an equitable manner, with due attention to assessing environmental and health impacts.

The food and nutrition landscape is changing.

In the current environment, the challenge for dairy will be to continue to demonstrate the value of dairy foods by highlighting the well-established nutrient contributions and health benefits of dairy foods, as well as the full breadth of dairy’s social, economic and environmental contributions to sustainability.

**GLOBAL IMPACTS**

FBDG provide recommendations about foods to consume to meet nutrient needs and promote health. Dietary guidelines often form the basis of food and nutrition policies, and they can impact the health and wellness marketplace by helping define what constitutes healthy eating.

Extensive evidence supports the role of dairy foods in FBDG, though there is no single diet that is appropriate for everyone. According to the WHO, “The exact make-up of a diversified, balanced and healthy diet will vary depending on individual needs (e.g., age, gender, lifestyle and degree of physical activity), cultural context, locally available foods and dietary customs.”

In the face of undernutrition, dairy foods provide important nutrients often missing in diets of at-risk populations, including children. An extensive review of milk and health by the FAO found that milk consumption is associated with better linear growth and nutrient status in undernourished or socioeconomically underprivileged children. In undernourished children, milk is likely to supply nutrients that are deficient in the diet and important for growth, and milk can help support growth and development, especially during the first two years of life.

Emerging data show a link between dairy food consumption and reduced risk for non-communicable diseases. Healthy eating patterns like the DASH or Mediterranean diets, which include low-fat or fat-free dairy foods, are associated with reduced risk for key chronic diseases, including cardiovascular disease (CVD) and type 2 diabetes. Studies published since the 2015-2020 DGA, have found total dairy food consumption is not associated with increased risk for CVD or coronary artery disease (moderate to high quality evidence), and it is associated with reduced risk for stroke (moderate quality evidence).
Currently, few FBDG include sustainability criteria, but there is momentum to change that.

The 2016 FAO report, “Plates, Pyramids and Planet,” found that out of the world’s 215 countries, only 83 surveyed had formal FBDG – and only four included sustainability considerations. The report outlines opportunities to change food systems and dietary patterns to be more healthful and respectful of environmental limits. It also highlights FBDG as a policy tool to achieve change.\(^{138}\)

Given FAO’s support of this perspective, there may be increasing efforts by countries to develop or adopt FBDG that include recommendations that consider sustainability.

When integrating FBDG and sustainability, the role of animal foods has been questioned on the basis of health and environmental impacts.\(^{129}\)

A definition of sustainable food systems that includes a balance of environmental, social and economic impacts, and a science-based approach to developing FBDG is needed to address health and sustainability. For example, the 2016 Foresight Report\(^{22}\) by the Global Panel on Agriculture and Food Systems for Nutrition stated, “Animal source foods (e.g., dairy, eggs, fish and meat) provide important nutrients. Policy support for these foods should be pragmatically evidence-based rather than driven by ideology.”\(^{22}\)

**U.S. IMPACTS**

Dairy foods have been part of the Dietary Guidelines for Americans (DGA) since the first one released in 1980 was built on guidance using the basic food groups, including the “milk, cheese, and yogurt” group.\(^{139}\) Since 2005, the DGA has recommended three servings of low-fat or fat-free dairy foods for Americans nine years and older as part of a healthy eating pattern to meet nutrient needs. This recommendation continued as a core part of the Healthy U.S.-Style Eating Pattern in the 2015-2020 DGA.\(^{43}\) The DGA notes dairy consumption is linked to improved bone health, especially in children and adolescents, and healthy eating patterns are associated with a lower risk for CVD, based on strong evidence, and lower for T2D, based on moderate evidence.\(^{43}\)

The 2015 Dietary Guidelines for Americans Committee (DGAC) Report included a chapter on food sustainability and safety for the first time in its history.\(^{129}\) The chapter concluded that “a diet higher in plant-based foods, such as vegetables, fruits, whole grains, legumes, nuts, and seeds, and lower in calories and animal based foods is more health promoting and is associated with less environmental impact than is the current U.S. diet.” Although the environmental recommendations were not included in the final DGA policy document, all of the 2015-2020 DGA dietary patterns contained more plant foods and dairy foods than the amounts Americans currently eat, on average, and included dairy foods in all Healthy Eating Patterns, including the Healthy Vegetarian Eating Pattern.\(^{43}\)

Some new research has begun to evaluate aspects of dairy foods on sustainability beyond environmental impact. One study found that nutrient-rich diets tend to have a higher environmental cost and that what is optimal for the planet also may not be healthiest for people. Sustainable diets should be nutrient-rich, affordable, acceptable and sparing of the environment. Dairy foods like milk are “nutrient-rich, affordable, acceptable and appealing,” based on multiple sustainability metrics,\(^{140}\) and the U.S. Dairy community is committed, industry-wide, to continuously and proactively reducing climate-related impacts.\(^{141}\)
PROGRESS AND OPPORTUNITIES

The food and nutrition landscape – including development of dietary guidelines in the U.S. and internationally – is changing. Looking ahead, dietary guidelines may include more guidance about sustainability, but getting there will involve debate on the topic.

Nutrient-rich dairy foods, including milk, cheese and yogurt, are core components of healthy eating patterns around the world. Three servings of dairy foods are included in the Healthy U.S.-Style Eating Pattern in the 2015-2020 DGA. More than 100 countries worldwide have FBDG. In the FAO FBDG database, there are 90 individual country pages that are provided in English. Of those, 78 percent contain some recommendations for dairy foods.

Research continues to demonstrate the role of dairy foods in providing essential nutrients and supporting health, and additional research is underway to help define dairy’s contributions to environmental, social and economic aspects of sustainability.

The public process to develop the 2020-2025 DGA began in 2018, and international efforts to develop new guidance are also underway. The dairy community has the opportunity to participate in the process, educating experts in nutrition guidance about dairy’s unique contributions to healthy eating patterns and sustainable food systems.
A HEALTHY DIET, DEFINED
The 2015-2020 DGA provides guidance on healthy eating patterns, including these key recommendations:

A healthy eating pattern includes:

- A variety of vegetables from all of the subgroups – dark green, red and orange, legumes (beans and peas), starchy and other
- Fruits, especially whole fruits
- Grains, at least half of which are whole grains
- Fat-free or low-fat dairy, including milk, yogurt, cheese and/or fortified soy beverages
- A variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas) and nuts, seeds and soy products
- Oils

DAIRY’S ROLE
The current conversation provides many opportunities to educate dairy stakeholders and experts about the role of dairy foods in healthy eating patterns and sustainable food systems. Reinforcing the multiple benefits of eating dairy foods – and correcting misconceptions about dairy’s health, environmental, social and economic contributions – can generate important dialogue.
Honoring the Harvest is about how we work together to use food with good purpose, so it’s never wasted.

That means ensuring all people have access to nutrient-rich foods and also utilizing parts of food people can’t or won’t eat by moving nutrients through food systems – from people, to animals and back to the land to grow food more sustainably – rather than going to a landfill. We all have a role to support this cycle and build sustainable food systems that benefit people, communities and the planet.

Learn how the dairy community contributes to a natural nutrient cycle.

Here’s how the dairy community contributes to a natural nutrient cycle – and you can help, too.

1. **NOURISH PEOPLE**
   - We need to ensure a variety of nutritious foods, including nutrient-rich dairy foods, are available and affordable to help all people thrive.
   - Enough food is produced globally to nourish 10 billion people. And yet, food insecurity impacts people in every region, including 1 in 8 Americans.¹

2. **NOURISH ANIMALS**
   - Just like people have specific nutritional needs, so do dairy cows.
   - Dairy cows have a unique, 4-chambered stomach, so they can unlock nutrition from parts of plants people can’t or won’t eat. For example, people drink the OJ and cows eat the citrus pulp, and people eat almonds and cows eat the almond hulls.
   - Cow manure’s unique composition helps restore nutrients in the soil, helping it be healthier, so food can be grown with reduced use of synthetic fertilizer, which is fossil fuel-based.

3. **NOURISH THE LAND**
   - Returning nutrients back to the land to replenish the soil completes the cycle.

   - Each day, 1 cow produces 17 gallons of manure, that’s enough fertilizer to grow 46 pounds of corn.²

   - 80% of what dairy cows eat can’t be eaten by people.

THE COST OF FOOD WASTE

Although hunger continues to plague millions, our food supply is increasingly abundant – and so is the amount of food we waste.\(^{144}\) FAO reports show that roughly one-third of the food produced in the world for human consumption every year is lost or wasted.\(^{145}\) Reducing food waste is essential to achieving sustainable nutrition.

The value of food lost and wasted each year is stunning, at roughly $680 billion in industrialized countries and $310 billion in developing countries.\(^{145}\)

Not only does food waste undermine the economy and food security, but it also squanders the considerable resources used to produce food and bring it to market, including water, land, energy, labor and capital. Compounding the problem, unwanted food left to decompose in landfills also emits methane, contributing to climate change.\(^{146}\)

Because of food waste’s enormous human and environmental costs, the U.N. addressed the problem in SDG 12 with this specific target: “By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.”\(^{147}\)

The U.S. Environmental Protection Agency (EPA) has also produced the Food Recovery Hierarchy, shown here, which provides guidance on what to do with excess or imperfect food. The hierarchy recommends feeding people first, then animals, digesters, composts and landfills.

“Food recovery can increase by 1.8 billion meals annually, nearly doubling the amount of meals rescued today and diverting 1.1 million tons of waste.”
– ReFED\(^{143}\)

Source: United States Environmental Protection Agency\(^{146}\)
In 2013, the EPA, together with the United States Department of Agriculture (USDA), launched the U.S. Food Waste Challenge. This gave leaders and organizations across the food chain a platform to share best practices on reducing, recovering and recycling food loss and waste.

In 2015, the U.S. announced its first national food waste reduction goal, calling for a 50 percent reduction by 2030. As part of this effort, the federal government established a public/private partnership to reduce food loss and waste in order to improve overall food security and conserve the nation’s resources.

Another public/private partnership – Further with Food – is focused on innovative approaches to reduce food loss and waste. This initiative has broad support from many organizations, including the Academy of Nutrition and Dietetics, Feeding America and the Innovation Center for U.S. Dairy, as well as government agencies and the Rockefeller Foundation.

Addressing food waste is an opportunity to mitigate hunger and reduce the food system's environmental impacts and resource use.

Increasingly, people rate sustainability-related attributes as an important consideration with their food and beverage choices. Environmental footprints calculate the total amount of natural resources individuals use to sustain themselves. We can examine food choices in a similar manner, calculating all the natural resources used in an individual’s diet or their foodprint.

According to calculations from a recent foodprint study, in 2010, the average American adult wasted 35 percent of food (by weight) available at the retail and consumer level.

When food is wasted, natural resources used to produce are wasted, too, and we also miss the opportunity to improve eating patterns and food security. Food wasted at the retail and consumer levels of the U.S. food supply in 2012 contained 1,217 kcal, 33 g protein, 5.9 g dietary fiber, 1.7 ug vitamin D, 286 mg calcium and 880 mg potassium per capita per day.
VI. Dairy’s Contributions to Sustainable Nutrition

The need for sustainable nutrition has galvanized the dairy community. Building on the long-standing commitment to providing nutritious, safe and high-quality foods, the dairy community is equally committed to advancing sustainable nutrition and contributing to the achievement of the SDGs.

People in the dairy community are exploring the environmental impacts of dairy production and finding new ways to reduce environmental impact and resource use. Additionally, exploration of opportunities to regenerate the environment is a priority.

Dairy representatives are educating more people about the nutritional and health benefits associated with consumption of dairy foods within healthy dietary patterns, while working to improve access to and affordability of dairy foods. Other dairy professionals are continually driving scientific research and sharing discoveries across the food, nutrition and dietary guidance landscape.

Working together, the dairy community will continue to explore new ways to help nourish a growing population with nutrient-rich dairy foods and ingredients that are affordable and accessible to achieve sustainable nutrition for all – today and for future generations.

As the dairy community works to demonstrate its value to society, it has the opportunity to reflect society’s changing values and concerns related to sustainable nutrition.

Its challenge and opportunity will be to keep pace with other major stakeholders who are already addressing food security and sustainable nutrition as strategic imperatives – acknowledging its impacts on human health, global peacekeeping and climate change.

A host of market forces in the food and nutrition space are also realizing that the sustainable nutrition challenge brings substantial new opportunities – estimated at $2.3 trillion.²

This significant opportunity is attracting many new stakeholders, eager to define what food should mean to healthy eating and sustainable food systems, and to prescribe how food should be grown. The dairy community can offer significant contributions to this important conversation.

While demonstrating leadership through its contributions to sustainable nutrition, the dairy community has an opportunity to reflect stakeholders’ related interests and concerns – including lifestyles of health and sustainability, the impact of food production on environmental sustainability and how food systems can help reduce food waste.
Contributing to Healthy Lifestyles

Dairy foods have historically been included in U.S. recommendations for healthy eating patterns, which have sound foundations in nutrition science. Dietary guidance in the U.S. has consistently communicated dairy’s role in a healthy eating pattern and its unique nutrient profile. These dairy attributes will likely resonate with consumers as they begin to embrace a broader definition of health – one that encompasses healthy and sustainable lifestyles, including environmental sustainability.

The dairy community has gained a deep understanding of its environmental impacts, but it has not effectively portrayed its positive impact and story in these broader terms. Now, the dairy community has a key opportunity to make its story more meaningful and relevant.

Dairy can reflect both the public and the public health community’s interest in the broader surroundings of food, nutrition and health – including how the dairy community cares for its animals and uses responsible production best practices to minimize the environmental impact of dairy production, from farm to table.

Conveying dairy’s broad benefits within the context of lifestyles of health and sustainability is a matter of some urgency. The scientific community continues to explore the composition and role of specific foods within sustainable diets and food systems. The dairy community is currently engaged in some of these conversations, but there is room for additional collaboration.
Commentaries, even in high-profile media outlets,\textsuperscript{159,160} suggest that animal agriculture is often not well understood or valued. Future DGA or other dietary guidance may address the environmental aspects of eating patterns and specific foods – with the potential for a recommended reduction in dairy servings as an unintended consequence of not considering all dimensions of sustainability.

As a result, the window is closing for the dairy community to have conversations with thought leaders, decision makers and consumers to raise awareness of the growing body of science-based evidence for dairy that will define sustainable diets and food systems.

It is critical for the dairy community to share and highlight its investments in scientific research that support the environmental, nutritional and health benefits of dairy foods and dairy ingredients.

The dairy community has a tremendous opportunity to engage with other stakeholders to share, with a unified voice, the positive social, economic and environmental benefits of dairy cows, dairy farmers and the entire dairy value chain, to demonstrate their valuable contributions to local communities and Americans – and to the world at large.
Addressing Food Waste and Hunger

Food waste is closely linked to environmentally sustainable food systems. Many parties – from government agencies, public and private companies and organizations to industries, thought leaders and the public – have raised awareness of this issue and the potential positive effect of reduced food waste on hunger, food security and planetary health.

As a result, these audiences are likely to be interested in dairy’s progress reports on waste reduction. Updates should frame waste reduction as one part of the dairy community’s contribution to sustainable food systems, with high-quality nutrition at the center.

This education and outreach can help bring to life key elements of the DGA, encouraging nutrient-rich foods with better portion control and reduced food waste. The dairy community can also help educate the public on the value of portion control in reducing waste and promoting balanced, healthy eating patterns that support well-being.

The dairy community’s timely engagement on the topic of food waste showcases its commitment to responsibly produced, nutrient-rich dairy foods that are fully appreciated for their value in nourishing people. Dairy foods are too good to waste.
Playing an Active Role in Sustainable Food Systems

The dairy community is well positioned to respond to the growing demand for sustainable nutrition. We can begin by addressing how dairy foods are responsibly made, how dairy cows are treated and how the dairy community is addressing hunger, food security and health.

At the same time, we should also share how the dairy community is continuously working to mitigate the environmental impact of agriculture and dairy production, reducing the dairy value chain’s environmental footprint.

The dairy community showcases agriculture’s larger potential. Agriculture can help solve the profound challenges of global food security, climate adaptation and resilience and economic security.

The dairy community must actively partner with global food systems stakeholders to define food security, establish a framework for environmentally sustainable food systems and create a path forward for worldwide economic prosperity.

The dairy community has the opportunity to engage at the highest level with those who are driving the global conversation and guidance on sustainable nutrition. It can also engage at the local community level, demonstrating its continuous commitment to sustainability, sustainable food systems and public health.

Through a commitment to continuous progress and being engaged in addressing sustainable nutrition, the dairy community can help sustain its integral role in food systems of the future, while helping ensure that other agricultural commodities endure and prosper as well.
VII. Appendix

KEY CONCEPTS

Arable land – Land under temporary agricultural crops (multiple-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years).167

Blue water footprint, also known as consumptive water use – Water that has been sourced from surface or groundwater resources and is either evaporated, incorporated into a product or taken from one body of water and returned to another. Irrigated agriculture, industry and domestic water use can each have a blue water footprint.168

Biodiversity – Comprised of the total sum of all plants, animals, fungi and microorganisms in a particular area.67

Buffer strip – Also known as conservation buffers, buffer strips are small areas or strips of land in permanent vegetation, designed to intercept pollutants or manage other environmental concerns.169

Carbon sequestration – Agricultural practices use the process of carbon sequestration to remove carbon dioxide from the atmosphere. Because carbon dioxide is the most important GHG emitted by human activities, sequestration can help prevent climate change by enhancing carbon storage in plant matter and soils.67

Consumer behavior – Reflects the choices made by consumers, at household or individual levels, on what food to acquire, store, prepare and eat, and on the allocation of food within the household. Consumer behavior is influenced by personal preferences determined by taste, convenience, culture and other factors.15

Consumptive water use – See “blue water footprint.”

Conventional agriculture – The prevailing agricultural system, which can vary from region to region, that allows for the use of techniques and practices not part of other systems (such as organic farming), like chemical fertilization and synthetic pesticides, among others.170

Environmental footprint – The measure of how much land and water is needed to produce a resource and to dispose of the waste that is generated.67
**Eutrophication** – The process by which a body of water becomes enriched by inorganic plant nutrients, especially phosphates and nitrates.67

**Food environment** – Refers to the physical, economic, political and socio-cultural context in which consumers engage with the food system to acquire, prepare and consume food. The key elements of the food environment that influence food choices, food acceptability and diets are: physical and economic access to food; food promotion, advertising and information; and food quality and safety.15

**Food system** – A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socioeconomic and environmental outcomes. Types of food systems include:15

- **Traditional** – Rely on minimally processed seasonal foods, collected or produced for self-consumption or sold mainly through informal markets.

- **Mixed** – In which food producers rely on both formal and informal markets to sell their crops. Highly processed and packaged foods are more accessible, while nutrient-rich foods are more expensive.

- **Modern** – Characterized by more diverse food options all year long, and by processing and packaging to extend food’s shelf life. Food safety is monitored and enforced, and storage and transport infrastructures are generally prevalent and reliable.

**Food supply chain** – Encompasses all activities that move food from production to consumption, including production, storage, distribution, processing, packaging, retailing and marketing. The decisions made by the many actors at any stage of this chain have implications for other stages.15

**Foodprint** – The environmental footprint (analysis of water, energy, land, fertilizer requirements and greenhouse gas emissions) required to sustain a diet, either for an individual or a group.76

**Greenhouse gas emissions** – Some gasses, including carbon dioxide, methane and nitrous oxide, trap heat from sunlight near the earth’s surface. These gasses are termed “greenhouse gasses” because they have the same effect in the atmosphere as glass in a greenhouse.67 Anthropogenic greenhouse gas emissions are those generated by human activities.

**Green water** – Water from precipitation that is stored in the root zone of the soil and evaporated or transpired through plants. It is particularly relevant for agricultural, horticultural and forestry products.171

**Grey water footprint** – The amount of fresh water required to assimilate pollutants to meet specific water quality standards. The grey water footprint considers point-source pollution discharged to a freshwater resource directly through a pipe or indirectly through runoff or leaching from the soil, impervious surfaces, or other diffuse sources.171

**Life-cycle assessment** – A method regulated by the International Organization for Standardization (ISO) that provides a standard procedure for assessing environmental impacts. It is a compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product or service throughout its life cycle.67
**Microbial soil inoculation** – Agricultural amendments that use beneficial microbes to promote plant health. ¹⁷²

**Micronutrient deficiencies** – Refer to the inadequate intake of vitamins and minerals. Those of greatest public health concerns globally are vitamin A, iron and iodine. Other important deficiencies are vitamin D, B12, folate, calcium and zinc. ¹⁵

**Nutrition transition** – Refers to changes in lifestyle and dietary patterns driven by urbanization, globalization and economic growth, and their resulting impacts on nutrition and health outcomes. ¹⁵

**Renewable energy** – Renewable energy is energy generated from naturally replenished sources. Examples include solar power, wind power, methane digesters and hydroelectricity. ⁶⁷

**Undernutrition** – Being underweight, stunted (low height-for-age) or wasted (low weight-for-age). ¹⁵

**Water quality** – A term used to describe the chemical, physical and biological characteristics of water. It is usually used to determine water’s suitability for a particular purpose. ⁶⁷

**Water withdrawal** – Describes the water removed from any water body. ⁶⁷
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