ASU, Stanford examine implications of bioenergy crops

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"We've shown that planting perennial bioenergy crops can lower surface temperatures by about a degree Celsius locally, averaged over the entire growing season," says David Lobell, of Stanford University, who collaborated with ASU's Matei Georgescu. Credit: stock.xchng photo

A team of researchers from Arizona State University, Stanford University and Carnegie Institution for Science has found that converting large swaths of land to bioenergy crops could have a wide range of effects on regional climate.

In an effort to help wean itself off fossil fuels, the United States has mandated significant increases in renewable fuels, with more than one-third of the domestic corn harvest to be used for conversion to ethanol by 2018. But concerns about effects of corn ethanol on food prices and deforestation had led to research suggesting that ethanol be derived from

perennial crops, like the giant grasses Miscanthus and switchgrass. Nearly all of this research, though, has focused on the effects of ethanol on carbon dioxide emissions, which drive global warming.

“Almost all of the work performed to date has focused on the carbon effects,” said Matei Georgescu, a climate modeler working in ASU’s Center for Environmental Fluid Dynamics. “We’ve tried to expand our perspective to look at a more complete picture. What we’ve shown is that it’s not all about greenhouse gases, and that modifying the landscape can be just as important.”

Georgescu and his colleagues reported their findings in the Proceedings of the National Academy of Sciences. Co-authors are David Lobell of Stanford University and Christopher Field of the Carnegie Institution for Science, both located in Stanford, Calif.

In their study, the researchers simulated an entire growing season with a state-of-the-art regional climate model. They ran two sets of experiments – one with an annual crop representation over the central United States and one with an extended growing season to represent perennial grasses. In the model, the perennial plants pumped more water from the soil to the atmosphere, leading to large local cooling.

“We’ve shown that planting perennial bioenergy crops can lower surface temperatures by about a degree Celsius locally, averaged over the entire growing season,” Lobell said. “That’s a pretty big effect, enough to dominate any effects of carbon savings on the regional climate.”

The primary physical process at work is based on greater evapotranspiration (combination of evaporated water from the soil surface and plant canopy and transpired water from within the soil) for perennial crops compared to annual crops.

“More study is needed to understand the long-term implication for regional water balance,” Georgescu said. “This study focused on temperature, but the more general point is that simply assessing the impacts on carbon and greenhouse gases overlooks important features that we cannot ignore if we want a bioenergy path that is sustainable over the long haul.”

Georgescu and Lobell have since started a new and exciting project extending their U.S. bioenergy crop work.

Provided by Arizona State University

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