

NC NEWS



NORTH CENTRAL FOREST EXPERIMENT STATION

June/July 1999

SPECIAL ISSUE

A Common Focus, A Confluence of Ideas:

Introducing North Central Research Station's Integrated Research Programs

A New Whole Way to Learn

This is a special issue of NC News, devoted to our future and your place in it. As Forest Service researchers, we work for you, developing information and products you can use as you make important natural resource decisions. We're charting new research directions for the next 5 years, and we want you to be a part of it from the start.

The world is changing. Set ideas about ecological systems are cracking wide open as our view expands from inside the forest to over the landscape, from studying the parts to studying relationships, from maximizing resource outputs to ensuring long-term sustainability. In every inquiry, we acknowledge that the patterns of a place are created by interwoven systems—ecologic, economic, and social—that together make a whole.

The way we work together is also changing. We realize more keenly than ever that research is not a solo endeavor. Understanding complex issues requires no less than complex, collaborative inquiry. As specialists, we were each trained to notice the world in a particular way. When we walk across a landscape together, we see more than each of us would alone. That's the power of integrated research—like an ecosystem, the

whole of our understanding is much more than the sum of its parts.

Interdisciplinary teams of researchers working together to answer common questions and often on common ground—that's the integrated model, the way we'll be working. *What* we work on is the question we'd like to explore with you.

From reports that detailed our clients' research needs (a tower of paper several feet tall), and from personal conversations with many of you, these three issues cropped up again and again:

Landscape Change: Human development is rapidly fragmenting the Midwest and changing the flow of forest goods and services, yet we know little about the drivers and the effects of this change.

Forest Productivity: Midwest timber supplies could fall short of future demands unless we find ways to optimize and sustain forest productivity on managed lands.

Riparian Landscapes: Clean water, recreation, and other forest resources depend on the health of "lands at the water's edge," yet we know little about the riparian areas that characterize our region.



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Why These Issues?

We did some soul searching to choose our three proposed programs. We wanted to make sure that (1) We were the right outfit for this work, (2) The work was a good “fit” for this region, and (3) A demand existed for the knowledge and products we would generate.

We looked carefully at our assets, that is, the skills we have, the knowledge we’ve already amassed, and the capacity we have to generate more. We found:

- A breadth of expertise (more than 15 scientific disciplines) that’s unusual within one organization.
- A depth of long-term data, from experimental forest studies, forest inventories, and data collection/maintenance efforts such as the National Atmospheric Deposition Program.
- A history of innovations—patents on harvesting systems, fast-growing species, genetic methodologies, original social survey techniques, pest control strategies, and a record of first-ever management guidelines that reach back to our founding 76 years ago.
- Talented collaborators who help us reach beyond ourselves.
- And last, but not least, a dedicated staff who feel fortunate to be doing this kind of work, at this time in history, in this place.

We also looked at what it is about this place, our home region, that sets it apart, to ferret out the obvious questions that arise here. We found:

- We have a region that is densely populated in its urban centers, with growth springing up across farmlands, forests, and in new epicenters of recreation and second home development.
- We are one of the Nation’s wood baskets, with the potential to “feed fiber to a hungry nation.” The capacity of our forests to produce all the benefits—wood, water, wildlife,

recreation, spiritual solace—is still intact. Sustainable productivity cannot just be assumed, however.

- The Midwest has more wetlands and lakes and rivers than anywhere else in the Nation.

Finally, you’ve let us know, through your requests for research, that some complex questions have not been adequately answered.

- You told us that you don’t currently have the scientific foundation or the tools needed to ensure that our abundant resources will continue to provide for us today and for our children and grandchildren tomorrow.
- You want practical answers to questions such as: How do we sustain the vital capacity of the Midwest’s lands and waters while meeting the competing needs of a growing and ever-more-diverse population?

We propose to spend the next 5 years tackling three critical natural resource issues in the Midwest, work that we believe will move us closer to the practical answers you require. At the end of that 5 years, we’ll assess our progress, and, if need be, our “virtual teams” will coalesce around new issues.

What Do You Think?

As you view this “snapshot” of our proposed integrated research programs, please consider:

- what rings true
- what’s missing
- how you might participate in this work.

Then give us a call, send us a note, or set up a meeting with us. If you find yourself scribbling question marks in the margins, let us know, and we’ll send you the full-length program documents, with more details than we have room for here. (See contact info on the back page.)



Population growth patterns of the Midwest are revealed in this view of US lights at night. (Defense Meteorological Satellite Program Operational Linescan System data.)



From Landscapes to Lots: Understanding and Managing Landscape Change



Seasonal homes comprise half or more of the housing stock in one-quarter of the townships in the northern forested portions of the Great Lake States. Forty-four percent of all townships in the ecoregion have at least 25 percent seasonal homes. (Great Lakes Assessment data.)

Across the U.S., 2,450 acres of open space are developed *every day*. It's happening here too, of course, as landscapes become lots for subdivisions, vacation homes, and mini-malls. Fragmentation and development transform not only the life of the landscape, but also the lives of people who live, work, and visit an area.

The fences that keep wildlife from circulating also restrict people who once depended on large tracts of forest for their livelihood and leisure. As access to private land narrows, resource managers are under greater pressure to make sure public lands are "all things to all people," none of whom seem to agree. Meanwhile, local community officials are grappling for ways to "grow smart" while protecting their critical resource base and the character of their home region.

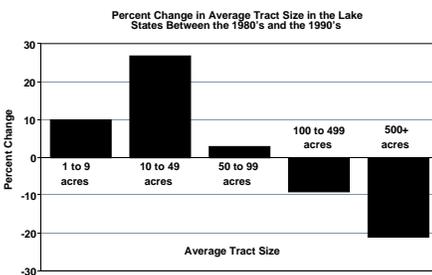
If there was ever a time for decision-support tools, it's now. Resource managers, business leaders, landowners, and community officials are making decisions that will ripple for years, yet they have little access to reliable information on the patterns, the process, or the implications of residential and commercial development. For instance, how fast is the change occurring and what spatial form will it take? How will these changes affect forest management for biodiversity? Recreation access (e.g., hunting)? Solitude and other experiential values of forests? How will people respond to attempts to mitigate undesirable effects? Surprisingly, no comprehensive research program is underway in the region to answer these questions.

We believe it's time to rigorously examine the phenomenon of landscape change. By deciphering the What, Why, So what, and Now what of landscape change, we aim to give policymakers the insight and tools they need to wisely guide growth.

In light of the...

- ☆ Rapid development across landscapes in our region
 - ☆ Potential implications of that change on economies, ecosystems, resource management, and people
 - ☆ Lack of science-based analysis of the phenomenon
 - ☆ Pressing need for knowledge and decisionmaking tools
- ...we propose an integrated research program that will...**

Characterize landscape change.



As lands were subdivided in the 1980's and the 1990's, the total area of timberland in the larger average tract size decreased, while total area in smaller parcels increased. Are we in danger of losing the unique benefits associated with large tracts of unbroken forest? (Forest Inventory and Analysis data.)

- What are the key landscape changes affecting the health and sustainability of natural resources and their related social systems?
- How can we best describe the rate and spatial extent of these changes?
- Which measures of landscape patterns and socioeconomic indicators work best to describe and quantify the full range of changes that are likely to occur?
- How do people perceive changes in landscapes and in their inter-linked social systems? Do local residents, seasonal residents, and visitors perceive landscape change in significantly different ways?
- Are there meaningful relationships between measures of landscape fragmentation and the "indicators of sustainability" currently being adopted by communities throughout the U.S.?

Understand what causes landscape change.

- What are the critical social and economic factors influencing landscape change? How do these drivers and their effects vary in different circumstances?
- What are the key linkages and dynamic interactions between the patterns of landscape change and the physical, biological, and social variables that drive these patterns?

- Can we develop ways to predict future landscape change (where, when, and how much)? How might these predictions help us maintain the health and sustainability of natural resources? How could we improve these predictions?

=== Determine how landscape change affects people.



- How will landscape change (including physical, biological, and social changes) influence
 - the goods and services available from the land
 - the economies in and near the changed areas
 - the quality of life for those who live in, visit, or travel through the landscape?
- If landscapes are preserved or enhanced, how might this yield a financial benefit to those developing industrial/commercial sites, seasonal homes, recreational facilities/resorts, and residential developments?
- How can we monitor change in a cost-effective way?

=== Determine how landscape change affects ecosystems.

- How will landscape change (including physical, biological, and social changes) influence:
 - the composition and structure of the forests embedded in the landscape
 - forest processes and functions (such as disturbance patterns, carbon cycling, and nitrogen cycling)
 - wildlife viability
 - relative abundance of plant and animal species
 - ecological food webs
 - amplitude of population cycles (including pest outbreaks)
 - water and air quality
 - land management objectives and implementation of management
 - goods and services provided by ecosystems
 - the link between ecosystem function and societal values.

▲ As we transform the landscape, how can we minimize negative consequences, such as disruption to wildlife habitat or increased susceptibility to forest pest outbreaks? ▼

=== Determine the effects of social, ecological, and management response strategies.

- To what extent and under what circumstances are individual landowners willing to change their management regimes to meet regional goals?
- How do non-industrial private landowners manage their lands in places where rapid parcelization is taking place?
- What should professional land managers do to help diverse forest landowners maintain the health and sustainability of forested landscapes?
- How can we predict and characterize local conflict over development issues?
- How effective are growth management tools such as purchase of development rights, growth boundaries, and other techniques for preserving forest areas in rapidly growing urban, suburban, exurban, and rural areas? Are these tools equally well-suited across a variety of social and biophysical settings? What forest management regimes are compatible with different growth management tools?
- How can areas that are being impacted by landscape change enhance forest-based economic growth from tourism, recreation, seasonal homes, and associated developments while retaining control over local character and quality of life?



Which Lands Will We Focus On?

- ☆ Three to five case study areas that are experiencing varying types and degrees of landscape transformation.
- ☆ Gradient studies along transects radiating from cities of varying sizes, including areas that are currently experiencing sprawl, as well as those that are not yet experiencing sprawl.

What Will We Provide?

- ☆ Data, maps, and models for decision-support systems for land-use planning.
- ☆ Science-based management guidelines to mitigate undesirable ecologic and social effects due to fragmentation.
- ☆ Predictive models that show the relationship between causes of landscape change and appropriate measures of that change (e.g., land use, land cover, distributions of forest types, species or communities of interest).
- ☆ Methods for determining how timber harvesting near urban and developing areas is affected by the spatial pattern of surrounding tracts of land by size, ownership type, and land use.



Sustainable Forests: Managing Forests More Productively



Meeting rising demands for wood products while protecting the long-term health and productivity of our forests is the goal of this integrated program.

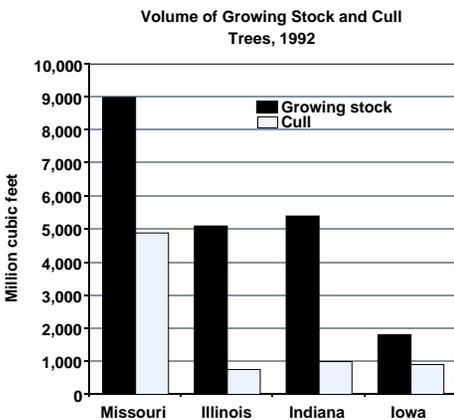
“Trees are the answer,” a wise bumper sticker once said. Trees are renewable and therefore an eco-logic-ally smart choice for today’s paper, structural, and manufacturing needs. The question is, what about tomorrow? Will our forests continue to be productive enough for future generations?

The demand for wood products is climbing at twice the rate of population growth. While the region’s forests account for only 11 percent of the Nation’s forest lands, they contain 20 percent of the Nation’s forest industry lands and hardwood growing stock. A steady demand for Midwest timber comes from 1,500 wood-using firms that employ more than 400,000 people.

On the supply side, changes in land-use patterns and social preferences mean that fewer lands in the Midwest wood basket are available for timber harvest. Actively managed lands are feeling the pressure, and on some ownerships, aspen harvest already exceeds net aspen growth—an unsustainable pattern. A history of high grade harvesting and a lack of management planning means that many forests, laden with cull timber and less than desirable species, are not as productive as they could be.

We’re headed into a funnel formed by these demand-supply trend lines, and we believe that research is one way to ensure we come out the other end with the productive capacity of our forests and our forest-based economy intact. What’s needed? In our estimation, significantly more wood must become available on public and private lands, and those increases will require (1) improved genetic material; (2) improved, cost-effective silvicultural systems; (3) more efficient, environmentally friendly harvesting systems; and (4) socially acceptable implementation of high-yield forestry.

We’re also aware that one silvicultural system will not fit all. This region is characterized by a diversity of ownerships, a continuum of management intensities (from plantation to natural stands), and a diversity of forest types (from aspen and jack pine to fine hardwoods). The challenge is to meet wood supply and sustainability goals in ways that are as diverse as the landscape. We believe “research is the answer,” but it will require new thinking and a far more active integration of disciplines than we’ve ever attempted.



Cull trees are unsuitable for industrial use because of rot, missing or dead material, form, or other defect. Through genetics, silviculture, and pest research, we can improve tree quality, and thus create a more sustainable, productive forest.

In light of the...

- ☆ Economic importance of our forest industry
- ☆ Steeply increasing demand for wood
- ☆ Anticipated supply shortfalls
- ☆ Need to produce wood today while building ecological and economic capacity for tomorrow

...we propose an integrated research program that will...

Improve nursery and plant management systems to increase timber productivity.

- How can we improve nursery practices to produce seedlings of higher quality? (e.g., physiologically vigorous, pest free, of appropriate size and stocking type for the site.)
- What is the potential for genetic improvement of key species under both mixed species and monocultural management strategies?

Design cost-effective, high-yield silvicultural systems.

- Are more efficient and effective regeneration techniques technically and economically feasible?
- Can we design new harvesting systems to recover more volume or to provide low-impact harvesting for small ownerships?



Effective silvicultural techniques can help landowners realize the productive potential of a site, while maintaining ecological diversity.

- How much can we increase productivity through fertilization, soil, water, and vegetation management?
- What is the right mix of silvicultural systems to meet the diversity of landscape, species, and ownership needs in the region?

Achieve timber productivity while protecting forest ecosystems.

- Which silvicultural prescriptions are best suited for managing ecological diversity at the landscape scale?
- How can we optimize harvesting systems to protect non-timber resources and environmentally sensitive areas?
- How do current silvicultural systems and harvesting practices affect non-timber components of forest ecosystems?
- How/where should we plant and grow improved genetic stock to enhance genetic diversity and decrease pest susceptibility?

Explore opportunities to implement high-yield forestry.

- What are the social and economic factors that limit wood availability?
- How much can we increase productivity on non-industrial private forest lands, and how likely are we to actually realize that potential?

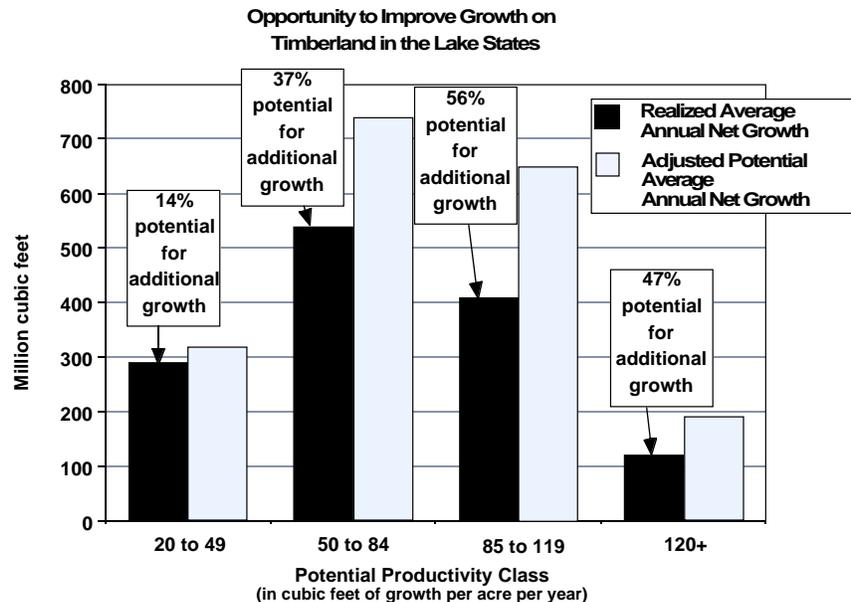
Which Lands Will We Focus On?

- ☆ Publicly and privately managed lands in the region.

What Will We Provide?

- ☆ Revised management guides for even and uneven-aged management.
- ☆ Improved genetic materials for plantation stocking of key species.
- ☆ Improved low-impact harvesting techniques for large and small ownerships.
- ☆ Guidelines on how to manage multiple species for multiple objectives (productivity, biodiversity, water quality) at the landscape scale.
- ☆ Improved decision-support models.
- ☆ “Research on Wheels”—Research brought to where land managers/owners live.
- ☆ Practical strategies to expand investment in timber productivity or to increase availability of timberlands for harvest.
- ☆ Targeted information for landowners, e.g., “What you can do to increase productivity?” and “What would increased forest productivity mean for local, regional, and national economies?”
- ☆ Enhanced ability of forests to withstand pest epidemics.

The difference between the two bars—between actual on-the-ground growth and what the site is capable of producing—is a measure of potential. The percentages indicate what we could gain through research and management efforts to boost productivity on timberlands across the Lake States. (Forest Inventory and Analysis data.)



Decisions at the Water's Edge: Sustaining Riparian Landscapes



Riparian areas are hubs for recreation, wildlife, and resource use, yet we know very little about how they function.

Riparian areas are at the interface—this side of wet and that side of dry—between land and water. Thanks to the generous helping of lakes, rivers, and wetlands in the Midwest, they are also our signature lands. Riparian areas cover 15 percent of our region's surface, weaving their way through a patchwork of private and public ownerships. The seven national forests in the upper Great Lake States—a mere 4 percent of total Forest Service lands—contain 41 percent of the lakes, reservoirs, and ponds in the National Forest System. As hubs for both recreation and resource extraction, these lands at the water's edge are in great demand, and therefore in great need of wise management.

Why then has so little research been done on the ecology and management of riparian areas? Why are we still using riparian best management practices based on research from *western* streams, which are so different from ours? And why isn't more known about the "social landscape"—the changing ways that people use and value these lands? Without this fundamental knowledge, debates will continue to rage about the appropriate level of protection and appropriate use of riparian areas. At North Central, we have a name for these crucial gaps in knowledge: research opportunities.

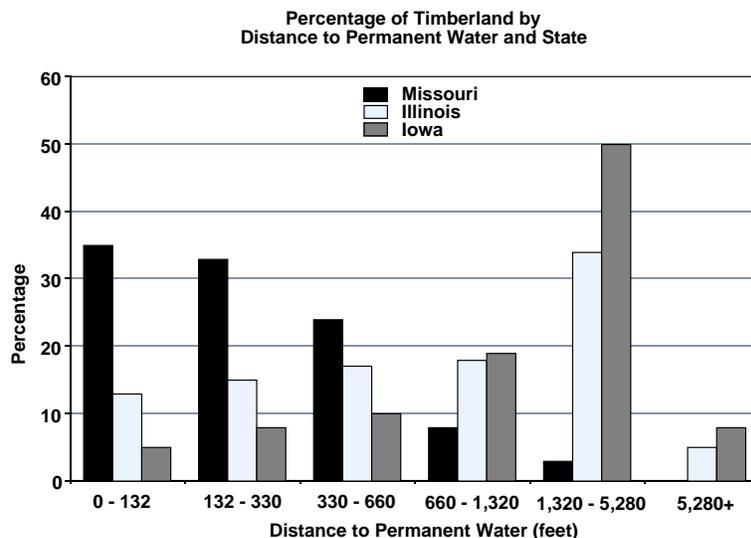
In light of the...

- ☆ abundance of lakes and wetlands in this region
 - ☆ conflicting uses and values associated with these systems
 - ☆ regional and national concerns about water quality
- ...we propose an integrated research program that will...

Increase understanding of ecological functions of riparian areas at multiple scales.

- How wide should a riparian buffer be? Can we define riparian areas functionally, and if so, how?
- What role does vegetation play? How should we restore damaged areas and how well do these restored areas function?
- What are the cumulative effects of riparian management? How does water quality differ between watersheds managed with and without riparian best management practices?
- How should we assess and monitor riparian areas? Can Forest Inventory and Analysis research help?
- What can local-scale studies tell us about entire regions—can the results be generalized?

Missouri, Illinois, and Iowa have significant amounts of timberland located near permanent water. These forests contribute to the economic and ecological health of our watersheds, helping to reduce erosion, maintain water quality, support forest industries, and nurture resident and migrating wildlife. (Forest Inventory and Analysis data.)



 **Predict and monitor changes in how people value and understand riparian areas and watersheds.**

- How do people use riparian areas; for example, how do year-round residents, second-home owners, and visitors differ in their use patterns?
- What benefits do individuals and communities derive from riparian areas? How do changing patterns of use affect local economies?
- How important are various ecological functions at providing these benefits?
- Do people understand how their use impacts the ecological health of riparian areas? Are they willing to change their own use patterns to protect or restore riparian areas?

 **Provide a scientific basis for management and policy guidelines for restoration and sustainable use of riparian areas.**



Fifteen percent of the surface area of the Midwest is riparian. These lakes are on the Huron-Manistee National Forest in Michigan.

- Are riparian management guidelines working? Are they protecting and/or restoring the health and benefits of riparian areas, including the ability to regenerate and grow desired timber species?
- How far can we develop or extract, without significantly altering riparian health?
- If we were to follow sustainable forestry and development guidelines in riparian areas, what would the cost/benefit tradeoffs be? How would these measures affect economic opportunities?
- Given restrictions in harvest practices, how can new harvest technologies and equipment be used to mitigate negative effects and improve economic potential?

Which Lands Will We Focus On?

- ☆ Predominately forested riparian landscapes.
- ☆ Watersheds dominated by forest management and residential development.
- ☆ Urban river corridors and forested riparian buffers on agricultural lands.

What Will We Provide?

- ☆ Science-based management guidelines.
- ☆ Better informed decisionmaking by the diverse owners and users of riparian and watershed resources.

Now It's Your Turn

With its quilt of land ownerships, its diverse landforms and forest types, and its surprisingly large population with disparate ideas about land use, the resource-abundant Midwest has some unique challenges ahead. It's an auspicious time and place to be doing natural resources research, and that's why we're excited about this new work. We're looking to forge new collaborations and to pioneer integrative approaches to research, which is where the cutting edge of science is headed. Ultimately, we're betting that this new approach will be a match for the complexity of the sustainability questions that face us.

As scientists, we believe we have a responsibility to meet society's needs. To be of greatest service, we need feedback from you, our clients and cooperators. Once again, we ask you to let us know:

- what rings true
- what's missing
- how you might participate in this work.

Call us, send us a note, or e-mail us:

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If this "snapshot" leaves you hungry for some more details, please contact us and we'll send you the longer program documents. If you'd like to speak with us in person, we'd be happy to set up a meeting with you. Thanks very much for perusing these, and we welcome your thoughts and suggestions.

