CASE STUDY

Measuring and Mitigating the Carbon Footprint of Organic Eggs

Beginning in 2010, Costco engaged its entire supply base to measure the greenhouse gas (GHG) emissions associated with the production of organic eggs. Working in collaboration with the Sustainable Food Lab and using the Cool Farm Tool, the project sought to spur reductions in emissions and introduce more sustainable production practices – from farm to shelf.

Ten large-scale organic egg suppliers collectively producing over 50 million dozen eggs received training to conduct self-assessments. Using the Cool Farm Tool, the farmers calculated the overall emissions of their operations and received a breakdown of emissions by source. From here, the farmers ran “what if” scenarios to determine reduction potentials and map out changes, from making adjustments in animal feed to establishing new transportation routes.

The process of learning about carbon footprinting, collecting comprehensive and accurate data, and understanding which practices can reduce emissions all required a farmer’s active participation and engagement. Recognizing this, Costco supplemented the individual farm assessments with annual summits, brought together their suppliers to review and discuss experiences, ideas and results. There were no external targets imposed on suppliers, but through the annual assessments and annual meetings, farmers were able to compare their performance to each other and learn new techniques for reducing their farm’s carbon footprint and improving the overall sustainability of their operations.

For example, one farmer introduced an idea to create a better racking system for delivery trucks in order to increase transport efficiency. Another farmer said, “We changed our feed ration to more of a wheat-based diet and found that this has had a real impact on lowering our overall emissions. We’re wondering if other farms found this?”

How It's Done: Calculating the Carbon Footprint of Organic Eggs Using the Cool Farm Tool

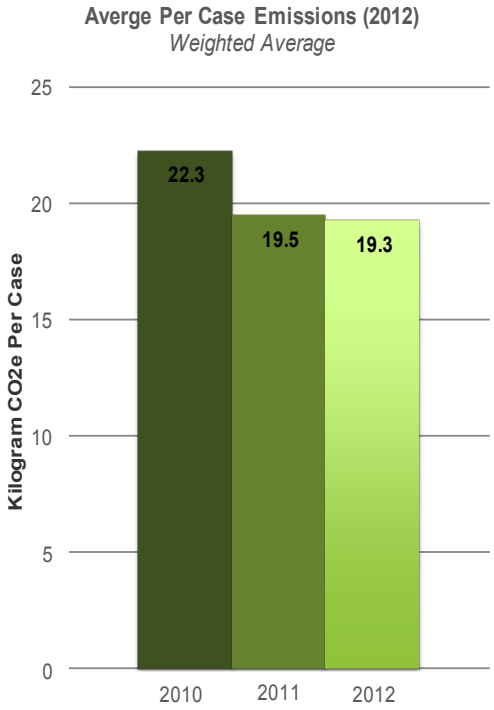
Each September for three years, data was collected from ten suppliers across the United States, representing Costco's entire organic egg inventory. Producers were asked to provide specific information on all aspects of hen and egg production so that the Cool Farm Tool could calculate the most accurate and comprehensive estimate of their farm's carbon footprint, including emissions associated with:

1. The production of feed components, such as corn and soy, for both pullets and adult hens. This includes emissions from the initial production of inputs used on the crop, like fertilizers and pesticides; fertilizer induced emissions; and energy used in producing and harvesting the crop. (For example, the Cool Farm Tool has built-in assumptions about the rates of nitrogen fertilizer applied when growing various feed crops. The tool also has default emission factors representing the manufacturing of fertilizer).
2. Transportation of feed components from the field to the mill, and from the mill to the poultry farms.
3. Energy used by the mill for processing grains and other components into feed.
4. Energy used in the brooder building for care of new chicks, including electricity and heating fuel.
5. Transportation of pullets to the layer houses, and transport of eggs to processing. Similarly, in year two, the project added transport of eggs from the farm or processing facility to the final retail outlet.
6. Energy used for lighting, ventilation, heating and other in-house machinery on the farm.
7. Manure management for all life phases of the hens.
8. Energy used for processing (washing and packing eggs).
9. Composting or incineration of spent hens.

Emissions estimates are reported in kilograms of CO_2-equivalence (CO_2e); this unit of measurement includes the impact of other greenhouse gases, such as Methane and Nitrous Oxide, and is reported per case of eggs. A case of eggs includes 30 dozen-sized cartons.

Results

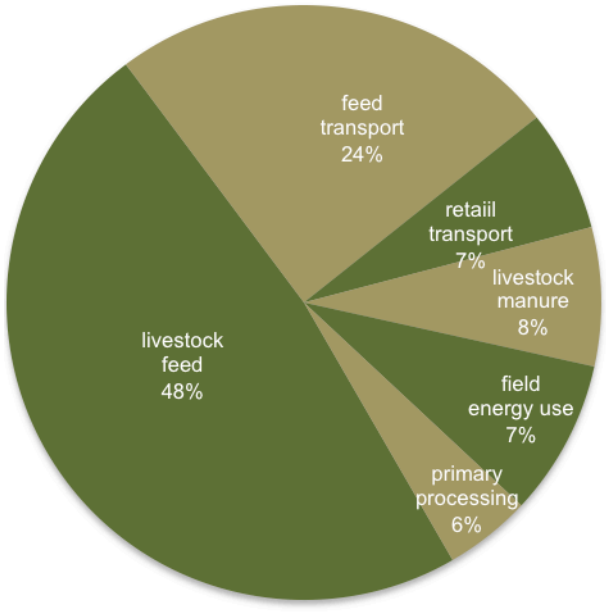
The average emissions of all ten farms supplying organic eggs to Costco in the project's first year as calculated by the Cool Farm Tool was 22.3 kilograms CO_2e per case. The following year, the company's suppliers achieved a GHG emissions reduction of 13 percent, with per case GHG emissions dropping to 19.5 kilograms CO_2e. Suppliers maintained these reductions in 2012 and succeeded in further decreasing emissions to 19.3 kilograms CO_2e per case.



When analyzing specific emission sources or categories, the results show that animal feed (that is, the embedded emissions from actually growing corn, soy and other crops for animal feed) is the largest single source of emissions for most farms and for the supply chain in aggregate, comprising approximately 50 percent of total emissions every year.

These emissions stem primarily from the nitrous oxide (N_2O) emissions that result when nitrogen (N) is applied to crops in the form of fertilizers, and from the energy involved in manufacturing fertilizers. These results are generally in line with other farming systems and with agriculture in general. In the United States, agricultural soil management is the largest source of N_2O emissions, accounting for about 75 percent of total U.S. N_2O emissions over the past two decades (N_2O has 300 times the global warming potential of CO_2).[1]

Average Per Case Emissions By Category (2012)

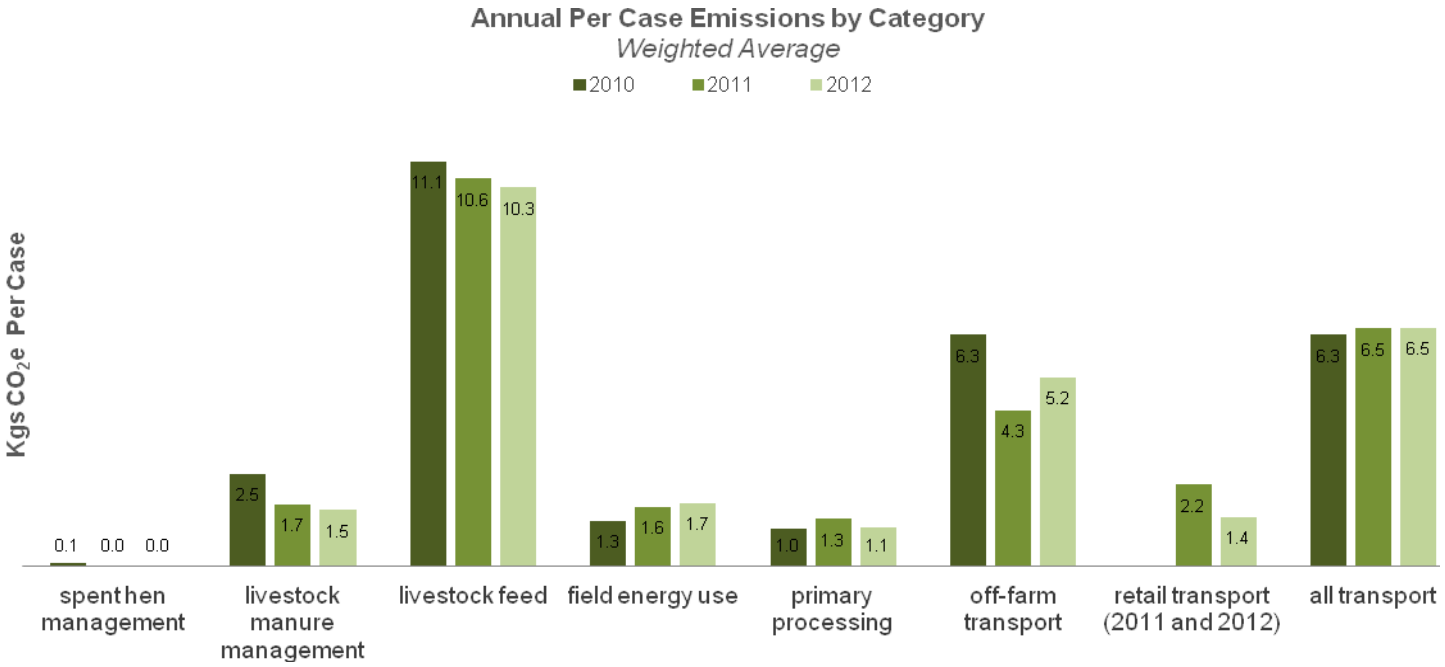


Transportation of the feed from field to mill and from mill to the poultry farm is the second largest contributor, accounting for roughly 20 to 25 percent of total emissions each year.
In 2011, Costco wanted greater insight into transportation-related emissions *after* the eggs are

[1] U.S. Environmental Protection Agency (EPA)

produced. Therefore, every supplier offered data on the number of miles and mode of transportation for their eggs from farm or processing facility to retail outlet or distribution depot. This enabled the Cool Farm Tool to add the emissions that result from transporting eggs to retail into the sum.

This additional retail transportation, averaged among all ten suppliers, added 2.25 kilograms CO_2e in 2011 and 1.37 kilograms CO_2e in 2012. However, for the sake of consistency, year-on-year, per case totals in the graph above are reported without retail transportation.



Identifying Reduction Potentials

After calculating the GHG emissions associated with production, each supplier conducts several “what if” scenarios using the Cool Farm Tool to identify practices that would potentially mitigate emissions.

With three year’s worth of data, Costco and its organic egg suppliers, along with the Sustainable Food Lab, analyzed the results and shared best practices during annual summits. Which farms experienced the most significant reductions? Among the many mitigation practices that were introduced, which had the greatest reduction potential, and can they be applied more broadly among suppliers in a commercially viable way? What other opportunities exist for further reductions? These are the questions that Costco and its community of suppliers are asking.

In the context of organic egg production, Costco suppliers identified several pathways to reducing emissions, including:

- ***Adjusting Animal Feed Components:*** As livestock feed is the most significant contributing factor to emissions on most poultry farms, it is an ideal starting point for improvement. Typically, both pullet and adult hens consume a blended grain diet that is primarily corn-based. Over the past three years, several farms were able to make relatively simple adjustments to feed components and realize significant emissions reductions. For instance, some suppliers experimented with decreasing the amount of corn and increasing the amount of wheat used in their feed, as wheat generally requires less nitrogen fertilizer than corn, thus resulting in fewer emissions (141 kg CO_2e for a ton of wheat compared to 271 kg CO_2e for a ton of corn). An increase in the portion of wheat and a decrease in corn reduced livestock feed emissions by 32 percent for one supplier and enabled them to achieve overall per-case emissions reductions of 30 percent since 2010. Similarly, a supplier in the Pacific Northwest achieved a 28 percent reduction in feed-related emissions within the first year by adopting a higher portion of alfalfa, an even more efficient feed ingredient (at 20 kg CO_2e per ton).

- ***Reducing Transport by Identifying Local Sources of Feed:*** After its production, the transportation of feed from the field to the mill and from the mill to the poultry farm represents the second most significant source of emissions. While some suppliers have the good fortune of living in a region amenable to growing feed crops, others are reliant on having to transport feed long distances over road and rail – sometimes more than 1,000 miles. The unavailability of local organic feed is major a challenge for some suppliers and caused one farm to have transport-related emissions more than twice the average. However, other farms were able to achieve transportation-related emission reductions, with one farm reducing transport emissions by 30 percent as a result of sourcing a higher percentage of feed from a more local source. Looking ahead, at least two farms plan to build their own onsite feed mills, a move that is projected to cut their transport-related emissions by nearly a third.

- ***Improving Manure Management Practices:*** According to the Cool Farm Tool analysis, manure management practices account for 8 to 10 percent of total emissions on average and avoiding prolonged manure buildup can help decrease emissions. For example, one of Costco's suppliers on the West Coast was able to reduce emissions from poultry manure by over 30 percent by storing less manure in an anaerobic lagoon. Another supplier achieved a 60 percent reduction in poultry manure emissions simply by having neighboring organic farms pick up the manure earlier in the season.

Additional improvements to other production processes can also bring about significant emissions reductions. For instance, by streamlining logistics and egg delivery to a distribution depot rather than to individual stores, one supplier reduced their retail transport emissions by over 90 percent, achieving the lowest retail transport emissions among all ten farms in 2012. That same farm also decreased emissions from energy used in its processing facilities by 50

percent by consolidating two buildings and introducing more efficient technology, including simple fixes such as installing skylights for increased heat.

When combined, these and other practices will continue to have a major impact on reducing GHG emissions at all stages of the production process. Since the project began, Costco's ten organic egg suppliers have been able to collectively reduce per-case emissions by 14 percent, or 3 kilograms of CO_2e, while also increasing their production and expanding their organic operations to meet rising consumer demand. When multiplied by the 2012 volume of eggs delivered to Costco, this amounts to more than 3,200 tons CO_2e in savings.

Today, food companies are challenged in effectively engaging with their supply chains on issues of sustainability. However, for these three years, Costco and its network of organic egg suppliers have relied on the Cool Farm Tool to build a foundation for continuous improvement around the critical issue of climate change, and the early results are encouraging.