

**THE MANAGER**

**ENVIRONMENTAL HOT TOPICS**

By Lee Telega

A dairy's greenhouse gas emissions from burbs, farts, manure storage and tractors are the biggest part of milk's carbon footprint

# Is dairy a carbon Bigfoot?

Now that greenhouse gas (GHG) emissions and global climate change have crept into the marketplace, dairy farms may start to feel some need to account for their carbon footprint. Milk is one of the first products identified by major retailers, including McDonald's and Wal-Mart, to report its carbon footprint. In the future, retailers will likely use this information to help consumers make environmentally informed purchases. They also may expect suppliers to soften their product's impact on the planet.

Getting to this point has taken time. Over a decade ago, when emissions from livestock farms first emerged as an issue, the major concerns were airborne compounds and particles with known health risks. Among these were ammonia (NH<sub>3</sub>), hydrogen sulfide (H<sub>2</sub>S) and fine particulates (PM<sub>10</sub> and PM<sub>2.5</sub>).

As livestock farms became larger and more concentrated in an area, public officials focused on the impact these emissions may have on air quality and their link to public health. During the same time period, dairy farms' neighbors became more vocal about manure odors.

In 2003 the National Research Council identified nine air emissions from livestock operations of global, regional or local concern (Table 1). Notably missing from this 8-year old list is the prin-

ciple GHG, carbon dioxide (CO<sub>2</sub>). The two other well-known GHGs, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), were listed and noted for their significant impact on global climate change.

### Milk's carbon footprint

Initially the term carbon footprint referred to the biologically productive area required to sequester enough carbon to avoid an increase in atmospheric CO<sub>2</sub>. It was calculated as an area of growing non-harvested forestland. Today carbon footprint refers to the net emission of GHGs in terms of CO<sub>2</sub> equivalents (CO<sub>2</sub>e) per unit of product. This is its global warming potential.

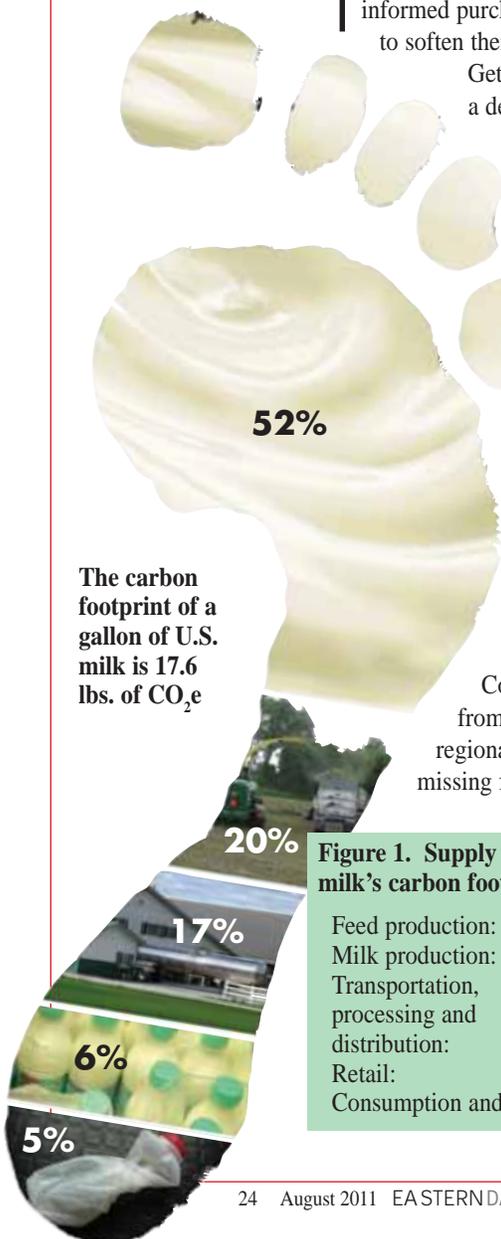
Different gases have different CO<sub>2</sub>e, as this list shows:

- CO<sub>2</sub> = 1 CO<sub>2</sub>e
- CH<sub>4</sub> = 24 CO<sub>2</sub>e
- N<sub>2</sub>O = 310 CO<sub>2</sub>e

The first national milk life cycle study pegs the carbon footprint of a gallon of U.S. milk – from growing feed to the disposal of the carton – at 17.6 lbs. of CO<sub>2</sub>e. Actually, the study is 90% confident the average is somewhere between 15.3 and 20.7 lbs. of CO<sub>2</sub>e.

The greatest share of milk's carbon footprint occurs on the farm. The production of feed accounts for about 20% of the carbon footprint; the production of milk contributes a little more than 50%. (Figure 1.)

Since photosynthesis takes CO<sub>2</sub> from the air, you'd think growing feed would actually reduce milk's carbon footprint. However, the uptake of CO<sub>2</sub>



The carbon footprint of a gallon of U.S. milk is 17.6 lbs. of CO<sub>2</sub>e

**Figure 1. Supply chain contribution to milk's carbon footprint**

Feed production:	20%
Milk production:	52%
Transportation, processing and distribution:	17%
Retail:	6%
Consumption and disposal:	5%

### FYI

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■ For a copy of the national milk life cycle study on dairy's carbon footprint, see this website: <http://usdairy.com/sustainability>.

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by plants is offset by cow respiration and the degradation of manure from the minute it hits the ground until it's applied to cropland.

The major GHGs contributed by producing feed are CO<sub>2</sub> and N<sub>2</sub>O from combustion of fossil fuels used by power equipment for planting, harvesting and ensiling feed. There are GHG emissions attributed to the production of commercial fertilizer and agri-chemicals. Also, cropland can emit N<sub>2</sub>O from applied manure and commercial fertilizers by the denitrification<->nitrification

processes of the soil nitrogen cycle. N<sub>2</sub>O emissions can be greatest in heavy soils during wet conditions.

The gut of cows and manure management account for most of the GHGs from milk production. A bit over half the GHGs comes from CH<sub>4</sub> released from both burbs and flatulence. A little less than half comes in the form of CH<sub>4</sub> and N<sub>2</sub>O from manure handling, storage and field application.

Anaerobic digestion, similar to that in a cow's gut, and denitrification<->nitrification, similar to reactions in soil, occurs with manure whether it's in bedded packs, stored in lagoons or plopped in lots or on pastures. A much smaller contributor to milk production's GHG emissions comes from the energy used to light and ventilate barns and to harvest and cool milk.

Though carbon footprint labels haven't hit your local grocery store yet, they may become as common as nutrition labels within the next 10 years. In fact, European Union countries will implement carbon footprint labeling of products in 2012.

Imagine the new milk carton with a brightly colored banner announcing, "Produced following management practices that reduce milk's carbon footprint." □



## On-farm strategies

Here are some practices you can implement on your dairy to make a difference in its GHG emissions and downsize its carbon footprint. These best management practices can also reduce the costs of doing business and increase your dairy's productivity and efficiency:

**1. Educate yourself about GHG emissions.** Dairies have significantly reduced their carbon footprint over the years by adopting new, sometimes costly, technologies and by better managing their cows. Share this information with your staff, children and farm neighbors as opportunities present itself.

**2. Improve the feed-to-milk conversion** through producing and feeding high-quality forages. This is the single most important way to reduce GHG emissions.

Feed is the major farm input in the production of milk; it also directly affects both digestion and the quantity of manure produced. Cornell researchers estimate a 63% reduction in the carbon footprint of milk since the 1940s primarily because today's herds produce more milk while feeding fewer cows more efficient rations.

**3. Reduce emissions from feed production** in the following ways:

- Use no or reduced-tillage to cut the number of trips across a field.
- Manage pastures efficiently if you graze.
- Be more precise in your application of fertilizer and agri-chemicals, and reduce commercial fertilizer inputs with improved use of manure nutrients.

**4. Install impervious covers** on long-term manure storages and flare off storage gasses.

**5. Adopt anaerobic digestions** where economically feasible.

**6. Install energy conserving equipment** in barns and milking centers to reduce emissions from producing milk.

**Table 1. Emissions from animal feeding operations**

Emissions	Global/Regional Impacts	Neighborhood Impacts	Primary Concern
Ammonia (NH <sub>3</sub> )	Major	Minor	Haze, deposition
Nitrous Oxide (N <sub>2</sub> O)	Significant	Insignificant	Climate change
Mono-N Oxides (NO <sub>x</sub> )	Significant	Minor	Haze, deposition, smog
Methane (CH <sub>4</sub> )	Significant	Insignificant	Climate change
Volatile Organic Compounds	Insignificant	Minor	Quality of life
Hydrogen Sulfide (H <sub>2</sub> S)	Insignificant	Significant	Quality of life
Small Particulates (PM <sub>10</sub> )	Insignificant	Significant	Haze
Fine Particulates (PM <sub>2.5</sub> )	Insignificant	Significant	Health, haze
Odor	Insignificant	Major	Quality of life

Source: *Air Emissions from Animal Feeding Operations: Current Knowledge and Future Needs*. NRC, 2003