U of A's 'game-changing' sensors revolutionize methods of monitoring climate science data

By Sheila Pratt, Edmonton Journal November 19, 2014

Student researchers from the University of Alberta install state-of-the-art wireless sensor networks in remote forests around the world to monitor high resolution photosynthesis and seasonal productivity trends to help track patterns in carbon dynamics near the Earth's surface.
Photograph by: Cassidy Rankine

EDMONTON - About 300 cellphone-sized sensors installed in the forest north of Peace River are the front lines of a revolution in climate science set in motion by University of Alberta scientists.

From his office on U of A campus, professor Arturo Sanchez can tell whether the forest soil is getting drier, whether spring is early or late, or whether lightning caused a forest fire — all from data streaming dozens of times a minute from the sensors.

"It's so cool," says the upbeat professor in the department of earth and atmospheric science and project leader working with a team of Canadian and international scientists. The data is so detailed it can measure how much carbon dioxide the forest is absorbing or emitting, how much sunlight plants are using in photosynthesis, and predict a drought.

The Alberta-developed technology is "a game changer" for researchers and a new tool in the world's battle to monitor climate change and reduce greenhouse gas emissions, says Sanchez.

It's also a great new tool to help Alberta policy-makers understand the environmental impacts of oilsands development or forestry companies and how to mitigate the impacts, he says.

Next week, Sanchez will take the system, called Enviro-Net, to a UN climate change conference in Lima, Peru, so the rest of the world can take advantage of this major scientific advance.

The concept of real-time measuring came to Sanchez but the technology wasn't there. So the U of A team had to built the specialized sensor which records 64 different climate details.

This one records two measurements every second and sends the data to a tower in the forest which relays it to the university.

"The University of Alberta has the capacity when faced with challenges to develop the technology," Sanchez adds.

The next problem was how to deal with the massive flow of data streaming in every second all day and all night from the censors; how to find the trends and changes.

"In other words, how to move from data to knowledge," says Sanchez.

That's where IBM came in with its software capable of handling large data streams — called advanced analytics.

The software provides real-time analysis for 10,000 points of data per second from sensors now placed in Australia, Costa Rica, Brazil and Mexico as well as Alberta.

"You can quickly see a trend line if soil moisture is rising or falling," he says.

The team chose the Peace River area for a test site about 2-1/2 years ago. The idea was to get baseline data about the health of forests before oilsands development takes off.

"We are finding out what are the conditions of the environment, the health of the forest, before development starts," Sanchez says.

Over the years, policy-makers can watch in real time the changes and measure them against the baseline data.

This Enviro-Net tool will enhance Alberta's ability to provide world-class environmental monitoring and keep track of changes due to climate change as well, Sanchez notes.

This technology will benefit many countries and that's why the U of A is taking the system to the public, he adds.

In Costa Rica, for instance, the sensors revealed that a forest there, under drought conditions, absorbed 40-per-cent less carbon than the year before.

That's a key piece of information for the country which is trying to become carbon neutral by 2020, says Sanchez, who began working on the system four years ago.

Scientists used to collect data themselves in the forest, then took months to analyze it and report it.

"Now we can basically 'see' the forest breathing in real time," he says.