In the Eastern United States

A Multifaceted Focus on Farms and Food

The project is a cartographer's dream: a map that melds layer upon layer of digital information to compile a comprehensive picture of the potential for local food production all along the eastern seaboard.

"We want to identify the information we need to assess our capacity to produce food locally that meets the needs of a large urban population," says Wayne Honeycutt, who is the research leader at the Agricultural Research Service (ARS) New England Plant, Soil, and Water Laboratory in Orono, Maine. "And we want to find out how this capacity changes all along the eastern seaboard region as the seasons change."

"It's an incredibly diverse undertaking," adds David Fleisher, an agricultural engineer with the ARS Crop Systems and Global Change Laboratory in Beltsville, Maryland. "We're going to compare county-level data on weather, soil types, fertilizer use, land availability, water availability, projected changes in climate, and plant suitability from Maine to Virginia."

Gathering the Data

For this project, the ARS scientists have pulled together a diverse array of research partners from the Massachusetts Institute of Technology, Tufts University, Iowa State University, Cornell University, and Pennsylvania State University. Two other USDA agencies—the Economic Research Service (ERS) and the Agricultural Marketing Service—are also contributing to the study.

The eastern seaboard is probably better known for its dense urban corridors than for its farm produce. In fact, from 2002 to 2007, around 911,000 acres of farmland were taken out of production for housing, shops, and other development. Still, according to the 2007 Census of Agriculture, the total market value of agricultural products in the study area—which includes 13 states and the District of Columbia—exceeded $20 billion.

The research team wants to examine the constraints imposed by time and space to pinpoint environmental, economic, social, and other geographic factors in local agricultural practices. Then they will use the data to build computer models to assess local food-production potential and the economic viability of realizing this potential.

Going Local

Until recently, low fuel prices contributed to the globalization of the U.S. food system. Food is grown and processed in a limited range of regions and then transported over long distances to many different markets. The result? More than 65 percent of the vegetables and 80 percent of the fruit consumed in the eastern seaboard is produced and brought in from somewhere else.

But today, says Pat Canning, an ERS economist and a partner in the research, "Fluctuations in fuel costs have significant cost implications for long-distance food shipments."

Fleisher and Honeycutt believe that relying more on strategic production of locally grown food can counter the challenges of rising transport costs, expanding populations, and vanishing farmlands. In addition, expanding opportunities for local food production could stimulate rural economies and offset the risk of food shortages in one area by increasing and diversifying local production in other areas. It would also shorten the time produce spends in transport, which can boost overall quality by preserving nutrients, freshness, color, and taste.

The team will model actual crop-production practices and the flow of agricultural products into supply chains, including all the associated handling and transportation costs, from furrow to market. This will help identify how the costs and benefits of locally grown produce compare with those of produce transported over long distances.

"When we have our results, I think we'll remember how fertile the eastern seaboard is," Fleisher says. "But at the same time, we'll be surprised at how much land is no longer available—and how much soil is not suitable—for crop production."

Honeycutt is convinced that establishing systems for local sustainable food production in the United States will be essential to meet future food needs. "We don't want to become dependent on other countries for our food supply," he says, "because as world population increases and economies develop in other countries, there will be increasing demand for food outside of the United States."

STEPHEN AUSMUS (D1632-2)

Microbiologist Patricia Millner and soil scientist John White review gas-emission data from an enclosed compost pile. A large metal box (seen being lifted with a tractor) is placed over the compost pile so that all gas emissions can be captured and measured.

The Complete Composters

In sustainable agriculture, every component counts. So at the ARS Environmental Management and Byproduct Utilization Laboratory in Beltsville, microbiologist Walter Mulbry is working on another piece in the matrix—recycling manure and discarded food to develop the perfect pile of compost.

"We want to find a balance between 'hot' composting practices—which increase the temperature of the compost pile and speed decomposition—and just letting materials decompose on their own," Mulbry says. Hot composting requires energy and labor to mix and aerate the compost piles, but it can generate high-quality compost relatively quickly. It may also reduce the amount of greenhouse gases emitted during the process.

"At the Beltsville Agricultural Research Center, we're able to follow the interconnected cycles of carbon, nitrogen, and phosphorus in a holistic manner, starting with raising the crops used to feed the animals," Mulbry says. "We collect the manure, compost it, and apply it back to crop fields."

STEPHEN AUSMUS (D1635-8)

Biologist Heekwon Ahn (left) and microbiologist Walter Mulbry check temperature and inspect recently harvested food-waste compost for items that did not biodegrade, like plastics, metal, and twist-ties. In the background, compost facility manager Randy Townsend and microbiologist Patricia Millner test a specialized pulper to pretreat cafeteria waste before it is composted.

STEPHEN AUSMUS (D1637-20)

Reaching into a soil-plant-atmosphere chamber, agricultural engineer David Fleisher measures potato leaf chlorophyll content. Results from these and similar studies are used in developing field models for estimating agricultural productivity in the eastern seaboard region.

The composting research also includes discarded food residuals. It is estimated that 12 percent of all municipal solid waste is food scraps and that only 2 percent of food waste is recycled.

Mulbry is working with Patricia Millner, a microbiologist at the ARS Environmental Microbial and Food Safety Laboratory in Beltsville, on reducing the release of methane from landfills by diverting food residuals and other organic materials to composting.

The two researchers want to measure greenhouse gas emissions from the composting process and compare how well the two composts—from manure and from food residuals—function as soil amendments. They also plan to capture ammonia during the composting process and use it to improve the nitrogen content of mature composts. Currently, about half of the carbon and nitrogen in composting materials—whether manure or food residuals—is lost to the air, rather than being captured in the compost.

"We are evaluating ways to compost food scraps, animal carcasses, and seafood in an environmentally sound way to produce useful products such as organic biofertilizer," Millner says. "Since it takes a lot of energy to produce nitrogen fertilizer, we could save part of that energy by recycling food scraps and capturing the ammonia in an organic matrix like compost." Millner has a cooperative research and development agreement with RCM, LLC of Maryland for the nitrogen-capture work.

Millner is comparing several types of insulated in-vessel composting units for self-heating uniformity, gaseous emissions, and other costs and benefits—a prime example of how sustainability and technology can go hand-in-hand.

Maryland Compost for the Nation's Capital

Millner is also partnering in a project that extends from the Beltsville composting grounds to the grounds of federal buildings in Washington, D.C. Every weekday, food scraps and compostable cafeteria ware are collected from the Maryland Food Distribution Authority in Jessup, Maryland, and from small, local foodservice and marketing establishments.

The materials are trucked to Beltsville, where they are mixed with woodchips, leaves, and other components. Several months later, some of the finished compost is delivered to the National Mall for use in landscaping around the Jamie L. Whitten Federal Building, the U.S. Botanic Garden, and the U.S. Capitol.

"We'll continue to make compost available for other federal green projects—such as roof gardens, rain gardens, and other landscaping designs—to retain water and reduce runoff at federal sites in the area," Millner says.

"There are a lot of practices that we can change for relatively little cost that might have a significant payoff," Mulbry observes. "We need to look at the different kinds of residuals and understand the different ways they need to be treated. We have to get moving on these issues—but we have to get moving on a scientific basis."—By **Ann Perry** and **Don Comis,** ARS.

STEPHEN AUSMUS (D1638-9)

Biological science aides Dante Hamilton (left) and Arvind Shantharam measure leaf development of potatoes grown at different levels of nutrient stress. The data is used to calibrate models for estimating crop productivity in the eastern seaboard region.

This research is part of Manure and Byproduct Utilization (#206) and Global Change (#204), two ARS national programs described on the World Wide Web at www.nps.ars.usda.gov.

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A Different Slant On Sustainability: More Nutrition Per Acre From Plants!

Enhancing plants so that the nutrients they offer can be more readily absorbed by our bodies isn't often part of conversations about sustainable farming.

It should be.

That's the opinion of ARS physiologists Ross M. Welch and Raymond P. Glahn. After all, gleaning more nutrition from every acre makes better use of America's farmlands.

Studies that Welch and Glahn conduct at the ARS Robert W. Holley Center for Agriculture and Health in Ithaca, New York, focus on compounds in foods that increase or, problematically, decrease absorption of nutrients from those foods.

One investigation by Welch, Glahn, and Cornell University collaborators revealed that a polyphenol known as "kaempferol" may be a key culprit in decreasing absorption of iron from red and pinto beans.

Scientists have long known that polyphenols interfere with absorption of iron from beans. The Ithaca study, however, is apparently the first to pinpoint a specific polyphenol in beans as a possible major player.

Working with laboratory cultures of human digestive system cells, the researchers also determined that polyphenols may have a more significant role in blocking the body's iron uptake than does phytate, a plant compound known to interfere with iron uptake.

But there's another side to polyphenols. "They're antioxidants and thus are potentially important nutrients," says Glahn. "We're investigating them further."

The ongoing research may help plant breeders and nutritionists sidestep the polyphenol problem. The work is invaluable, not simply because these and other dry beans are a traditional and popular part of cuisines worldwide, but also because the little legumes have more iron—and protein—than many other major crops.

Making the iron in beans more readily absorbable could, says Glahn, "help alleviate the iron deficiency that today afflicts more than 2 billion people worldwide."—By **Marcia Wood,** ARS.