



## Localizing the Northeast Dairy Supply Chain May Not Offer Many Benefits

A summary of “Environmental and Economic Impacts of Localizing Food Systems: The Case of Dairy Supply Chains in the Northeastern United States,” by Charles F. Nicholson<sup>a,b</sup>, Xi He<sup>b</sup>, Miguel I. Gómez<sup>c</sup>, H.O. Gao<sup>b</sup>, and Elaine Hill<sup>c</sup>. Published in *Environmental Science & Technology*, Volume 30, Issue 4, October 2015.

Locally grown foods are generally assumed to travel shorter distances from farm to table than foods grown further away, and also are often touted as more environmentally and economically responsible. The degree to which these claims are true depends in part on one’s definition of local. In recent years, initiatives aimed at increasing local food purchases have proliferated. Referred to here as “localization” initiatives, they all seek to reduce the distance that food travels from farm to consumer, but they use varying definitions of local.

The USDA defines local food as grown, processed, and distributed within state boundaries or within 400 miles of its purchase location. The state-boundary definition has become more popular because it is easier to communicate to consumers and a number of state governments have a long history of promoting foods grown and distributed within their boundaries (e.g., PA Preferred and Pride of New York). Other programs promote foods grown within a certain region (e.g., the Chesapeake Bay or New England). However, few studies have examined the broad implications of localization programs and the potential tradeoffs they pose. Thus, there are several unanswered questions about their environmental and economic outcomes. For example, resources to support storage and processing facilities are limited. If these resources are directed toward localization efforts for one product, how will this influence the distances traveled by other products? By restricting localization efforts to state boundaries, might food end up traveling further than in scenarios where neighboring states provide closer food sources or markets?

<sup>a</sup> Department of Supply Chain and Information Systems, Penn State

<sup>b</sup> School of Civil and Environmental Engineering, Cornell University

<sup>c</sup> Charles H. Dyson School of Applied Economics and Management, Cornell University

### Key Takeaways

- The study analyzed the existing Northeastern U.S. dairy supply chain, which served as the baseline scenario, and compared it to two possible localization scenarios.
- Reconfiguring the dairy supply chains to increase localization may have unintended consequences.
- The study shows that increasing localization leads to greater distances traveled by fluid milk and by all other dairy products and to increased greenhouse gas emissions.
- The use of state or sub-regional boundaries in “buy local” promotion programs may be counter-productive to goals of reducing food miles, costs, and emissions.

### Objectives

The authors of this study wanted to better understand the tradeoffs posed by initiatives that promote the purchase of foods grown and processed within certain geographic boundaries. They analyzed the existing Northeastern U.S. dairy supply chain, which served as their baseline scenario, and compared it to two possible localization scenarios. One of the comparison scenarios used state boundaries as its definition of local, while the other used regional boundaries formed by small groups of states. The goal of this comparison was to determine the distances that milk or milk products travel between farm and their final

consumption locations under different localization restrictions. Using these distances, often referred to as “food miles,” the researchers could then determine the greenhouse gas emissions and transportation costs associated with each scenario. They also wanted to understand how each scenario would influence regional employment and economic activity.

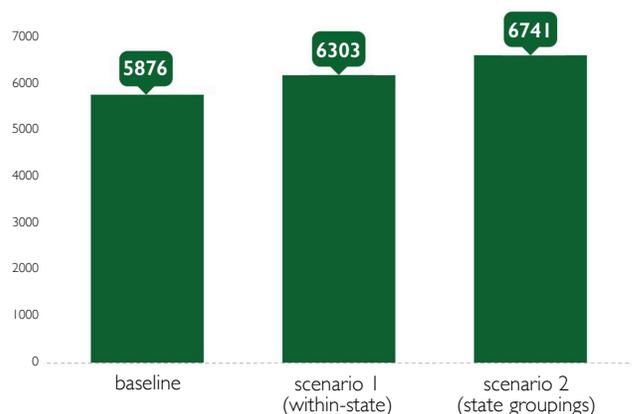
The researchers chose to study the dairy supply chain for several reasons. First, as the largest agricultural sector for several states in the region, the dairy sector is economically important to Northeast agriculture. As a result of its abundance in the region and the expense involved with transporting it, fluid milk is already widely consumed as a regional food by Northeast residents. Finally, as a key ingredient in the manufacture of other dairy products, milk offers researchers a look at how localization efforts of one food item can affect supply chains for other food items.

### The study

The dairy supply chain, which comprises more than two dozen dairy products including cheese and butter, is quite complex. The researchers’ first step was to identify ways to collect milk from milk suppliers, ship it to and between processing facilities, and distribute the end products to their final demand locations where products are sold, while minimizing distances traveled and associated transportation costs. To calculate this least-cost solution, they developed a computational model using national data on the locations of these supply chain facilities and on supply and demand for various milk products. The result, which assumes no localization and approximates the current Northeast U.S. dairy supply chain, served as the team’s baseline scenario.

Next, the researchers developed two “what if” scenarios to compare to the baseline, imposing constraints to simulate the effects of localization. The first of these asked, “What if each Northeast state produced and consumed fluid milk only within its own geographic boundaries?” Only five of these states (Maine, New Hampshire, New York, Pennsylvania, and Vermont) actually produce enough

Figure 1. Simulated greenhouse gas emissions (in megatons) resulting from transportation of fluid milk in three scenarios, using data from March 2011.



When compared to the baseline scenario, the within-state localization scenario resulted in a 7 percent increase and the state-grouping scenario resulted in a 15 percent increase in total miles traveled and greenhouse gas emissions.

milk to meet their populations’ demand, so the model allowed for the remaining states to receive milk from any other state in the U.S.

The second scenario broadened the localization parameters by asking, “What if groups of states form self-sufficient sub-regions, with all fluid-milk consumption, production, and processing occurring within the confines of each sub-regional boundary?” This approach divided the Northeast into three sub-regions: (1) New England, comprising the six New England states; (2) New York and New Jersey; and (3) the remaining states of Pennsylvania, Delaware, and Maryland.

The researchers compared these two localization scenarios to the baseline scenario to see how they differed in terms of the distance that the milk or milk product travels between the dairy farms and the final consumption location. Using these findings, they next calculated the greenhouse-gas emissions that would result given each scenario’s food miles, using the U.S. Environmental Protection Agency’s Motor Vehicle Emission Simulator and considering the modes of transportation that are typically employed within the dairy supply chain.

To arrive at the economic effects of each localization scenario, they calculated the change in the number of

---

jobs in the processing and distribution of four dairy products (fluid milk, cheese, butter, and dry milk) resulting from the reconfiguring of the supply chain.

## Findings

The researchers found that reconfiguring the dairy supply chains to achieve either of the two localization scenarios considered in the study increased the overall distance traveled by fluid milk and by all other dairy products. That's because some of the least-cost solutions identified in the baseline scenario, like sourcing farm milk across state lines, are not permitted in either localization scenario. The within-state localization scenario resulted in a 7 percent increase in total miles traveled, and the state-grouping scenario resulted in a 15 percent increase, although in each scenario, the actual difference from the baseline differed by product and by state or state grouping. Considering that milk is a raw material used in the manufacture of so many other dairy products, impacts were observed elsewhere in the dairy supply chain, too. Transportation costs also rose slightly, as a result of the increased travel distances.

In terms of greenhouse gases, increases in emissions that correspond with the increased travel distances in both localization scenarios also were found. The relationship isn't linear, however, owing to the fact that different vehicles would be employed for different shipment sizes, with variable emission consequences. Nonetheless, the researchers warn that even small increases in diesel emissions could significantly elevate health risks for those living in close proximity to active supply chain nodes.

Each of the two increased localization scenarios showed slight differences from the baseline in terms of employment and economic activity. Gains in employment and economic activity that resulted from either localization scenario were modest, suggesting limited opportunities for meaningful growth in these areas. Fewer than four new jobs in the entire Northeast would result, and economic activity in the region would increase by less than \$1.7 million per month, which represents a very small slice of the economic activity generated by the Northeast dairy industry of over \$2.1 billion per month.

## Conclusion

Despite commonly held assumptions that localization efforts achieve desired outcomes such as decreased food miles, transportation costs and emissions, and increased employment, this study demonstrates that the outcomes of such efforts are not well known. The researchers show that the use of state or sub-regional boundaries in "buy local" promotion programs may be counter-productive to these goals in certain circumstances and with certain products and supply chains. Rather, the study suggests that an appropriate definition of "local" could differ, based on desired outcomes and specific products. In the case of fluid milk in the Northeast, the existing supply chain, which is already a regionalized system, appears better suited than more "localized" alternatives to achieve certain environmental outcomes. The study also suggests that achieving the goals of food localization may require a more nuanced approach that accounts for various trade-offs and region- and product-specific variables. ❖

### About the EFSNE project

The work described here is part of a larger research project called "Enhancing Food Security in the Northeast through Regional Food Systems" (EFSNE). From 2011 to 2017, the EFSNE project engaged more than 40 partners at multiple universities, non-profits and government agencies around the question of whether greater reliance on regionally produced food could improve food access in low-income communities, while also benefiting farmers, food supply chain firms and others in the food system. Learn more at <http://agsci.psu.edu/research/food-security>.

EFSNE is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number (#2011-68004-30057) and is led by the Northeast Regional Center for Rural Development. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the view of the U.S. Department of Agriculture.

This brief was written and edited by:

- Kathy Ruhf, Northeast Sustainable Agriculture Working Group
- Kristen Devlin, Northeast Regional Center for Rural Development
- Kate Clancy, Food Systems Consultant

The authors acknowledge the contributions of Carol Geisecke, Delaware State University.