River Almanac

An Information Sharing Bulletin of the
Long Term Resource Monitoring Program

U.S. Department of the Interior

Common carp may find zebra mussels a taste treat

by Madelon Wise

The surprise came one day last summer when John Tucker, a biologist with the Illinois Natural History Survey and the Upper Mississippi River Long Term Resource Monitoring Program Alton, Illinois, Field Station, was fishing with his daughter at Brussels Ferry, Illinois. According to Tucker, he and 11-year-old Moynell M. Tucker caught a 12-inch carp, and to satisfy her scientific curiosity, "Moynell insisted on taking it home to dissect." At home, Tucker and his daughter examined the gut contents of the common carp. To Tucker's surprise, "The fish's gut was completely packed with fragments of zebra mussels."

Zebra mussels are the "exotic" species of mussel transported from Europe via shipping boats to the Great Lakes in 1988 and are of concern because of their potential economic and ecological impacts on the Upper Mississippi and other rivers. Scientists, navigators, boaters, and farmers are concerned about the effects zebra mussels could have on natural ecosystems, river navigation, recreational boating, and agricultural irrigation. Large populations of unionid mussels have already been lost in the Great Lakes from zebra mussel colonization on native mussels.

Because the common carp, itself an exotic species, has not been reported to feed extensively on this newly introduced mussel species in the United States, Tucker approached Alton Field Station colleague Fred Cronin with news of his discovery. Subsequently, field

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1994 aerial photographs covering 1300 river miles of the Upper Mississippi River System are now available via the Internet. The EMTC provides these photos as a service to UMRS natural resource managers, industry, and the general public. This photo shows Lock and Dam 8. Note the barge tow leaving the lock. The *Home Page* address is http//www.emtc.nbs.gov *(EMTC Photo).*

Floodplain river hydrologic attributes and ecosystem management objectives

by Kenneth S. Lubinski

Ecosystem management is the process of obtaining information, making decisions, and acting to maintain an ecosystem within identified limits of quality or integrity. For the Upper Mississippi and Missouri Rivers, this means taking the necessary steps to keep these systems looking and acting like floodplain rivers. Past management approaches on the Upper Mississippi River System (UMRS) have emphasized site and species management. Ecosystem management will require a more holistic perspective that recognizes the river as a subsystem of the stream network and basin (Fig. 1). The importance of the hydrologic regime in sustaining ecosystem structure will be a primary consideration in ecosystem management.

Information used in making ecosystem management decisions can be divided into four categories: system objectives and action levels, system status, causal

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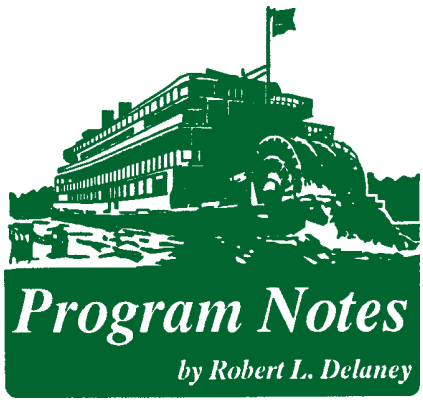

The Mississippi River is by far the largest riverine ecosystem in North America; the river floodplain and deltaic plain total nearly 12 million hectares (30 million acres). Draining 41% of the contiguous United States, the River is one of the most significant environmental factors influencing the Gulf of Mexico. Valued as a natural, historical, cultural, commercial, recreational, and transportation resource, the Mississippi River has been a major influence on development and settlement of the United States.

Over the past 200 years, the Mississippi River and its floodplain have been—and continue to be—seriously degraded by massive water pollution, wetland drainage, deforestation, habitat destruction, waterflow modification, and floodplain development. Two of the most deleterious river modifications have been (1) the reduction (90%) in the amount of seasonally inundated floodplain due to levee construction and (2) alignment and maintenance of the navigation channel which traverses 85% of the river's length. Altered hydrology and sedimentation patterns have progressed to the point that geomorphic processes have been severely disrupted.

Continued fragmentation of management responsibilities among and within government agencies hinders scientifically sound management of the river and floodplain. Given current management practices, policies, and use, the ecological condition of the river and its floodplain is expected to worsen.

*Center Director Robert L. Delaney presented, by invitation, the "**Environmental history of the Mississippi River floodplain: Forecasting the future given current management practices and use**" at the Third Princess Chulabhorn Science Congress, Water and Development: Water is Life, December 11-15, 1995, in Bangkok, Thailand. All expenses were paid by the Kingdom of Thailand.* ❐

Selected abstracts of ongoing LTRMP efforts

Building islands for habitat rehabilitation in a backwater lake of the Upper Mississippi River

Soballe, D. M., R. F. Gaugush, and J. T. Rogala. 1994. Paper presented at the 14th Annual International Symposium of the North American Lake Management Society, Orlando, Florida, October 31-November 5, 1994.

The Environmental Management Program for the Upper Mississippi River has sponsored Habitat Rehabilitation and Enhancement Projects (HREPs) at selected sites along the River to improve conditions for fish and wildlife. One of these HREPs involved the construction of islands in a backwater lake of Pool 7 near La Crosse, Wisconsin. This multifaceted project was designed to deepen and improve water circulation in one section of the lake by dredging, while using dredged material to create islands elsewhere in the lake to (1) reduce wind fetch and resuspension, (2) provide sheltered areas for aquatic biota, and (3) provide increased riparian areas for waterfowl. To guide further projects of this type, studies have been under way for 2 years to model and evaluate the limnological and hydraulic effects of the constructed islands. The results obtained thus far indicate that significant changes have resulted from island construction.

Do migrating ducks affect the population dynamics of fingernail clams?

Burkhardt, R. 1995. Poster presented at the Twenty-Seventh Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 27-28, 1995.

I conducted an in situ experiment on the effects of predation by migrating diving ducks (primarily scaup *Aythya* sp., canvasback *A. valisineria* and ring-necked *A. collaris*) on the densities of fingernail clams (*Musculium transversum*). Ponar samples were taken prior to waterfowl migration (October) and post-migration (November) from four control and eight duck exclosure sites within a 200-m area during 1994 in Lake Onalaska, Mississippi River. Diving ducks were denied access to food sources within the exclosures. Mean adult (>3 mm) fingernail clam populations decreased from pre-migration Ponar samples (5,135 m^{-2}, standard deviation = 127) to post-migration samples (192 m^{-2}, standard deviation = 17), while changes in young (1-2 mm) fingernail clam populations remained relatively unchanged (47,173 m^{-2}, standard deviation = 1,223 to 36,019 m^{-2}, standard deviation = 956). There were no significant differences between control and exclosure sites for fingernail clams pre- and post-migration, suggesting that predation by diving ducks was not a factor in the decline of adult fingernail clams.

Does water velocity and depth affect fingernail clam distributions in Lake Onalaska?

Burkhardt, R. 1995. Poster presented at the Twenty-Seventh Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 27-28, 1995.

Twenty-four standard Ponar grabs were collected near Arrowhead Island at 100-, 300-, and 500-m intervals along eight transects during September 1993 and 1994. In 1994, four additional transects were sampled near Broken Gun and Cormorant Islands. Bathymetry coverages were used to estimate water depth. FastTABS was used to estimate water velocities based on average discharges from Lock and Dam 6 during June, July, August, and September 1993 (80,000 cfs) and 1994 (30,000 cfs). Fingernail clam densities were significantly (P <0.001) associated with water velocity and depth. However, fingernail clam density and bulk sediment density were uncorrelated (P >0.05). These data suggest that fingernail clams may prefer specific ranges of water velocities and depths in Lake

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Hydrologic attributes *from page 1*

factors, and evaluations of management alternatives. All these categories are vital, and information must be coordinated among categories to successfully achieve management objectives.

Setting system objectives and action levels requires a clear definition of the system and its boundaries. Placing spatial bounds on a floodplain river ecosystem is especially difficult given the many spatial scales over which river structures and controlling factors operate. For example, UMRS macroinvertebrate community patterns are determined partly by the presence of point source pollution gradients (at the stream network scale), partly by impounded conditions created by the dam system (reach scale), and partly by within-pool hydrologic patterns caused by the physical complexity of a site (habitat scale) (see Fig. 1).

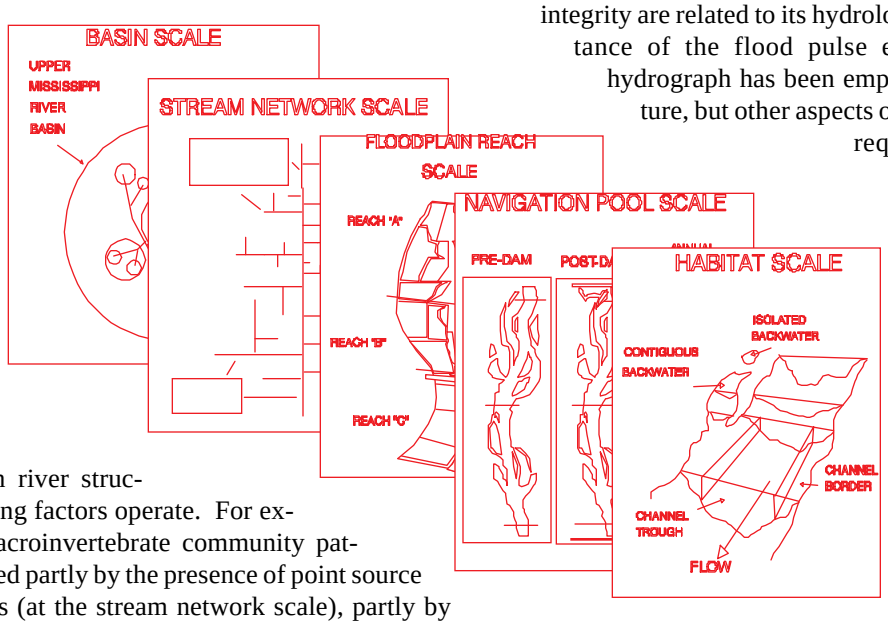

Figure 1. Five spatial scales related to floodplain river management. Causal factors of natural resource problems can usually be associated with a certain spatial scale, and the solution to the problem is often most effectively implemented at that same scale.

Ironically, some management strategies designed to provide biological benefits at single sites at the habitat scale may compromise ecological values at larger scales. For instance, a traditional way of protecting selected fish, plants, or waterfowl has been to levee off a backwater and install a pump to control water levels. We possess a considerable body of knowledge on how to create benefits for selected species in this way, and the method is a common tool. Ultimately, however, if the technique is repeated at many sites, the aquatic-terrestrial transition zone can shrink within the floodplain and thus detract from ecological values (nutrient exchange, expansion of fish and wading bird feeding areas) associated with the annual flood pulse at the pool or reach scale.

Unfortunately, we have little hard data to tell us how much of the "natural" floodplain of a river is required to sustain all of the river's important ecological processes and values. In particular, we are concerned that managing for site rather than system objectives leads to a progressive or sometimes immediate inability to support migratory fishes and birds. A critical experiment we could now begin to develop would seek to quantify the relationship between "natural" floodplain land use and the long-term survival of native plants and animals, whether they be permanent residents or temporary migrants.

During the development of ecosystem management strategies for the UMRS, we are identifying acceptable metrics and criteria for establishing ecosystem objectives. Several of the metrics necessary to track and evaluate river ecological integrity are related to its hydrologic regime. The importance of the flood pulse element of the annual hydrograph has been emphasized in recent literature, but other aspects of the annual hydrograph require attention as well (Fig. 2). Long-term hydrologic events such as droughts and channel-forming floods are believed to contribute to the ecological diversity and character of a floodplain river, and the dynamic conditions created by these events need to be incorporated into river management objectives. When infrequent floods or droughts can not be simulated at a particular location or time, other management tools may have to be developed as necessary system-resetting devices.

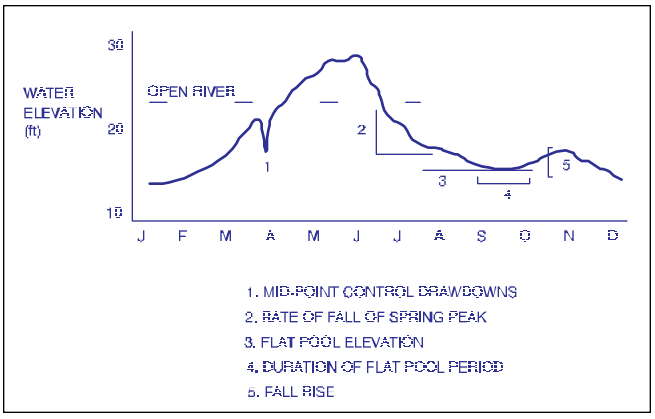

Figure 2. Different elements of the annual hydrograph can be the target of a management strategy. Preventing larval fishes from being stranded on the floodplain requires reducing the rate of fall of the spring flood peak (2). Manipulating the elevation and duration of summer low flows (3, 4) and sometimes the fall rise (5) will maximize moist-soil plant production for migrating waterfowl.

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Onalaska. These criteria may be used to determine other locations of fingernail clams using FastTABS and bathymetry coverages.

Changes in landscape structure along the Mississippi River

Craig, M. R. 1995. Paper presented at the Working in a World Dominated by Humans conference, Minneapolis, Minnesota, April 23-26, 1995.

In many landscapes, especially cultural, landscape structure may change dramatically in a short period of time. Anthropogenic activities along and within stream and river channels have rapidly and substantially modified landscape structure along the stream and river corridors of North America. Nowhere is this phenomenon more apparent perhaps, than along the Upper Mississippi River (UMR), where construction of 29 locks and dams has created large impoundments. In this paper, I present an analysis of historical changes in landscape structure arising from the installation of navigation improvement structures and flood control structures along the UMR. For the purposes of this analysis, I used FRAGSTATS to compare landscape structure for 1890s vintage and 1989 land cover data for five river reaches (i.e., Pools 4, 8, 13, 26, and an unimpounded stretch of "open river") along the UMR. Although changes in landscape structure differ among river reaches (i.e., in terms of landscape dominance, relative evenness, landscape diversity, contagion, edge density, and patch dispersion), I find that, in general, the areal extent of areas classified as "woody terrestrial," "sand/mud," or "grasses/forbs" has decreased significantly. The decrease in areal extent and patch size of these three land cover types documents the fragmentation of terrestrial habitats. Not too surprisingly, the areal extent of areas classified as "open water" or "marsh" has increased substantially, particularly in the upper pools. This increase has been associated with a concomitant increase in the average patch size of areas classified as "open water"; the average patch size of areas classified as "marsh," however, has decreased.

Overview of the Upper Midwest Gap Analysis Program

Fitzpatrick, D. 1995. Paper presented at Liaison Committee Meeting, National Water Quality Assessment Program, Western Lake Michigan Drainages, Green Bay, Wisconsin, March 28-29, 1995.

The conventional approach to maintaining biological diversity generally has been to proceed one species or one threat at a time. Gap analysis is a methodology to identify gaps in the representation of biodiversity in areas managed exclusively or primarily for

Meetings of Interest

UMRCC 52nd Annual Meeting, March 5-7, 1996, Cape Girardeau, Missouri. For more information contact: UMRCC, 4469 48th Avenue Court, Rock Island, IL 61201.

Symposium: The Mississippi River and Her People - March 14-16, 1996, Memphis, Tennessee. For more information contact Dr. Beverly Watkins, 312/581-7816.

WATERSHED '96 - Moving Ahead Together, June 8-12, 1996, Baltimore, Maryland, Sponsored by a variety of Federal agencies including the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey. WATERSHED '96 provides an interactive forum on the progress and future of watershed management. ***You are invited by the sponsors of WATERSHED '96 to propose a paper or presentation to be presented at WATERSHED '96.*** To receive complete proposal submission guidelines and information, call the Water Environment Federation at 1-800/666-0206.

Second International Airborne Remote Sensing Conference and Exhibition, San Francisco, California, *June 24-27, 1996.* For more Information: ERIM/Airborne Conference, P.O. Box 134001, Ann Arbor, MI 48113-4001, USA, Phone: 313/994-1200, ext. 323, Fax: 313/994-5123.

Minnesota GIS/LIS Consortium Annual Conference - *September 25-27, 1996*, Sheraton Park Place Hotel, St. Louis Park, Minnesota **-** The Minnesota GIS/LIS Consortium is a forum for communicating information to, and improving cooperation among, those interested in Geographic Information Systems (GIS) and Land Information Systems (LIS) in the State of Minnesota. For More information contact GIS/LIS Consortium c/o LMIC, 330 Centennial Bldg., St. Paul, MN 55155.

Eco-Informa '96 - Lake Buena Vista, Florida, USA. *November 4-7, 1996*. This major international conference, organized by leaders in the environmental science and policy communities, focuses on worldwide communications for environmental applications and addresses the critical need to share information that promotes responsible decision making in environmental problem solving. For more information contact: ERIM/Eco-Informa, P.O. Box 134001, Ann Arbor, MI USA 48113-4001, Telephone: 313/994 1200, ext. 3234; Fax: 313/994 5123.

the long-term maintenance of populations of native species and natural ecosystems. Gap analysis is conducted by overlaying vegetation and species richness maps with public ownership and management maps, so that gaps in the management of biodiversity can be identified. These data layers are developed, displayed, and analyzed using geographic information systems (GIS) techniques. The goal of gap analysis is to ensure that all ecosystems and areas rich in species diversity are adequately represented in the planning and management for biodiversity.

The Upper Midwest Gap Analysis Program (GAP) is in the initial stages of implementation. It is a partnership designed to avoid duplicating efforts while meeting the diverse information needs of the participating State and Federal cooperators. Cooperative agreements are in place with the Departments of Natural Resources of Michigan, Minnesota, and Wisconsin to develop current vegetation maps and public ownership and management maps. This three-state effort is being coordinated by the Environmental Management Technical Center (EMTC), National Biological Service, Onalaska, Wisconsin.

Satellite imagery from the Landsat Thematic Mapper is being received from the EROS Data Center of the U.S. Geological Survey through the Multi-Resolution Land Characteristic Consortium program. These scenes are being reviewed and archived by the EMTC before being forwarded to each state for computer-assisted processing and classification. A proposed image processing protocol for the Upper Midwest GAP has been developed by Dr. Tom Lillesand, Director of the Environmental Remote Sensing Center of the University of Wisconsin, Madison, who is serving as the Upper Midwest GAP Technical Coordinator. Among the technical approaches being evaluated are (1) the use of multidate GIS-assisted stratification into urban and non-urban and upland and lowland categories, (2) the use of an extendable classification scheme which can be cross-walked into other classification systems, (3) stratification into spectrally consistent geographic units for classification based on ecoregions, (4) the use of hybrid classification techniques for non-urban uplands, and (5) the use of geographically stratified systematic sampling for collection of training and accuracy assessment data.

Upper Midwest GAP is a collaborative "bottom-up" approach that allows for creativity at the local level to meet local needs. National standards are, however, of enormous importance if we are to provide ecologically meaningful information that is useful at the ecoregion or multistate scale. That is, GIS information layers that are consistent across the entire range of a species or of a vegetation type's occurrence are needed. Toward that end, one of the objectives of the national GAP is to generate and distribute digital thematic maps of existing land cover vegetation types and distributions of terrestrial vertebrates. These vector coverages will be of uniform scale and format, meeting Federal Geographic Data Standards. They will be made publicly available and distributed via the Internet. In addition, Upper Midwest GAP plans to make available the original satellite-derived raster coverages of current vegetation at their full resolution.

As Upper Midwest GAP evolves and moves into the species range modeling and gap analysis phases, steering committees comprised of cooperating agency and organization staff will be integral to advancing a program that successfully meets cooperator needs. The EMTC is committed to facilitating that process and encourages the participation of additional partners.

River Almanac

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River Almanac's purpose is to provide an ongoing exchange of information between the EMTC and other Long Term Resource Monitoring Program participants and the general public.

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Recreational use survey on Upper Mississippi River Pool 13

Gent, R. 1995. Poster presented at the Upper Mississippi River Conservation Committee meeting, Dubuque, Iowa, March 13-15, 1995.

Recreational use on Pool 13 of the Upper Mississippi River was estimated for a 12-month period, March 1991 through February 1992, using access-based non-uniform probability sampling and data extrapolation techniques. During the study, 18,950 individuals were interviewed, yielding an estimated 237,896 recreational visits totaling 2,094,244 hours. Twenty-two recreational activities were identified in the sample taken. Open water fishing was the primary activity, with an estimated 104,278 trips and 44% of all visits. Recreational boating and ice fishing ranked second and third, with 27,625

and 25,282 estimated trips. Camping, open water fishing, and recreational boating accounted for most hours spent by activity, with 1,255,069, 423,265, and 168,481 hours. Sport anglers caught an estimated 757,319 fish, for a mean catch rate of 1.35 fish/hour but released nearly half of the catch, harvesting an estimated 346,024 fish, with a mean harvest rate of 0.62 fish/hour. Bluegill, black crappie, and channel catfish accounted for 56%, 10%, and 10% of the harvest. Waterfowl accounted for 95% of wildlife harvested, with an estimated 10,978 birds taken. Recreationists surveyed traveled an average of 60 miles to reach Pool 13, with a mean trip duration of 8.8 hours, ranging from 0.7 hours for sightseeing to 67.2 hours for camping. A subsample of 1,021 recreationists were surveyed to estimate trip expenditures and durable goods purchased. Mean trip expense was $22.32, for a total annual expenditure of $5,310,368. Mean annual expenditure for durable goods relating to recreation activities was $1,388 per person.

The taxonomic and distributional status of *Notropis volucellus* and *Notropis wickliffi* in the Upper Mississippi River

Hrabik, R. A. 1995. Paper presented at the Missouri Forest, Fish, and Wildlife Conference, Lake Ozark, Missouri, February 1-3, 1995.

Robbins et al. (1991) recently recognized *Notropis wickliffi* (channel shiner) as a full species, elevating it from a subspecies of *Notropis volucellus* (mimic shiner). Trautman (1981) originally described the channel shiner from the Ohio River and recommended that it be given full specific status at that time. Several icthyologists, including T. M. Cavender, D. A. Ethnier, and C. R. Gilbert, have expressed confidence that these taxa are full species and sometimes are sympatric (Robbins et al. 1991).

Both species occur in the Upper Mississippi River. Biologists with the Long Term Resource Monitoring Program have collected numerous specimens that, until recently, were all assigned to *N. volucellus*. In 1991, I began to examine voucher specimens retained by the six field stations in the Program. I determined that all records from the open river listed as *N. volucellus* were actually *N. wickliffi*. By 1992, I concluded that *N. wickliffi* was the dominant form in the Upper Mississippi River from Pool 13 to the Ohio River. However, cursory separation of *N. wickliffi* from *N. volucellus* becomes increasingly difficult in areas above Pool 13. Specimens I examined from Pool 8 were mostly *N. wickliffi*, but several appeared to be intergrades. Characters that seemed to work well in distinguishing each species from downstream portions of the river were not reliable for Pool 8 populations.

A study will be conducted to assess the meristic, morphometric, and genetic variation of these two species, particularly in the Upper Mississippi River drainage.

Plant colonization of flood-created land on the Upper Mississippi River

Kruse, K. M., and W. Barnes. 1995. Poster presented at the Twenty-Seventh Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 27-28, 1995.

Deposition by the 1993 flood on the Upper Mississippi River resulted in the emergence of numerous parcels of land to elevations sufficient to support terrestrial vegetation. Plants colonized these sandbars immediately upon recession of the 1994 spring floodwaters. In August and September of that year, we quantitatively surveyed 17 sandbar communities. Sites are distributed from river mile 801 near Red Wing, Minnesota, to river mile 744 near Buffalo City, Wisconsin. Their sizes range from 348 to 10,426 m^2, their substrates are composed of greater than 85% sand, and they each contain from 17 to 57 species. A total of 114 species were encountered on the 17 sites. Mean elevations are at less than 0.70 m above summer water surface levels at all sites. Seven species that occurred with moderate to high frequency at nearly all sites are cottonwood (*Populus deltoides*), peach-leaved willow (*Salix amygdaloides*), silver maple (*Acer saccharinum*), black willow (*S. nigra*), sandbar willow (*S. exigua*), and two species of flatsedge (*Cyperus odoratus* and *C. squarrosus*). In order to generate hypotheses concerning factors responsible for differences in composition among the 17 sites, frequencies of occurrence of 20 common species were used to ordinate the sandbar communities based on their dissimilarity (Bray-Curtis). Species richness, percent sand, sampling date (phenology), and geographical position do not appear to be correlated to site arrangement along either axis. However, composition does appear to be influenced by a site's position within a navigation pool. Communities clustered in the upper right quadrant of the ordination are found in the impounded/downstream portion of a navigation pool, while those outside that quadrant are tailwater/upstream communities.Locally, micro-topographical differences as small as 3 cm may influence community composition. Rice-cutgrass (*Leersia oryzoides*) clearly decreases, and peach-leaved willow (*S. amygdaloides*) increases with increasing elevation. These trends occur within an elevation range of less than 0.30 m.

Long-term trends (1959-1994) in fish populations of the Illinois River with emphasis on upstream-to-downstream differences

Lerczak, T. V., R. E. Sparks, and K. D. Blodgett. 1995. Poster presented at the Twenty-Seventh Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 27-28, 1995.

Twenty-six stations were electrofished during late summer-early autumn for most years since 1959. Three river segments were recognized: the upper 80 km near Chicago; the next 242 km (middle river); and the final 128 km (lower river). The upper segment has

been the most impacted by industrial wastes and sewage, while the lower/middle segments have been more degraded by excessive siltation. Catch rates (number collected per hour) for indicator species with different tolerances to pollution and data on external abnormalities for all species were analyzed for trends. Common carp and goldfish were considered tolerant of low dissolved oxygen (DO) and toxicants. Centrarchids, treated as a group because of similar interspecific habitat needs, were considered pollution-intolerant relative to carp or goldfish. Green sunfish data were not included with other centrarchid data because of green sunfish tolerance to degraded conditions.

From 1962 to 1994, carp catches decreased for all river segments, and centrarchid catches increased on the lower and upper river; goldfish decreased in upper river catches and were absent or collected in small numbers elsewhere. The number of species making up 95% of the total catch for the middle and upper river was greater in recent years compared with the 1960s. In 1963, for example, the 95% list consisted of 10 species on the middle river and just four species on the upper. In 1994, the 95% list consisted of 15 species on the middle river and 16 species plus one hybrid on the upper. The number of species on the 95% lists for the lower river were similar in 1963 (11) and 1994 (10); carp ranked first in 1963 (comprising 34% of the total catch), while bluegill were consistently first since 1991, ranging from 25% to 40% of the total catch. Increases in catches of centrarchids are probably related to increases in DO and decreases in ammonia concentrations since the 1960s. Declines in carp and goldfish may be due in part to higher predation on young-of-the-year by some centrarchids. Centrarchid numbers may not have changed in the middle river because increased production in some areas may have been offset by decreases in other areas that had more extensive losses of spawning habitat from siltation.

Benthic fishes (e.g., carp) had higher incidences of external abnormalities than pelagic fishes (e.g., bluegill) for all years in the upper river, and for most years in other reaches. Percentages of benthic fishes with abnormalities increased in the upstream direction, and concentrations of toxicants in sediments of the upper river were higher than in other reaches, which suggests abnormalities on benthic fishes are related to contact with contaminated sediments. The percentage of pelagic fishes with abnormalities decreased from 1959 to 1994 in all river segments, possibly reflecting better water quality.

Electron transport system enzyme activity and oxygen consumption in zebra mussels: Potential applications to in-situ determinations of metabolic rate

Madon, S. P., D. W. Schneider, J. A. Stoeckel, and R. E. Sparks. 1995. Paper presented at the Fifth International Zebra Mussel and Other Aquatic Nuisance Organisms Conference 1995, Toronto, Ontario, Canada, February 21-24, 1995.

Measurements of metabolic rate are vital to studies on energetics and functional responses of zebra mussels to environmental variables. However, due to artificial and often simplified conditions in the laboratory, estimates of metabolic rate often fail to reflect metabolic costs in natural systems. The electron transport system (ETS) enzyme assay provides an alternative method for deriving in-situ estimates of metabolic rates in zebra mussels. The ETS assay relies on the fact that the process of oxygen consumption in organisms is accomplished via the electron transport system; therefore, ETS enzyme activity is strongly correlated with oxygen consumption. In-situ metabolic rates can be predicted from the ETS-oxygen consumption relationship if ETS levels are measured in organisms collected from natural systems. The ETS assay is particularly advantageous because it is insensitive to immediate stress associated with capture and collection of organisms from natural systems. Evidence from other ETS studies in marine systems suggests that the nature of the ETS-oxygen consumption relationship varies from species to species.

We are currently conducting experiments to calibrate the relationship between ETS activity and oxygen consumption in zebra mussels of various size classes (10 to 12 mm, 15 to 18 mm, and 25 to 28 mm). Zebra mussels were collected from the Illinois River and are being maintained in the laboratory on a commercially prepared diet of preserved diatoms. Previous experiments suggest that metabolic rates of zebra mussels vary with ration and temperature. We will therefore use various ration and temperature levels to generate a wide range of oxygen consumption and corresponding ETS enzyme levels for each size class of zebra mussels. ETS enzyme activity was measured using a procedure adapted from Owens and King. Initial experiments show enzyme kinetics to be comparable to ETS studies in other species, suggesting its utility in measuring zebra mussel respiration. Oxygen consumption will be measured via the Winkler method. We will use the ETS-oxygen consumption calibrations to predict differential metabolic rates of individual zebra mussels at various positions (on the surface and toward the core) in typical clump-like aggregations found in the Illinois River.

River modifications and their influence on the forest of the Upper Mississippi River floodplain in Illinois

Nelson, J. C., and Y. Yin. 1995. The Illinois Renewable Natural Resources Conference, Springfield, Illinois, March 29-31, 1995.

Large river-floodplain systems are among the most highly productive ecosystems worldwide. Many ecologists attribute this high productivity to annual variations in river stage or the flood pulse. The relationship between a large river and its floodplain can be described as one of interdependency and interaction generated by flood

pulses. The annual hydrograph of the natural or undisturbed Upper Mississippi River System (UMRS) is characterized by seasonal flood pulses. Normally, spring and autumn flooding expands main river channels into backwater and floodplain habitats. Today, natural hydrologic patterns are significantly altered by navigation dams, stream channelization, and levee systems. Despite human alterations to the UMRS, species adaptations to the flood pulse still dictate plant assemblages on the floodplain. For this reason, it is likely that hydrologic alterations are a key factor in understanding past and present vegetation patterns throughout the UMRS. Like many large rivers worldwide, the UMRS has been extensively modified by agricultural land conversion, urban development, and navigation projects. All of these modifications have had wide-ranging effects on the natural processes, particularly hydrology, that drive and maintain the floodplain ecosystem. Because the UMRS has been so extensively modified, it is difficult to imagine natural or presettlement floodplain landscapes. Fortunately, there is a reliable source of information that can help us reconstruct presettlement floodplain landscapes of the UMRS. The Government Land Office (GLO) surveyors' field notes contain a record of the presettlement environment and are the basis for many presettlement forest reconstructions. In conjunction with modern forest sampling, the GLO records provide a means of evaluating forest change. Our intention is to summarize some of those changes with special emphasis on hydrology and floodplain forests in Illinois.

A method for measuring the spatial accuracy of coordinates collected using the Global Positioning System

Owens, T. W., and D. M. McConville. 1995. Poster presented at the Twenty-Seventh Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 27-28, 1995.

Evaluating locational accuracy of spatial data is important to determine the appropriate use of these data. However, a good method has not been documented to measure locational accuracy. We have found that the Global Positioning System (GPS) ameliorates the difficulty of measuring the location of objects and enables non-surveyors to determine their location with relative ease and accuracy. This study devised a straightforward, repeatable, and statistically sound method of estimating the horizontal accuracy of GPS-derived locational data. We concentrated on the spatial accuracy of points because points represent simple locations and not cartographic abstractions such as lines or polygons.

When GPS coordinates are taken at surveyed locations, the quantity of interest is the difference from the surveyed (assumed true) coordinates. This difference in coordinates is a bivariate quantity and the probability distribution function (PDF) can be described by an ellipse with the center at X and Y. An ellipse is an appropriate shape for a PDF; it has two dimensions but is not rectangular because the joint probability of points occurring in the corners is very small, and it is generally not circular because X and Y are not necessarily the same. There are three ellipses of interest: the standard ellipse, the confidence ellipse, and the tolerance ellipse. The standard ellipse is a descriptive tool used to visualize the ellipse's shape and orientation. It contains about 40% of the sample, is not dependent on the sample size, and cannot be used for statistical inference. The other two ellipses have identical shapes and orientation but different major and minor axes. The confidence ellipse is an estimate of accuracy; the sample mean is or is not significantly different from the survey locations at a given α. The tolerance ellipse is an estimate of precision; a given percentage of the population sampled is enclosed in the tolerance ellipse at a given α.

Thirty-six locations were measured and compared to surveyed locations. The average offset was -1.05 m in the northing (Y) direction and 0.74 m in the easting (X) direction. Hotelling's one sample test determined that H_o (no significant departure from the survey locations exists) was rejected at the 0.05 level, which indicates there was a systematic error in the sample. The sample mean was offset in the south and east directions. Ninety-five percent of the population sampled (at the 0.05 level) was contained in an ellipse that was centered on (0.74, -1.05), had a major axis of 9.06 m and a minor axis of 6.83 m, with an angle of 31.68°. Thus, if an additional point were taken, we are 95% confident that it would fall within this ellipse.

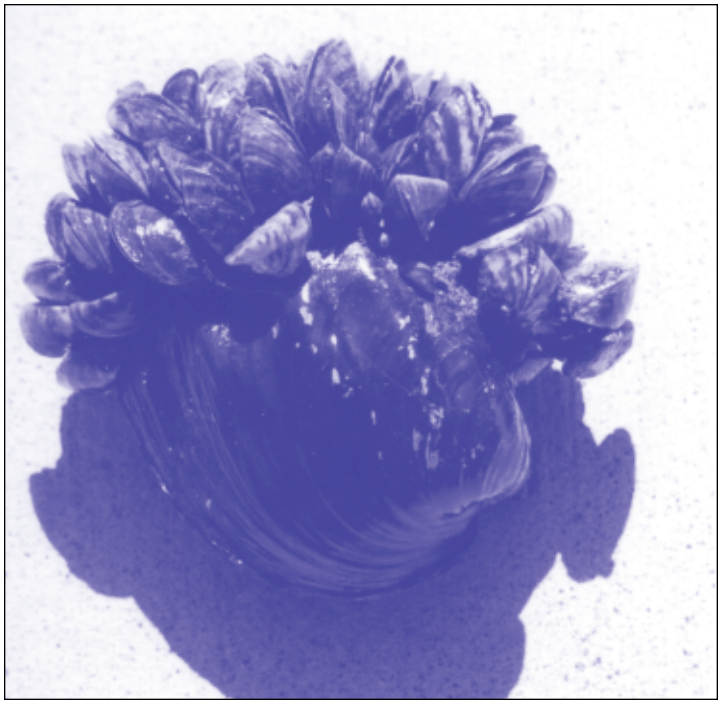
Characteristics of suspended material in the Upper Mississippi River System

Soballe, D. M. 1995. Paper presented at the Twenty-Seventh Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 27-28, 1995.

Suspended particulate material plays a significant role in the ecological structure and functioning of the Upper Mississippi River System (UMRS). For example, suspended particulate organic matter (POM) is the primary food resource utilized by filter-feeding organisms (including mussels, other invertebrates, and several fish species). Many

contaminants absorb readily to particles; thus, the transport and deposition of contaminants is tied closely to particle movement.

Since 1991, the Long Term Resource Monitoring Program (LTRMP) has monitored the levels of total suspended particulate material (TSS), organic suspended particulate material (POM), and planktonic chlorophyll in five sections of the UMR and in La Grange Pool of the Illinois River. These data show that the concentration of total suspended material (TSS) increased in a downstream direction and that the concentration of TSS in backwaters was generally lower than in the main channel. The data also indicate that the contribution of organic particulate (POM) to the total suspended load declined by about half (from 15% to 7%) from upstream (Pools 4, 8, and 13) to downstream (Pool 26 and Open River). Phytoplankton (estimated by chlorophyll) appeared to be a significant portion of POM in backwaters (on the order of 50% by weight), but organic material other than phytoplankton appeared to dominate the POM of the main channel. The contribution of phytoplankton to POM varied among study areas. Chlorophyll and POM were both maximal in the Illinois River. In the mainstem of the Mississippi River, average chlorophyll and POM concentrations were highest in Pool 8 and generally declined in the downstream direction. Although the total quantity of TSS increased downstream in the UMRS, its nutritive value to filter feeders (as suggested by chlorophyll and POM fractions) appeared to decrease.



Water quality monitoring: Program design and limits to data interpretation

Soballe, D. M. 1995. Paper presented at the Symposium on Stream Flow and Water Quality Monitoring in Wisconsin, Madison, Wisconsin, June 7, 1995.

Monitoring is invaluable as a means to detect changes, patterns, or trends in limnological parameters (e.g., water quality) but is only useful to managers if it produces good information. Data (raw numbers) are converted into information (answers) by analysis and interpretation. Analysis and interpretation of monitoring data relies upon a good understanding of (1) the data collection effort (methods and sampling design), (2) the system being monitored, (3) appropriate spatial and temporal time scales, and (4) the rules of scientific inference. Examples are presented here to demonstrate the consequences of ignoring these factors when compiling and interpreting monitoring data.

Because large volumes of monitoring data have been amassed (at considerable expense), there is strong motivation to maximize the use of these existing data and to ensure that future monitoring data are "compatible" with them. To this end, emphasis has been placed upon standardization of collection and analytical methods. Standardization of methods is important, but data compatibility is not determined by analytical methods alone. The intent of a sampling program determines what use can be made of the resulting data, and data properly collected to answer one set of questions may be wholly inappropriate for others, irrespective of analytical technique. Although generality of sampling design is desirable to ensure the long-term value and "compatibility" of monitoring data, focus is also required to ensure that defined goals are achieved with available resources. As a result, incompatibility in design is sometimes unavoidable and cannot be evaluated without detailed documentation of sampling design. Coordination among monitoring programs and the advent of "metadata" (data about data) can help alleviate this situation but cannot eliminate it.

Fluctuations in zebra mussel (*Dreissena polymorpha*) demographics in the middle and lower Illinois River, 1993 to 1994

Whitney, S. D., K. D. Blodgett, and R. E. Sparks. 1995. Poster presented at the Fifth International Zebra Mussel and Other Aquatic Nuisance Organisms Conference 1995, Toronto, Ontario, Canada, February 21-24, 1995.

Since 1993, we have quantitatively assessed the demographics of newly established zebra mussel (*Dreissena polymorpha*) populations in the lower and middle Illinois River. This research is designed to provide a better understanding of their impacts on specific riverine species and on the riverine ecosystem as a whole. Zebra mussel populations exploded in the lower Illinois River during summer 1993, only 2 years after their initial discovery in this waterway. By August, the 1993 Flood had carried veligers from upriver populations to the lower Illinois River, where newly

settled zebra mussels averaged 10,905 and 60,956/m^2 at river miles (RM) 66.8 and 5.5, respectively. These downriver populations consisted almost entirely (>99%) of similarly small (<15 mm in length) zebra mussels resulting from the first settlement of 1993. By October 1993, zebra mussels had experienced significant mortality, averaging 47.6% at RM 66.8 and 21.9% at RM 5.5. By August 1994, 98.1% of the zebra mussels we collected at RM 66.8 and 51.4% at RM 5.5 were dead; live zebra mussel densities were 420/m^2 at RM 66.8 and 3,883/m^2 at RM 5.5, indicating mortality may have been underestimated at RM 5.5 due to displacement of dead mussels. Length frequency distributions and settling block data collected in June 1994 indicate very poor settlement of young zebra mussels at both lower Illinois River sites. Conversely, successful settlement occurred at Mississippi River RM 217, which is only 1.5 river miles below the confluence with the Illinois River. Dissolved oxygen concentrations as low as 1.7 ppm and temperatures as high as 31.2 °C were recorded near the bottom of the main channel at RM 5.5 during sampling in late June 1994. Low dissolved oxygen, high water temperatures, and low water levels persisted throughout most of July 1994 and may explain the poor settlement and increased mortality of the lower Illinois River populations.

Further upstream on the middle river, live zebra mussel densities at RM 162.3 increased from 1,793/m^2 in August 1993 to 6,998/m^2 in October 1993 and have remained relatively stable through August 1994 (5,836/m^2). Mortality remained low from July 1993 through June 1994, averaging between 0% and 2.1%. However, demographics indicate that overpopulation in 1993 and poor environmental conditions in 1994 combined to cause a crash in lower Illinois River populations. Dramatic fluctuations in flow and water quality factors in the Illinois River are expected to produce significant fluctuations in zebra mussel populations. However, zebra mussel densities from 3,000 to 7,000/m^2 appear to be sustainable over the wide range of environmental conditions experienced during the past 2 years. ❐

Carp from page 1

station biologists collected a series of common carp specimens from the Mississippi River, just below the confluence with the Illinois near Grafton, Illinois. This collection site has been monitored for zebra mussels since 1992 and is known to be heavily colonized by them.

Thirty-one common carp were collected at River Mile 217; twenty-six contained from 1 to 204 zebra mussels. With few exceptions, the shells were crushed and well fragmented, but the beaks (the pointed end of the mussel that attaches to rocks) were intact. Tucker reports that the field station has saved the beaks for future measurement. "Because there is a straight-line relationship between the length of the beak and the length of the zebra mussel itself, we will be able to determine the size of the zebra mussels each carp had eaten."

Future scientist Moynell M. Tucker

Some scientists propose importing potential zebra mussel predators in an attempt to control the exotic mussels, a concept which concerns Tucker. "Two common Upper Mississippi River System species have already been found to eat zebra mussels—freshwater drum and now the common carp. The ability of these species as control agents should be investigated before other exotics are imported."

Tucker believes that because the common carp is both widespread and numerous, its potential impact on zebra mussel populations is worth investigating. Dr. Steve Gutreuter, who directs monitoring and research at the EMTC, agrees that further investigation appears warranted, cautioning that "It is far too soon to tell whether carp might help control zebra mussel populations. The fact that zebra mussels and carp are both abundant in some areas of the Upper Mississippi River suggests that carp are unlikely to be controlling the densities of zebra mussels. However, in areas where zebra mussels may already be limited by lack of suitable conditions, the additional mortality from carp predation might be important." ❐

Hydrologic attributes from page 3

Finally, managers responsible for decisions about future water level regulation will need to recognize that a single set of rules and regulations may not be appropriate to help sustain a system that is characterized and defined by both small- and large-scale spatial dynamics. In order to maintain the overall physical and structural diversity of a floodplain river, a dynamic hydrograph needs to be viewed as a long-term tool to ensure the optimal survival of some species in one year and different species in the next. With this philosophy in mind, managers can work more effectively with the year-to-year flow variations created by climatic processes rather than against them. ❐

Field stations to retrieve and download LTRMP data through "remote connectivity"

by Madelon Wise

As of January 1996, all field stations will have the capability to retrieve and download the LTRMP data they have been collecting for the last 7 years. Accessed through a modem, data can be retrieved at any time. With software on a Unix system, users can select data inquires by such fields as component, field station, pool, or various analytical fields and can parse the query down to specific data.

According to Computer Specialist Steve Hagedorn, "With this connectivity, field station staff members can generate their own queries and can later use the data in a SAS application or in Lotus. This capability enables the field stations to create datasets for analyzing special projects and for quality assurance of the data. This totally interactive, menu-driven software is easy to use. The EMTC has the capability to satisfy and send a special request, a year's worth of data, several years of data, or whatever combination is desired using an automated method."

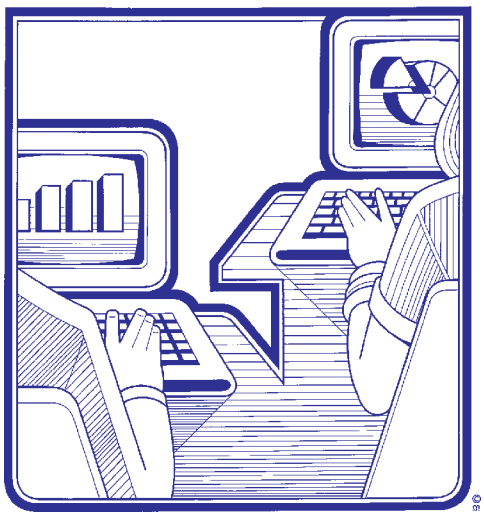
When field stations requested data previously, Hagedorn had to send the data by E-mail after an ASCII file containing the data was generated. As revisions were made to the database, the ASCII files would become outdated. "With the new software," explains Hagedorn, "the field stations are connected directly to the online database, so the data they retrieve is in real time, plus they can do it themselves, and they don't have to rely on me or anyone else to retrieve the data for them."

In addition to the capability to serve LTRMP data to the field stations, Hagedorn and EMTC Computer Specialist Dave Bergstedt are developing the capablity to serve LTRMP data over the Internet. This new application also allows users to create queries specific to their needs. It works much the same way as the field station software, except that this application uses point-and-click software that is accessed through the Internet via the EMTC Home Page. ❐

LTRMP component database spatial query tool

by Douglas A. Olsen

The EMTC collects component data for fisheries, water quality, vegetation, and invertebrates, and stores these data in a relational database management system. While the geographic locations of these data are also collected and stored, there were no tools available to automate the integration of these data with other spatial data. In response to this need, a new Unix-based application has been developed at the EMTC.



The LTRMP Component Database Spatial Query Tool is an ARC Macro Language application that uses the ARC/INFO geographic information system (GIS) to facilitate visualization and spatial querying of component data. The application includes data for fisheries, water quality, and invertebrates for all six key pools (Pools 4, 8, 13, and 26, the open river, and La Grange Pool). The application provides a graphical user interface which requires no prior GIS knowledge to operate. The user can select a pool and component, zoom to the area of interest, then create a spatial subset of sampling sites by graphically defining a bounding box or polygon. Next, the user can construct a query and apply it to the spatial subset of sites. Output options include graphical screen display, hardcopy map, and/or comma-delimited ASCII file.

Upgrades planned for the coming year include enhancements based on user feedback and possibly porting the application to the PC platform. Until this application is available for PC-based platforms, use is limited to those staff members with Unix systems running ARC/INFO GIS software. However, any Program partner wishing to test this application may submit a request to the EMTC. For more information about this interface, contact the Geospatial Applications Division at the EMTC. ❐

Biology professor on sabbatical at EMTC

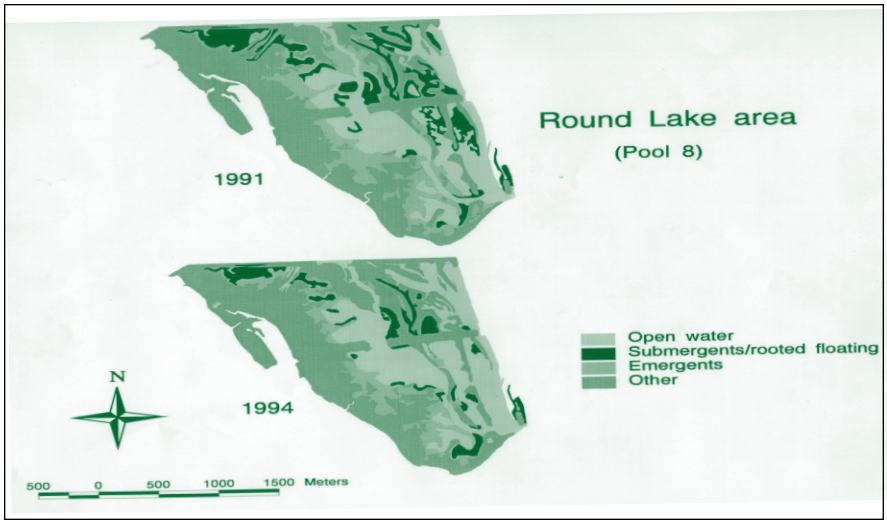
by Tom Owens

Dr. Rob Tyser, a member of the Biology and Microbiology Department at the University of Wisconsin-La Crosse, is spending a year's sabbatical at the EMTC. During his sabbatical, Tyser is performing research on temporal changes in aquatic vegetation in selected areas of Upper Mississippi River System (UMRS) Pool 8. Tyser earned his Ph.D. in ecology in 1978 from the University of Wisconsin-Madison. Since graduation, he has taught at the University of Wisconsin-La Crosse. For the past 10 years, he has been studying exotic plants invading Glacier National Park and has published several research articles on this topic.

Dr. Rob Tyser, professor of Biology and Microbiology at the University of Wisconsin-La Crosse. *(Photo by Madelon Wise)*

Tyser will analyze several years of data to determine what changes are occurring in the Pool 8 vegetation and the causal factors for those changes. His research, which uses geographic information systems (GIS) technology and spatial statistics, will focus on short-term or annual changes in vegetation, rather than long-term changes that may be due to gradual processes such as sedimentation or succession. Once the vegetation community changes are quantified and described, the role of disturbance on community structure will be defined.

The data Tyser is using were created by the EMTC's Cartographic Services Group, Geospatial Applications Division, using the Stereo Zoom Transfer Scope (SZTS). GIS coverages of land cover use have been created for the years 1991-1995. Operated by a skilled interpreter using photogrammetric principles, the SZTS can create accurate land cover databases from interpreted 1:15,000-scale color-infrared aerial photos. The spatial accuracy of features in the databases are within 5 meters of their actual location. Tyser anticipates using several analytical approaches for his project, including the calculation of "transition matrices."



Examples from Tyser's study of GIS coverages derived from the Stereo Zoom Transfer Scope.

Transition matrices track the proportion of a land cover type that changes to another land cover type or types in following years. This analysis should indicate the magnitude of yearly variation as well as overall directions of change; for example: Are open water areas declining? Is emergent vegetation increasing? The inclusion of four study sites will permit an among-site analysis of variance.

"I am very excited about this project," Tyser states. "Contrary to popular opinion, it will be possible to teach an old dog some new GIS tricks." He notes that his research is very much a team project, drawing upon the active collaboration of EMTC staff, including SZTS interpreter Larry Robinson; Tom Owens, who is providing GIS support; and Sara Rogers, who is providing ecological guidance. Tyser intends to build upon his experience at the EMTC when his sabbatical ends. "I will initiate a GIS course in the Biology and Microbiology Department, with the UMRS as a focus," he says.

This project is an excellent example of cooperation between the EMTC and the river community. The EMTC is providing the computing facility, data, and technical expertise; Tyser is providing his scientific expertise in applying the data to solve a specific problem and will facilitate the transfer of GIS technology to the university classroom.❐

What a catch! - A day of electrofishing

One of many field sampling activities conducted by the Long Term Resource Monitoring Program is electrofishing. During the summer and fall months, LTRMP field station staff can be seen plying Upper Mississippi River backwaters in electrofishing craft such as the one in the photograph below.

Electrofishing is used to collect a large number of fish at one time in a relatively small area. At the front of the boat are rings with dangling metal rods, which are lowered into the water during the electrofishing process. These rods deliver an electrical current to the water, harmlessly stunning the fish, which can then be scooped up in nets (above, right).

Once collected and put into a holding tank aboard the boat, the fish are measured (top left) weighed, or both, depending on size class and species. Scale samples may also be taken for later analysis. Fish are then released, unharmed.

The process often brings up fish that would make any angler proud, including the handsome black crappie above. *(Text and photos by Mi Ae Lipe-Butterbrodt.)* ❐

Personality Profiles

A closer look at the people who make the LTRMP a success

by Madelon Wise

Linda Leake approaches her career with a firm belief in customer service. "You must approach your work with a nucleus of providing service and you must do it with a smile." The multiple-award-winning employee sees herself as "a resource rather than an expert" and describes her role as that of "a coordinator, team leader, ideas person, trouble-shooter, guider, and promoter."

Although Leake has over 13 years of service in the Federal Government, most of her career has been in the private sector, where her expertise in automation began. She became interested in computers 12 years ago, when she used one for statistical analysis of industrial scrap rates.

Information Management and Technology Support Manager, Linda Leake *(Photo by Mi Ae Lipe-Butterbrodt)*

A member of a military family, Leake moved to and from many locations and needed to keep her employment options flexible. At Fort Richardson, Alaska, Leake was the only computer operator in her division and witnessed the early inroads of PCs into the Federal Government. At a time when PCs were not the norm on everyone's desk, Leake was promoted to computer specialist at Fort Richardson, which supported the Financial Management Divisions for all three army installations in Alaska. Her job was twofold: to introduce the user community to PCs and to design a network in PC configuration.

At the Sacramento, California, Army Depot, Leake worked with the automation support team, which began "grassroots automation support" for 2,000 people. Leake's team set up PCs, implemented Unix management, and was the first "self-directed" working team the Depot had, experimenting with team review, team supervision, and team performance appraisals. Teamwork has remained a central theme in Leake's management style.

During this period, Leake also continued her "nontraditional approach to education" by taking college courses to provide skills needed in her current job. In her quest to remain marketable no matter her location, she has attended community colleges, universities, the Department of Defense Engineering College, and schools in Europe.

Leake believes a job needs to "keep the fun in" to remain exciting and challenging. "Keep an open mind and an open outlook. You must be up to the challenge," she asserts. When Leake's facility in Sacramento became targeted for closure, she began to search for a new position that would provide her the challenge she demands. After discussions with EMTC Information and Technology Services Director Norman Hildrum, Leake believed that the EMTC would meet her criteria.

Leake has seen remarkable changes in the four years she has worked at the EMTC, as the Center moved from a PC and stand-alone DOS software environment to a networked high-tech data serving center. The biggest job Leake's group had to undertake was "organizing and loading component data into a master database process to review, update, and make data available." As the group moved to a Unix environment, the goal of creating a network was to share information in a cost-effective manner. "We now have six Unix servers configured in a distributed system; if one server goes down, the software is either distributed in such a way that everyone keeps working or it can be loaded on another system if needed."

Leake is very encouraged and excited about the "team spirit among EMTC and field station staff members. By working together as a team, we can be more proactive than reactive." She states that the EMTC has a "highly technically competent staff" she calls the "cream of the crop."

"That's why we can produce and are producing. The facilities, staff, and resources are above average, and the staff has the technical ability and aptitude to make things happen. The successes of the information management group would not happen without this talent. Without their dedication and hard work, we would be years behind where we are now."

Leake sees the Internet as a self-help tool with which "anyone who wants data can get it. Having our data available on the Internet has resulted in a real boost in data availability, as well as in more people asking more questions. The old way of thinking was that 'only a computer jockey can do those things.' That is not the way business is done today. Now the computer group is here to provide services and tools to staff members and the community."

One accomplishment Leake is especially proud of is her work with Western Wisconsin Technical College. In 1993, she started discussions with WWTC and subsequently a cooperative agreement was implemented with the college to employ their students at the EMTC. "This is a wonderful opportu-

nity for students to obtain real world skills. As a result of their experiences here, they become very marketable job seekers. By developing a student base, we also reap benefits. The cooperative agreement has been rewarding to watch grow through the years."

By working together as a team, we can be more proactive than reactive.

In addition to serving as a resource for local schools and other Federal facilities, Leake also serves on the WWTC Computer Advisory Committee. In her second year as the only representative from the Federal or State sector, Leake serves with computer experts from the area's major private corporations such as Trane, Heileman, and Dairyland Power. The Committee meets semi-annually to review the curriculum and make recommendations to the college.

Leake states that her participation in the 1993 U.S. Fish and Wildlife Service Management Training Program was instrumental in developing her management philosophy. She rates this training as an A plus. The training "gave me a bag of tools and helped me learn more about teamwork."

Teamwork is paramount in Leake's group, where the workload is heavy. She promotes empowerment of her staff, and staff members manage the day-to-day operations. Leake believes in informed group decisions and cross-training. "I'm here to help them hurdle problems."

"I like to afford my staff opportunities to see the bigger picture of the LTRMP; for example, having them work on the Annual Work Plan, give tours, go to a meeting for me, or act in my place." She reminds her team, "We're here because of the Program." ❐

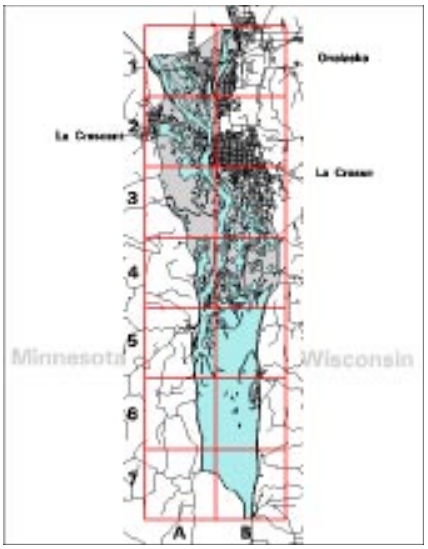
New tools for an old problem

by Beverly Friesen

The Environmental Management Technical Center hosts a World Wide Web site to provide free access to a wide variety of biological, physical, spatial, graphic, and written information relating to the Upper Mississippi River System (UMRS) and adjoining geographic areas. One application that has proven useful to our Partners is the ability to view and download aerial photographs. Through an interactive map, photos of the UMRS can be accessed at the EMTC's Home Page by graphically pointing and clicking on an area of interest.

Recently, Steve Lee of the Minnesota Pollution Control Agency was called out to an oil spill when the St. Paul Coast Guard detachment reported a strong diesel fuel odor and an oil sheen 3 miles long north of Lock and Dam # 8. Following this call, Lee was in contact with the EMTC and noted:

"We are learning to use new tools for an old problem—responding to spills and the illegal disposal of oil into our waters. A couple of the tools we are very excited about are the sensitive area database and related mapping being done by the EMTC and Upper Mississippi River Basin Association in support of the Environmental Protection Agency's efforts to develop oil spill preparedness plans under the Oil Pollution Act of 1990. These tools will allow us to prepare for spills before they happen and will greatly improve the decision making processes during response to spills."



Interactive map from the EMTC Home Page. Users can point and click on areas of interest to download aerial photographs.

Lee continues, "Recently, oil showed up at Lock and Dam 8. Wisconsin and Minnesota Department of Natural Resources game wardens and the Coast Guard began field efforts to locate the source of the oil. While we were in contact with them, we connected to the EMTC Home Page via the Internet and downloaded several aerial photographs of the area. These photographs helped us to better interpret the more traditional maps and charts we have been using. Had this been a major spill, the sensitive area data, maps, and aerial photographs would be invaluable. We're looking forward to completion of the mapping and photo projects and their distribution to spill planners and responders."

In January, a link will be added to serve Environmental Protection Agency digital data and files for the Inland Waterways Mapping Project, a special interagency project between EPA Region 5 and the EMTC to provide community planners and oil spill responders with graphical information on the resources at risk during a spill. The Center serves as the central repository site for all data for this project, including databases for water intakes, marinas/ramps, potential spill sources, locks and dams, and tribal lands, plus scanned 1:24,000-scale and 1:100,000-scale USGS quadrangles for the six states within EPA

See New Tools on page 16

New Reports

The following reports were recently completed and have been distributed to Program partners. LTRMP reports are available through the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (800/553-6847 or 703/487-4650).

Admiraal, D., and M. Demissie. 1995. *Velocity and discharge measurements at selected locations on the Mississippi River during the Great Flood of 1993 using an Acoustic Doppler Current Profiler.* Pages 222-234 *in* the Proceedings of the International Joint Seminar on Reduction of Natural and Environmental Disasters in Water Environment, Seoul National University, Seoul, Korea, July 18-21, 1995. Reprinted by the National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-R007. 13 pp.

Arndt, L., and D. Olsen. 1995. *Long Term Resource Monitoring Program standard operating procedures: Production ARCEDIT digitizing.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-P008-3. 12 pp. + Appendixes A-K.

Bhowmik, N. O. 1995. *Impacts of 1993 floods on the Upper Mississippi and Missouri River Basins in the USA.* Pages 127-154 *in* the Proceedings of the International Joint Seminar on Reduction of Natural and Environmental Disasters in Water Environment, Seoul National University, Seoul, Korea, July 18-21, 1995. Reprinted by the National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-R005. 28 pp.

Demissie, M. 1995. *Sediment load during flood events for Illinois streams.* Pages 341-357 *in* the Proceedings of the International Joint Seminar on Reduction of Natural and Environmental Disasters in Water Environment, Seoul National University, Seoul, Korea, July 18-21, 1995. Reprinted by the National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-R006. 17 pp.

Hill, L. 1995. *Geospatial Application: Refuge expansion acreage analysis.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-P005. 13 pp. + Appendixes A-C.

Joria, P. E. 1995. *Geospatial Application: Assessment of merged Landsat TM and SPOT panchromatic data for Pool 26, Upper Mississippi River System.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, September 1995. LTRMP 95-P010. 21 pp. + Appendix A.

Nelson, J. C., A. Redmond, and R. E. Sparks. 1995. *Impacts of settlement on floodplain vegetation at the confluence of the Illinois and Mississippi Rivers.* Reprinted by the National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-R004. 17 pp.

Olsen, D. A. 1995. *Geospatial application: Aquatic habitat analysis and visualization tool.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin. May 1995. LTRMP 95-P006. 5 pp.

Owens, T., and K. D. Hop. 1995. *Long Term Resource Monitoring Program standard operating procedures: Field station photointerpretation.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-P008-2. 13 pp. + Appendixes A-E. (NTIS #PB95-114715)

Owens, T., and K. D. Hop. 1995. *Long Term Resource Monitoring Program standard operating procedures: Photointerpretation.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P008-1. 7 pp + Appendixes A and B.

Robinson, L. 1995. *Long Term Resource Monitoring Program standard operating procedures: Automated Stereo Zoom Transfer Scope*. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, November 1995. LTRMP 95-P008-4. 16 pp.

Wlosinski, J. H., D. E. Hansen, and S. R. Hagedorn. 1995. *Long Term Resource Monitoring Program procedures: Water surface elevation and discharge.* National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-P002-4. 9 pp. + Appendixes A-O. ❐

New Tools from page 15

Region 5 (Indiana, Illinois, Michigan, Minnesota, Ohio, and Wisconsin). Locations of pertinent documents and additional sources of information also will be provided through links to other web sites and Home Pages on the Internet.❐

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