Habitat Restoration in Streams in the Driftless Area
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TUDARE – What is it?

Jeff Hastings

Trout Unlimited, E770 Hastings Lane, Westby, WI 54667
JHastings@tu.org

Trout Unlimited Driftless Area Restoration Effort (TUDARE) is an ambitious endeavor to restore and protect the coldwater streams and watersheds of this unique region. Project Manager, Jeff Hastings will give a brief overview about the project and outline what TU hopes to accomplish in the next five to ten years.

TU Driftless Area Stream Restoration Mapping and Inventory Project

Tom Thrall

Thrall Conservation Consulting, LLC, 222 S. Hamilton, Madison, WI 53703
tthrall2@yahoo.com

Using ArchView, TU is mapping all streams where restoration work has been done in the Driftless Area. Information gathered includes what, when and where work was done, who funded or otherwise assisted on the project, and public access info. Over 400 sites have been mapped in the four states.

A Review of Iowa's Trout Habitat Improvement Program

Bill Kalishek

Fisheries Biologist, Iowa Department of Natural Resources, 2321 Siewers Spring Road, Decorah, Iowa 52101
bill.kalishek@dnr.state.ia.us

Iowa's trout habitat improvement program has historically relied on the use of rock to stabilize stream banks and the placement of instream overhead cover. New techniques are reducing the dependence on rock for bank stabilization and relying more on native vegetation to stabilize entire riparian zones. The importance of the health of the entire watershed as it relates to in stream habitat is also being recognized and programs are being proposed to ensure continued watershed protection.

A Historical Program Overview of Trout Stream Habitat Improvement/Restoration Efforts In Southeast Minnesota

Steven Klotz

Area Fisheries Supervisor, Minnesota Department of Natural Resources, Lanesboro Area Fisheries Office, 23785 Grosbeak Rd., Lanesboro, MN 55979
steven.klotz@dnr.state.mn.us

Trout stream habitat improvement has been a focus of fisheries management activity in southeast Minnesota since the 1940's. A summary of stream improvements in southeast Minnesota from 1942-1956 details techniques used one half century ago. According to a GIS data layer that has recently been developed, approximately 125 miles of southeast Minnesota streams have seen improvement work. In 2003 a "Fisheries Long-Range Plan for Trout Stream Resource Management in Southeast Minnesota 2004-2009" was completed. The plan called for the development of a set of methods and guidelines covering all aspects of managing trout habitat southeast Minnesota. A set of standard methods for future habitat development, implementation and evaluation are currently being completed. The emerging guidelines will direct future efforts to maximize restoration benefits to both anglers and the coldwater resource.

Back to the Future

Dave Vetano
Wisconsin Department of Natural Resources, 3550 Mormon Coulee Rd., La Crosse WI, 54601
David.Vetrano@dnr.state.wi.us

Agricultural land use changes after European settlement resulted in the almost total extirpation of native brook trout in Driftless Area streams. Hillside grazing denuded native vegetation and compacted hillside soil preventing percolation of rainwater and snowmelt. "Up and down" row cropping (not following the contours) exposed the "loess" soil to easy downhill transport by heavy summer downpours. By the 1940's most lower valleys floors had 12-15 feet of sediment deposition. Natïve brook trout were almost totally wiped out. Recent improvements in land use, instream habitat restoration and an aggressive "wild" trout program have re-established self sustaining brook trout population to many area waters.

Landscape Scale Habitat Conservation Efforts: The National Fish Habitat Action Plan and the Eastern Brook Trout Joint Venture

Eric C. Schwaab
Resource Director, Association of Fish & Wildlife Agencies, 444 North Capitol Street, NW, Suite 725, Washington, DC 20001
eschwaab@fishwildlife.org

The Association of Fish and Wildlife Agencies, representing fish and wildlife agencies working closely with key federal agencies and many private conservation partners, recently launched the National Fish Habitat Action Plan. Tapping the shared interests of state and federal agencies, Native American tribes, non-profit organizations and corporations, the Action Plan has rallied partners nationwide in a concerted commitment to bring strategic attention and deliver results that improve the health of our aquatic systems.

The National Fish Habitat Action Plan is modeled after the highly successful North American Waterfowl Management Plan, which has made tremendous progress for waterfowl over the past 20 years through a strategic focus on "joint ventures" that coordinate and leverage partners' resources and efforts.

Some of the emerging regional fisheries partnerships being explored on a pilot basis include the:

- Eastern Brook Trout Joint Venture
- Matanuka-Susitna Salmon Conservation Partnership
- Midwest Driftless Area Restoration Effort
- Southeast Aquatic Resources Partnership, and
- Western Native Trout Initiative

This presentation will discuss current status of the National Fish Habitat Action Plan and demonstrate its use through application under the Eastern Brook Trout Joint Venture, an early pilot effort of the National Fish Habitat Action Plan.

Systems Based Stream Restoration

Luther P. Aadland, Ph.D.
Natural Resources Program Consultant, Stream Habitat Program, Division of Ecological Services, Minnesota Department of Natural Resources, 1509 1st Avenue North
Fergus Falls, MN 56537
Luther.Aadland@dnr.state.mn.us

Streams are complex systems and can be defined in terms of hydrology, geomorphology, water quality, biology, and connectivity. These variables interact and changes to one of these variables can cause changes in each of the other variables. Failure to recognize these interactions can result in unexpected results to the overall health of the stream. Most degradation of our streams has resulted from three primary activities; watershed changes, channelization, and fragmentation. Straightening and dredging of streams has long been termed “channel improvement”; a testament to the unanticipated damages that can result from well-intentioned efforts with narrow focus. Successful river restorations must use natural templates and account for river processes if they are to restore stream functions over the long term. This presentation will offer a definition of stream restoration and provide examples of using this approach for dam removal, fish passage, and channel restoration projects.

Trout Stream Monitoring in Wisconsin – A New Approach

Lawrence E. Claggett
Coldwater Fisheries Ecologist, Bureau of Fisheries Management, FH/4, Wisconsin Department of Natural Resources, Box 7921, Madison, WI 53707
Lawrence.Claggett@dnr.state.wi.us

The latest evolution of monitoring for trout streams in Wisconsin uses a statistical approach to address the issues of scale and variation. With 3,000 trout streams totaling over 10,000 miles, Wisconsin has too many trout streams to sample them all or manage by individual water. In addition, variation due to sampling, spacial, and temporal does not allow point estimates to be particularly useful. Our goals were to develop specific quantified management objectives for all Wisconsin trout streams, stratify streams into similar groups, select a simple set of metrics that can be routinely sampled, and develop a sampling design to evaluate objectives and determine if management actions are needed or working. We used information in our fisheries database that includes all of our trout stream surveys since 2001 and many before 2001 (approximately 1400). Although we would like to have measures of the basic factors affecting trout populations – recruitment, growth, natural mortality, and fishing mortality – we only had access to estimates of population size (CPE and population estimates) and size structure (PSD, stock length CPE, and quality length CPE). The Trout Team chose six variables to construct the stratification system based on factors that have been demonstrated to affect trout stream populations: location (ecoregion and DNR region), natural reproduction (trout stream classification - 1,2,3), size (stream order), temperature, and gradient. We wanted to analyze flow, productivity (alkalinity or geology), width, width to depth ratio, and substrate, but these variables weren’t available or couldn’t be applied to all streams. All variables analyzed were significantly related to at least 2 of the 5 metrics for each species, yielding at least 186 possible groupings. A simpler set of variables is suggested that reduces the groupings to a maximum of 12 per region. A quartile analysis can be used to set management objectives by species, metric, and stratification variable. Coefficients of temporal variation of metrics ranged from 29% to 60%, suggesting that we need a change of greater than 50% on average due to a management action before we can detect it. Estimates of sample sizes per group needed to detect a change of 50% (alpha=0.1, beta=0.2) range from 22 to 133, with an average of about 50. We recommend the continued sampling of high-profile streams and reference sites to determine long-term variation. A sampling protocol is recommended that will provide the minimum data necessary to measure basic fish population metrics, classify trout streams, and evaluate most of our management actions. Detailed measurement of habitat has not proved particularly useful, with the possible exception of pools for brook trout, and overhead cover for brown trout. We are currently working out the logistical details of this approach for application in 2007.

Geomorphic Considerations for In-Stream Habitat Structures

Dan Salas
Ecologist, Project Manager, JFNew, 1402 Pankratz St., Suite 302, Madison, WI 53714
dsalas@jfnew.com www.jfnew.com

Fish habitat structures offer great potential for increasing the availability of cover, flow variation, and macroinvertebrate habitat. However, these techniques can often be mis-applied and not achieve their full potential. In this session we will discuss the various aspects of stream morphology that can determine the effectiveness of fish habitat structures including channel type, dimensions, substrate, and stability. We will also consider which habitat structures are best suited for particular conditions.

Instream Habitat Restoration Targeting Brook Trout Versus Brown Trout in Sympatric Populations: a Case Study in Elk Creek and Big Spring Branch, Wisconsin

Matthew Mitro
Wisconsin DNR – Science Operations Center, 2801 Progress Rd., Madison, WI 53716
matthew.mitro@dnr.state.wi.us

There is current interest in stream habitat restoration for brook trout, the only trout native to Wisconsin streams. Questions remain, however, on how to best tailor restoration efforts to benefit brook trout over brown trout where they coexist. I am investigating the response of sympatric brook and brown trout populations to instream habitat restoration in Elk Creek and Big Spring Branch, Wisconsin. One reach in each stream was restored with cover-creating habitat improvements intended to favor brown trout and another reach was restored with non-cover-creating habitat improvements intended to favor brook trout. Initial populations of trout differed between streams. Brown trout were the dominant salmonid species in the Elk Creek restoration zone targeting brook trout, but brook trout have had a stronger presence in the analogous restoration zone in Big Spring Branch. Preliminary results suggest initial population condition may be an important determiner of success and instream habitat restoration alone may not be sufficient to improve brook trout versus brown trout numbers in sympatric populations. Brook trout constituted about 56-73% of the trout population in the Big Spring Branch reach restored without overhead cover, but brook trout have not responded positively to similar restoration in Elk Creek, constituting less than 5% of the trout population. Brown trout numbers have increased in reaches restored with overhead cover in both streams. Monitoring will continue in each stream as instream habitat restoration was only recently completed. Alternative approaches to brook trout restoration will also be investigated. Additional instream habitat restoration proposed for Elk Creek will create a refuge for brook trout in a tributary stream by using a barrier to prevent upstream migration of brown trout, while allowing downstream migration of brook trout.

West Branch Sugar River Removed From 303D List

Pat Sutter
Dane County Conservationist, 1 Fen Oak Court, Room 8, Madison, WI 53718
Sutter@co.dane.wi.us

The West Branch Sugar River (southwest of Mount Horeb, WI) was the first river in Wisconsin to be removed from the EPA's 303(d) list as a result of restoration projects. Conservation practices applied through federal, state and local agency programs to the surrounding land and more recent restoration projects have resulted in the stream being restored to a condition that not only prompted its removal from the State's list of degraded waters but also offers recreational opportunities that have not existed for many years. Nearly $1 million in grant funds, matching funds and in-kind labor were used to remove debris, reshape and seed the banks and install over 1,000 LUNKERS through the Targeted Resource Management (TRM) program. That's a little over $10 per foot in actual cash spent on the restoration—an incredible bargain. Because of the TRM projects, 12 miles of the West Branch now have public access easements that allow anglers to fish and others to hike a beautiful trout stream.

MESBOAC: Letting the Stream Design your Stream Crossing to Maximize Fish Passage and Minimize Instability

Karl Koller,
Minnesota Department of Natural Resources, 1201 East Highway 2, Grand Rapids, MN 55744
karl.koller@dnr.state.mn.us

Dr. Sandy Verry, retired Research Hydrologist from the U.S. Forest Service, has developed a protocol for designing stream crossings that allow fish passage and maintain stream stability at the crossings. The basis for the design is that culverts should be sized and placed to match the dimension, pattern and profile of the stream. The acronym, MESBOAC describes the requirements: M = Match culvert(s) width to bankfull stream width, E = Extend culvert through toe of slope, S = Set culvert at same slope as stream slope, B = bury culvert 1/6 to the bankfull width, O = Offset multiple culverts, with the thalweg buried as described above, and other culvert(s) set one foot higher, A = Align culvert with stream alignment, C = Consider head-cuts and cut-offs. These requirements and underlying geomorphic basis will be discussed in this talk as well as some discussion about how MN is incorporating them into the permitting process. After all, while the impact of an individual culvert that is improperly placed may seem relatively insignificant relative to other impacts in the watershed, the cumulative effect of thousands of improperly designed culverts across the state adds up to a significant impact. Add to that the fact that those impacts will last for decades due to the durability of a culvert and one realizes that changing the way we design stream crossings can have a significant, long-term positive impact on our fluvial resources.

Stream Access and Conservation Easements: Tools used in Wisconsin and their transportability to other Driftless Area states

John W. Welter
White, Welter & Schilling LLP, P. O. Box 228, Eau Claire WI 54702
jwelter@ameritech.net

As part of habitat improvement projects, it is recommended that legal agreements ensuring access be developed. Tools available include simple access agreements for the project period itself, ongoing angler access easements, purchases of access rights, or conservation easements including access provisions for recreational users to the area adjacent to the stream thread itself. As long as they meet the legal requirements of the various states, easements can contain flexible terms to make them acceptable to the parties thereto. Such tools clarify rights and responsibilities of landowners and users, ensure that access rights can persist even after the original landowner sells the property, build community and NGO support for stream habitat projects, provide needed funds for stream projects and in some cases increase saleability of streamside parcels. If NGOs and agencies encourage or require access as partial consideration for "investing" their restoration resources, they can create the dual benefits of public access to recreational opportuniuties as well as healthier streams. Some landowners resist both stream restoration and public access, and others will carry out stream restoration but not grant public access. The Public Trust Doctrine has been developed separately and interpreted differently in each of the four Driftless State, but negotiated or purchased public access agreements can supplement it as a useful tool for public access. Because real estate law is controlled by state statutory and common law requirements, stream access and conservation easements must be carefully drafted to meet the legal requirements of the state in which they are to apply in order to be valid. Model forms will be provided.

Wild Trout Early

Dave Vetano
Fisheries Supervisor, Wisconsin Department of Natural Resources, 3550 Mormon Coulee Rd., La Crosse WI, 54601
David.Vetrano@dnr.state.wi.us

In 2006, only feral brook and brown trout were stocked in La Crosse Area streams. The now statewide wild trout program had it's start in an old springhouse once used to cool milk. Obsolete hatching trays, a modified lawn fertilizer and stainless steel cheese vats were used to test the feasibilty of raising wild trout. Research proving better survival of "wild" strains compared to "domestic" strains convinced propagation specialists and fisheries biologists that the raising of feral trout was indeed possible on a large scale. A statewide program was started in 1995 and has raised millions of feral trout for stocking in waters all over Wisconsin.

Summer Habitat Associations of Large Brown Trout in Southeast Minnesota Streams

Doug Dieterman*, William Thorn**, and Jeff Weiss***

*Fisheries Research, Minnesota Department of Natural Resources, 1801 South Oak St., Lake City, MN 55041
douglas.dieterman@dnr.state.mn.us

** Minnesota Department of Natural Resources – retired. 15098 Sunrise Circle, Mountain, WI 54149
billthorn@ez-net.com

***Fisheries Specialist, Minnesota Department of Natural Resources, Lanesboro Area Fisheries Office, 23785 Grosbeak Rd., Lanesboro, MN 55979
Jeffrey.Weiss@dnr.state.mn.us

We evaluated summer habitat use of large brown trout *Salmo trutta* (TL > 380 mm) in pools and stream reaches of southeast Minnesota to identify important variables and develop a habitat quality classification to guide management. We sampled large trout with electrofishing gear and measured selected habitat features. We collected 224 large trout in 126 of 581 pools in 41 stream reaches during 2003 and 2004.

The probability (P2) that a large trout was present in a pool was positively associated with presence of instream rock, overhead bank cover, woody debris, and water deeper than 90 cm in a logistic regression model. Similarly, large trout abundance in pools was best predicted with a Poisson regression model with four variables (pool width, length of overhead bank cover, instream rock, and area of water deeper than 60 cm). Large trout abundance in stream reaches increased linearly with mean P2-value, which explained 54% of the variation among study reaches, and was also positively related to late-summer low flow discharge. We categorized habitat quality of stream reaches based on mean P2 values. In large streams (>0.43 m^3/s), with poor to fair habitat quality, management should increase overhead bank cover, instream rock, woody debris, and water deeper than 90 cm. Habitat management in smaller streams (<0.43 m^3/s) is more complex and may simply be more limited.

Vane Structures for Erosion Control and Aquatic Habitat Enhancement

Dan Salas
Ecologist, Project Manager, JFNew, 1402 Pankratz St., Suite 302, Madison, WI 53714
dsalas@jfnew.com www.jfnew.com

Rock vanes, log vanes, J-hooks, and cross vanes are structures increasingly being used to stabilize stream channels and provide fish habitat. Rather than armoring against erosion, these structures manipulate streamflow to reduce erosive stress while creating scour pools and cover for aquatic life. In this session we will review these types of structures, how they work, their application, design considerations, and examples of projects including lessons learned.

Big Woody Cover in the Namekagon River

Frank Pratt
Senior Fisheries Biologist, Upper Chippewa Basin,
Wisconsin Department of Natural Resources, Hayward DNR Service Center,
10220 N State Highway 27S, Hayward WI 54843
Frank.PrattJr@Wisconsin.gov

Big woody cover (BWC)is a critical habitat type in large, coldwater streams, like the Namekagon in northwest Wisconsin. The author discusses this stream's history, the current status of BWC, and a proposal to restore it. The author hypothesizes that BWC is currently in limited supply, currently exists in remnant status relative to baseline natural and optimum fish production. Pratt advocates for active management to restore BWC because natural stream-bank/forest dynamics are currently incapable of restoring riverine wood-Even in the best watersheds, like the Federally protected Namekagon.

A Comparative Study of Fish Assemblages Associated with Newbury-weir Riffle Pool Complexes and Natural Riffle Pool Complexes in Seven Headwater Streams in JoDaviess County Illinois

Kraig McPeek
US Fish and Wildlife Service.4469 48th Avenue Court, Rock Island IL 61201
Kraig_McPeek@fws.gov

We conducted investigations on fish assemblages in 14 sections of 7 northwestern Illinois, Jo Daviess County, USA streams between June 2003 and August 2004. Fish were collected using a standard (2.44-meters X 1.52-meters) 0.64 centimeter mesh-stretch minnow seine. The fish surveys yielded 7,581 fish from 25 species and 6 families. Fish collections were analyzed using Simpson's Index of Diversity,

Morisita's Index of Community Similarity, and the Mann/Whitney nonparametric U-test. The construction of stone-weir structures (Newbury weirs) in local streams did not impact fish communities. Fish communities found within Newbury weir zones were not different from communities of natural riffle-pool complexes. Construction of stone-weirs by the Jo Daviess County Soil and Water District (SWCD) and the Streambank Stabilization and Restoration Program (SSRP) resulted in no biologically significant differences in species diversity, community similarity, abundance of stream specialists, or trophic structure. The ecological implications of these structures are discussed with respect to stream restoration and stabilization projects in the state of Illinois and the greater Midwest

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Incorporating Herpitile Habitat into Stream Restoration Efforts

Joe Schmelz
Soil Conservationist Tech., Iowa County Field Office, 138 S. Iowa Street, Suite 3
Dodgeville, WI 53533
joe.schmelz@wi.usda.gov

Through the years conservation groups have become very skilled at stabilizing eroding stream banks and incorporating a variety of stream habitat techniques for the benefit of cold water fisheries. Some of these structures, while providing cover for fish also provide beneficial habitat for herpitiles and some with a bit of tweaking, could also benefit both fish and herpitiles. Also, there are a few stand alone practices when installed will give a greater assistance to the entire stream corridor ecosystem. In this session we will discuss these different habitat types and their appropriate placement.

Genetic structure of southeastern Minnesota brook trout populations and the impact of stocking

Loren Miller
Research Associate, Dept. Fisheries, Wildlife & Conservation Biology, University of Minnesota, 1980 Folwell Ave.,St. Paul MN 55108
lmm@umn.edu

Brook trout are native to southeastern Minnesota's driftless area but they have also been stocked extensively in the region. In the past many of the stocked fish came from eastern U.S. hatchery sources, and the extent to which this stocking contributed to current populations is unknown. We examined genetic diversity within and among 21 southeastern Minnesota brook trout populations using seven microsatellite DNA loci. The Minnesota populations were compared to extensive data from populations throughout the range of brook trout and from several hatchery sources. Many Minnesota populations, and one from northeastern Iowa, formed a cluster of genetically similar populations, distinct from the eastern populations. Within southeastern Minnesota, populations tended to group according to watersheds. The current genetic structure suggests that many of the brook trout populations are remnants of original populations in the region. There was some evidence of genetic impacts from successful stock transfers within the region.

Reintroduction of native sculpins to streams in the driftless area: an overview of reintroductions and research activities.

David D. Huff, Loren Miller, Eric Merten, Vaughn Snook*, Becca Hunt, Lisa Pugh and Bruce Vondracek[#]

University of Minnesota
Department of Fisheries, Wildlife and Conservation Biology
1980 Folwell Ave.
Saint Paul, MN 55108
huffx056@unm.edu

* Minnesota Department of Natural Resources. Lanesboro, MN
[#] Minnesota Cooperative Fisheries and Wildlife Research Unit, U.S.G.S.

Restoration of native trout has sometimes proven to be problematic because the biotic and abiotic associations that shaped the species, and formed the basis for the selective pressures under which it flourished, no longer exist. The goal of restoration, therefore, is to encourage the persistence of native trout populations by regressing conditions toward those that favor native trout through physical manipulation of habitat and re-introduction of native taxa. Large-mouthed predatory sculpins occur with salmon and trout throughout the Northern hemisphere and are often the most abundant vertebrate in coldwater streams.

The Minnesota DNR is re-establishing viable, self-sustaining populations in Southeast Minnesota trout streams where native populations were present historically, but were likely extirpated through agricultural activities. Restoring this ecologically important species and providing an additional forage component to wild brook trout populations is a perceived benefit. Currently, DNR personnel stock nine streams with sculpins from three donor streams. Our goal is to exploit the unique opportunity provided by this reintroduction program to study various aspects of sculpin and indirectly, trout ecology. Our research program includes determining the fitness of hybridized populations, examining the implications of local adaptation, determining the genetic structure of populations within the region, developing biochronology methods, and exploring diet and habitat interactions.

Land Use in Southeast Minnesota: Interactions With Trout, Water Quality, and Stream Channels

Bruce Vondracek
USGS, Minnesota Cooperative Fish and Wildlife Research Unit
University of Minnesota
1980 Folwell Avenue
St. Paul, MN 55108
(612) 624-8748
bvondrac@umn.edu

Kristen Blann
The Nature Conservency
40234 Hwy 10
Cushing MN 56443

Joseph Magner
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

Adam Petersen
Montana Fish, Wildlife, and Parks
730 N. Montana Street
Dillon, MT 59725

Our goal was to understand the importance of various factors at different spatial scales in structuring stream channel characteristics, water quality, and stream fish assemblages to inform restoration efforts in watersheds of southeastern Minnesota. Streams are linked to and structured by the terrestrial landscape by complex processes operating across a range of spatial and temporal scales. However, different factors may appear to dominate at any given scale. We used three different approaches in our research. First, we used a GIS analysis and stream survey data from the Minnesota Department of Natural Resources to examine how fish communities respond to variables at multiple scales. We sought to separate as much as possible the effects of land use from related influences of catchment size, soil type, geology, and other characteristics of watersheds, riparian areas, and channel characteristics. Second, we examined the relationships between channel morphology and geology, specifically related to stream bank erosion and in-channel habitat along grazed and ungrazed riparian areas. Finally, we used a simple model to estimate the impact of placing vegetative buffers around sinkholes on water quality. We found that topography, geology, and soils primarily structure stream habitat and both coldwater and warmwater fish assemblages across all scales. However, fish assemblages are associated with land use, specifically wooded areas and row crop cultivation. Brown trout and brook trout abundance is affected by topography and geology, but both species are more associated with habitat improvement, easements, intact wooded riparian areas and other riparian vegetation. Stable stream channels were associated with riparian areas that were not grazed, whereas channels were least stable along conventionally grazed areas, with intermediate channel stability along managed-grazed pastures. Vegetated buffers 10-30 m wide placed around sinkholes could reduce runoff, sediment, nitrates, and phosphorus that enters groundwater by 80% with little land removed from production. Our research indicates that streams in southeast Minnesota can be influenced by modifying current land use.
