Researchers combining data and technology to make agriculture more sustainable

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Due to the large usage of water in agriculture, many California communities no longer have running water, and collapsing aquifers have caused roads and buildings to sink several feet. Purdue University electrical and computer engineering professor David Ebert is using data collected from agricultural sites to respond to these problems.

With this data, researchers are working to create a software that would simplify the complex relationships between agriculture and resource scarcity. This software will be on a desktop or mobile device for in-field use and would make it easier for farmers to make decisions that foster long term solutions to problems of water scarcity in agriculture; it is called a human-computer collaborative decision-making system.

"We're trying to help growers get usable information to improve their practices for both economic and ecological sustainability," Ebert says. "We're trying to take a sea of data and turn it into decisions that people have to make so they can make better, more effective decisions."

The team hopes to accomplish their goals by collaborating with growers of crops that live year-round, known as perennial crops. Common perennial crops include grapes, apples, bananas, asparagus and almonds. The researchers will discuss with growers what problems they are having with water scarcity then address the problems with various business practices and commercialization models. Lastly, the team will take present and pending data from these growers and other partners and transform it into usable information for agricultural producers and other decision makers.

Discovery Park, a research park at Purdue that specializes in interdisciplinary research, is funding the project through the Big Idea Challenge, a program that provides resources to interdisciplinary teams with innovative research.

When it comes to optimizing resources in agriculture, a lack of water was a natural place to start for Ebert and his team. According to Ebert, 80 percent of California's water usage goes to agriculture, and just a 0.6 percent reduction of this agricultural usage would supply Los Angeles' water needs for a year.

"It's really a competition of resources," says Jao Surakitbanharn, a Purdue research analyst working on the project. "Even the smallest amount of water savings has tremendous impacts."

The research focuses on perennial crops such as grapes and nuts because those crops "are even more complicated decision-making environments. You don't start with a blank slate each year," says Ebert

Additionally, Ebert notes that nut, wine and grape crops contribute more than $250 billion final market value to the United States economy. Therefore, a reduction in available water could have adverse economic impacts regarding the production of these products, including job loss and community destruction.

"By going after nuts, grapes and wine grapes, these are crops where the value of the crop is very high, so the impact that we can have can easily be turned into an increase in profit," Ebert says.

Ebert's approach stems from understanding how data and tech can be turned into information that helps people make better decisions. To do this, his team will need to combine plant science, soil,

hydrology as well as the market drivers for the crops. They will then combine data, models and business practices to get a solution to address all of it. Ebert then plans on applying the findings from a small scale to a large scale. The team will explain their findings and approach to local growers, enabling them to change their practices and come up with policies to support these practices.

The team is focusing most of its research on the western United States because that area has the most problems with drought. One of the team's partners is Robert Biale Vineyards in Napa, California. Bob Biale, one of the founders of the vineyard, says that the team's work has taken vineyard management to another level.

"Because of David and his team's knowledge of a working vineyard, this system has made the difference for us and is a great tool as it gives us the extra confidence that we need to meet our production goals," he says.

The researchers are also collaborating with Huber's Orchard, Winery and Vineyards in Borden, Indiana. Wineries and orchards in areas such as Indiana often have the problem of too much water, but the decision-making technology could still be applicable.

Collaborating with growers is essential for this project; being able to collect data from the source and understanding problems at the operational level is very helpful for researchers. Therefore, the team's partners include grape farmers, the Almond Board of California and vineyard owners.

"We're there to listen to them about their problem and help them address it," says Surakitbanharn.

Ebert and his team have also been able to meet with various California state universities that have connections or experience in irrigation, crop growing and wine business management.

Interdisciplinary research is a key component of the research, so the team is made up of experts in policy, soil science, plant science, food science, sensing technology, environmental engineering, data analytics and agricultural business.

The team's overarching goal is to optimize resources. They want long term solutions to the problems caused by scarcity, emphasizing the importance of not wasting any resources.

"The less you waste things because you know what the impact is going to be, the better it is both ecologically and economically," says Ebert.

Through the Big Idea Challenge's funding, the team has already been able to visit California to talk to growers about issues facing agricultural production as well as look at existing sensor data.

"Without the Big Idea's funding, we wouldn't have been able to make these connections in order to expand our research" says Surakitbanharn.

The end goal for the researchers is to develop a human computer collaborative decision-making system for growers to help them make better decisions regarding their farming practices. The decision-making system will be a graphical interface that will enable users to easily see and analyze information. The system will be a fluid and natural way to give growers the information they need and also put their feedback into the system, which will refine the analysis for further use.

Provided by Purdue University