North Central Research Station News

Spring 2002

How Much Wood are We Using, and Where Does It Come From? Findings From the New Timber Resources Report

In the News.....

It used to be that farmers cleared their own fields and used the felled wood to build farmhouses. Suburbanites no longer clear their own garden plots, and the wood for their houses comes from many different places. As local economies become global, it's easy to lose sight of where our wood and fiber come from and how our consumption of wood products affects local, regional, and global forest sustainability.

A Different Way to Think About Sustainability

Some maintain that the United States has attained timber sustainability, pointing to studies showing that we harvest less wood biomass in a year than forests accumulate through growth. But a new report, to be presented at the Forest Productivity Integrated Program workshop in Ames, Iowa, May 29-30, suggests that analyzing removals vs.

NC's new report finds that we consume far more wood than we harvest in the region.

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growth isn't the only way to look at the problem. In the report, titled *The Status of Timber Resources in the North Central United States*, NC researchers compared the amount of wood consumed by people living in the North Central U.S. with the amount of timberland, timber growth, and timber harvest in the region. They found that although the region has 14 percent of the Nation's timberland, we grow only 10 percent of the Nation's wood, and we harvest and process only 7 percent of the Nation's wood. However, we consume 17 percent of the Nation's wood.

That's 73 cubic feet of wood including 740 pounds of paper products per year, per person. And despite programs to recycle and curb waste, overall U.S. consumption of wood is likely to grow. *The USDA Forest Service 2001 RPA Assessment of Forest and Range Lands.* (FS-687) estimates that by 2050 U.S. wood consumption will rise by 40 percent due to increasing population.

The result is that the United States is a net importer of wood, primarily from Canada. "That raises the question of what it really means to be sustainable," says Steve Shifley, a research forester at NC's Central Hardwood Ecosystems unit in Columbia, Missouri.

It's Got to Come From Somewhere

The report aims to help answer the question of what it means to be sustainable, giving citizens and planners a refreshingly new framework to consider production in the context of regional consumption and regional timber resources. In the past few years, attempts to achieve sustainability have resulted in cutbacks in harvests in the West and parts of the Midwest. At the same time, pressure to meet U.S. consumers' demands for forest products was transferred elsewhere. Much of that demand was absorbed by southern forests, prompting the U.S. Forest Service to conduct the Southern Forest Resource Assessment, which indicated that those forests are in fact handling the increased pressure relatively well.

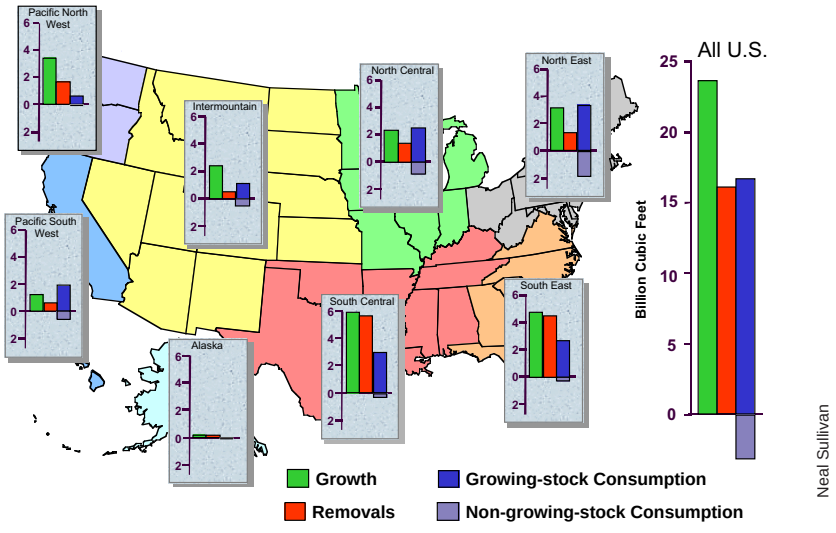
But the demand has also been transferred to other countries. "Much of the increase is coming from northern Quebec, where indigenous people have made land claims and feel they are being disenfranchised by increased logging in the woods. It's not just the environmental impact; it's also the social impact, and the effect on local and indigenous people ought to be a part of the consideration," said Douglas W. MacCleery, Assistant Director for Planning in the Forest Service's Washington Office.

Shifley hopes the new report will help people realize the importance of balancing wood consumption with timber growth and processing in the North Central Region. "We all have an impact on forests through consumption, and we all have a responsibility for forest sustainability," says Shifley. "There are many ways we can shift the balance of forest growth and consumption in the North Central Region. We can consume wisely, we can increase timber production, and we can think more seriously about what the region's 73 million acres of timberland *could* contribute to meet our consumptive demand. It's all about finding balance and understanding our own regional opportunities and responsibilities relative to national and global issues of sustainability."

Such studies are indeed good starting points, agrees MacCleery. "I think regional assessments are useful, but to be really useful they need to look at how our present consumption patterns relate to what we were doing in the past—are we becoming less and less self-sufficient? And what are the implications of the increased imports?"

This new report is indeed only the first step as North Central's Forest Productivity team considers the best ways to sustain forests in the region. "This report set the groundwork by organizing the research and defining the pressing problems," Shifley said. "Now that we know the scope of the issue, the question is: Where do we start if we want to become both more sustainable and better balanced?" This team, which has proven the power of seeing the world through new eyes, may just surprise us with its answer.

by James Kling



This chart compares timber growth, removals, and consumption patterns by U.S. region. The consumption bars are split into consumption met by products derived from growing stock (top portion) and consumption met by products derived from non-growing stock (bottom portion), such as recycled wood products. Growth and removals refer to growing stock trees on timberland.

Make Your Own Maps, Thanks to Award Winner Pat Miles

Barb Stepka

The Forest Inventory and Analysis (FIA) program has been around since the 1930s. The project is an annual survey dedicated to collecting data on factors such as tree height and diameter, damage, slope of plot, and distances to water and roads. Some of this data became publicly available in electronic form in 1977, presenting a useful way for forest managers and planners to track the current and past status of woodlands. But one limitation still existed. Each of the regions that collect FIA data stored them in different formats, making cross-regional analyses difficult.

In 2001, those data were standardized and combined to form the Forest Inventory and Analysis Database (FIADB). North Central research forester Patrick Miles took the next step, designing the Forest Inventory Mapmaker Web application, which draws from the FIADB, allowing users to filter data and create nationwide tables and shaded maps. In recognition of that achievement, Miles is this year's winner of NC's Award for Excellence in Technology Transfer.

The Mapmaker became available at http://www.ncrs.fs.fed.us/4801/FIADB/index.htm last year, marking the first time users could view data in a consistent national format. "Now you can generate statistics not just state by state, but also for any portion or all of the lower 48 states," Miles said. "You can also be more specific in how you filter the data… maybe you're only interested in certain forest types or certain diameter classes, or large trees of a certain species—you get more flexibility in viewing the data," says Miles.

No Need to Be a Computer Programmer

Attempts to unify the regional FIA data formats in the 1980s led to the Eastwide and Westwide data formats, but users were still limited in what they could do on a national basis. The data could be combined, but only by those with the requisite computer expertise and time necessary to develop their own in-house programming solution. It's no wonder that Miles' Mapmaker has been accessed more than 4,000 times over the past year. And the pace is accelerating. Miles reports that the Web site is now logging over 1,000 retrievals per month.

The Mapmaker attracts a wide variety of users, including Native American agencies, consultants, universities, and members of the forest industry. Miles is also using it as part of a biomass assessment that will underpin the National Fire Plan. "Areas with the greatest biomass are depicted in red; those with moderate biomass are yellow; and those with the least biomass are green. At a glance, you can see where the highest and lowest concentrations of biomass exist," Miles said.

One of the advantages of the Mapmaker is that it is based on an Oracle database rather than random access files. That means that any change to the database is automatically incorporated into the Mapmaker, minimizing the maintenance needed to serve users the freshest data.

"The Mapmaker certainly looks like a useful tool," says Jorge Negron, the forester responsible for vegetation inventory in the Forest Service's Eastern Region. The Region is developing an in-house database that will incorporate FIA data along with data on vegetation, air quality, and wildlife. "The programs will allow one national forest database," said Negron. "When that happens, I can see an explosion of use by our resource managers. We're going to need this data (and an easy way to view it) for national analyses to help sustain forest productivity."

by James Kling

The Secret Chemical Life of Plants

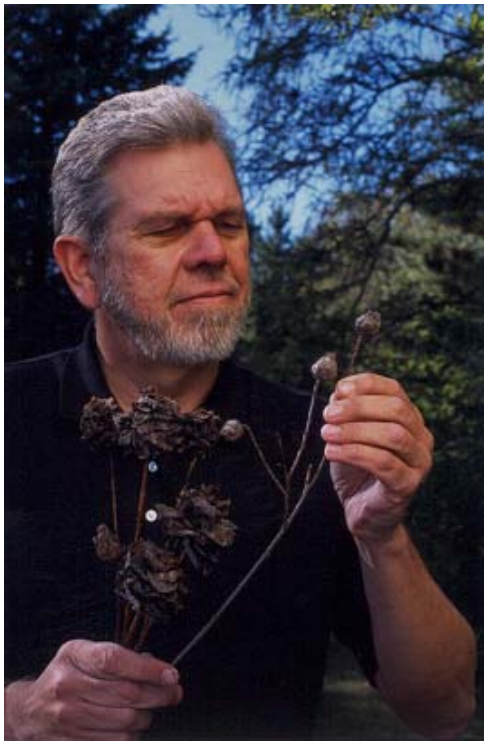
Farmers have long understood that plants use highly evolved chemical defenses to ward off insects. Researchers know that too, but have only recently begun to unravel the complex chemical pathways and ecological interactions they influence.

Bill Mattson is one of those pioneers. A research insect ecologist with the Physiology unit in Rhinelander, Wisconsin, Mattson has spent the last 20 years examining plant's chemical defense molecules (called secondary metabolites) and the environmental conditions under which trees produce them.

Field experiments demonstrate that the molecules have a broad range of activities against insects, from poisoning to preventing egg deposition. Not long ago, most researchers were convinced that secondary metabolites were little more than waste products, not truly important to the survival and health of plants. But ongoing research by Mattson and others has changed that perception. "I think now the consensus is nearly unanimous that these are like Swiss army knife compounds. They're incredibly useful, serving multiple needs beyond just deterring herbivores," says Mattson.

The molecules can have effects that are surprisingly targeted to particular species of insects. Insects in turn wage their own battle, so that some have evolved to become partially or fully immune to the defenses thrown up against them. "Lots of compounds that we find in plants are sieves that (filter) out most of the herbivores—but there are always a few insects that have evolved a preference or tolerance for those compounds in the leaves," according to Mattson.

Some plants respond to that tolerance with a counterattack. When an insect goes to work on its leaves, for example, a plant may funnel more protective chemicals to that region, eventually forcing even the most tolerant insect to move on to nearby "naïve" plants.



Bill Mattson is one of the pioneers in the study of how plants defend themselves against insect pests.

Recently, Mattson has become interested in how these defense systems respond to environmental variables aside from insects.

At the Rhinelander FACE site, (FACE is an experiment that exposes growing trees to predicted 2100 levels of CO_2 and ozone), Mattson found a 20 percent increase in tannins under elevated CO_2. Now he wonders: How might the breakdown of high-tannin leaves affect the uptake of minerals and nutrients such as nitrogen by the roots of the trees?

Implications for Forest Management

"Other experiments suggest a competition between growth and defenses," says Mattson. The more resources a tree puts into new growth, the fewer it appears to put into defenses. At high levels of soil nutrients, growth increases but the production of secondary compounds declines.

And that could have important implications for tree plantations and forest management, says Daniel A. Herms, an assistant professor of entomology at Ohio State University. "There is an emphasis on increasing growth by selecting (or engineering) fast-growing trees, but we may be unwittingly selecting for trees that will be more susceptible to insects."

Mattson's most recent work on the effects of increasing levels of carbon dioxide and ozone on plant defenses could also have important implications for pest management. A better understanding of how resistance is influenced by the environment could help forest managers better predict and manage insect outbreaks, according to Herms.

Still, Mattson admits that we are a long way away from fully understanding those mechanisms and the costs that a plant pays for maintaining them: "Computer modeling may provide an answer, but the current generation of models focuses on whole plant organs, such as the roots and leaves. To get at the problem of molecular resistance and its costs, researchers will have to model decisions at the cellular level, while understanding the underlying genes."

So for now, the mantra for the experimentalist and the modeler is the same: Go to the molecular level to learn more.

by James Kling

Meet New Riparian Leader Randy Kolka

It is with great pleasure that the Station welcomes Randy Kolka as the new project leader of the Ecology and Management of Riparian and Aquatic Ecosystems unit in Grand Rapids, Minnesota. Kolka grew up not far from Grand Rapids in north central Wisconsin, receiving his B.S. in soil science from the University of Wisconsin-Stevens Point and his M.S. and Ph.D. in soil science, with minors in forest and water resources, from the University of Minnesota.

After receiving his doctorate in 1996, Kolka was a research soil scientist with the Southern Research Station on the Savannah River Site in South Carolina. He then became assistant professor of Forest Hydrology and Watershed Management in the Department of Forestry at the University of Kentucky. While his work with students was fulfilling, the opportunity to become project leader for NC's Riparian and Aquatic Ecosystem unit beckoned him.

"It was simply too good to pass up," said Kolka. "My previous research experience fits well with the unit's goals. I did my Ph.D. research on the Marcell Experimental Forest, which is now one of my responsibilities. Sandy Verry, our research hydrologist, was on my dissertation committee. The research, location, and the people are really what drew me here."

Protecting Nature's Protective Filters

Kolka relishes the idea of leading a unit whose research is potentially so vital to our quality of life. As Kolka explains, the health of our aquatic ecosystems is critical to our survival on the planet. The riparian areas surrounding streams, lakes, ponds, and wetlands are the last line of defense against the transport of terrestrially derived pollutants to aquatic ecosystems.

"Unfortunately we know very little about how riparian areas function, both at the local and landscape scale," said Kolka. "We continue to struggle over how to define 'riparian area' and how to delineate these regions in the landscape. That's why our goal is to understand riparian area processes, clarify their extent in the landscape, and determine how various management and restoration strategies affect *how they function*. We have a number of ongoing studies that are beginning to provide some answers."

Unit scientists Sandy Verry and Clay Edwards have an ongoing project that is determining the relationship between riparian areas, stream water quality, fish habitat, and fish communities in northern Wisconsin. Brian Palik, newly appointed acting project leader of Grand Rapid's Silviculture unit, is involved in studies looking at (1) the effect of management on riparian and stream processes and (2) the effect of riparian areas on small upland ponds. Collaborators from the University of Minnesota are studying the effect of acid rain on the transport of mercury through riparian and aquatic ecosystems.

Don Nagel

"Through the use of the Marcell Experimental Forest and research on both private and other public lands, we hope that we can install some large-scale manipulative studies to understand the critical interaction between riparian areas and aquatic ecosystems," Kolka said.

A Collaborative Future

Kolka hopes the work unit will grow with assistance from both inside and outside collaborators. "We will need to do a good job of competing for extramurally funded projects and developing a network of interested scientists, both within and outside NC," said Kolka. "With the completion of the new Marcell Experimental Forest building (planned future construction), we'll have a state-of-the-art lab, meeting, and housing facility for NC scientists and our collaborators, and we'll be poised to develop new studies and generate new research interest."

North Central research forester Tom Schmidt, who was acting project leader of the Riparian unit for nearly 2 years, views Kolka's appointment as a real plus for the Station.

"Randy's strong research background, combined with his personal enthusiasm, makes this an exciting time for the Station and for the Grand Rapids Lab," said Schmidt. "I think Randy's research interests in riparian ecology, forest soils, and forest ecology will make an enduring contribution. He's already exhibited his commitment to forest soils by returning to his 'roots' here in Minnesota!"

In his free time, Randy enjoys various outdoor pursuits with his friends and family. His wife Susan is a grade school teacher and they have two children, Ashley, 17, and Ryan, 11.

Contributed by Laura Hutchinson

Breathing Easier: Understanding Atmospheric Effects on Fire Behavior and Smoke Movement

If you lived in the Bitterroot Valley of Montana a couple of summers ago, you got to know fire on a first-name basis. Its smoke filled your days and brought tears to your eyes, but worst of all, its unpredictability made you fear for your land as you watched the wind blow and prayed for rain.

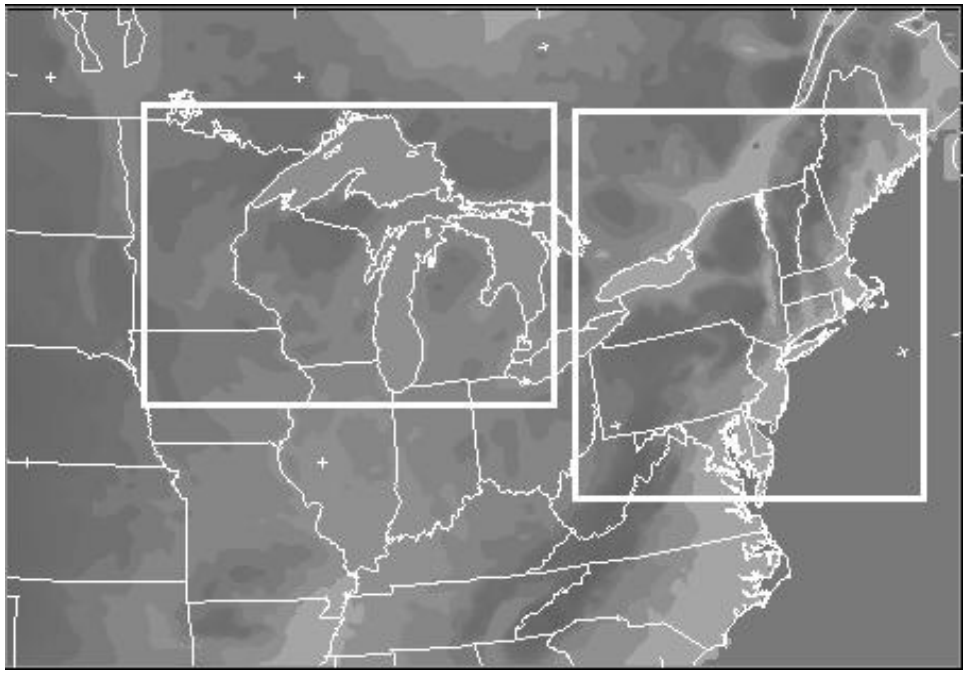
Today, almost 2 years later, fire is still terrifying, but it's beginning to lose some of its mystery as Forest Service scientists develop models to more accurately predict how fire will affect the atmosphere and vice versa. Part of that modeling effort is underway here at the North Central Research Station (NC), which has joined with other Federal, State, academic, and private agencies to create the Eastern Area Modeling Consortium (EAMC). Headquartered in East Lansing, Michigan, the EAMC works on fire-weather, fire-behavior, and smoke transport issues in the north central and northeastern United States and in the Nation as a whole.

In particular, researchers in NC's *Atmosphere-Ecosystem Interactions at Multiple Scales* unit in East Lansing are bringing their meteorological knowledge and modeling skills to bear upon two problems. They're looking at what happens to smoke from wildfires and prescribed fires and how it affects overall regional air quality, an especially important issue in the heavily populated East. They're also trying to shed light on what atmospheric conditions lead fires to behave erratically, with the kind of unpredictable fury that can kill firefighters.

The EAMC is one of five regional modeling consortia, set up across the country as part of the National Fire Plan, that soon will be able to give fire agencies new and improved information and tools needed to develop fire attack strategies, allocate firefighting resources, and warn citizens of impending fire-related risks.

For more information, contact Warren Heilman, Jay Charney, and Brian Potter, the NC research meteorologists in East Lansing who have been instrumental in setting up the EAMC. Call them at 517-355-7740 or check out the new consortium Web site at http://www.ncrs.fs.fed.us/eamc/

Contributed by Lucy Burde



Jay Charney

The geographic areas covered by the Eastern Area Modeling Consortium atmospheric simulations. The white boxes represent regions where fine scale, higher resolution data are also being generated. The shading depicts topographic contours.

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