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Iowa UrbanFEWS
Food-Energy-Water Systems Integration

UrbanFEWS in the News

INSIDE THIS ISSUE:

We're on the Web!

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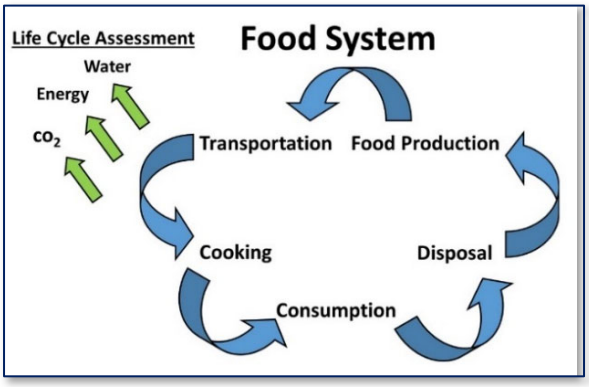
Life Cycle Assessment of Food Systems

Food systems in the US are complex and often have embedded large-scale elements (national and global). In Iowa, about 90% of table food is imported from outside of the state. Our team of researchers are using models to explore what would happen if up to half of the food eaten in the Des Moines area was produced locally.



Life Cycle Assessment (LCA) is a modeling tool that accounts for energy use and environmental impacts of the food system cycle. Our team is using an LCA model developed by scientists at the US Environmental Protection Agency to determine the amount of energy used at every food system stage and to adjust the model for some important (Iowa-specific) local differences.

For example, the scale of fruit and vegetable farms in Iowa is much smaller on average (8 acres) compared to California (59 acres) where about half of fruits and vegetables in the US are currently grown. This smaller scale has an effect on production methods: for example, which labor is done by hand or with equipment, and what quantity of pesticides are used. In addition, there are important environmental differences such as temperature, rainfall and production seasonality (of course in Des Moines and surrounding areas we don't grow vegetables outside during the winter!).

We have met with a set of production specialists to quantify the current local food system and build a model for current conditions, and our next step will be to make projections to allow us to model future food system changes and energy use.

In the News: Sustainable Iowa Land Trust (SILT)

SILT has started an ambitious new campaign to circle ten Iowa cities with ten food farms in ten years ("Circle Our Cities"). Their mission is to support local food systems with novel ways to protect local farms for the long-term.

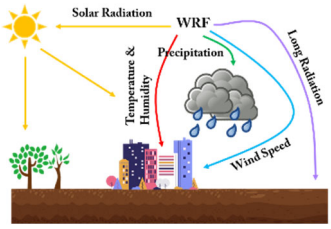
The Sustainable Iowa Land Trust (SILT) was founded when 25 of Iowa's respected leaders in sustainable agri-culture, as well as planning and development, met to save and protect small, diverse, and clean farms that can produce food to feed Iowans. SILT accepts land donations in order to preserve agricultural land and offers long-term leases to eligible farmers, freeing them from land debt. Early-career farmers can also work with SILT to develop new table-food farms.

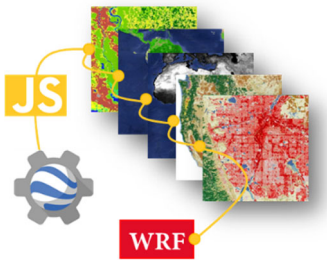
Ask Our ABM Team: What is an ABM Model?

Agent-based modeling (ABM) is a computational simulation modeling method that uses software agents to represent heterogeneous real-life actors. In our models, the agents represent Iowa farmers and consumers, and we will use the model to simulate production and consumption decisions over time. Like real-world humans, agents are capable of autonomous decision making and action, and they can be programmed with the ability to acquire new knowledge, change their behaviors, and adapt their decision-making over time, based on their objectives and their interactions with other agents. Empirical behavior data can be used to realistically characterize agents as humans with complex psychologies.

Team members Dr. Caroline Krejci and graduate student Nilufer Oran-Gibson are analyzing survey data collected by the research team to create "personas", or lifelike representations of Iowa farmers and consumers. These personas will serve as templates for the development of the agents. We will then embed the agents into an environment representing the Des Moines area, and the model will be used to perform experiments that test the impacts of different potential policies on the agents' decisions and behaviors.

UrbanFEWS team creates weather models





The Weather Research Forecasting (WRF) model is a mesoscale numerical weather prediction system that we are using to generate hourly air temperature data at 1-km spatial resolution for building energy use modeling. The WRF model offers ways to represent land and atmosphere interactions over complex and variable land surfaces. WRF, when coupled with a suite of other tools can be used to describe urban climate in both high spatial and temporal resolutions by incorporating local as well as remote sensing data for urban land uses, building characteristics, human-caused heating, and moisture sources. Team members Dr. Yuyu Zhou and graduate student Wei Chen have used WRF with land surface data and global weather data to estimate air temperature in urban areas of Des Moines. In the future, they will integrate their WRF model and urban expansion model to predict air temperature in the future for a variety of scenarios.

Urban Heat Island effects in Des Moines

Our team conducted a WRF simulation (see details above) with 1-km spatial resolution and 1-hour temporal resolution in Des Moines. Hourly air temperature observations at two meteorological stations (in Des Moines and Ankeny) were used to evaluate the performance of WRF air temperature simulations.

With an acceptable error between observations and simulations, we extracted air temperature data to explore spatial variation of the urban heat island (UHI) in August 2012 within Des Moines. The results show that monthly UHI intensity is close to 3.0°C in the center of Des Moines and decreases gradually along the urban-rural gradient.

We observed a stronger UHI effect in the southeastern area of the city compared to the northwestern area.