Highlights 2010

NORTHERN RESEARCH STATION

Research that improves people's lives and helps sustain natural resources in the Northeast and Midwest . . .

OUR VISION: HEALTHY FORESTS, HEALTHY PEOPLE, HEALTHY COMMUNITIES

The Northern Research Station serves the most densely populated and most heavily forested portion of the United States. We envision a region where trees and natural resources support a high quality of life; where resilient habitat supports thriving wildlife, fish, and plant communities; where clean water abounds and where people work together to sustain, and where necessary, restore the health of forests, from urban centers to deep wilderness. We further envision forests that provide a wide array of benefits and renewable products from hardwood for furniture to bark for native basketry, to bioenergy to heat homes and schools, to a sunset viewed from a mountain top. The Northern Research Station is dedicated, organized, and staffed to provide the high-quality scientific information that people need in a form they can use.

FROM THE STATION DIRECTOR

The Northern Research Station (NRS) is making a difference. From tools that help city planners expand urban tree cover and its associated environmental benefits to workshops that train foresters on the latest techniques for growing healthier forests, the work of NRS scientists is improving people's lives and the health of our nation's natural resources. These pages highlight some of the scientific advancements made in 2010. More detail is available on our website, www.nrs.fs.fed.us.

This year, the NRS, and the Forest Service as a whole, also made a difference in local communities through the 2009 American Recovery and Reinvestment Act. With $15.449 million in funding, NRS supported 20 projects, including those that reconstructed roads in critical research areas, are reducing energy costs at facilities in Connecticut and Wisconsin, and are replanting Detroit neighborhoods devastated by emerald ash borer. And most importantly, we put people to work, whether it was replacing culverts, installing solar panels and energy-efficient windows, cleaning inner city vacant lots, or restoring native plants to a Lake Superior island. The jobs created in recession-ravaged communities and the investment in job skills and infrastructure promoted economic recovery as well as a stronger research infrastructure, and a better future for the Nation's forests and waters.

I look forward to continuing to work with you as we find new ways for the Northern Research Station to deliver the science that meets the needs of rural and urban communities and helps sustain the landscapes of the Northeast and Midwest.

Michael T. Rains

Overview

NORTHERN RESEARCH STATION

KEY POINTS

As part of the U.S. Forest Service Research and Development mission area, the Northern Research Station provides leading-edge science and technology applications and effective information delivery.

- Our work extends across 20 states of the Northeast and Midwest.
- Our 24 field locations include Baltimore, Chicago, and New York City.
- We operate a network of 23 experimental forests that produce unique insights into long-term trends in natural resource conditions.
- We inventory and monitor forests in 24 states.
- We work with a wide range of clients and partners to conduct research and deliver results.

Our work helps advance the stewardship of landscapes along a rural to urban gradient to ensure the long-term health and productivity of the region's natural resources.

SCIENCE THEMES

The Northern Research Station's five science themes are the driving force of its science portfolio. The program direction for each theme is achieved through the coordinated actions of 14 research work units. Our science themes are:

- Forest Disturbance Processes
- Urban Natural Resources Stewardship
- Sustaining Forests
- Providing Clean Air and Water
- Natural Resources Inventory, Monitoring, and Assessment

Our program focus of environmental literacy integrates NRS research into regional efforts to improve environmental literacy, which helps people make responsible choices about the environment through lifelong, place-based, inquiry-based learning.

CARBON AND WATER CYCLE RECOVERY PATTERNS AFTER DISTURBANCE IN FOREST ECOSYSTEMS

The recovery of carbon and hydrologic cycling following two major disturbances in pine and oak-dominated stands in the New Jersey Pine Barrens—invasive insect defoliation and fire—are being measured by NRS scientists Kenneth Clark and Nicholas Skowronski. Both disturbances immediately reduced leaf area in each forest, reducing stand productivity and water use, which then closely tracked the recovery of leaf area. Understory vegetation played a major role in the regrowth of foliage after each disturbance. Within 1 year after defoliation or prescribed fire, stands were again sequestering carbon dioxide from the atmosphere. When integrated over all years measured, both stands approached carbon neutrality within 2 to 3 years. Clark and Skowronski's research has been published in *Global Change Biology* and will appear in the *Journal of Geophysical Research* soon.

Contacts: Kenneth Clark (kennethclark@fs.fed.us) and Nicholas Skowronski (nskowronski@fs.fed.us)

Nicholas Skowronski, U.S. Forest Service

A prescribed fire conducted in the Pine Barrens of New Jersey. Researchers are measuring the recovery of carbon and water cycling following fire and insect defoliation in forests in the Pine Barrens.

PARTNERS
Karina Schafer, Rutgers University, Newark, NJ

CLIMATE CHANGE RESPONSE FRAMEWORK PROJECT IN NORTHERN WISCONSIN MODELS STRATEGIES FOR PREPARING FOR GLOBAL CLIMATE CHANGE EFFECTS

The Northern Research Station's Northern Institute of Applied Climate Science and its cooperators—the Chequamegon-Nicolet National Forest and Northeastern Area State and Private Forestry—have developed an exciting new approach to preparing adaptive strategies for possible global climate changes. Although this project is focused on forests in northern Wisconsin, the participants hope that it will be a model for many regions and ecotypes. The Climate Change Response Framework Project (CCRFP) has reached out to involve not just scientists and organizational stakeholders but private forest landowners, tribal nations, and local governments in the gathering, assessing, synthesizing, and sharing of information.

The Climate Change Science Applications and Needs Workshop brought together more than 55 experts in climate change science, policy, forest management, and forest ecology to ensure that products from the CCRFP incorporate current understanding of the science of climate change, climate change impacts, carbon accounting, and interactions with ecological and social systems. The Shared Landscapes Initiative Workshop assembled 65 participants from across northern Wisconsin to foster dialogue on climate change. They represented federal, tribal, state, and county agencies, nongovernmental organizations, universities, and industry groups. The Ecosystem Vulnerability Assessment and Synthesis, a component of the CCRFP, was finalized in the summer of 2010 by an analysis team led by NRS scientist Christopher Swanston. It describes the current landscape and forest types of northern Wisconsin and summarizes projected changes to the climate of northern Wisconsin by 2099.

Linda Parker, U.S. Forest Service

Iconic northern forest scenes such as this one may become more rare as climate change intensifies.

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PARTNERS
U.S. Forest Service Chequamegon-Nicolet Forest; U.S. Forest Service Northeastern Area State and Private Forestry

EMERALD ASH BORER DAMAGES ESTIMATED, BIOCONTROL GOES NATIONAL

David Cappaert, Michigan State University

Dead landscape ash trees; second tree shows epicormic shoots characteristic of decline caused by EAB,

Emerald ash borer (EAB), a nonnative invasive bark boring beetle discovered near Detroit, MI, and Windsor, Ontario, in 2002, is now found in 13 states and two Canadian provinces (January 2010). Much of the damage occurs in urban forests. NRS scientists continue to study various aspects of EAB management and control. Robert Haight was a member of a working group supported by The Nature Conservancy and The National Center for Ecological Analysis and Synthesis that estimated the 10-year costs of ash treatment, removal, and replacement of 38 million ash trees. This number is being used by governmental program managers to justify the benefits of continued EAB research and eradication and treatment programs.

Deborah L. Miller, U.S. Forest Service

Oobius agrili (<1mm long), an egg parasitoid of emerald ash borer (EAB) being released in the U.S. for EAB biocontrol, is laying her egg inside an EAB egg.

Leah Bauer, working with many partners, designed a biological control program for management of EAB. At present, removal of dead trees or insecticide injections of high-value trees are the only options available to landowners and municipalities. EAB natural enemies (small parasitic wasps from China) have been released into infested ash stands. These wasps seek and destroy EAB eggs or larvae in ash trees. These parasitoids are now established in areas of Michigan, Ohio, and Maryland.

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PARTNERS

Noel F. Schneeberger, Forest Health Program U.S. Forest Service; Paul Chaloux, National EAB Program, USDA APHIS; and Darrell E. Zastrow, Wisconsin Department of Natural Resources

HAZARDOUS FUEL ASSESSMENTS USING LIDAR AND FIELD MEASUREMENTS

Lasers, in what is termed Light Detection and Ranging (LiDAR) systems, are being used by NRS researchers Nicholas Skowronski and Kenneth Clark to measure forest structure and canopy fuel loading at the Silas Little Experimental Forest in the New Jersey Pine Barrens. These systems can detect and accurately quantify flammable parts of canopy and understory that will burn in wildfires in 1-meter-thick layers. Currently, they are used to determine hazardous fuel loads around homes and commercial developments. This information can be used to guide risk-mitigation practices and zoning policy and is applicable to any wildland-urban interface area. Skowronski and Clark's research will appear in *Remote Sensing of Environment* soon, and researchers at the Silas Little EF have recently received a grant from the Joint Fire Sciences Program to validate crown fuel estimates made using LiDAR technology.

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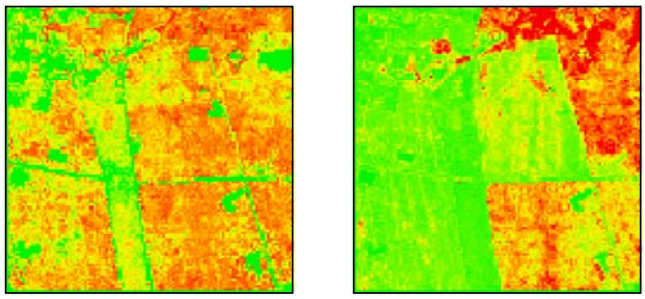

LiDAR 1-2 m, pre-burn LiDAR 1-2 m, post-burn

LiDAR data showing understory vegetation before and after prescribed fire in the Pine Barrens of New Jersey. Green indicates <10 percent cover, and red indicates >40 percent cover. The area covered by the figures is 9 km^2.

PARTNERS

New Jersey Forest Fire Service; Dr. Richard Lathrop, Rutgers University; Dr. Ross Nelson, NASA Goddard Space Flight Center; Matthew Duveneck, Portland State University

FUNGICIDE TREATMENT ALTERS WOOD ANATOMY AND SUPPRESSES OAK WILT

Oak wilt, a devastating fungal disease of mature trees in rural and urban forests of the eastern and southern United States, is spread by insects that visit tree wounds (including pruning cuts) and also travels through natural root system grafts. Injection of the fungicide propiconazole in the root flares has been standard commercial practice by arborists, who have found that retreatment is necessary after several years. NRS scientist Jennifer Juzwik, in collaboration with the University of Minnesota and a commercial arboriculture company, found that injected propiconazole in the tree roots and lower stem degraded below levels required to stop the disease fungus after 2 years. Results of a related study showed that alterations of the wood anatomy formed in the first to third growing seasons after injection into red oaks may likely contribute to the control of oak wilt during the same time period. Juzwik's findings provide the scientific basis for properly timed applications of the fungicide to control oak wilt as part of an integrated oak wilt control program.

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PARTNERS

Ryan Blaedow and Brian Barber, University of Minnesota; Shawn Bernick, Rainbow Treecare Scientific Advancements; Mark Stennes, S & S Tree Specialists, Inc.; International Society of Arboriculture TREE Fund; U.S. Forest Service, Pesticide Impact Assessment Program; Minnesota Turf and Grounds Association

Jennifer Juzwik, U.S. Forest Service

Excavation for oak wilt research. The devasting tree disease can spread through root grafts.

MODELS FOR ECOLOGICAL RESTORATION IN URBAN AREAS: LESSONS FROM THE USA AND EUROPE

Lynne Westphal, U.S. Forest Service

View of Chicago skyline from Calumet restoration sites.

Ecological restoration often aims to recreate so-called presettlement conditions, but this can be problematic in urban areas where human activities have erased most traces of presettlement conditions. NRS researchers Paul Gobster and Lynne Westphal and German colleague Matthias Gross analyzed urban restoration projects and developed several alternative models that articulate the various possible types of restoration projects. The classical model restores sizeable patches of indigenous plants through traditional practices like invasives control and replanting. The sensitive species model focuses on protecting and enhancing sensitive individual species, often a specific bird or butterfly. The habitat model aims more broadly to provide appropriate conditions for a range of desired species such as wetland-dependent birds, as well as appropriate nonnative species to provide food and cover. The cultural landscape restoration model recognizes the importance of human endeavors and their history as reflected on the land in addition to plant and animal assemblages present. In the rehabilitation model, restorationists work from almost nothing to bring back natural systems in severely degraded sites. Together, these models can help project managers determine what kind of restoration is desirable and if it is possible.

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PARTNERS

Matthias Gross, Helmholtz Centre for Environmental Research, Department of Urban and Environmental Sociology, Germany

PERCEPTIONS AND IMPACTS OF CRIME ON THE USE OF URBAN PARKS BY LATINO RESIDENTS

Perceived safety has long been known to play an important role in people's use of urban parks, but little is known about how the everyday leisure behavior of neighborhood residents is altered by the presence of gang activity. NRS scientist Paul Gobster examined how the perceptions of Latino residents in two inner-city Chicago neighborhoods affected their use of outdoor recreation environments and how they responded. Residents reported a near-constant gang presence in and around the neighborhood parks studied, and drug-related activity made it particularly unsafe for residents and their children to access and use parks. Residents employed a number of strategies to cope with gang problems, including avoiding parks and neighborhood locations or altering their times of use, adopting protective behaviors such as using parks in large groups and/or under the presence of police, and devising collective behaviors such as organizing neighborhood crime watch programs, park clean-up activities, and supervised youth programs. Understanding these strategies is particularly important in inner-city and low-income communities where park space is often already at a minimum and residents have limited alternatives.

Contact: Paul Gobster (pgobster@fs.fed.us)

Ad Meskens, Wikimedia Commons

"Protective" and "collective" behaviors such as organized group picnics are among the strategies that some residents have adopted to combat gang activities in their neighborhood parks.

PARTNERS
Kimberly Shinew and Monika Stodolska, University of Illinois at Urbana-Champaign

URBAN AND COMMUNITY FOREST SUMMARIES FOR THE LOWER 48 STATES

NRS scientist David Nowak and others have recently published several important summaries of tree and forest information. The first is a summary and comparison of urban tree cover and its associated benefits in the lower 48 United States, *Sustaining America's Urban Trees and Forests* (GTR-NRS-62). The second is a compilation of tree and impervious cover data and population statistics for each of the lower 48 United States (in seven publications, GTR-NRS-38, 47, 50, 54, 56, 58, & 59) using National Land Cover Data (NLCD) and U.S. Census data. Statistics are reported and mapped for every community, county subdivision, and county in each state and for urban and community lands. Ecosystem services provided by these forests and trees were estimated. This information was compiled by NRS scientists David Nowak and Eric Greenfield and should prove useful to those developing state urban forest assessments and plans. Several other parts of the Forest Service were partners in these projects: the RPA Assessment staff; Northeastern Area State and Private Forestry's Urban and Community Forestry Program, the Cooperative Forestry staff; and the U.S. Forest Service Pacific Northwest Research Station.

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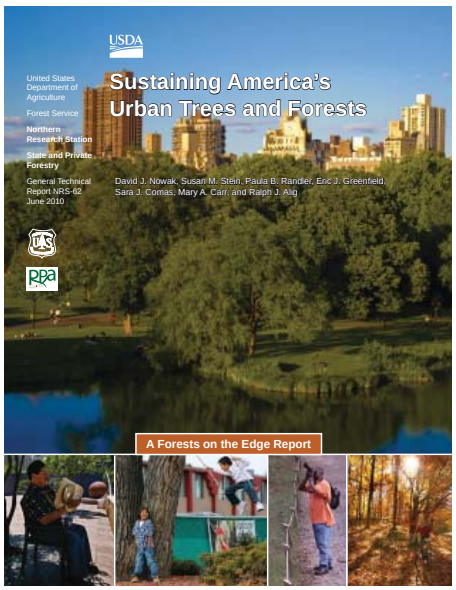
PARTNERS
U.S. Forest Service Washington Office, Resources Planning Act (RPA) Assessment staff; Northeastern Area State and Private Forestry's Urban and Community Forestry Program; the U.S. Forest Service Pacific Northwest Research Station



A summary and comparison of urban tree cover and its associated benefits is assembled in this NRS publication.

DNA TOOL DETECTS WHITE-NOSE SYNDROME FUNGUS IN BAT CAVES

Over 1 million bats, including rare and endangered species, have succumbed to white-nose syndrome (WNS), a disease first observed in 2007 in upstate New York. This lethal disease is caused by the fungus *Geomyces destructans*, which continues to spread across the United States. Assessing the distribution of *G. destructans* in environments occupied by hibernating bats is critical for WNS surveillance and management. NRS scientists Daniel Lindner and Jessie Glaeser are collaborating with the U.S. Geologic Survey's Wildlife Health Laboratory in Madison, WI, to characterize the distribution of *G. destructans* in cave sediment samples from bat hibernation sites in the eastern United States. They are using molecular identification techniques that Lindner helped to develop. The fungus was found in cave sediment samples from states where WNS is known to occur, suggesting that the fungus can persist in the environment, but was not found in caves outside the region of known infestations; closely related fungi, some previously unknown to science, were also found. Bat biologists are using this research to devise strategies to save these animals from extinction.

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PARTNERS
U.S. Geologic Survey's Wildlife Health Laboratory; Symbiology Inc.

A. Hicks, New York Department of Environmental Conservation

Bats showing symptoms of white-nose syndrome (WNS).

CENTER FOR FOREST MYCOLOGY RESEARCH EXPANDS WEB-ENABLED DATABASE

The culture collection and herbarium maintained by the Center of Forest Mycology Research (CFMR) in Madison, WI, is one of the largest fungal "libraries" in the world. The collection specializes in fungi associated with wood and contains both living fungi and dried reference specimens that are used by researchers worldwide in studying forest pathology, disturbance biology, fungal genetics, distribution of invasive species, and impact of climate change on forest ecosystems. The CFMR's web-enabled database, accessible at *http://www.fpl.fs.fed.us/research/centers/mycology/culture-collection.shtml,* has recently been enlarged and updated. It enables researchers around the world to access files about the CFMR's 13,000 cultures and 50,000 dried specimens representing more than 1000 fungal species in a user-friendly software interface. NRS scientists Beatriz Ortiz-Santana, Daniel Linder, and Jessie Glaeser at CFMR have developed molecular tools—including "genetic fingerprinting" using DNA sequencing and cloning techniques—to detect and identify fungi both in culture, as well as directly from wood and other substrates. These techniques are currently being used to identify fungi associated with wood decomposition under different climate regimes and fungi associated with bat hibernacula for management of white-nose syndrome (a devastating disease of bats in the eastern United States) as well as for tracing the spread of destructive tree root pathogens in U.S. forests.

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S. Schmeiding, U.S. Forest Service

Examining specimens in the CFMR herbarium.

PARTNERS
U.S. Forest Service Forest Products Laboratory

SECOND EDITION PUBLISHED OF *THE ECOLOGY AND SILVICULTURE OF OAKS*

The second edition of *The Ecology and Silviculture of Oaks* was recently authored by retired NRS scientist Paul Johnson (Columbia, MO) and NRS scientist Stephen Shifley, with their colleague Robert Rogers, emeritus, University of Wisconsin–Stevens Point. With 580 pages and more than 200 figures, the second edition includes much new material on artificial regeneration, effects of climate change, managing for biomass and carbon sequestration, oak decline, and sudden oak death as well as the material covered in the 10 chapters of the first edition. This book presents a holistic approach to oak ecology and silviculture across the more than 200 million acres of oak forests and mixtures in the United States. It is not a manual or how-to guide for oak silviculture, but rather a source of ideas on how to think about oak forests as responsive ecosystems.

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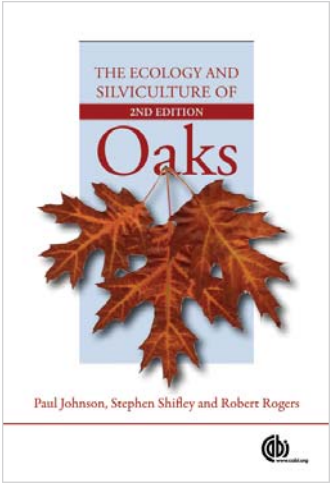
PARTNERS
Paul Johnson, retired, U.S. Forest Service; Robert Rogers, emeritus, University of Wisconsin–Stevens Point



Cover photo by CABI Publishing, Wallingford, UK

Johnson, P.S.; Shifley, S.R.; Rogers, R. 2009. **The Ecology and Silviculture of Oaks**, 2nd ed. Wallingford, UK: CABI Publishing. 580 p.

U.S. Forest Service

A white oak in southeastern Ohio, 47 inches in diameter.

LANDSCAPE-LEVEL DEER HERD REDUCTIONS RESTORE FOREST UNDERSTORY PLANT COMMUNITIES BUT NOT SPECIES DIVERSITY

White-tailed deer overbrowsing has altered forest understory plant species (forbs) diversity throughout eastern North America. Since 2001, NRS scientist Alejandro Royo has tracked the response of herbaceous plant communities to deer herd reductions throughout the 70,000-acre Kinzua Quality Deer Cooperative (KQDC) in northwestern Pennsylvania. Royo and his partners—forest managers from the Allegheny National Forest, the Bradford Watershed, Forestry Investment Associates, the Collins Pine Company, Sand County Foundation, and RAM Forest Products—found rapid, dramatic increases in overall forb and shrub cover of deer-palatable understory plants, such as trilliums and Canada mayflower, but no changes in plant species diversity. Thus, controlling deer alone may not promote diversity in overbrowsed, species-poor forests without additional restoration strategies. These results are being incorporated into a vegetation monitoring proposal by the Pennsylvania Bureau of Forestry for use in its 2.5 million acres of state forests.

Stephen B. Horsley, U.S. Forest Service, retired

Trillium grandiflorum flowering is an indicator of low deer browsing pressure at the Kinzua Quality Deer Cooperative.

Contact: Alejandro A. Royo (aroyo@fs.fed.us)

PARTNERS
U.S. Forest Service Allegheny National Forest; Forestry Investment Associates; Collins Pine Company; Sand County Foundation; RAM Forest Products; city of Bradford, PA, Watershed

CLIMATE CHANGE EFFECTS ON STREAMFLOW

Climate change has the potential to alter streamflow regimes, which has ecological, economic, and social implications. In the northeastern United States, it is unclear how climate change may affect the surface water supply, which is critically important in this densely populated region. NRS scientist John Campbell and collaborators have been evaluating the impact of climate change on streamflow at small gauged watersheds at the Hubbard Brook Experimental Forest in New Hampshire. These headwater streams are the source waters for larger rivers and therefore may serve as an indicator for potential climate change effects. Campbell's research evaluates past long-term hydrologic data and modeled future streamflow through the end of the 21st century using several climate change scenarios. Preliminary results indicate that earlier snowmelt and the diminishing snowpack is advancing the timing and reducing the magnitude of peak discharge associated with snowmelt. However, there is little change in the overall quantity of streamflow because increases in precipitation offset increases in water loss via evaporation and plant transpiration. This study is improving our understanding of the hydrological consequences of climate change and will begin to provide a foundation for sound future decisionmaking on climate change policy.

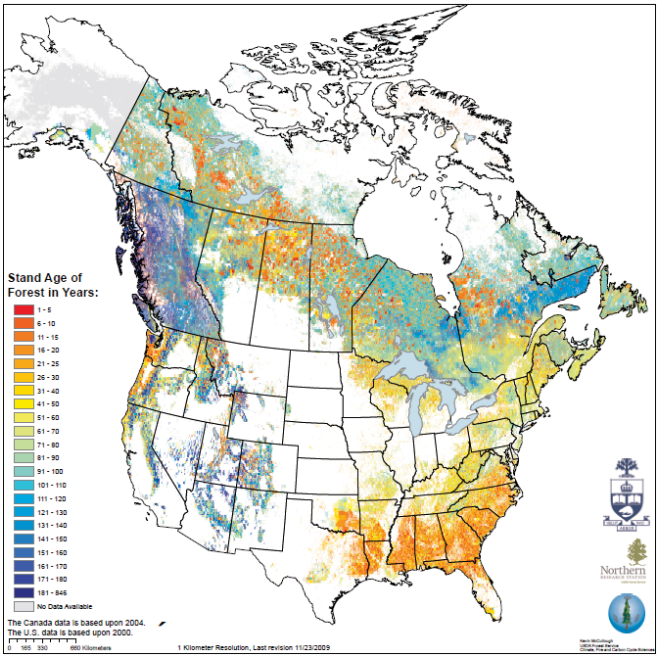
Jim Hornbeck, US Forest Service

Streamflow during snowmelt at Hubbard Brook Experimental Forest.

Contact: John Campbell (jlcampbell@fs.fed.us))

PARTNERS
Charley Driscoll and Afshin Pourmokhtarian, Syracuse University; Katharine Hayhoe, Texas Tech University

THE FIRST CONTINENTAL-SCALE FOREST AGE MAP OF NORTH AMERICA



Forest age distribution in North America (excluding Alaska and Mexico), which was developed by combining forest inventory data (of United States and Canada) with several remote-sensing-based disturbance data sources.

Forest age determines its growth rate and whether it sequesters or emits carbon. Over large regions, forest age reflects past management actions and disturbances that continue to affect forest functions for future decades. To help support the United States response to climate change, NRS scientist Yude Pan analyzed forest age dynamics to determine what kinds of management activities can be applied to increase carbon sequestration or reduce emissions of greenhouse gases. When mapped over whole nations, forest age data will help develop policies and improve monitoring of the atmosphere for verifying compliance with climate treaties. This North American forest age map was developed and published in collaboration with scientists at the University of Toronto, Canada, and is a major Forest Service contribution to the multi-agency North American Carbon Program.

The research was recently published online at http://www.biogeosciences-discuss.net/7/979/2010/bgd-7-979-2010.html

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PARTNERS
University of Toronto; North American Carbon Program

CRITICAL LOADS OF NITROGEN DEPOSITION FOR U.S. ECOREGIONS

Nitrogen (N) deposition has reached a level that has caused or is likely to cause alterations and damage in ecosystems across the United States. NRS scientists Linda Pardo, Erik Lilleskov, and Molly Robin-Abbott used the critical loads approach to determine levels of N deposition by synthesizing current research relating atmospheric N deposition to effects in terrestrial and aquatic ecosystems. Responses to increased N deposition included changes in biological community structure, altered soil N cycling, increased N leaching to soil and surface waters, increases in susceptibility to secondary stresses, increases in invasive species, and altered fire regime. The range of critical loads for nutrient N they found for U.S. ecoregions, inland surface waters, and wetlands is 1 to 39 kg N/ha/yr. In some regions, the critical load for sensitive receptors has been exceeded. This approach is an ecosystem assessment tool with great potential for simplifying complex scientific information and effectively communicate with the policy community and the public.

Elevated nitrogen inputs to a prairie grassland in Minnesota (left) resulted in a decrease in species richness and an increase in invasive grasses (right).

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PARTNERS

Mark Fenn and Linda Geiser, U.S. Forest Service Pacific Northwest Research Station; Christine Goodale, Cornell University; Charles Driscoll, Syracuse University; Edith Allen and Robert Johnson, University of California, Riverside; Jill Baron and Steve Perakis, U.S. Geologic Survey; Roland Bobbink, B-WARE Research Center, the Netherlands; William Bowman, University of Colorado; Bridget Emmett, Center for Ecology and Hydrology, United Kingdom; Frank Gilliam, Marshall University; Christopher Clark, Tara Greaver, Lingli Liu, Jason Lync, and John Stoddard, U.S. Environmental Protection Agency; Sharon Hall, Arizona State University; Knute Nadelhoffer, University of Michigan; Kathleen Weathers, Cary Institute of Ecosystem Studies

WATERSHED-SCALE EROSION MODEL ACCURACY IMPROVED

The Revised Universal Soil Loss Equation (RUSLE) is a computer model commonly used to estimate sediment delivery to streams from forested watersheds. However, much of the coefficient development and validation of RUSLE has been based on results from plot studies, or from extrapolation of data collected from agricultural fields. From 1999 to 2008, NRS scientist Pam Edwards measured sediment delivery annually from an entire forested watershed and compared these measurements to those generated from RUSLE. Edwards and her co-investigators Greg Hamons and Jingxin Wang found that the RUSLE estimates greatly overestimated the measured soil losses, probably because RUSLE assumes sheet erosion from the entire watershed surface. The results of the field measurements showed that most sediment delivered to the stream originated within 20 horizontal meters of the stream.

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PARTNERS

Jingxin Wang, West Virginia University; Greg Hamons, West Virginia University Extension Service; U.S. Forest Service, Monongahela National Forest; Michael Bill, Southern Illinois University

Pam Edwards, U.S. Forest Service

Potential sources of sediment within a watershed were surveyed and mapped. This information was used in conjunction with the sediment delivery data to identify the most common features, such as the windthrow shown here, that contribute sediment to forest streams.

SHRUBLAND BIRDS AND THEIR HABITATS

Populations of shrubland birds throughout North America have decreased to historical lows, causing great concern among managers, researchers, and the birding public. Birds are highly valued by Americans. According to a recent U.S. Fish and Wildlife Service report, 20 percent of the U.S. population is interested in bird watching, thus spending 85 billion dollars and creating more than 800,000 jobs. Unfortunately, 13 percent of the world's bird species are threatened with extinction in the near future. Shrubland birds require constant management, and thus, the need for reliable knowledge to guide management efforts is acute. NRS researchers David King and Mariko Yamasaki are working to answer critical management questions such as 1) How effective is silviculture, fuels reduction, and prescribed fire in shrubland bird conservation? 2) Do urbanization and invasive plants affect shrubland birds? 3) How much shrubland habitat exists and who is responsible for its management? and 4) Does shrubland management affect mature forest birds? King and Yamasaki have also been active in educating and federal land managers as well as extension personnel, who are often the first to receive questions from homeowners and private forest landowners.

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Dave King, U.S. Forest Service

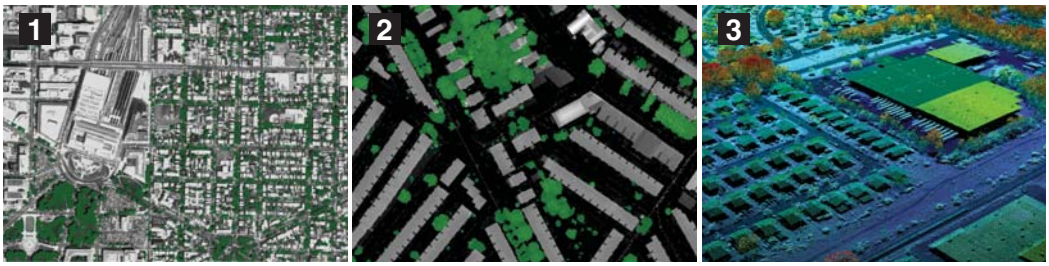
The chestnut-sided warbler is a neotropical migratory bird that depends on shrubland habitats. Their populations have declined by nearly 60% over the past few decades. NRS research shows that even-aged management is the most effective method to manage habitat for this species.

PARTNERS

University of Massachusetts—Amherst; U.S. Forest Service White Mountain National Forest; Massachusetts Division of Fisheries and Wildlife; Connecticut Department of Environmental Protection; the U.S. Natural Resources Conservation Service; the Northeast Utilities Foundation; and the Massachusetts Audubon Society

URBAN TREE CANOPY ASSESSMENT PROGRAM

Despite millions of dollars spent each year by federal, state, and local governments on remote sensing datasets, decisionmakers sometimes still find that they lack basic information about their community's tree canopy because these datasets have not been converted into practical, readily interpretable information. In the Urban Tree Canopy (UTC) Assessments Program, NRS scientist Morgan Grove, with a partner from the University of Vermont's Spatial Analysis Laboratory, has developed advanced processing techniques that help fill this information gap. They have provided new land-cover maps that are 900 times more detailed than existing datasets. These assessments have been completed for more than 30 communities in the United States and Canada. The UTC Assessment Program has been recognized for its outreach activities by the Association of Natural Resource Extension Professionals and for its use of advanced image processing algorithms by Nobel laureate Dr. Gerd Binnig.



(1) High-resolution tree canopy mapping for District of Columbia from Quickbird satellite imagery. This tree canopy dataset was used by the District to set their 40% tree canopy goal. (2) Advanced object-based image analysis techniques were applied to available imagery from the National Agricultural Imagery Program to extract high-resolution land cover for Hartford, CT. This land cover dataset is being used by Hartford to target areas for tree planting. (3) View of a LiDAR point cloud for Philadelphia, PA. LiDAR technology allows for detailed three-dimensional mapping and is particularly valuable in urban areas. This LiDAR dataset is being used to map and inventory the trees in Philadelphia.

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PARTNERS

Jarlath O'Neil Dunne, University of Vermont, Spatial Analysis Laboratory

HOUSING GROWTH IN AND NEAR PROTECTED AREAS

America's public lands include some of the most scenic and highly valued resources in the country and thus attract nearby housing growth. NRS researcher Susan Stewart and cooperators at the University of Wisconsin and Oregon State University analyzed housing data from 1940 to 2000, within and surrounding each national park, national forest, and wilderness area. They found that 28 million new housing units had been built within 50 km of protected areas and that 40,000 new houses were added within national forest boundaries. During the 1990s, housing growth averaged 13 percent nationally, but grew at 20 percent within 1 km of protected areas. If these long-term trends persist, another 17 million housing units will be built within 50 km of protected areas by 2030, greatly diminishing their conservation value. Concern about the integrity of protected areas has focused on developing nations, where resource use pressure taken off a protected area can intensify pressure on surrounding lands. In the United States, demands on resources are typically for scenic vistas and proximity to trails; this research alerts resource managers, state and local planning authorities, and conservationists that when houses are built to satisfy these amenity demands, forests are fragmented, habitat lost, migration corridors disrupted, and biodiversity reserves isolated.

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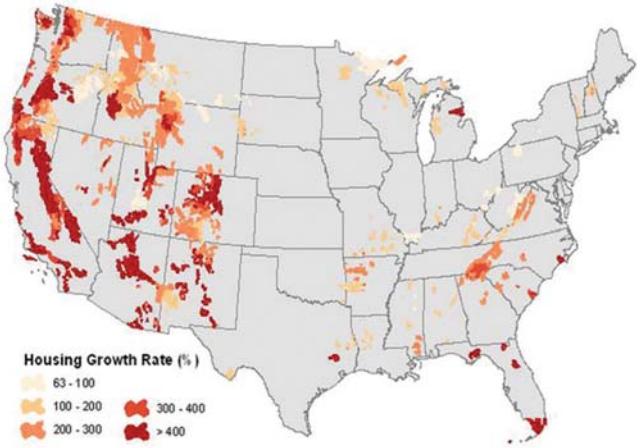

Housing growth rate 1940–2000 within 50 km of each national forest, national park, and wilderness area within the conterminous United States

PARTNERS
Volker C. Radeloff, Anna M. Pidgeon, Urs Gimmi, and David P. Helmers, University of Wisconsin—Madison; Roger B. Hammer, Oregon State University; Todd J. Hawbaker, U.S. Geologic Survey; Curtis H. Flather, U.S. Forest Service Rocky Mountain Research Station

WOLF RECOVERY AND WISCONSIN'S FUTURE FORESTS: A TROPHIC LINK?

Overabundant white-tailed deer populations have serious negative effects on understory plant community structure and composition. Wolves, which are top predators of deer, have been recolonizing central Wisconsin since the early 1990s. NRS scientist Keith Moser and partners from the University of Georgia are measuring trophic cascade effects, that is, whether wolves are reducing local browse intensity by white-tailed deer and thus mitigating the biotic impoverishment of understory plant communities. Wisconsin Department of Natural Resources wolf territory data combined with Forest Inventory and Analysis (FIA) data were used to develop a landscape-level spatially explicit analysis protocol in FIA plots categorized as high wolf impact areas and low wolf impact areas. Preliminary results suggest that seedling survival of preferred, browse-sensitive seedlings is higher in areas continuously occupied by wolf packs.

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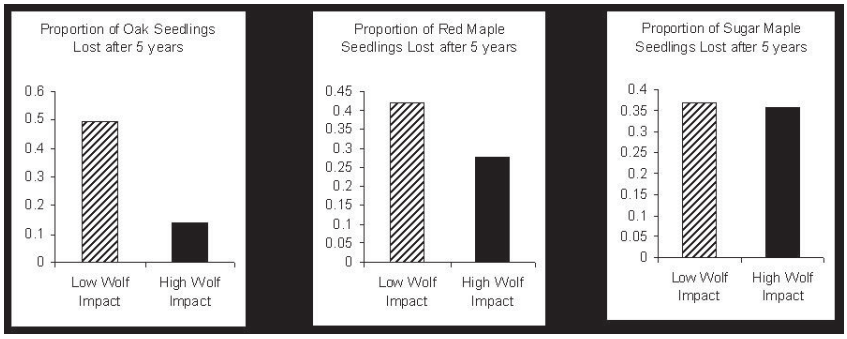

Average loss of select seedlings in FIA plots after 5 years of wolf occupancy. Solid bars represent high-wolf-occupancy plots (areas occupied for 8–11 of the past 11 years). Oak seedlings are both browse sensitive and subject to high browsing pressure by white-tailed deer. Red maple seedlings are also subject to high browsing pressure but are less sensitive to browsing. Sugar maple is relatively browsing-insensitive.

PARTNERS
Ramana Callan and Nathan P. Nibbelink, University of Georgia, Warnell School of Forestry and Natural Resources

NATURE IN THE CITY: DAY CAMP FOR INNER CITY KIDS

Syracuse, NY, has an inner-city school district with a 78 percent districtwide poverty rate where fewer than 50 percent of entering kindergarten students eventually graduate from high school 13 years later. In the 2009-2010 school year, the Syracuse City School District adopted an innovative approach to education, partnering with "Say YES! to Education, Inc.," a national nonprofit committed to raising high school and college graduation rates for inner city youth.

In support of this initiative, NRS conservation education specialist Barbara McGuinness and the NRS Environmental Literacy Program partnered with Say YES! and the Baltimore Woods Nature Center on a pilot program "Nature in the City Summer Day Camp." In this 4-week ecological exploration of Elmwood Park in a 182-acre nature preserve with woods, fields, ponds, and streams, 25 elementary students got their hands dirty as they discovered the surprising diversity of urban environments right in their own neighborhoods. The program was so successful that Say Yes! agreed to fund the entire program at Elmwood Park for the summer of 2010, and Baltimore Woods hopes to expand the program to other Syracuse city parks in future years. Additional partners include Syracuse City School District's Roberts Elementary Summer Institute, the Syracuse Department of Parks, Recreation and Youth Programs, the Mary Ann Shaw Center for Public and Community Service at Syracuse University, and St. Peter's Outfitter.

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PARTNERS
Say YES! to Education, Inc.; Baltimore Woods Nature Center, Marcellus, NY; Syracuse City School District's Roberts Elementary School Summer Institute; Syracuse Department of Parks, Recreation and Youth Programs; the Mary Ann Shaw Center for Public and Community Service at Syracuse University; and St. Peter's Outfitter, Oswego, NY.

Barbara McGuinness, U.S. Forest Service

Kindergarten students in Syracuse, NY, are hoping to catch Mill Pond's big bass as part of the Nature in the City day camp sponsored by the Northern Research Station, Say YES! to Education, and Baltimore Woods Nature Center.

GREENSKILLS: FOSTERING COMMUNITY IMPROVEMENT THROUGH URBAN ENVIRONMENTAL EDUCATION

The Urban Resource Initiative (URI) is a nonprofit partnership with Yale University's School of Forestry and Environmental Studes that is designed to foster community improvement through urban ecology and environmental education. In partnership with the Northern Research Station, URI is implementing "GreenSkills," a citywide program that hires New Haven, CT teenagers to inventory and plant street trees in the city's public spaces. High school students gain professional training and work experience, and they benefit from regular interaction with Yale student mentors. New Haven benefits from the increased number of street trees, which remove pollution, lower energy use, improve water quality, improve human comfort, and increase urban property values. Happy with initial results of this partnership, the city of New Haven recently announced a new goal—planting 10,000 trees in cooperation with URI. NRS biological scientist Dave Bloniarz with the Urban Natural Resources Institute is expanding the program by developing a Google interface that will allow New Haven residents to find out what trees are in their neighborhoods, to understand the ecosystem services those trees provide, and to request new trees as needed.

This project has been supported by the Northern Research Station's Civil Rights Diversity Committee and Northern Science, Technology, and Applied Research Results (NorthSTAR) program funding.

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PARTNERS
Common Ground High School, New Haven, CT; the Sound School, New Haven; Yale University School of Forestry and Environmental Studies

Urban Resources Initiative

Students from Common Ground High School planted 379 trees during the 2009–10 school year as part of NRS's GreenSkills partnership with the Yale School of Forestry and Environmental Studies Urban Resources Initiative.

NRS RESEARCH WORK UNITS

RWU No.	Research Work Unit	RWU Leader
NRS-01	Ecological and Economic Sustainability of the Appalachian Forest in an Era of Globalization	Jan Wiedenbeck
NRS-02	Sustaining Forests in a Changing Environment	Susan Stout
NRS-03	Ecology and Management of Invasive Species and Forest Ecosystems	Kurt Gottschalk
NRS-04	Genetics, Biological Control, and Management of Invasive Species	Jim Slavicek
NRS-05	Forest Inventory and Analysis	Dennis May
NRS-06	Climate, Fire, and Carbon Cycle Sciences	Rich Birdsey
NRS-07	Center for Research on Ecosystem Change	John Brissette
NRS-08	Urban Forests, Human Health, and Environmental Quality	Dave Nowak
NRS-09	People and Their Environments: Social Science Supporting Natural Resource Management and Policy	Lynne Westphal
NRS-10	Biological and Environmental Influences on Forest Health and Productivity	Kevin T. Smith
NRS-11	Sustainable Management of Central Hardwood Ecosystems and Landscapes	Dan Dey
NRS-12	Northern Science, Technology, and Applied Results Program (NorthSTAR)	Mark Twery
NRS-13	Institute for Applied Ecosystem Studies: Theory and Application of Scaling Science in Forestry	Eric Gustafson
NRS-14	Hardwood Tree Improvement and Regeneration Center	Charles Michler

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