



Pioneering climate change research with analytics

December 6, 2016 | Written by: Arturo Sánchez-Azofeifa

The **University of Alberta Centre for Earth Observation Sciences (CEOS)** is using advanced data analytics to better understand climate change in sensitive tropical forests. Dry tropical forests, such as can be found in Costa Rica, are some of the least monitored ecosystems in the world. There are 525 carbon flux sites worldwide, 25 of these are in the tropics, but only two of them monitor dry forests. Yet, dry forests can yield incredible insights into climate change and how environmental changes can impact society. This is because dry forests are typically on very fertile soil and on lands used for tourism development. Environmental impacts seen in the dry forests often affect nearby communities.

Presenting to UN leaders at the UN Framework Convention on Climate Change Conference of the Parties (COP) 22 in November and at the UN COP 13 Convention of Biological Diversity science forum this past Friday, I have been sharing why understanding change in dry forests is critical. I have also demonstrated how much more research and insights we can achieve with the help of technology.

Shifting the research paradigm

There is currently a shift in research paradigms. We are now moving to the fourth paradigm of science, which is enabled by technology. Basically, computers are no longer just storing data. Rather, they're storing knowledge and that knowledge is derived by applying advanced data analytics to previously collected data. We are now gaining greater knowledge depth and using data as a powerful tool for environmental conservation and management of our tropical forests.

Accelerating climate change insights

We gather information from remote sensing data, biodiversity and forest structure surveys, drone-based photography and more. It is staggering the amount of data that we now have access to. Honestly, it can be overwhelming. Our carbon flux systems in the Costa Rican dry forest collect data every two hertz. In other words, we're gathering two cycles of data every second at the Santa Rosa National Park in Costa Rica. We've defined the Santa Rosa National Park as an Environmental Monitoring Super Site because of the large scale of environmental monitoring equipment currently deployed collecting forest respiration and micro-meteorological information. This all leads to about 10 billion data points per year from one single tower site.

At the beginning of this project, we started working in spreadsheets, but realized there had to be a better way. Now, with the IBM advanced analytics software, IBM Streams, I can ingest, analyze and correlate a year of light sensors data in about 30 seconds. We can work either from a year of already collected data, or gather data in real time. Real-time sensors allow me to see from my lab in Alberta, Canada, what is simultaneously occurring in the Costa Rican dry forests. We are transitioning from research on what has happened to evaluating what is happening now. The difference is amazing and unique.

Sharing our research with world leaders

Now that we can gain insights on dry tropical forest climate changes, it's important we share this knowledge. Presenting at the UN climate change meeting last month, I made the fundamental point that we need to start realizing that the tropics are so much more than just the Amazon. In the Americas, dry forests are the first frontier for economic development, so any changes that occur there directly relate to nearby communities. The response of tropical dry forests to climate change can also be quantified with higher precision than in tropical rainforests. For example, as a result of our monitoring, we can now provide warnings to governments about natural disasters as much as 100 days before they occur. This enables local governments to inform their populations and plan more effective responses.

The UN COP 13 forum that I presented at on Friday, December 2nd was a meeting on biodiversity conservation, a totally different type of meeting. There, my goal was to demonstrate that we need to change how we work to actually understand the impacts of climate change on tropical dry forest biodiversity, and how, as a global community, we need to be integrating analytics, so we can understand the sensor data available to us. With the right tools in place, we can make a bigger impact.

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