Enhancing food security in the Northeast

by Madeline Fisher
and 2007, Rhode Island, New Jersey, and three other Northeastern states lost a larger proportion of their agricultural lands to development than anywhere else in the country. The region now has more than 20% of the United States’ population, but only 5 to 6% of its farmland. As much as 75 to 80% of the fruits and vegetables consumed in the Northeast come from faraway places like California, and more than seven million of its citizens lack access to healthy and affordable food. Add in uncertainties like California’s extreme, ongoing drought, and it’s clear why many people believe the Northeast is vulnerable when it comes to food.

Some of the discussion started back in 2007 among a handful of researchers and national program leaders at USDA-ARS. As energy prices soared, the group began to wonder what would happen if the trend continued. Would the price of fruits and vegetables spike, too, due to rising transportation costs? Could those costs even force shifts one day in where food is grown? And how might climate change factor in?

At the same time, other researchers were looking at the issue from different, but related, angles. Stephan Goetz, a Penn State University agricultural economist, was interested in the economic benefits of regional food production—not only for farmers, but also food distributors, retailers, and others businesses in the supply chain. Food systems expert and consultant Kate Clancy, meanwhile, was asking whether more regionally produced food could be directed to low-income neighborhoods.

In 2009, these people all began talking together, and in 2010, they submitted a grant proposal to the Agriculture and Food Research Initiative (AFRI) of the USDA National Institute of Food and Agriculture (NIFA). Funded in 2011, the ambitious, interdisciplinary project now has 50 researchers, educators, entrepreneurs, and community leaders from 12 states working toward a common goal: to see whether “re-regionalizing” the Northeast’s food system truly can achieve greater food security for its citizens.

Just how much food the region can grow therefore becomes an essential question to answer. But others are equally important, says Goetz, the project’s overall director. “Once the food is produced, how do you get it to the consumer most efficiently and effectively?” he asks. “And how do consumer preferences get signaled back to farmers so that the farmers know what to produce?”

Many studies—including hundreds upon hundreds in agriculture, of course—have examined problems of production, distribution, and consumption one at a time; what makes this project different is its integration of the three. “This really is a systems project,” Goetz says. “We’re trying to understand how everything hangs together.”

Future vs. Immediate and Regional vs. Local

Another novel aspect, adds Clancy, the project’s deputy director, is the team’s concern with food security on two levels. There’s food security in a future sense (what happens to all of us if irrigation in California’s Central Valley plummets due to climate change?), and there is the immediate food security of the Northeast’s poor and disadvantaged. In conversations about regional food, these groups have often been left out, Clancy explains. People assume regionally sourced foods will be too expensive for low-income residents, for example, or that market demand for them doesn’t exist in disadvantaged neighborhoods. But to Clancy, the distinction makes no sense.

“It’s not like low-income populations exist in a vacuum,” she says. “They exist inside the same food system everyone else does.” That’s why focusing on them is so powerful, she adds. These groups have real and pressing needs, offering the team a tangible target to aim for even as it explores questions at larger scales and more theoretical levels.

“If we only looked at production, we’d have some interesting information about capacity,” she says. “But there would really be no connection to where that information needs to go, doi:10.2134/csa2014-59-7-1
which in our case, first of all, is stores in low-income areas.”

The other point she emphasizes is that while people often use the terms “local food” and “regional food” synonymously, they aren’t the same. “Local” typically refers to food grown within 50 to 100 miles of a consumer’s location, whereas regional food in the Northeast could be sourced from any of the 12 states.

The difference is important, Clancy asserts. She and the others not only think regional food may be more environmentally and economically sustainable than strictly local sources, but they also believe the full land base of the Northeast will be needed to sustain its population. And that brings the conversation around again to how much food the Northeast can produce—or, more precisely, the extent to which it can meet the food needs of its residents, says Tufts University professor Tim Griffin.

His production team on the project is charged with answering that question. Before tackling it, though, the scientists wanted to gauge how close or far away the Northeast is today from what they call “regional self-reliance,” says Griffin, an ASA and SSSA member who worked for USDA-ARS before joining Tufts in 2008. For example, what’s the total amount of milk produced on Northeast dairy farms versus the region’s total consumption of dairy products?

While general data are available on the region’s total acres of farmland and number of people it needs to support, he explains, information on specific foods is tougher to find. So, in a study published earlier this year in *Renewable Agriculture and Food Systems*, he and his colleagues collected a decade’s worth of land use and production data for 100 regionally grown crops, along with livestock products and seafood. They then calculated the net balance between production and consumption for various food types.

Some of the results verified their expectations. “The production of leafy green vegetables is so concentrated in California and Arizona, for example, we knew the [regional] number would be low,” Griffin says. And sure enough, it was less than 10%, meaning the Northeast currently imports more than 90% of the leafy greens it consumes. Milk, in contrast, turned out to be “inherently regional,” he says: The Northeast produces about as much fluid milk as it uses. That also wasn’t surprising given the Northeast’s high concentration of dairy farms.

What Griffin didn’t expect is how alike Northeast agriculture is to farming in other regions. People assume it’s fairly diversified, he says. But when his team actually analyzed the regional uses of farmland, they saw dominance by just three crops: Corn, soybean, and wheat. “The same crops,” Griffin notes, “that dominate other parts of the country.” For instance, 40% of Northeast cropland grows corn today, mostly for animal feed. And when soybean and wheat are factored in, the three make up 70 to 75% of production.

Regional-Scale Modeling and Analysis

So, if the Northeast wants to grow a wider assortment of its own food in the future, there are two main choices. One is that land currently devoted to corn or wheat could be shifted to other crops. The second would be to bring additional land into cultivation. Griffin is now working with his former USDA-ARS colleague, Fleisher, and others to explore the myriad ways those scenarios might play out in the future.

Why are the possibilities so vast? First, the group isn’t trying to predict where different crops can be most productively grown on a single farm, in a single watershed, or even in one region.
Vegetable Breeders Work to Boost Food Production in the Northeast

Agricultural researchers and social scientists aren’t the only ones working to boost Northeast food production; vegetable breeders are doing their part, too. In the Cornell University lab of Michael Mazourek, the target crops are winter squash, peppers, cucumbers, melons, and snap peas, all of which are already cultivated in New York State, especially in the local foods mecca surrounding Cornell.

Still, a recent study led by Tufts University found the Northeast as a whole produces just 26% of the vegetables it consumes, so there’s a lot of room to grow. To help things along, Mazourek’s group follows a “holistic” breeding approach, says doctoral student Lindsay Wyatt—taking into account market trends, interests of the vegetable seed industry, and, of course, the needs of area farmers.

Like crop breeders everywhere, the Cornell researchers are always helping farmers stay ahead of new and emerging diseases. Wyatt’s fellow grad student, Bill Holdsworth, recently bred cucumbers to resist a troublesome new strain of downy mildew. The group has also been tackling the blight caused by *Phytophthora capsici*, a hardy pathogen of bell peppers that spreads easily to other vegetables. And farmers care eternally about yield, so yield is also a constant breeding goal.

When the focus is on vegetables for regional markets, though, some less common qualities also come into play. In her work on butternut squash, for instance, Wyatt keeps close tabs on fruit flavor, texture, and nutrient content. These traits can “get lost in the shuffle of breeding sometimes,” she says. But they’re extremely important to buyers of local produce, who expect homegrown offerings to be tastier, lovelier, and more nutritious than foods trucked from California.

California does have one huge leg up on the Northeast, however: It can provide fresh vegetables year-round. That’s why Mazourek’s breeding program and many others are trying to extend the season for produce grown in northern climes. As part of an initiative called NOVIC (Northern Organic Vegetable Improvement Collaborative), Mazourek’s group examined the factors influencing the storage life of winter squash, so that it lasts longer into winter. At the other end, corn breeders are developing sweet corn varieties that mature earlier. This way, farmers can offer local corn sooner in the summer, when they can charge premium prices.

Making regional production more profitable is just part of the equation, though. The other piece is consumer demand, and here plant breeders think they’ve got some answers, as well. “It seems like having more choice is always better for getting people excited about things,” Wyatt says, especially food. Apples come in dozens of varieties, for instance, and specialty and heirloom tomatoes are rapidly gaining popularity. In the meantime, one butternut squash at the grocery store seems the same as any other. So, why not have special varieties of squash or cucumber, too?

Giving people a wider range of delicious, nutritious, and regionally sourced veggie options might just increase demand. And there’s definitely enough genetic diversity within the cucurbit family to breed new varieties, Wyatt says.

Then it would just be a matter of educating consumers about the choices. “So, maybe they’ll have their favorite cucumber one day,” she says. “Who knows?”
state; they’re trying to assess this for the entire Northeast at once. Then layered on top are all the unpredictable things that may happen: shifts in climate, additional loss of farmland, or changes in population, policies, or peoples’ diets. Given all this, the production team realized it needed a tool for investigating the various scenarios—one that planners and policy makers could also use to make decisions.

“We’re not trying to prescribe what the future should be,” Griffin emphasizes. “But there hasn’t been a strong, cohesive framework that allows alternatives to be evaluated. So that’s what we’re aiming for.”

As a first step, they’ve created a computerized interface for integrating crop models that simulate plant growth and crop yield in farm fields, with spatial sources of information on land use, weather, soil quality, and other factors. Efforts to bring crop models and spatial data together aren’t exactly new, explains Jonathan Resop, a spatial modeling expert who led the interface’s development as a postdoc with Fleisher. But nobody had spelled out a precise, step-by-step methodology for marrying the two. Nor is it common to try to predict crop production both at field scales as fine as 30 meters and across an area as sizeable as 12 to 13 states.

The latter is just what the interface, known by the acronym GAMCAF, now allows the team to do. “We can take field-scale crop models and apply them at the regional scale,” Resop says.

The team’s first use of the interface, reported in the January–February 2014 issue of Agronomy Journal, was to estimate the Northeast’s total capacity for potato production by integrating a well-developed potato crop model into GAMCAF. Fleisher has since added a corn crop model, is working on inserting a model for wheat, and hopes to add many more. And that’s really the point.

“The first paper was kind of a giant ‘what if?’” Fleisher says. “If you could put all of the region’s agricultural land into production for [just one] commodity, which happened to be potato, how much could this region produce?” But once other crop models are included, the team can begin exploring trade-offs: Where in the Northeast does potato grow best, for example, versus corn, soybean, or broccoli? Fleisher envisions eventually creating a map or response surface that would display the yield indices for all the Northeast’s different crops. “It’s a way to optimize the spatial production of our commodities for our regional needs,” he says.

That’s only part of what GAMCAF can do, though. “The real power of the interface is that it lets you look at different scenarios of land use, water, and climate change,” Resop says. It now includes climate data from the IPCC (Intergovernmental Panel on Climate Change), for example, enabling predictions of how future carbon dioxide, temperature, and precipitation scenarios will affect crop yields. If temperatures across the Northeast rise by the predicted 2 to 3°C over the next 40 years, for instance, “that would have a much bigger effect on potato than it would on a crop like corn,” Fleisher says.

Yet other scenarios the platform could explore are the impacts on yields of shrinking farmland acreage or dwindling irrigation supplies. Or, conversely, it could examine the effects of bringing abandoned farmland in places like Maine back into production. There’s also no reason why it couldn’t be used one day to make similar forecasts for other U.S. regions or even the entire country, Fleisher adds.

Re-regionalizing Supply Chains

First things first, though. If Northeast food production does re-regionalize, then supply chains will need to, as well, Goetz says. How best to accomplish this is a question he’s currently tackling with his postdoc, Hamideh Etemadnia. USDA already knows that small- to mid-sized farms often struggle to access established distribution infrastructures, such as trucks and storage facilities, making it hard to get their products to retailers and con-
sumers as efficiently as possible. So to ease the problem, the agency has proposed establishing regional “food hubs,” or wholesale sites.

But situating wholesale links so that they minimize food waste and transportation and inventory costs for supply chain businesses—all of which can affect food prices in stores—is no easy matter. It’s also for Goetz a critical piece of the entire puzzle. “That’s really the question,” he says, “How can we connect underserved members of the community with regional production while also benefiting all the supply chain members?”

To begin answering it, he and Etemadnia have developed a tool for modeling the optimal locations of these hubs in the chain—or more appropriately, network—linking farmers and their customers. Published last summer in the Transportation Research Record, the model lets users see how much the current distribution system deviates from the optimum, for instance, or the cost savings businesses could achieve by relocating distribution centers, especially as fuel costs rise. In this way, the tool is very similar to the models being developed by the production team. And like the production team members, Goetz and Etemadnia hope that planners and policy makers will eventually make use of it.

Not to be outdone, researchers on the consumption team have been creating their own tools; in particular, a new survey instrument for capturing what grocery stores in low-income neighborhoods truly look like in terms of the foods they stock and how well they serve their customers’ needs—as opposed to what stereotypes say. And sure enough, the surveys are finding that significant diversity exists among stores, Clancy says, with some of them having “enormous offerings of fresh produce” and some providing very little.

The results have also served up an important reminder: Many stores already offer local and regional foods. “[Regional products] have never gone away in some cases,” Clancy says. “It’s just that people maybe aren’t as aware of them as they should be.”

Solid progress is being made on all three research fronts, in other words; what remains to be seen is how everything will fit together to address the region’s immediate and future food security concerns. Indeed, even within the production team the way forward isn’t always clear, Griffin admits. “We’re actually working a lot of things out as we proceed. It’s been fun. It’s also a bit bigger job, I think, than any of us expected.”

The way Clancy sees it, though, the project team doesn’t need to hold all the answers. The bigger goal is to deliver better tools and information to store owners, customers, suppliers, community leaders, policy makers, and others in the current food system—because the power to transform the system ultimately lies with them. “Part of what we’re trying to do is make people a lot more aware of how the food system operates at the granular level,” Clancy says, “especially people who want to bring more local or regional food into low-income areas.”

Meanwhile, the researchers are also having their awareness raised. Working on the project has been more stimulating and enriching for undergraduates and graduate students than any of the project leaders anticipated. “They come back from a store survey or focus groups with communities, and they’re just so alive. They come back full of ideas.”

Longtime agricultural scientists like Griffin are feeling the excitement, too. “It’s been a fascinating process,” he says. “This is one of the most interesting—if not the most interesting—experiences I’ve had in the past 25 years.”

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