

OF POTENTIAL INTEREST TO ALL

http://www.eos.unh.edu/Spheres_1114/williams.shtml

Pinpointing a Pint-sized Pest From On High

Justin Williams inspects a hemlock branch. Photo by Kristi Donahue UNH/EOS.

by David Sims University of New Hampshire Institute for the Study of Earth, Oceans, and Space, 112014

The hemlock woolly adelgid is the single greatest threat to hemlock health and sustainability in the East. The potential ecological impacts are comparable to that of Dutch elm disease and chestnut blight. —USDA Forest Service It would seem like the very definition of looking for the proverbial needle in the haystack: using satellites to hone in on a 1/16-of-an-inch—about the size of the period at the end of this sentence—aphid-like insect under the forest canopy before visible signs of its destruction appear.

But that's precisely what master's student Justin Williams set out to do as he began his thesis work three years ago, and just what he accomplished working with the US Forest Service under the federal Pathways Program.

"Under the Pathways Program, I was employed full-time and paired with a mentor from the Forest Service," Williams says. "By working for the Forest Service I was able to use their resources, such as vehicles and scientific instruments, for my research while a graduate student at UNH."

Although there have been efforts to use satellite imagery to map the damage or defoliation caused by the hemlock woolly adelgid—an invasive Asian insect that first appeared on the East Coast of the U.S. in the early 1950s—Williams' work is unique in that it set out to map the distribution of the pest before major defoliation occurs and do so at a larger scale than previous efforts, almost 9,000 square kilometers using Landsat imagery compared to less than 1,500 square kilometers via other methods. As of 2011, eighteen states from Maine to Georgia had infestations of hemlock woolly adelgid. The pest can kill a hemlock in just a few years, sucking it dry of the nutrients and starch reserves it needs to survive.

"Justin's work is quite significant," notes Barry Rock of the Earth Systems Research Center and Williams' advisor. "He has documented the ability to remotely detect hemlock woolly adelgid infestation using remote sensing methods and, most importantly, also showed there is an initial increase in needle chlorophyll concentrations before the trees eventually succumb to the disease, which appears to be the initial response in the trees' attempt to 'fight off' the infection."

This increase in needle chlorophyll concentration—indicated by how certain wavelengths of light are reflected back to the sensor—turned out to be the key finding in Williams' work. And it was what made it possible to find the needle in the haystack.

"We knew the hemlock woolly adelgid was affecting the reflectance properties of individual hemlock needles based on some lab-based measurements that we made," Williams says, "but we weren't sure we would be able to pull those differences out with the satellite imagery where you're dealing with mixed land cover pixels and confusion between coniferous species. So it was a very pleasant surprise."

Boots on the ground



Working with the US Forest Service, master's student Justin Williams helps develop a way to detect the hemlock woolly adelgid via satellite

Before the surprise finding, Williams and colleagues used modeling and groundwork to identify where they would find suitable hemlock habitat in their study area, which ranged from a bit north of Concord and west to Mount Kearsarge in New Hampshire and, in Maine, north to Biddeford.

“For this project to be successful we really needed relevant ground data, so we went to 110 randomly placed points—each point being 30 by 30 meters or the equivalent of one Landsat image pixel—throughout the study region and looked at the percent of hemlock and surveyed for the pest,” Williams says. “This gave us our reference data from which we were able to build our hemlock habitat model.” The ground-based reference data also allowed them to attempt a Landsat data classification in order to zero in on high-value, high-density hemlock stands. But, Williams notes, the classification based on the percentage of hemlock wasn’t nearly as robust as the classification based on whether or not the pest was present. “So it was at that point we realized that the reflectance differences we observed under laboratory conditions were also being recorded in the satellite data.”

Just why infested needles contain greater amounts of the photosynthetic pigment chlorophyll is a mystery.

Says Williams, “It’s a really interesting question that we are still debating. Is this a compensatory response by hemlock? That is, even with initial, modest defoliation by the pest there would be fewer needles and therefore the trees could increase photosynthetic capacity in the remaining needles. Another possibility could be it has something to do with the feeding mechanisms of the hemlock woolly adelgid itself—perhaps there’s something enzymatic within the needles that’s happening. That’s all just hypothetical; we can’t determine ‘the why’ based on our data.” He adds, “When you conduct research, many times you end with more questions than answers, and that is what propels the science forward.” Ahead of the damage curve Williams’ research has indeed propelled work in this area forward and it is his hope that it will eventually lead to formal procedures that could help lessen the damage wrought by the hemlock woolly adelgid. “This work was done with the Forest Service and they’d really like to see a set of protocols that they can use or that can be given to state agencies as a way to empower these agencies to do it themselves. The significance of this work is early detection; we want to know where this pest is before large-scale infestation and damage occurs so that we can initiate management decisions that might reduce future damage.” Since early detection has been and still is mostly boots-on-the-ground surveying, the newfound remote sensing technique could become a very powerful and cost-effective tool. “It could save a lot of time, money, and effort,” Williams notes. But he adds that before the methodology can be rolled out for widespread use, more study would need to be done to determine if his master’s project work is repeatable and can be expanded to other regions with different topography and diversity of trees. Overall, he says, the project served as a good pilot study.

“At some point I’d like to continue this research. I love the fieldwork and data analysis aspects of what we do in terms of forestry and natural resource management. In addition, using satellites and other technologies to look at how things are happening at the landscape scale is a unique skill set and it really makes the work more fun and interesting.” But Williams thinks it unlikely he’ll be able to take the next step with the adelgid/remote sensing work unless funds are made available, which, he says, “I don’t think is in the cards right now.” And going for a doctorate is also not in the cards at the moment for Williams. “I have entertained thoughts about going for a Ph.D., but I’ve now been in school for nine years and so I’m looking forward to a bit of an academic break,” he says. “You can learn a lot in the classroom and a lot through your research program as a graduate student, but I feel that gaining some real-world experience and developing relationships with other professionals is really important at this point.” As *Spheres* goes to press, Williams reports he’s just landed a job with the U.S. Forest Service Southern Research Station in Starkville, Mississippi. “As a research forestry technician, I’ll be working with scientists on a project that studies the annual variation in bottomland oak species reproduction,” he says adding, “and my remote sensing and GIS skills will be put to work through spatial analysis and mapping.”

Pew, Pew, Pew! NASA space lasers to map Earth's forests in 3D

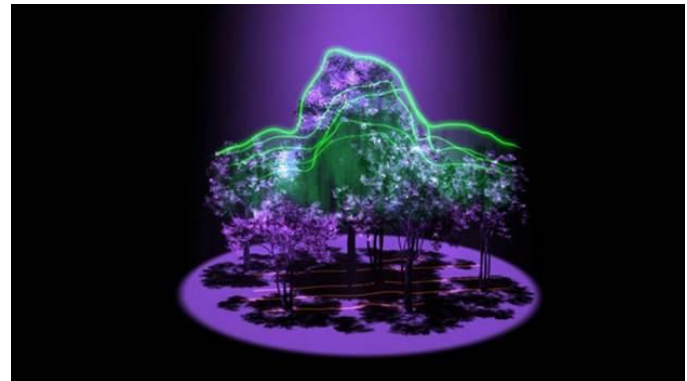
<http://www.foxnews.com/science/2014/11/19/pew-pew-pew-nasa-space-lasers-to-map-earth-forests-in-3d/>

An artist's conception of the 3D maps of forest architecture that data from GEDI could produce. (NASA's Goddard Space Flight Center)

By Kelly Dickerson Space.com, November 19, 2014

A new laser instrument developed for the International Space Station is expected to generate incredible 3D maps of Earth's forests.

The instrument called Global Ecosystem Dynamics Investigation (GEDI) uses lidar, a special kind of laser technology, to create detailed 3D maps and measure the biomass of forests. NASA has already launched a satellite designed to measure carbon dioxide in the atmosphere, but the new instrument, once launched, will allow scientists to estimate the total amount of carbon stored here on Earth inside trees.



"GEDI lidar will have a tremendous impact on our ability to monitor forest degradation, adding to the critical data needed to mitigate the effects of climate change," Patrick O'Shea, chief research officer at the University of Maryland, said in a statement. Scientists already knew that trees absorb carbon. What scientists don't know is how much they store. This is a problem because scientists can't predict how much extra carbon would escape into the atmosphere if a forest was destroyed or if planting new trees would be enough to offset the emissions. "One of the most poorly quantified components of the carbon cycle is the net balance between forest disturbance and regrowth," Ralph Dubayah, the GEDI principal investigator at the University of Maryland, said in the same statement. GEDI's lidar instrument works by shooting streams of light particles at the Earth that then reflect back and are picked up by a detector. The time it takes the particles to reach Earth and bounce back is converted into a distance. Every material that the light particles pass through on their journey leaves behind a "fingerprint" that the detector can read. That means that light particles that pass through leafy tree canopies will look different than the particles that pass through branches or trunks. The unique markers will allow scientists to construct detailed 3D maps of forest architecture. The lidar pulses will measure the height of trees to about a 3-foot accuracy and allow scientists to estimate the total biomass in a forest and how much carbon it's storing. GEDI will have three lasers that will shoot out a total of 14 laser beams that will cover about 4 miles. The team of engineers behind GEDI estimate that it will send out about 16 billion laser pulses every year. Piers Sellers, deputy director of Goddard's Sciences and Exploration Directorate, said GEDI's data will be invaluable when it's combined with historic records of carbon levels collected by satellites like Landsat and MODIS which have been hovering over Earth for decades. Scientists will also combine the 3D maps with images, maps and data collected from other satellites. The ultimate goal is to create a database that will monitor changes in forests over time. Scientists hope the combined data will reveal more about land use, biodiversity and climate change effects. NASA officials estimate that engineers will complete GEDI by 2018. Once aboard the space station, it will scan most tropical and temperate forests between 50 degrees north and 50 degrees south latitude. The instrument is being developed by NASA engineers and researchers from the University of Maryland.

ILLINOIS

Rolling Meadows OKs Contract To Trim 344 Trees

http://www.journal-topics.com/news/article_3350f154-70fd-11e4-abbe-d36d596ee4c5.html

By DIANE TURNER-HURNS Journal & Topics (IL), Thursday, November 20, 2014 6:00 pm

Rolling Meadows aldermen unanimously approved a contract with R.W. Hendricksen Tree Services of Wheeling to trim 344 city parkway trees at a cost of \$19,605. Most of the work will be done during the remainder of this year.

Rolling Meadows Public Works Director Fred Vogt told the council the contractor has trimmed city trees before and is also removing ones infected by emerald ash borer (EAB).

Funding for the tree trimming is included in the 2014 city budget, which allotted \$26,000 for the work. Trees to be trimmed are located on the following streets: Central Road (east of Jay Lane), Birch Lane, Cedar Street, Adams Street, Maple Lane, Wilson Street, Oak Lane, Davis Court, Carr Street, Vermont Street, and Linden Lane.

Vogt also provided an update on EAB tree removal in the city noting that as of this past Oct. 1, about 320 EAB infected trees had been removed from city parkways. EAB is a green beetle native to Asia and Eastern Russia. It is an invasive species and highly destructive to ash trees. EAB was first discovered in the United States in 2002. Cities across the U.S. continue to identify and remove affected trees. In the near future, public works will remove about 450 dead or dying EAB infected trees. "We'll be working on these in the fall through the winter as conditions allow and into 2015," Vogt told the council. "Projections are not accurate because we still have no way of knowing at this point how many will be needed to be removed, but our estimate is approaching 600 for 2015 in addition to the 450 marked at this point."

Vogt noted the department lost about three weeks in time to work on EAB tree removals because of the Sept. 5 wind and rain storm.

"Thanks to staff and the overwhelming response from the Illinois Public Works Mutual Aid Network, we collected approximately 1,000 yards of debris or 250 tons from parkways and residential homes due to the storm," Vogt said. Vogt also noted the city is replacing the removed EAB trees with new ones.

IOWA

Naturally Speaking: Public open space – an American idea

<http://amestrib.com/sports/outdoors/naturally-speaking-public-open-space-american-idea>

Steve Lekwa for Ames Tribune (IA), November 20, 2014 - 9:49pm

My wife, Sue, and I went walking late Sunday afternoon. The temperature was only in the teens, but the sun was shining and winds were fairly calm. We could have walked around the neighborhood as we sometimes do, but I really prefer walking in a quiet woods or some other more natural setting. Thankfully, we had several options to choose from within a few minutes drive from our home in Nevada. We chose the Jennett Heritage Area and Robison Wildlife Acres south of town.



Public open spaces, parks and wildlife areas are not unique to America today, but the idea is truly an American one, based on our democratic traditions. President Theodore Roosevelt started the ball rolling early in the 1900s by setting aside what he felt were the best, most scenic federal lands as national parks and monuments. He also created the first federal wildlife refuges by presidential decree.

America boasted 230 million acres of national parks, wildlife refuges, national forests, and national monuments by the time Roosevelt left office in 1909. Nowhere else in the world was wildlife, its habitat and scenic open space set aside and managed for the enjoyment of all, regardless of wealth or social standing. Royalty and the very wealthy reserved those things for their private enjoyment elsewhere in the world. Thankfully, the American idea caught on and many nations take pride in their own national parks today.

The public land movement soon caught hold in states and eventually in cities and counties as well. President Franklin Roosevelt created the Civilian Conservation Corps (CCC) and the Works Progress Administration (WPA) during the Great Depression of the 1930s to put young men back to work. Many of the country's favorite national and state park trails, bridges and lodges were built during that time. The men also planted many thousands of acres of trees on public land in the nation's first major reforestation efforts and did some of the first major soil conservation work in the country on public and private land. Iowa's unique county conservation board system is now nearly 60 years old.

President Lyndon Johnson signed the Wilderness Act into law 50 years ago, insuring that at least some of the nation's federal road-less areas would remain undeveloped and pristine, areas where the web of life still functions with most of its original diversity intact. Wilderness areas serve as benchmarks that can be used to measure the health of the rest of our more human-influenced land. They also offer all Americans the chance to visit at least a few places that still appear pretty much as our forefathers found them.

Our Sunday afternoon walk took us through areas that were being restored to native prairie and woodlands where work is ongoing to remove alien invasive plants like Asian honeysuckle, multi-flora rose and European buckthorn. We enjoyed seeing mixed flocks of native sparrows feeding on wildflower seeds in the prairie reconstruction area. Dried stems of native forest wildflowers were apparent above the snow where sunlight could again reach the forest floor.

I was hoping to see at least a pheasant track or two in the newly fallen snow but was disappointed. Several years of harsh winters and flooded-out nesting seasons have combined with extensive habitat loss to decimate pheasant populations in our area. They're still hanging on in a few isolated pockets of habitat that may have missed heavy storms long enough for a few nests to be successful. Good-sized areas of appropriate habitat and a few years of spring weather that allows successful nesting will give pheasants a chance to demonstrate their amazing reproductive potential, though.

The setting sun was filling the woods with a warm, rosy glow in spite of the chilly temperature as we returned to the car. We are thankful that we have places like we visited to enjoy. The human body was designed to move and be active, and there's no better place than the great outdoors to do that, in my opinion. Bundle up and visit some of our area's many fine public parks and wildlife areas this winter. You and your body will be glad you did.

Steve Lekwas is a former director of Story County Conservation. Contact him at 4lekwas@midiowa.net.

MINNESOTA

Bitter winter has impact on gypsy moth

http://www.ifallsjournal.com/news/outdoors/bitter-winter-has-impact-on-gypsy-moth/article_2768720a-7509-5e64-86c5-d33cb3ae5906.html

Contributed photo. Gypsy moth caterpillar

International Falls Tribune (MN), 5:40 pm, Thu Nov 20, 2014.

MDA REPORT

Last winter's harsh temperatures have resulted in some positive benefits – a decline in the state's gypsy moth population.

The Minnesota Department of Agriculture captured approximately 500 moths this year in traps around the state. That's a major shift from last year's count of over 71,000 moths.

"We knew going into this survey season that our numbers would be down," said Kimberly Thielen Cremers, MDA's Gypsy Moth Program supervisor. "Studies have shown extended stretches of extreme cold have an impact on gypsy moth eggs as they overwinter. However, we cannot let our guard down over this invasive insect."

In fact, University of Minnesota research has shown gypsy moth egg masses can survive a harsh winter if located below the snowline.

"While the decrease in moths is good news, we know they will bounce back quickly," said Brian Aukema of the forest insect laboratory at the University of Minnesota. "A single surviving egg mass will produce more than 500 hungry caterpillars."

The placement of survey traps throughout the state also affected 2014 trapping numbers.

"We placed 60 percent fewer traps in the quarantined counties of Lake and Cook this year," said Thielen Cremers. "We know a reproducing population is established there; 90 percent of the moths caught in the state in 2013 were in those two counties, so this year we placed more traps ahead of that established population to keep on top of the spreading gypsy moth infestation."

Gypsy moth caterpillars, which are not native to North America, eat the leaves of many trees and shrubs. Severe, repeated infestations can kill trees, especially when the trees are already stressed by drought or other factors.

For more information on gypsy moth, go to www.mda.state.us/gypsymoth.

