Canopy

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WOODS HOLE RESEARCH CENTER

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this issue

WHRC in the News

An interview with Deputy Director **Scott Goetz** was published by Environmental Research Web this month, in which he discussed the capabilities of remote sensing technologies to distinguish the unique characteristics of threatened species' habitats to better identify conservation targets.

Senior Scientist **I. Foster Brown** attended the annual meeting of the Governors' Taskforce on Climate and Forests (GCF) in Rio Branco, Acre, Brazil, where Senator Jorge Viana, Vice-President of the Brazilian Senate and one of the most influential senators from Amazonia, debated climate change using results provided by Dr. Brown.

The Woods Hole Research Center is an independent research institution where scientists investigate the causes and effects of climate change to identify opportunities for conservation, restoration, and economic development around the globe. Learn more at http://www.whrc.org.

New Insights from an Old Routine

Dr. Richard Houghton, Acting President

From the earliest days of the Woods Hole Research Center, scientists have been determining the annual global emissions of carbon that result from the management of land. In recent decades the largest emissions have come from tropical deforestation, and the long-term work of WHRC helped provide the basis for an international agreement for reducing those emissions (REDD – Reducing Emissions from Deforestation and forest Degradation). The emissions of carbon from land use were determined with a computer model that calculated the changes in carbon that accompanied any change in land use (for example, deforestation or reforestation). The model was conceptually simple (like balancing a checkbook) but tracked land areas and carbon stocks under different types of management – globally. In accounting for logging and shifting cultivation, as well as changes in agricultural land, the model kept track of regrowing forests.

Because the emphasis had always been on the annual emissions of carbon, we paid little attention to other results that were calculated by the model – until fairly recently, when we asked a different question: how much carbon is taken out of the atmosphere each year as a result of forest growth? Emissions result from deforestation, not forest growth, so we hadn't paid much attention to forest growth. But the emissions we were reporting were *net* emissions, composed of still greater *gross* emissions to some extent offset by *gross* uptake of carbon in forests recovering from logging and agricultural abandonment.

Think of it this way. When a forest is logged, the wood products find their way into paper, lumber, houses, *National Geographics*, etc., none of which lasts forever. Every year there is some burning or decay of these products. Further, when a forest is logged, there are often branches, roots, stumps, and leaves left behind in the forest. This debris also decays over time, releasing carbon to the atmosphere. Altogether these emissions are the gross emissions. But logging is often following by forest regrowth, which removes carbon from the atmosphere. That removal is a gross uptake of carbon. Put the gross emissions and the gross uptake together, and you have the net flux of carbon.

So, we knew (the model calculated) the amount of carbon removed from the atmosphere each year as a result of forest growth everywhere on the Earth – or at least forest growth from logging, shifting cultivation, and agricultural abandonment. And that gross uptake, globally, is 1-3 billion metric tons of carbon per year. If we add that 1-3 billion tons of uptake to the reduced emissions (another billion metric tons if deforestation and degradation were stopped, a number that also comes from the model) and another billion that would be taken out of the atmosphere if millions of degraded lands were reforested, we have the potential to remove 3-5 billion tons of carbon from the atmosphere, annually, just by managing forests.

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New Publications

Assistant Scientist **Susan Natali** co-authored a new paper entitled, "Modeling permafrost thaw and ecosystem carbon cycle under annual and seasonal warming at an Arctic tundra site in Alaska" published in the *Journal of Geophysical Research: Biogeosciences* finds that a warming tundra has the potential to greatly exacerbate climate change.

Recent Grants

Assistant Scientists **Wayne Walker** and **Alessandro Baccini** have been awarded a grant from NASA to investigate new approaches for directly estimating annual changes in aboveground forest carbon stocks.

Senior Scientist **Josef Kellndorfer** has been awarded a grant from SilvaCarbon to map deforestation and degradation in Mexico, Columbia and Peru through a process using time series radar data from Europe's new SENTINEL-1 satellite.

New Insights from an Old Routine *...continued*

Forests don't grow and accumulate carbon forever, but they do grow for tens to hundreds of years. And if the world's forests were managed to take advantage of this growth, forest management could keep the carbon dioxide concentration from increasing long enough to replace fossil fuels with a new infrastructure of renewables and to implement new efficiencies in energy use. In other words, forest management is not the solution to climate change. Getting off fossil fuels is. But forest management could play a strategic role in the transition. It could keep concentrations of carbon dioxide from increasing during the years we're reducing fossil fuel use.

And that simple concept (obviously not simple to implement globally) has been noticed. The United Nations Development Programme is releasing the New York Declaration on Forests later this month, and that Declaration promotes the restoration of degraded landscapes as a means to counter global warming. The Global Commission for the New Climate Economy, whose Programme Director is Jeremy Oppenheim (a WHRC Board member), also points to the use of land and forest management as a means for taking carbon dioxide out of the atmosphere. The simple concept and the numbers behind it have the potential to result in a new agreement much more powerful and comprehensive than REDD, involving not only tropical countries and not only forests. We have the potential to restore the biosphere, producing more food at the same time we reduce emissions of greenhouse gases. There's much more at stake than land, carbon and climate, but monitoring, modeling, and understanding those elements is the business of the Woods Hole Research Center.

Mr. Fix It

Paul Lefebvre was the 13th person to be hired by WHRC, and as Richard Houghton explained when hiring him, "You have many abilities and a number of us want to use you." Those skills included GIS and remote sensing capabilities earned at the prestigious University of California Santa Barbara Department of Geography, but he also had an innate ability to fix or build almost anything with limited resources, which quickly earned him the nickname "MacGyver".

During his tenure with WHRC Paul has faced many technical challenges. He built an automated gas chromatography lab in the Amazonian frontier town of Paragominas, then nicknamed Paragobalas (Parago-bullets) for its violent land tenure struggles. In spite of the difficulty of maintaining delicate instruments in a dusty logging town, the lab ran for years and allowed WHRC scientists to compare greenhouse gas emissions from forests and deforested lands. Paul went on to establish the GIS laboratory at the fledgling Amazon Environmental Research Institute (IPAM) in Belém, Pará, and also helped set up their computer and telephone networks. He later built a satellite tracking and receiving station to help detect fires in northern Amazonian forests that were out of range of existing stations.

Paul in his 'office' - setting up a soil moisture monitoring system in a 10m deep forest soil pit on Tanguro Ranch.

Nowadays Paul provides technical support to WHRC and IPAM field research at Tanguro Ranch, an 80,000 hectare soy farm in the southeast Amazon basin. He trains field technicians, mentors graduate students, builds and installs equipment for experiments, and he still fixes everything. When not on the ranch he stays busy making maps and illustrations.

When interviewing to work at WHRC in 1989, Senior Scientist Foster Brown asked him where he saw himself in five years. Paul answered, "I hope to be doing good technical work in support of a meaningful mission." 25 years on, he's is still doing it.

A Changing Cape Cod

When environmental geologist Tom Stone joined WHRC in 1987, his work focused on the exotic – countries like Russia and Brazil, where he studied deforestation using satellite imagery. That changed when he came across a collection of photographs of Nantucket taken in the late 1800s and 1980s, respectively, which showed radically different landscapes on the same land. The photos caused him to ask, What happened here and what does it mean?

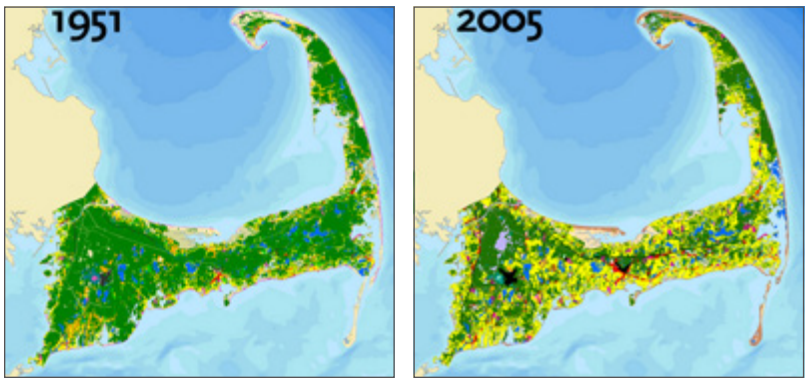
The answer it turns out is a series of events and innovations that have changed the landscape of Cape Cod multiple times in the last few hundred years. The verdant forests, which beckoned the first European settlers, were transformed by them into open landscapes that were deforested for fuel, for building or claimed by expanding agriculture and pasturelands. Then the industrial era brought trains with inexpensive foodstuffs to Cape Cod and work opportunities in the factories of places like Lowell, New Bedford, Fall River, and Brockton. The exodus to the factories and to the better soils of the Midwest left Cape Cod with fewer people, who no longer required hundreds of acres for grazing or growing crops, and the land began to transform again.

World War II converted Camp Edwards, an inconsequential military training facility on Cape Cod, into a small city of 30,000, replete with roads, new homes and other developments. From the '40s and '50s until and throughout the 1990s, Cape Cod's improved roads again led to greater residential development and a population increase from 50,000 to 225,000. Not surprisingly, the end of this period also coincided with the emergence of land trusts to conserve expanses of wild, native vegetation.

Tom Stone speaking to local residents at the launch of the Losing Cape Cod/Saving Cape Cod map that focused on land cover change, sea level rise, and increased storminess due to climate change.

In 1999, Mr. Stone created the first Losing Cape Cod maps, showing land use changes from 1951 to 1990. In 2006, he created Losing Cape Cod / Saving Cape Cod, maps that illustrate changes in land use on Cape Cod between 1990 to 2005 and focus on climate change threats of sea level rise and increased storminess.

The changing climate has and will continue to alter the shorelines and the landscapes of Cape Cod. Mr. Stone continues to document these changes in the hopes that better choices will mitigate the effects of climate change on both Cape Cod and the rest of the world. Last fall he convened a Cape Cod and the Islands Climate Change and Energy Conference, which brought experts and local planners together to discuss inevitabilities and opportunities for adaptation and mitigation. This fall he is orchestrating the Ocean Acidification and Southern New England Conference, which will look at the impacts of climate change in the waters around Cape Cod, where greenhouse gases are acidifying the ocean, threatening shellfish, marine foodwebs and the livelihoods of those who depend on them.



The rate of development on Cape Cod can be seen in these comparison maps.

Upcoming Events

Ocean Acidification and Southern New England: A Conference Ocean acidification is a lesser known danger of climate change, yet it could have profound and irreversible effects upon the oceans of the globe, as well as significant impacts on both shell fishing and fishing. The acidity of the oceans has already increased by 30% over 200 years, and one consequence is the loss of billions of oyster larvae in Washington and Oregon states. What does this mean now for aquaculture, scallops, lobsters and other shellfish, and what will it mean for the future? Is it possible to somehow mitigate the effects of this change in ocean chemistry?

The conference will examine the science behind ocean acidification, the concerns of stakeholders from the aquaculture, shellfish and fishing industries, and the possible policy and legislative options for adapting to or mitigating ongoing ocean acidification.

The conference is a companion to the successful Cape Cod and Islands Climate Change and Energy Conference held in Hyannis in September 2013 and organized by WHRC.

The conference will be held on Monday, October 20, 2014, at the Fairfield Inn & Suites in New Bedford. For information or reservations, please contact Wendy Kingerlee: wkingerlee@whrc.org

This event is sponsored by Woods Hole Research Center, Buzzards Bay Coalition, UMass Dartmouth School for Marine Science & Technology, and the Woods Hole Oceanographic Institution.

Recent Events

WHRC, led by Senior Scientist **Josef Kellndorfer**, hosted the NASA/ISRO (Indian Space Research Organization) science definition team, composed of representatives from NASA Headquarters, the Indian Space Agency and several distinguished scientists from the solid earth, ice, and ecosystems community. The goal of the meetings was to define the US and India radar satellite mission. For more information about this mission: http://nisar.jpl.nasa.gov

There's a Big Hole in the Biosphere

The crisis of global climate is a crisis of the biosphere involving annual flows of approximately 100-200 billion tons of carbon between the atmosphere, the terrestrial biota, especially forests, soils, and the oceans. Those flows were balanced until humans disrupted them by mining massive quantities of stored carbon, destroying forests and soils, and releasing the wastes, principally carbon dioxide, into the atmosphere, thereby creating a hole in the biosphere, the living Earth system. Human welfare depends on the stability of the biosphere as a whole. It is time to stop digging and restore the biosphere; apart from chaos and misery, there is no alternative. Restoration of the biosphere requires a vigorous new interest, not only in new sources of energy as we stop digging, but even more importantly, in rebuilding the biosphere, starting with forests. WHRC's expertise in forest science can play a leading role in stabilizing the biosphere.

–George M. Woodwell, WHRC Founder

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