Scientist taking infrared laser look at forests

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Dr. Sorin Popescu, at right, leads his students, Shruthi Srinivasan, Ryan Sheridan and Nian-Wei Ku, left to right, on work with lidar remote sensing for assessing forest vegetation. (Texas A&M AgriLIfe Research photo)

The old adage "you can't see the forest for the trees" might mean more to Dr. Sorin Popescu than most people.

Popescu, a Texas A&M University associate professor in the department of ecosystem science and management, uses remote sensing and other advanced technology to make sure he sees both the individual trees and the overall forest.

Forests change continually for various reasons – fires, insect defoliation, hurricanes, drought and more, he said. These changes can affect the communities that depend on the forest industry.

Popescu monitored the Sam Houston National Forest from 2004 to 2009 and now he is measuring again to see what has changed. There are not many studies that use the multi-temporal lidar remote sensing data sets to see how forests change overtime.

Lidar is similar in operation to radar but emits pulsed laser light instead of microwaves. Popescu's work involves measuring vegetation canopy height as a basis for estimating large-scale biomass and change to that biomass with space-borne lidar sensors.

"With these remote sensing methods, we are better able to assess and monitor forest conditions over time and at various scales," Popescu said.

In East Texas, this information is vital to the timber industry, as well as for protecting the soil and environment, and habitat for wildlife, he said. Understanding the data also helps to mitigate climate effects and protect or improve recreational values.

Popescu is wrapping up one four-year study funded by NASA and has just started a new study, both aimed at developing algorithms and software tools to process lidar data that can estimate forest biophysical parameters, such as stand density, tree height, crown diameter, volume and biomass.

Up until 2009, there was one lidar space-borne sensor known as the Ice Cloud and Land Elevation Satellite or ICESat. But the laser burned out, Popescu said, and now NASA is working on bringing a second generation ICESat2 online in 2016.

But before that comes online, there is much work to be done, he said.

Popescu is working on a new NASA-funded study as a co-investigator with Dr. Ross Nelson, an adjunct faculty with Texas A&M and a physical scientist with the Biospheric Sciences Branch of NASA in Greenbelt, Md. Also on the team is Dr. Kaiguang Zhao, Popescu's former doctorate student and now a postdoc at Duke University.

Popescu's algorithms will process the data when received from ICESat that will aid in measuring forest biophysical parameters, such as biomass. Also, half of the biomass is carbon, so, he said, they can measure the carbon sequestering of forests over large areas and that will relate to climate-change studies.

"The way NASA works, they don't want to wait for ICESat2 to come only before continuing the study, so they have built some airborne sensors that are attached to airplanes and collect similar data," he said. "We are processing that data, as well, for different atmospheric conditions, vegetation heights and terrain topography."

This new NASA project goes hand in hand with one they funded for Popescu four years ago. As he wraps up the first study, he said, the primary focus was to develop and learn the methodology needed to use lidar to assess forests.

While lidar used for forest studies is not new – it started back in the early 1980's – the sensors have evolved tremendously and now can provide a three-dimensional look, which provides the best estimates on

height and forest structure.

The sensors allow three platforms of vision – terrestrial, airborne and satellite, Popescu said. When all three are combined, each bit of data helps to better understand the other. They each vary by what aspect and resolution they give – and scientists can zoom way in to see even how leaves and branches are distributed on a particular tree.

Knowing the general tree dimensions and linking that with the forest coverage can help estimate biomass in a region and tell the carbon accumulation and how the forest is responding to climate, he said.

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