Spotlight: Campus Research

Environmental and Computer Science Collaboration Produces Surprising Results.

By Joe Thiel

New collaboration between the MSU departments of Computer Science and Land Resources and Environmental Science (LRES) is yielding surprising results showing how collaboration across disciplines can produce unforeseen solutions.

Last year, LRES Professor Geoffrey Poole approached Computer Science professor Clemente Izurieta about collaboration on development of software to facilitate simulation of ecological systems. This collaboration is designed to produce computer software that will help model increasingly complex ecological systems. "We often collect data that represent a snapshot of ecosystem structure," said Poole. "However, it is equally important to create simulation models that formalize how ecologists think a system behaves over time."

That is where Izurieta came in. Poole and Izurieta are engineering computer software that facilitates development of models representing the behavior of complex ecosystems, such as how the pattern of water movement across a floodplain may affect nitrogen cycling and other ecosystem dynamics in rivers. The software helps track the cycling of ecological variables such as water, heat, carbon, and nutrients according to rules defined by ecologists.

"Imagine if you had to create a word processor every time you wanted to write a letter. That's how most complex ecosystem models are developed – from the ground up," said Poole. "If I know the underlying accounting software works, I can focus on the problem." In other words, Poole and Izurieta are developing software that will allow ecologists to focus on the theory rather than on computer programming.

The software is being designed to also allow the creation of simulation models for disciplines other than ecology. Just as Poole's stream ecosystem model represents a floodplain as a network of channels and gravel deposits that exchange water, energy, and nutrients, an economy might be represented as a network of people exchanging money, goods, and services.

Thus a program initially designed to help understand how water navigates through floodplain channels and gravel might help provide insight into how peoples' individual decisions and behaviors might influence an economic system. Using the software, model development becomes a task of defining the rules that governing the exchange of multiple interactive resources among parts of a linked network.

Based on Poole's description of software needs, Izurieta also realized that algorithms used to design computer chips and simulate their behavior could be applied to simulate ecosystem dynamics. "Algorithm design tends to cross between fields," Izurieta said. For example, computer chip design algorithms that describe the function of different levels of a computer chip can be used to represent different hierarchical levels of an ecosystem. "We can borrow solutions from these microchip problems and reapply them to different fields," said Poole. "You can't come up with such solutions without collaborating across disciplines."

Currently the collaboration includes several MSU students and a postdoctoral researcher working on related projects. Graduate students at Duke University and the University of Georgia are also applying the modeling techniques pioneered by Poole and Izurieta. The collaboration between departments will yield more robust re-engineered software that can be extended and scaled to support more complex models. Poole and Izurieta are still "looking for people interested in the convergence of software engineering and ecology."

Sidebar

GET INVOLVED

What: Computational Ecology Research Group

Projects: Investigating the intersection between computer and ecosystem sciences

Looking for: People interested in the convergence of software engineering and ecology

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