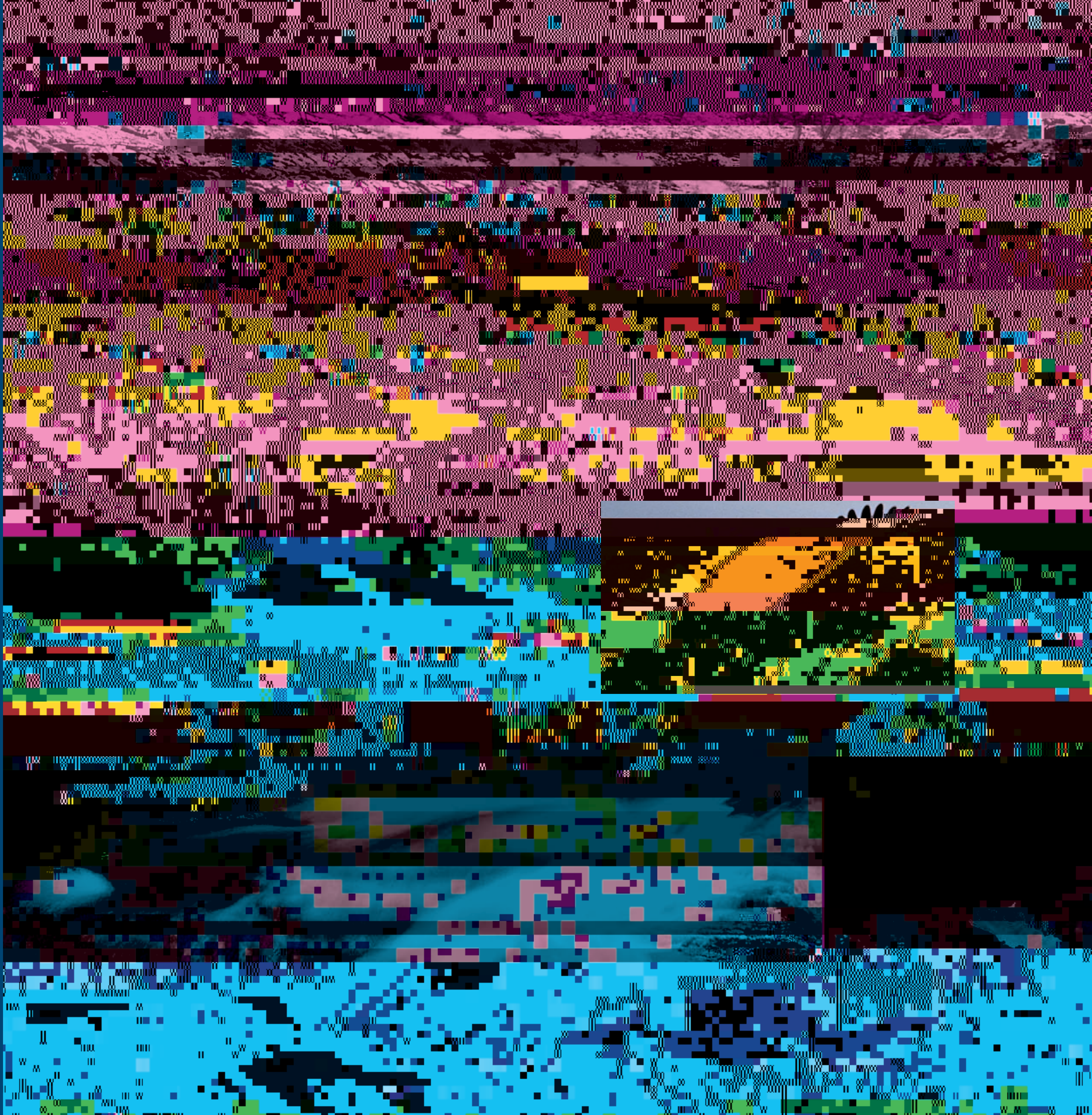
Decisions at the Water's Edge

Sustaining Riparian Landscapes in the Midwest



Acknowledgments

The research findings described in this report stem from a sustained effort among Station scientists and collaborators since the inception of the Riparian Landscapes Integrated Research and Development Program in 1998. Those playing a critical part in shaping the program included Tom Crow, Linda Donoghue, Sue Barro, Dave Bengston, Dan Dey, John Dwyer, Paul Gobster, Jud Isebrands, Pamela Jakes, Randy Kolka, Brian Palik, Don Riemenschneider, Thomas Schmidt, Herb Schroeder, Steve Shifley, Dave Shriner, Stephanie

Decisions at the Water's Edge: Sustaining Riparian Landscapes in the Midwest

A Progress Report

North Central Research Station
Sustaining Riparian Landscapes Integrated Research and Development Program

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Science Co-Leaders

Riparian areas in the Midwest Regi n in de and ar nd s a er a es t p p nds idd e and s a er ri ers and ree s tt

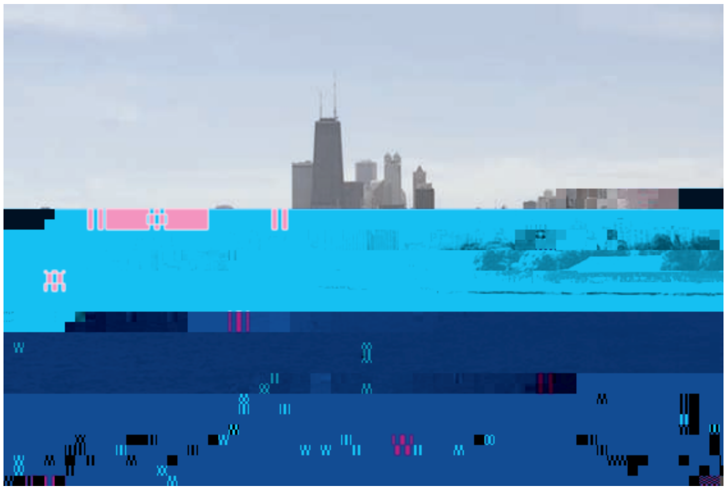
Executive Summary

Few regions in the country have a greater abundance of lakes, rivers, streams, wetlands, and their associated forested riparian areas than the seven States of the Midwest region. In developing an integrated approach to issues in the region's riparian areas, we are seeking answers to the following important questions for policymakers, planners, and managers:

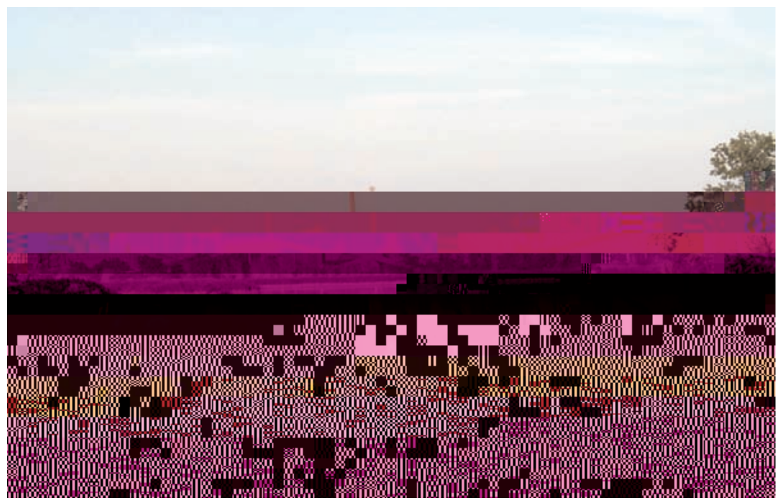
1. How much riparian area do we have?
2. Who's using riparian areas and what's happening to these areas?
3. How do we rehabilitate riparian areas?

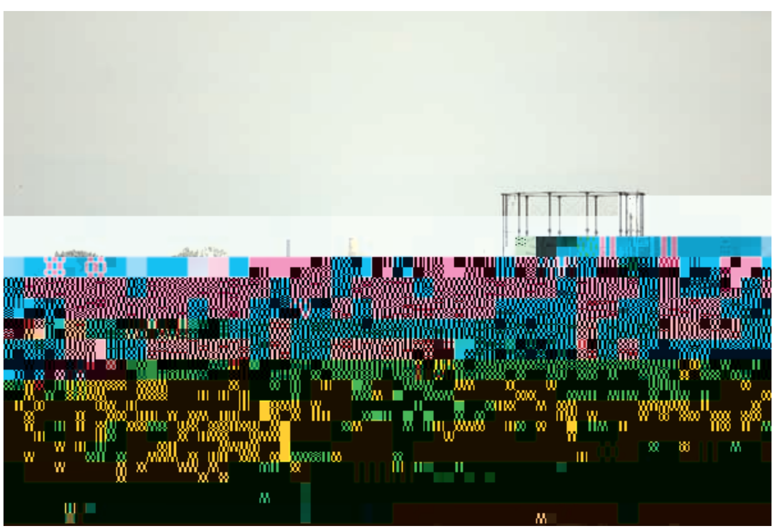
We can now partially answer these questions.

How much riparian area do we have? Although determining how much riparian area we have seems like a simple task, it's not. The process is complicated by the crucial first step of defining what areas actually are riparian. The first-ever estimation of riparian lands in the Midwest region conducted by North Central Research Station (NCRS) scientists, indicates that 8 to 13 percent of the land base in the r



Midwest riparian areas include both urban and rural lakes (above), streams, and wetlands along with ecologically friendly industrial sites (right and bottom).





CONTENT

INTRODUCTION

The Sustaining Riparian Landscapes Integrated Research and Development Program is one of three integrated research programs developed by the North Central Research Station in 2000. These programs were described in the Station's strategic plan, *The Nature of Tomorrow*, that outlined the research needed to guide decisionmakers in enhancing and sustaining our region's natural resources.

Riparian areas are where the land and surface water meet and influence each other. Few regions in the country have a greater abundance of lakes, rivers, streams, wetlands, and their associated riparian areas than the seven States of the Midwest region. The forests riparian areas in the West are important because they are rare; in our region, they are important because they are common. Common they may be, but that does not mean that these riparian areas are understood, or that they do not have unique characteristics. Three striking features of Midwest riparian areas are the intermix of riparian areas with working forests, the amount of home development in riparian areas, and the impact of rust-belt industries on urban riparian areas.

Riparian areas are vital to healthy ecosystems. Vegetation in these areas provides shade that cools the water, critical for some fish species. Coarse woody debris at the land/water intersection provides nutrients and shelter for wildlife and other organisms critical to ecosystem functioning. Plants, trees, and soils filter ground and surface water, playing a critical role in maintaining water quality. Riparian areas soak up and store excess rain and snowmelt, reducing flooding downstream. Such interactions take place not just at the water's edge, but also much further into the uplands, depending on local terrain and other conditions (fig. 1).

Riparian areas are also important to people as places to live, work, and play. Water is a primary draw for homebuilding, whether it is a first or second home. Hiking, biking, boating, fishing, wildlife observation, and other free-time activities have long been of interest, but in some riparian areas, particularly urban ones, these activities are rising again in popularity. 0.71053 0 Tdas-but

Intercepti

ig re 1 *Stylized representation of a riparian area showing the lateral extent of various ecological interactions between land and water (Palik* et a *2004).*

managing riparian areas difficult: we need to find ways to meet peoples expectations and preserve these important aspects of quality of life while also protecting the health and vitality of the lands themselves.

To determine how diverse land use in the Midwestern region affects riparian landscapes, we bring information from the physical, biological, and social sciences together to work across multiple scales ranging from single organisms to the landscape level. The program mission is "*Fostering multidisciplinary research to understand, predict, and monitor the effects of land use on the diverse benefits people gain from riparian areas*."

Our program is focused on the following questions:

(1) How much riparian area do we have?
(2) Who's using riparian areas and what's happening to these areas?
(3) How do we rehabilitate riparian areas?

Research on these issues is providing valuable information that policymakers and managers can use to make wise decisions at the water's edge. In this report we highlight some of our progress on what we have learned about riparian areas and we outline our future research directions.

A fixed-width buffer approach for delineating riparian areas is expedient but does not capture the true variable nature of riparian areas on the ground. Therefore, Station scientists are exploring alternative means of defining riparian areas that rely less on expediency and more on accuracy. One approach looks at the topography of floodplains for clues, and another approach looks beyond the floodplain for other geomorphic clues to riparian delineation.

Delineating riparian areas based on the width of flood-prone areas creates very different riparian areas, depending on the shape of the valley. A narrow valley between steeper hills will have a narrower riparian zone compared to a broad, flat stream valley with a wide floodplain (figs. 5 and 6). On the whole, this more functionally based delineation method leads to significantly increased estimates of riparian area in a watershed. For example, a pilot test of this method in several watersheds the shifts in the overstory composition occurred beyond the influence of flooding. This suggests that it might not be flooding as much as other processes such as glacial soil deposition that control vegetation communities across stream valleys. Therefore, expanding riparian management zones to include these unique areas is an important policy and management step.

Our next steps in developing more precise methods to delineate riparian areas will build on these recent advancements: clues from geology and topography and elsewhere that can help us develop functional methods, rather than expedient, fixed-width methods, for riparian area delineation. The better we get at delineation, the more finely tuned—and effective—our policies can become.

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Who is using riparian areas? Industry; agriculture; timber producers; home developers; recreationists; birds, fish, and other wildlife. The intensity of riparian use can threaten the ecological integrity of this resource. Industry, agriculture, home development, and recreation threaten the habitat that birds, fish, and other animals, insects, and plants need to survive. Dams, levees, and channelization of streams and rivers reduce or eliminate seasonal flooding essential in maintaining habitat that is crucial for wildlife. Increasing environmental concern and the laws and regulations created to addr

regeneration than other methods while minimizing soil and residual tree disturbance. These and other results have been incorporated into riparian zone guidelines that are being used by many State and Federal agencies.

Major environmental laws have led to cleaner rivers and streams, leading in turn to renewed use of these waterways for recreation. Industries can no longer discharge untreated water into wetlands, rivers, and streams. Green development ideas are catching on: more often stormwater is handled in vegetated swales rather than sewers, roofs are planted with sedum instead of covered in tar. These changes create meaningful improvements in both riparian health and broader ecological health.

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Riparian Buffers Provide Numerous Benefits

Buffers along rivers, lakes, and wetlands can provide many benefits and are therefore the focus of many policies. We have been exploring the ways in which buffers can both provide critical habitat and cushion different land uses (fig. 7). For example, buffers can help improve water quality, and hybrid poplars in buffers object to the introduction of buffers that might

Lake Management Profiles Can Predict Future Development Impacts

All too often, planners and managers are left responding to the impacts of development after it has occurred. Figure 9 shows the lakeshore development in Three Lakes, Wisconsin, between 1938 and 1998. Imagine if, in 1938, Three Lakes Township planners could have foreseen the development that was coming. Being able to plan would have been an immense help in protecting important habitats. With this in mind, Station scientists and others developed a way to identify lake development hotspots. They created lake riparian development profiles that allow planners to compare all lakes in a region and identify lakes with fewer barriers to development.

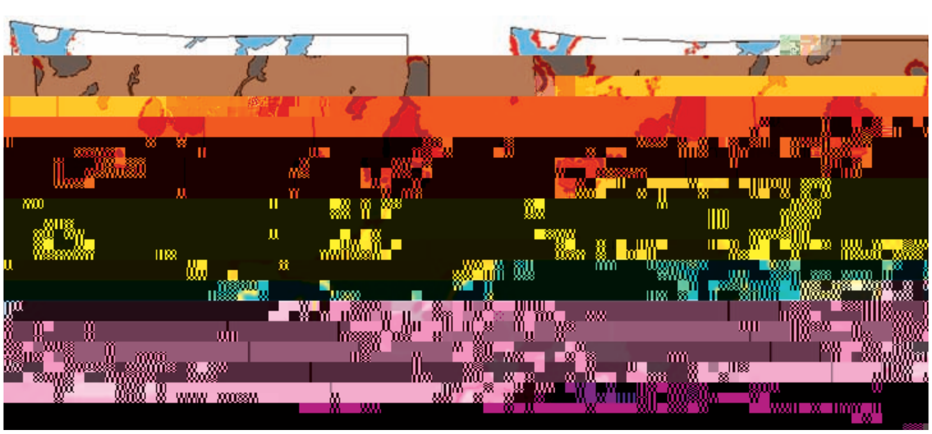
The profiles (fig. 10) are built from readily available, mappable information describing physical and social characteristics important to development. These include:

(1) dwelling density,
(2) percent riparian area developed,
(3) potential development limitations (a characteristic that combines information on the soils' suitability for construction and the distance to an existing road),
(4) percent private ownership,
(5) aesthetic appeal (a characteristic that combines information on beach soils and vegetation), and
(6) distance to a retail center.

For example, imagine two lakes, Blue Lake and Clear Lake. They are similar in many respects except that Blue Lake's undeveloped riparian area has soils that will not support the construction of roads or septic systems while Clear Lake's undeveloped riparian area has soils that will support construction. New development will most likely occur around Clear Lake before it occurs around Blue Lake. Land use planners looking to manage or direct development would want to concentrate first on the development potential of Clear Lake, then consider Blue Lake.

Currently, the test-run profiles developed for Itasca County, Minnesota, are being used by the Itasca County Soil and Water Conservation Service in developing new regulations on residential growth in riparian areas, and by the Chippewa National Forest in revising the forest management plan.

As we said earlier—everyone is using riparian areas, in ways they recognize (streamside walks) and ways they may not (high quality drinking water). The impacts on riparian lands need to be fully understood and, where necessary, mitigated. Tools like lake development profiles, computer models, and riparian buffers can help balance the many demands made on riparian areas.



ig re *Housing locations and housing density changes in riparian areas in Three Lakes Township, Oneida County, Wisconsin, 1938 (left) and 1998 (right). Each red dot indicates one house. (Graphic created by Charlotte Gonzolez-Abraham, University of Wisconsin-Madison.)*

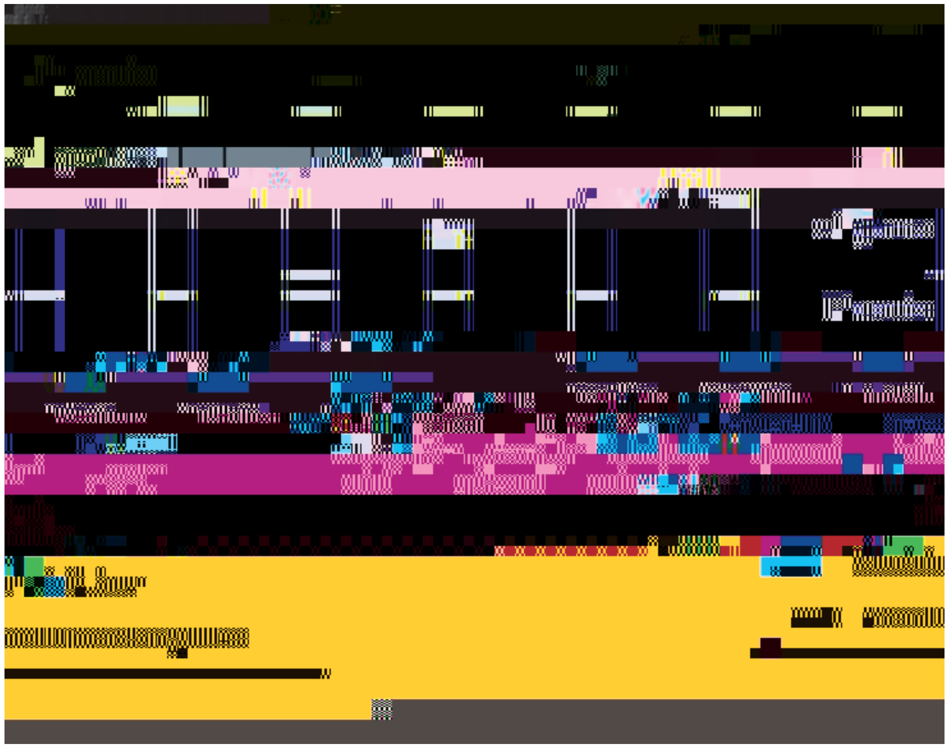
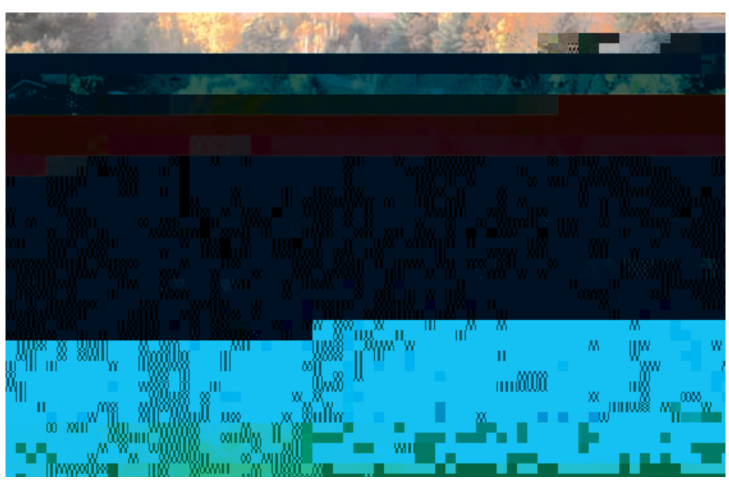


Figure 10 *Lake riparian area development profile for Jessie Lake (Minnesota Department of Natural Resources, Division of Waters, lake #786), Itasca County, Minnesota.*



A common sight around the Midwest region are second home developments in and around riparian areas.

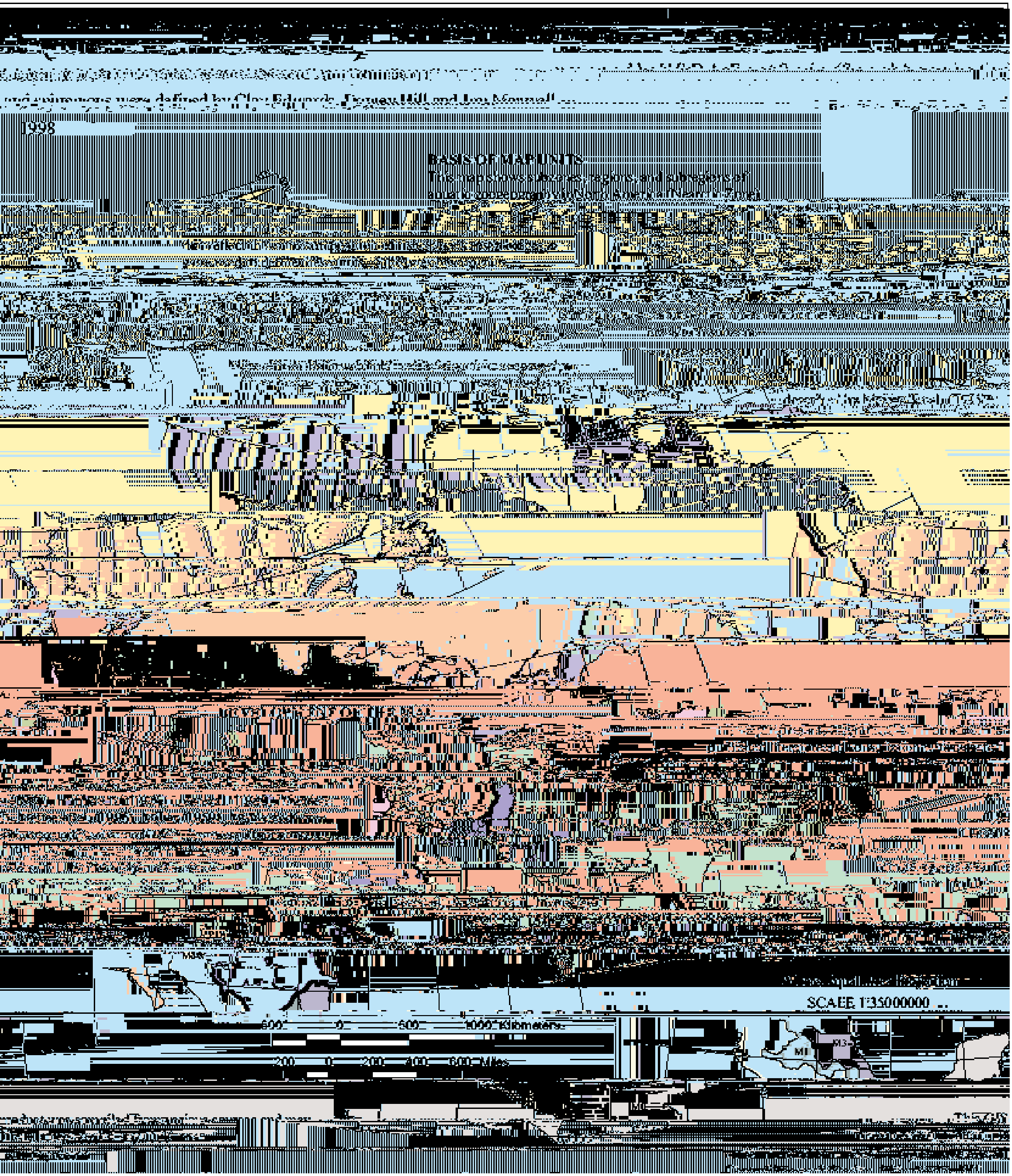
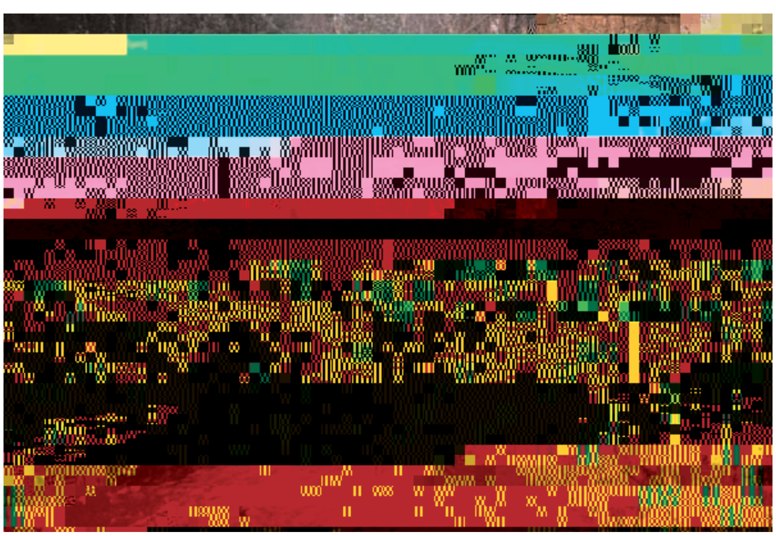


Figure 11.—Aquatic zoogeography of North America (nearctic zone)

From Landscape Level to Microsite: The Importance of Culvert Placement for Riparian Health

The seemingly simple act of placing a culvert can have surprising impacts on stream and riparian health. Placed improperly, culverts wreak havoc on the riparian landscape by increasing erosion, degrading habitat, and limiting fish spawning. Given the vast number of culverts, even minor damage by individual culverts have a dramatic, cumulative impact across the landscape. Therefore, to help restore and protect riparian areas, NCRS scientists have developed culvert placement guidelines that non-engineers can use for smaller crossings and professionals can use when placing larger culverts. These guidelines have been field-tested on 20 new culverts; 2 years of followup measurements show success. Culverts placed according to our guides keep soil in place, allow fish to reach spawning grounds, and will support roads for at least 50 years, thereby helping to transform an old ditch into a healthy stream or river (fig. 12a and b).



ig re 1 a and *Installation of an off-set culvert pair. The lower culvert is set into the stream bottom (about 1/6th of its diameter); the upper culvert is a foot higher. This allows low flows to occur in a narrow (and deeper) path where fish can pass more easily. The two culverts together should equal the bankfull channel width so that fish can pass during bankfull flows at velocities near 3 feet per second. A single culvert, equal to the bankfull channel width could have been used, but the low rise to the road surface suggested multiple culverts.*

The Ford Motor Company has implemented the Station's plans for the segment of Indian Creek that runs on Ford's newly acquired land. Transformed from that measly ditch, Indian Creek's new design—pools and riffles, stream widths based on appropriate bankfull dimensions, and improved sinuosity—is creating aquatic and riparian habitat that brings new ecological health to the site. Local anglers will catch more fish, and kids will have better chances to find tadpoles and other aquatic creatures.

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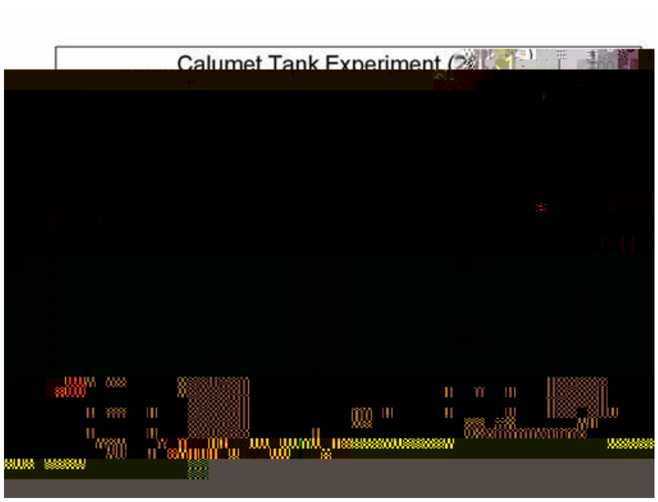
In many ecological rehabilitation projects, site contamination must be addressed. This is true in both urban and rural locations. When natural areas are contaminated, or even when insects and other wildlife are exposed to less-than-natural contaminated sites, contaminants can move into the food chain resulting in problems for wildlife, plant species, and humans (e.g., mercury buildup in fish). The environmental impact, or potential impact, of toxicity from contaminated sites is sometimes referred to as eco-toxicity or "ecotox" for short.

Phytoremediation is one possible means of dealing with contamination, and thereby reducing the potential ecotox impacts of a polluted site. Phytoremediation harnesses the natural processes by which plants absorb, transport, and transform water and chemicals in their roots, stems, and leaves, to remove contaminants from soil and ground water. Matching plants to the contaminants they handle most effectively is the key element of phytoremediation design.

In Calumet, NCRS scientists conducted above-ground tank experiments testing the effectiveness of native willow, cottonwood, and switch grass in removing contaminants from Cluster Site soil and ground water (figs. 16 and 17). This research looked in part at whether species planted for phytoremediation will, in fact, clean up the target contaminants and improve site conditions. For example, some, but not all, cottonwoods can mitigate trichloroethylene, a common ground water pollutant.

But might phytoremediation move contaminants into the food chain? This is a serious concern in a place like Calumet, where there are important species and habitats to protect. To be an effective cleanup tool, phytoremediation cannot have unintended ecotox consequences like this. To begin to address this issue, the Calumet study includes a test of heavy metal accumulation in insects feeding on phytoremediation vegetation.



ig re 1 *Final biomass of individual cottonwood and black willow trees growing in clean and contaminated water during the 2001 tank experiment.*

In *The Nature of Tomorrow*

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Appendix 1.—Riparian IP P

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(Appendix 1 continued on next page)

(Appendix 1 continued)

Project Title	Cooperating Institution	Unit	NC Contact/PI	Cooperator Contact/PI
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We believe the good life has its roots in clean air, sparkling water, rich soil, l estpha nne M str Mi hae .

•• **Decisions at the water's edge: sustaining riparian landscapes in the mid-west.** en e h Rep . 4 , t a M , , epart ent A gri t re rest, er i e rth . entra Resear h, tati n 1 p

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