Forest fertilization can increase production, decrease carbon emissions, expert says

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Dr. Eric Jokela, professor and principal investigator on the Pine Integrated Network Education, Mitigation and Adaptation Project from the University of Florida, and Dr. Jason Vogel, Texas A&M University department of ecosystem science and management assistant professor, look at the effects of fertilizer on trees. Credit: Texas A&M

(Phys.org)—Fertilizing one's lawn is considered a necessary practice, as is with most agricultural crops. But how many people know about fertilizing a commercial forest, and how that might affect the environment and their investment?

Dr. Jason Vogel, assistant professor of forest ecosystem science within the Texas A&M University department of ecosystem science and management, is studying just how much difference fertilization can make to the productivity of the forest and carbon sequestration.

Vogel is a part of the Pine Integrated Network Education, Mitigation and Adaptation Project, known as PineMap, a coordinated adaptation project awarded in 2011 by the U.S. Department of Agriculture National Institute of Food and Agriculture. The institutional leads are the University of Florida and Virginia Tech, and there are 12 institutions and 52 principal investigators participating.

Joining Vogel on the Texas A&M team of researchers are Dr. Tom Byram, Dr. Jason West, Dr. Carol Loopstra, Dr. Jinbang Gan and Dr. Eric Taylor, all faculty members of the ecosystem science and management department. These researchers share $2.1 million of the total $19.1 million five-year grant.

The entire project is trying to prepare southern pine forest owners for potential climate change, Vogel said. The region in the study is from North Carolina to Oklahoma and Texas, plus everything south. The climate is expected to be warmer, which could induce drought stress on trees.

In the southeastern U.S., forests are responsible for 5.5 percent of all the jobs and 7.5 percent of industrial output, he said.

"This is a commodity that supports a lot of communities from East

Texas to the eastern seaboard, so it is important we know how to best manage this natural resource," Vogel said.

Vogel's primary interest is in the below-ground processes of a forest – how much root mass the trees carry and how soil organisms respond to fertilization and climate. The larger goal is to find the best management scheme that maximizes a forest landowner's investment in a sustainable way.

"My role is to try to determine how forestry practices can be made efficient in terms of fertilizer use and to sequester more carbon," he said. "I'm focused mainly on production forests, where large landowners already use some fertilization."

His study also is assessing the sensitivity of loblolly pines to reduced water availability.

"Can we quantify how our management schemes affect a tree's ability to take carbon out of the atmosphere and store it in their tissues and in the soil?" Vogel questioned.

Within his study, Vogel and his students are going to forested areas in East Texas, Oklahoma and Arkansas to measure tree biomass, soil carbon and other nutrients in the soil.

"Trees are generally fertilized when they are planted and again when they are between eight and 10 years of age," he said. "When the trees are 20 to 25 years old, they are considered harvestable."

Trees are estimated to take up about 13 percent of the carbon dioxide emissions from a region. If they are fertilized, thus growing bigger faster, they can store more carbon in their tissue and in the soil beneath them, Vogel said.

"That's my interest – why does the soil take up more carbon?" he said.

More carbon means improved properties for plant growth, and eventually, less carbon release into the atmosphere, Vogel explained.

"On the front end, the carbon is in the ground, and as the tree grows faster, more carbon is pushed into the soil," he said, "then the microbes begin the decomposition process. But the rate of decomposition is slower because there are plentiful nutrients. This slowed decomposition then slows down the carbon release into the atmosphere.

"You want the sequestration to be larger than the emissions," Vogel said. "So we are looking at different levels of nitrogen and phosphorus fertilization to see how it changes the carbon emissions and the input in the plants."

Through a modeling component of the combined study, Vogel will take what his study finds about the below-ground life of a forest and add it to the other researchers' findings.

"We hope in the end PineMap will have a web-based interface that landowners can go to and learn about their options for what types of trees to plant and fertilizer recommendations given the potential for future climate change," he said.

Part of the project is aimed at letting the smaller landowners with managed forest land know what changes they might make to improve their forest's productivity and resistance to change in climate, Vogel said.

Decisions by small landowners are critical because it is estimated that 65 percent of the forests in Texas are owned by small landowners. The PineMap study will give them the tools needed to help make decisions

on the best future avenues to take.

"The big issue for a small landowner is whether the land will stay in their family," he said. "They have to make an investment today that will not pay off for about 25 years. And the question is, 'Will that land still be with their children or grandchildren and so will it pay for us to make an investment in forest management?'"

Provided by Texas A&M University