Feeding Chicago

Accessing the potential for locally grown food

Just as a watershed traces the course of water over the landscape, a foodshed traces the path food follows as it travels from its source to consumers. While the global community can be thought of as one massive foodshed, breaking down foodsheds to the neighborhood level is interesting to local leaders addressing issues such as energy, environmental sustainability, and quality of life within their own communities.

Buying local food can benefit communities by supporting local farmers, keeping money circulating within a community, and making growing and raising animals profitable so land will remain productive agricultural land rather than being sold for development. Local food is fresher and tastes better because it doesn't have to travel as far. This also reduces carbon dioxide emissions and packing materials. Also, knowing where food was grown helps consumers take control of what they eat by allowing them to know if chemicals, pesticides, hormones, or antibiotics were used and whether crops were grown from genetically modified seed.

"Foodsheds are an incredibly interdisciplinary problem," said Esther Bowen, a graduate student at the department of the geophysical sciences at the University of Chicago. "We found that GIS was the thread that connected all these disciplines."

"Caring about the environment is sometimes hard to impress upon people, but when you start to talk about the environment through food, it becomes a more interesting social problem," said Pamela Martin, assistant professor of geophysical sciences at the University of Chicago. Martin focuses on the environmental implications associated with dietary choices, like buying and eating only locally sourced food. To address this question quantitatively, she enlisted Todd Schuble, a GIS specialist for the social sciences division at the University of Chicago and a senior lecturer in the university's committee on geographic studies.

Martin, Schuble, and a group of professors and graduate students decided to try to map the potential capacity of a foodshed at a local community level, starting with Chicago.

Using ArcGIS and a few datasets, they set out to answer two simple questions: Can enough food be grown locally to sustain Chicago? and What changes to the local farming system would be needed to accomplish this? They used ArcGIS to process data and provide a holistic way to view all the information.

Finding and collecting the massive amount of data needed to analyze this problem was the most difficult challenge. Information on drainage, the chemical makeup of the soil, and land classification by land plat are just a few of the important data types available by county for the entire United States from the United States Department of Agriculture (USDA). Add to that information on water quality and watersheds for the whole United States and it's easy to see how one can start to drown in the vast amount of data. "Making it usable for us to do analysis was a challenge," said Schuble. "We had to figure out how to organize this amount of data in order to model what we wanted."

The model is not new. In the past, raster datasets were used at low resolution. Keeping the data at a high resolution was important to the team so that the data could be used by a wide range of people from local to national levels. Creating this model using vector data at the plat level was extremely valuable. "Using data at this level, we can visit a small rural area and say, 'Here is what your foodshed should look like,'" said Schuble.

The team developed Python scripts to download, clean, and compress data to learn where farmland with the highest yields exists in certain areas. Scripts scrubbed millions of data records. "Using ArcGIS with Python scripting to handle the mundane tasks of finding files, extracting the data, joining it to other files to make a new one, and then creating a data layer was a lifesaver," said Schuble.

Rather than finding the closest land, Schuble's team built a routine to find the appropriate spaces. Using a radial pattern to reach out from the urban center, the team measured the area to find how much suitable land was available to feed Chicago's three million people.

For this model, the team could only consider crop yield for grains and vegetables. Further foodshed analysis will be based on realistic yields collected from a

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research project. In this project, students have collected data from local farmers for the past two years. This allowed them to not only build into the model yield data from conventional agriculture but also take into account smaller, highly diverse, sustainable local farms that have a much smaller growing area and offer more diverse varieties of foods.

What they found was surprising. The foodshed wasn't really that large. An 80-mile buffer around Chicago encompassed sufficient land to adequately feed the city's inhabitants. Many areas designated as high-yield farmland were already being farmed. "We weren't looking at having to plow under tracts of homes in order to feed people," said Schuble. "We were using already cultivated land for our model."

Recently, this foodshed analysis has expanded to 12 states, and the team is ramping up capacity to look at the entire United States. All the while, Schuble is refining his model to take into consideration factors such as choice. In a free market, economics plays a significant role. Crops are usually chosen based on profitability. With government subsidies and incentives, farmers can sometimes make more money from growing corn for ethanol rather than lettuce for salads. Schuble is looking forward to incorporating a transportation model into the GIS foodshed model. He is also looking at measuring proximity from the urban core in terms of time rather than distance. "If you have a corn field off the interstate, it is easier to get to and costs less than having to travel a gravel road," said Schuble.

He noted, "From local farmers to the USDA to city officials, there are a lot of people who are starting to get more interested, especially as topics such as energy efficiency and environmental impacts gain in popularity." Using GIS as an envisioning and planning tool, the team has been able to ask powerful questions and create a base model for learning about what exists today and what can be achieved tomorrow. "This is a project about hope," said Schuble. "We are looking at what is possible."