Computational modeling may soon help researchers predict, and prevent, food insecurity

June 4 2018, by Krista Timney

Project researchers are working to develop models that illustrate how farmers make decisions about food production and to help explain how those decisions affect, or are affected by, strains on the environment and social systems.

Imagine a world where scientists use computers to predict the impact of climate change and other stressors on international food security, migration, and civil conflict, and then use those predictions to increase the availability of vital resources.

Kelly Cobourn, assistant professor of water resource policy in Virginia Tech's College of Natural Resources and Environment, is working on a project that may bring us a step closer to that reality.

She is part of a team of researchers from the University of Southern California, the Pennsylvania State University, the University of Minnesota, and the University of Colorado that brings together experts in artificial intelligence, model coupling, hydrology, agronomy, and economics.

Cobourn's role will be leading the socioeconomic modeling work needed to develop a computer modeling system that will help predict how human activities can impact the natural world, and vice versa.

More specifically, her work will contribute to an understanding of food security via the integration of socioeconomic and biophysical models, as well as the streamlining of data tools used in assessing food security issues.

"Food security is a big issue in much of the world, and it's probably going to become a more pressing issue moving forward," said Cobourn, a faculty member in the Department of Forest Resources and Environmental Conservation. "Climate change contributes to food insecurity, and food insecurity contributes to civil conflict."

In considering the complex interplay between humans and environmental issues such as climate change, the researchers are working to develop models that illustrate how farmers make decisions about food production. They will then create models to help explain how those decisions affect, or are affected by, strains on the environment and social systems.

The four-year project, called MINT for Model INTegration, is led by Yolanda Gil, professor of computer science at the University of Southern California's Information Sciences Institute. It is funded with a $13 million grant from the Defense Advanced Research Projects Agency (DARPA) as part of DARPA's World Modelers program.

According to Cobourn, who is also affiliated with the Global Change Center housed in Virginia Tech's Fralin Life Science Institute, the issue of food security also has defense applications.

"Food insecurity can often lead to conflict in many parts of the world. Ultimately, we want to understand how different factors drive food security outcomes and how that can lead to civil unrest," Cobourn explained. "This can also help us better understand what measures should be taken to guard against food insecurity and prevent some of that conflict."

The members of the research team also hope to use their varied expertise to speed up data collection and food security modeling.

"Right now, modeling involves a lot of data collection," Cobourn said. "A researcher working on food security would go collect field data or manually gather it from various sources. It could take years to gather data and then figure out how to couple models between disciplines. This project would create computational ways of pulling data from various sources and automate the modeling process."

By automating data collection and modeling, the team will be able to greatly reduce the amount of time needed to connect models across disciplines, which will lead to a fuller understanding of the intersection between human activity and the environment.

Over the next four years, the researchers will develop models of human activity and impacts on natural resources to create predictions for certain parts of the world based on such factors as climate change and crop yields.

"I'll primarily be developing models and creating human behavior and policy scenarios," Cobourn said. "The computational experts know how to automate the data collection and modeling process, but they may not have background in the disciplines that are working on these problems. The other disciplinary experts and I will help them bring together things like agronomic and economic models in a way that makes sense.

"It's exciting to work with such a large team of experts and think about how we can push forward coupled human and natural systems modeling efforts by developing new computational tools," she added.

Provided by Virginia Tech