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Chicago WILDERNESS

Chicago: Geographers' Metropolis

Mark Bouman, Chicago State University
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Share in the reflections of geographers Mark Bouman and William Peterman as they explore the intersection of the fields of geography and conservation.

When 5,471 geographers descended on the Palmer House Hilton in early March 2006 for the Annual Meeting of the Association of American Geographers (AAG), the most ever assembled at an AAG meeting in the Western Hemisphere, it was not only a sign of disciplinary vigor, but also a reminder of the longstanding connections between the field of geography and the Chicago region. Issues of interest and concern to members of Chicago Wilderness were at the foreground of the meeting's plenary sessions, its special and regular sessions, its fieldtrips, and its publications. Several geographers from Chicago Wilderness organizations played a significant part in the meeting. Geography may not immediately come to mind as a key disciplinary field associated with biodiversity and the environment, but it should. The March meeting provided an opportunity to briefly consider the relationship between geography, the Chicago region, and Chicago Wilderness.

Efforts to preserve and enhance the region's biodiversity certainly make use of cutting edge geo-technologies such as geographic information systems (GIS) and remote sensing, but they also rest on concepts deeply rooted in the traditional core of geographic study—the importance of mapping; the careful study of a region; the analysis of the way that cultural and natural features are distributed across the land; and the vexing but vitally important study of the relations between human societies and the environment. In fact, geography may be the discipline that best appreciates the somewhat oxymoronic term, "Chicago Wilderness". To geographers it is just everyday work to look for the new ways of living that bloom from such seeming paradoxes.

The modern studies of geography and ecology grew together in the fertile ground of the Chicago region. The nation's first Ph.D. program in geography was established at the University of Chicago (U of C) in 1903 and was later joined by a program at Northwestern University. Geographers mapped land use and vegetation patterns; analyzed the human imprint on the landscape from the earliest occupants to the present; took on questions of urban and regional planning; and worked on knotty issues of open space preservation. Several Chicago area and Chicago trained geographers participated in an important international symposium on Man's Role in Changing the Face of the Earth in 1955. The massive volume that resulted from the symposium identified many environmental and urban environmental issues still relevant today. Geography is currently represented in departments at a number of colleges and universities throughout the Chicago Wilderness region.

Even more striking is the number of geographers who work outside of traditional geography departments (such as the School of Social Service Administration at U of C and the Center for Urban Economic Development at the University of Illinois at Chicago) or outside of academia altogether at places like the Northeastern Illinois Planning Commission, the City of Chicago Department of Environment, The Field Museum of Natural History, The Newberry Library, Chicago Transportation Authority, and even on the very staff of Chicago Wilderness. Indeed, the Association of American Geographers claims nearly one hundred fifty members in the region, and roughly half of them work "off campus". Such diversity in this profession suggests that there is a geographers' ecology of sorts, each tending to a particular niche, each mindful of the whole piece. Thus geographers were comfortable and found meaning with the opening plenary session at the recent AAG meeting that began with a discussion of the environmental history of the making of Chicago by William Cronon of the University of Wisconsin and author of *Nature's Metropolis: Chicago and the Great West.* The symposium continued with a presentation that linked the economic and historical geography of the region with emerging regional patterns of growth and decline by Northwestern's John Hudson, author of the newly published *Chicago: A Geography of the City and its Region*; and ended with DePaul professor and *Sun-Times* columnist Laura Washington's personal reflections on the social make-up of the region.

At the Chicago AAG meeting attendees had the opportunity to hear nearly 500 different presentations on the topic of "environment"; 625 presentations on the topic of "urban geography"; more than 260 presentations on the topic of "land use"; more than 230 presentations on the topic of "biogeography"; nearly 200 presentations on the topic of planning; nearly 180 presentations on the topic of "water resources"; and nearly 50 presentations on the topic of "recreational geography". Twenty-nine sessions specifically addressed Chicago issues, including topics such as bio-politics, wetland mitigation, historic park preservation, the urban forest, and rain gardens. Many geographers find themselves more at home "in the field" than in hotel conference rooms and field trips always play a large part in AAG meetings. The Chicago meeting was no exception. Field trips took meeting attendees from a walk through Millennium Park to the region's "Edge Cities" of Oak Brook, Naperville, Schaumburg, and Hoffman Estates; on a specially chartered "L" train throughout the city; and to Haymarket Square. Two field trips that were organized in conjunction with the Ecological Cities project of the University of Massachusetts – Amherst (whose Director Rutherford Platt, made special remarks at Chicago Wilderness' 10 Year anniversary celebration in May) took participants to the green roof atop City Hall, the City's Center for Green Technology, Garfield Park Conservatory, along the Chicago River, and to the vast open space of the Calumet area on Chicago's southeast side, thus giving attendees a chance to see how Chicago is working towards living up to its motto, "*Urbs in horto*".

A unique feature of this AAG meeting was a volume of essays containing articles about Chicago and authored by local geographers. Edited by Richard Greene (Northern Illinois University), Mark Bouman (Chicago State University), and Dennis Grammenos (Northeastern Illinois University), the volume, entitled

Chicago's Geographies: A Twenty-First Century Metropolis, sounds the theme of the region's continuing social diversification and economic change in the wake of globalization; its environmental challenges and opportunities; and its rich political texture. In eighteen essays a variety of topics of interest to Chicago Wilderness members are covered, including "How the Geophysical Environment Has Influenced Chicago" (John Schroeder – Joliet Junior College), "Chicago and the Rediscovery of Nature" (Mark Bouman – Chicago State University), and "Infrastructure Development and the Tourism Industry in Chicago" (Costas Spirou – National Lewis University). The AAG will be making these volumes available to the general public at www.aag.org in the near future.

Academic meetings are like an annually occurring Brigadoon, they arise seemingly from thin air—albeit at different locations each year—and then disappear just as quickly seemingly without leaving a trace. But it is not quite as simple as that. Geographers have always contended that space matters and the March meeting of the AAG in Chicago has once again made this case about the Chicago region, with its complex natural, social, and political ecologies. The formal and informal sessions, field trips, and the resulting collection of Chicago-focused essays makes the case that Chicago is not to be ignored, not just because it remains one of the country's largest metropolitan regions, but for the way it continually shows up as a bellwether of new trends and perspectives that can be a model for other regions. Chicago Wilderness can be proud that several of its members are at the forefront of efforts by geographers to make this point and that these geographers will be taking lessons learned at the March meeting and turning them into practice.

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It's Easy Being Green—Green Makeover: Retrofitting Sites in Urban Areas to Enrich City Environments

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How well do various stream restoration techniques work? This article reports on a study to assess which techniques are commonly used in the region and how well they are working.

Introduction

Historic land use decisions have resulted in land consumption that is occurring at twice the rate of population growth. Across America sprawl contributes to habitat destruction, decreased biodiversity, water quality impairments, air quality problems associated with increased auto usage, and poor health. As an alternative, "green retrofit", defined as practices that emphasize environmental and human health considerations in an urban setting, focuses on redeveloping infill sites (vacant parcels of land within a built-up city or town) in ways which maximize air and water quality, habitat, and human health benefits.

The United States Environmental Protection Agency (USEPA) and the Wisconsin Department of Natural Resources, along with other local and nonprofit partners, convened the October 2005 "Green Makeover: Retrofitting Sites in Urban Areas to Enrich City Environments" conference in Milwaukee, Wisconsin. The conference explored strategies, quantification efforts, and case studies relating to the green retrofit of urban sites. It also included a hands-on interactive design charrette, where participants applied what they learned earlier in the conference on three brownfield sites within the city of Milwaukee.

The knowledge and designs that were created and shared at this conference serve as the basis for a long term effort to quantify the benefits of green retrofit approaches at urban sites, with the ultimate goal of encouraging public and private sector redevelopment projects to build "green."

Green Retrofitting

Over the course of several years, it has become clear that the application of sustainable revitalization and redevelopment practices in an urban setting needs to be better understood, communicated, and quantified. Environmentally sensitive design techniques are being increasingly employed in suburban conservation-style developments. Examples of these techniques include native landscaping, innovative storm water management practices such as the use of rain gardens, bioswales, and pervious pavement, and the use of interconnected street grids. However their implementation in a dense urban setting, either through retrofit of existing sites or during site redevelopment, could help achieve many cross-programmatic goals, such as improved air and water quality, biodiversity and ecological function, storm water management, and human health.

Translating these green practices from a low-density, greenfield setting to a high-density, urban setting presents unique challenges specifically related to the contamination and land use constraints typically found in cities. However, implementation of these practices also offers communities and those involved in coordinating brownfield[1] redevelopment with an opportunity to maximize a myriad of environmental and human health benefits beyond those typically achieved in a traditional cleanup project.

Recognizing the timely importance of these issues regionally and across the country, a multi-agency workgroup formed in January 20052. The goal of the workgroup was twofold: (1) to bring together academic experts and practitioners to share knowledge on current research and best practices related to green retrofitting; and (2) to initiate a process to organize quantified information on the performance and benefits of green design features and best management practices, and identify information gaps that potentially can be addressed in future research projects.

Green Makeover Conference

First, the workgroup planned the "Green Makeover: Retrofitting Sites in Urban Areas to Enrich City Environments" conference, which took place October 19-20, 2005. The workgroup defined green retrofit to encompass planning the features of a site or neighborhood with an eye toward achieving enhanced storm water management, air quality, ecological function, and livability; the conference focused on creating more environmentally, socially, and economically vibrant urban spaces. On the first day, participants learned about green retrofit case studies and planning principles, they explored the storm water, air quality, and habitat/biodiversity benefits of green retrofit, and examined how to create a better human environment. On the second day, attendees participated in a dynamic learning charrette, where they examined existing brownfield sites in the Milwaukee area and used them as canvases for designing sustainable approaches to redevelopment. Charrette participants generated design plans with the creative and artistic assistance of university students. Loosely translated, "charrette" means "cart" in French. The word is commonly used in the fields of architecture and planning in reference to an intensive and collaborative design process. This process often integrates local stakeholder opinions with

[1] *Brownfields are any "real property, the expansion, redevelopment or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant."*

[2] *Organizations represented on the workgroup included: the US EPA, Region 5 and Cincinnati Office of Research and Development, the Wisconsin Department of Natural Resources, the University of Wisconsin-Milwaukee, the Urban Open Space Foundation, 1000 Friends of Wisconsin, the University of Wisconsin-Stevens Point, the city of Milwaukee, the city of Chicago, and the University of Illinois at Chicago, Great Lakes Center for Environmental Training.*

professional advice to create a visual design product. This unique application of the word "cart" is believed to have originated during the 1800s when a cart, or "charrette", was pushed around from table to table to collect final design sketches. The conference also included a tour of Milwaukee area green retrofit, brownfield, and flood mitigation projects.

Feedback from the conference indicated that the participants, speakers, and planners considered the Green Makeover conference a success. The most popular component of the conference was the innovative participatory model, which featured a learning charrette. For the Green Makeover Conference, the charrette was adapted to focus on the environmental, human health, and social importance of incorporating green infrastructure into urban redevelopment projects. The charrette was planned in partnership with University professors and students. Two graduate-level courses, one an urban design studio at the University of Wisconsin-Milwaukee's College of Architecture and Urban Design and the other a course on the sustainable development of brownfields at the School of Natural Resources and Environment at the University of Michigan, and several independent studies students from the University of Wisconsin-Madison, concentrated on analyzing the sites selected for the charrette. The students provided site characterization analysis and initial site design, produced high quality materials for the conference, participated in the conference as site experts, recorders and drawers, and provided post-conference plans and drawings for each of the sites. University partnerships and students proved to be a valuable resource for this type of project. Partnering with them allowed us to reach the next generation of redevelopment professional and generate quality research at local institutions. What emerged from the conference with such a wide range of partners and the inclusion of 45 students from architecture, landscape architecture, urban planning and business disciplines were detailed, thoughtful, and environmentally respectful redevelopment proposals on three sites within the city of Milwaukee. The conference also educated approximately 160 participants on how they can approach similar revitalization projects in their own communities.

The following are examples of some of the designs developed during the conference. They were further refined and presented during an end-of-the-semester review by the students. More information on the Green Makeover Conference can be found at: http://dnr.wi.gov/org/es/science/landuse/greenmakeover/.

The workgroup's second goal was to use the Green Makeover conference as the launching point for a multi-year quantification effort to analyze the performance of green redevelopment practices on contaminated properties. Feedback from members of the public and private sectors indicates that a lack of information on the performance, costs, and benefits of these green design practices is often an impediment to their adoption.

Green Retrofit Quantification Research Project

Many of the costs associated with traditional methods of redevelopment (high percentages of impervious surfaces, low density development, destruction of prime farmland and greenfields, increased vehicle miles traveled, and increased operation, maintenance, energy and infrastructure costs) are external to the developers' costs and are borne by society and downstream/downwind populations and ecosystems. Conversely, the economic, social, ecological and environmental benefits of

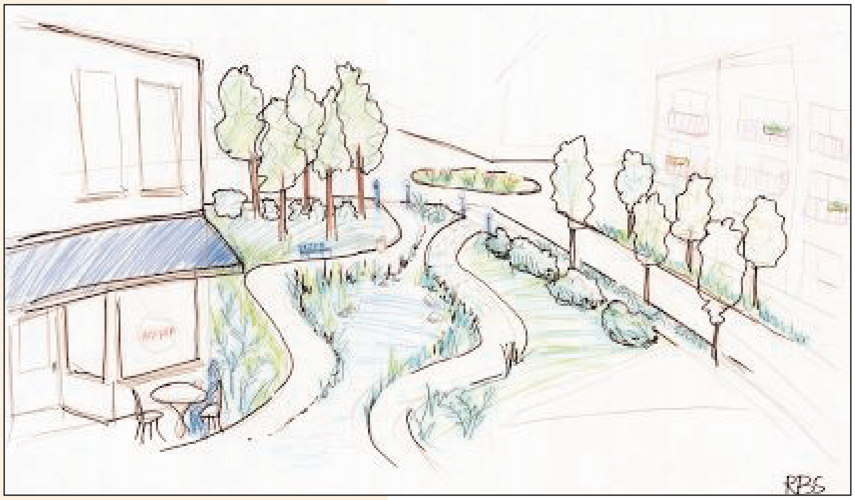

Figure 1. Aesthetically pleasing storm water management and a mixture of building uses.

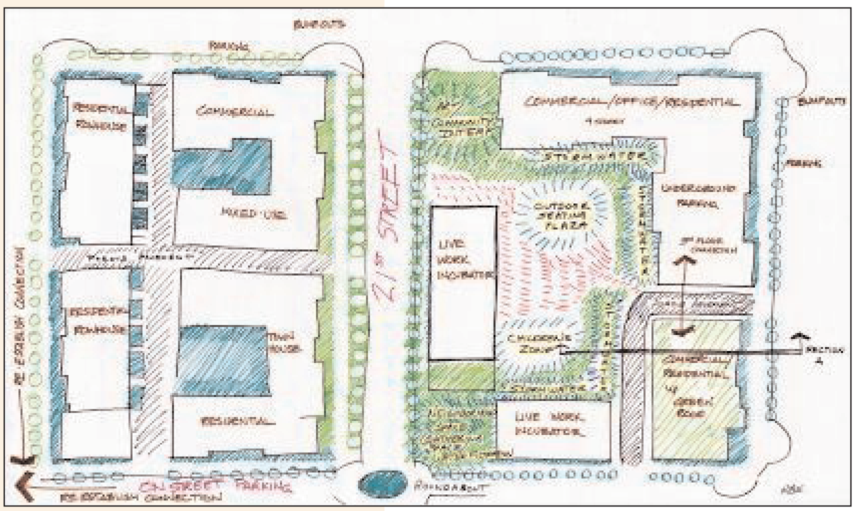

Figure 2. Charrette participants redevelop site using green space and focusing on neighborhood integration.

sustainable, low-impact style developments are not well known or well accounted for in the current market structure. Further, a lack of quantified information on the performance and benefits of "green" design features is an obstacle to implementing green retrofit best management practices. There is a need to provide engineers, lenders, developers, planners and project decision-makers with accurate, reliable, and quantified information on the performance, cost effectiveness, and environmental benefits of these features if we hope to see them widely implemented. Quantified green retrofit data will also allow local, state, and federal environmental agencies to better measure and document the environmental and human health improvements attributable to sustainable design practices.

The goal of the green retrofit quantification research project is to partner with subject matter experts, users of the data, and universities to identify key green retrofit quantification needs in the areas of air quality, water quality, storm water management, ecological function and economics. From this information, a research agenda with a few top priority projects for each topic area will be developed that supports the use of these green design practices.

The green retrofit quantification research project was formally initiated with the Green Makeover Conference. However, the issue was initially explored through other conferences, including the "Landscaping with Native Plants: Exploring the Environmental, Social, and Economic Benefits" conference, which was held in Chicago in December 2004. Native landscaping is one component of sustainable redevelopment, and during the conference the speakers evaluated the scientific literature to determine the current state of knowledge on

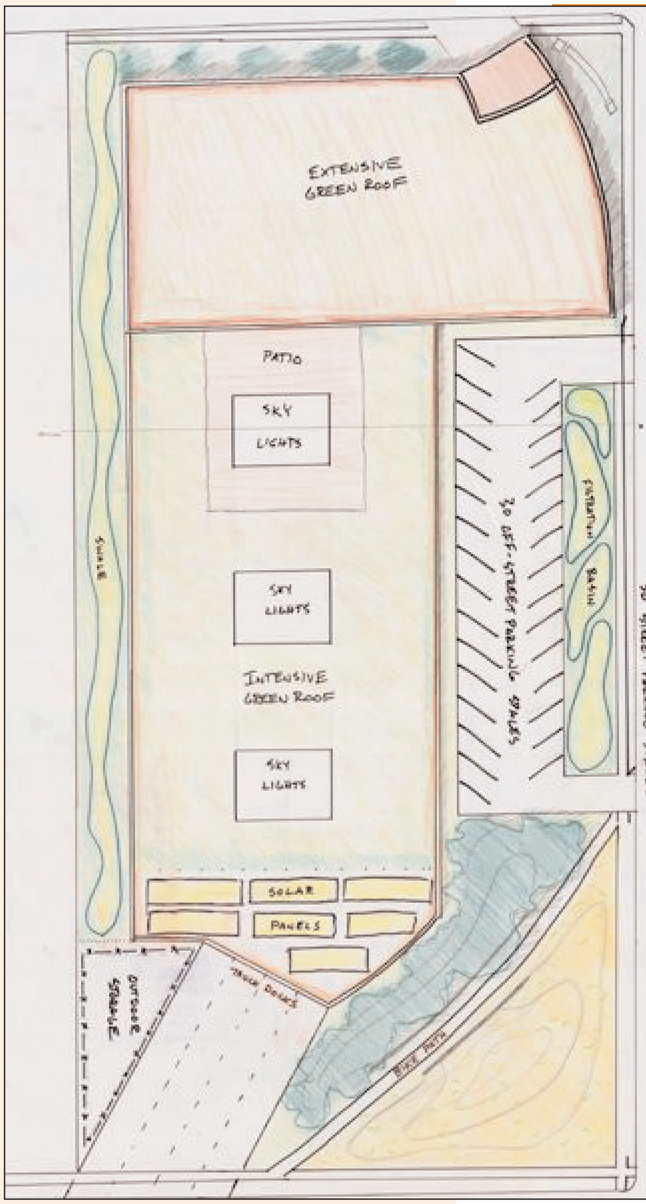

Figure 3. Green building techniques.

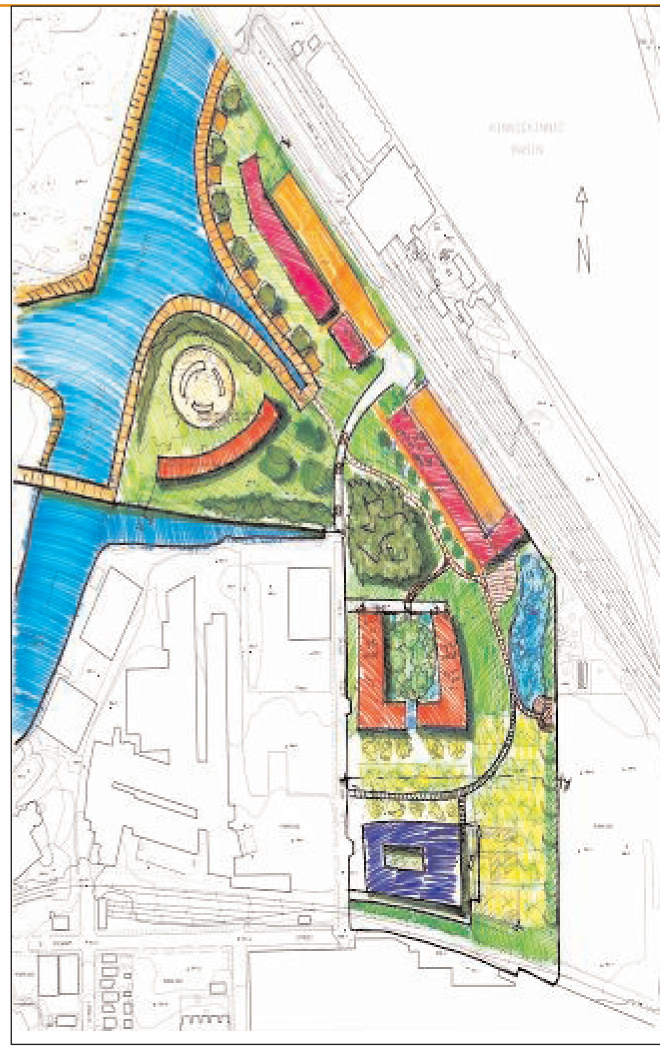

Figure 4. Greening of an industrial brownfield.

native landscaping and its environmental, social, and economic interactions. This yielded a broad range of research questions that merit further research. These questions have been documented in a native landscaping research agenda, which will provide a systematic approach to addressing the identified gaps in scientific knowledge. The quantification research project is utilizing the native landscaping research agenda when selecting priority projects.

Discussion

There several key lessons learned from this project. First, the design charrette was a highly effective method for communicating the educational concepts presented at the conference. The charrette activities were especially valuable because they: (1) reinforced the lessons of the conference; (2) established and strengthened professional networks between participants; (3) created a collaborative educational experience for students and professionals; and (4) created excitement about the conference content and potential post-conference work.

Second, the experience with our University partners was outstanding. The value added was so great that we now try to collaborate with universities on these types of projects whenever possible, and we recommend it highly for others planning similar work. The design students were incredible artists and added tremendous visual punch to the charrettes, and they had very creative and practical ideas about how the sites could be redeveloped sustainably. Partnering with the universities, and having courses structured around the conference and the concept of sustainability in the built environment, provided an opportunity to promote cross-fertilization of ideas between academia, the non-profit sector, developers, engineers, and local, state, and federal government.

Finally, the conference set the stage for a multi-year quantification effort, which will lead to measurement of the environmental benefits of green site reuse including reduced storm water runoff, reduced contaminant concentrations in runoff, reductions in vehicle miles traveled, and ecological enhancement. The conference provided an excellent launching point for this work and has generated a great amount of excitement and interest in this topic both externally and internally. Barriers and opportunities to foster the widespread implementation of green design practices are similar in many ways to those that impacted brownfields 10 years ago. At that time, through focused discussion and analysis, key policy changes to liability, risk, and brownfields definition, allowed the private market to redevelop tens of thousands more brownfields than could have ever been redeveloped through government assistance alone. We believe the same is true with the implementation of sustainable design practices. There may be fairly simple things that we can do to dramatically increase the implementation of sustainable design practices, and our quantification effort is a step in this direction. For more information, please contact one of the authors

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Learn how woody invasive species can influence the hydrology of a site as Geoffrey Parish and Jean Sellar discuss their research results and its implications for ecological restoration.

Thirsty Plants, Dry Soil: Changes in Soil Moisture Content After the Removal of Invasive Species

Geoffrey Parish, Graef, Anhalt, and Schloemer
Jean Sellar, U.S. Army Corps of Engineers

Abstract
Invasive woody species were removed from a monitored basin. Levels of soil moisture and ground water were compared to an adjacent control basin. Following the removal there were statistically significant increases in the soil moisture level and the elevation of the water table in the treated area compared to the untreated area.

Introduction
The Prairie Creek 1 Project Area is located near the western boundary of the Midewin National Tallgrass Prairie immediately north of River Road, near Wilmington, IL. As represented on a USDA Forest Service web page, a 19th century agricultural survey indicates that the landscape of the area now known as Midewin National Tallgrass Prairie was 86% prairie, including wet prairie and shallow marshes, and approximately 14% timber, with less than 1% swamp (USDA Forest Service, 2002). The boundaries between the timbered and prairie areas fluctuated based on precipitation. During dry years, fire would destroy the smaller oaks and hickories and grassland areas would increase. During wet years, oak and hickories would start to expand into grasslands, and the timbered area would increase.

Since the original survey, parts of the Midewin National Tallgrass Prairie landscape became degraded by the growth of non-native plants, fire suppression, agricultural practices, and development. While the Prairie Creek 1 site supported scattered mature oaks (*Quercus spp*.), hickories (*Carya spp*.), and black walnuts (*Juglans nigra*) in the upper canopy, it was overwhelmed by non-native woody shrubs, principally common buckthorn (*Rhamnus cathartica*), amur honeysuckle (*Lonicera maackii*), and multiflora rose (*Rosa multiflora*). Green ash (*Fraxinus pennsylvanica*) and box elder (*Acer negundo*) also were prevalent and heavily shaded the ground. To rehabilitate the Prairie Creek 1 Project Area to a savanna similar to pre-settlement conditions, non-desirable woody vegetation was scheduled for removal. Prior to the removal, the site was divided into an eastern experimental side and a western control side so that changes in soil moisture, ground water levels, and vegetation could be compared before and after the planned restoration.

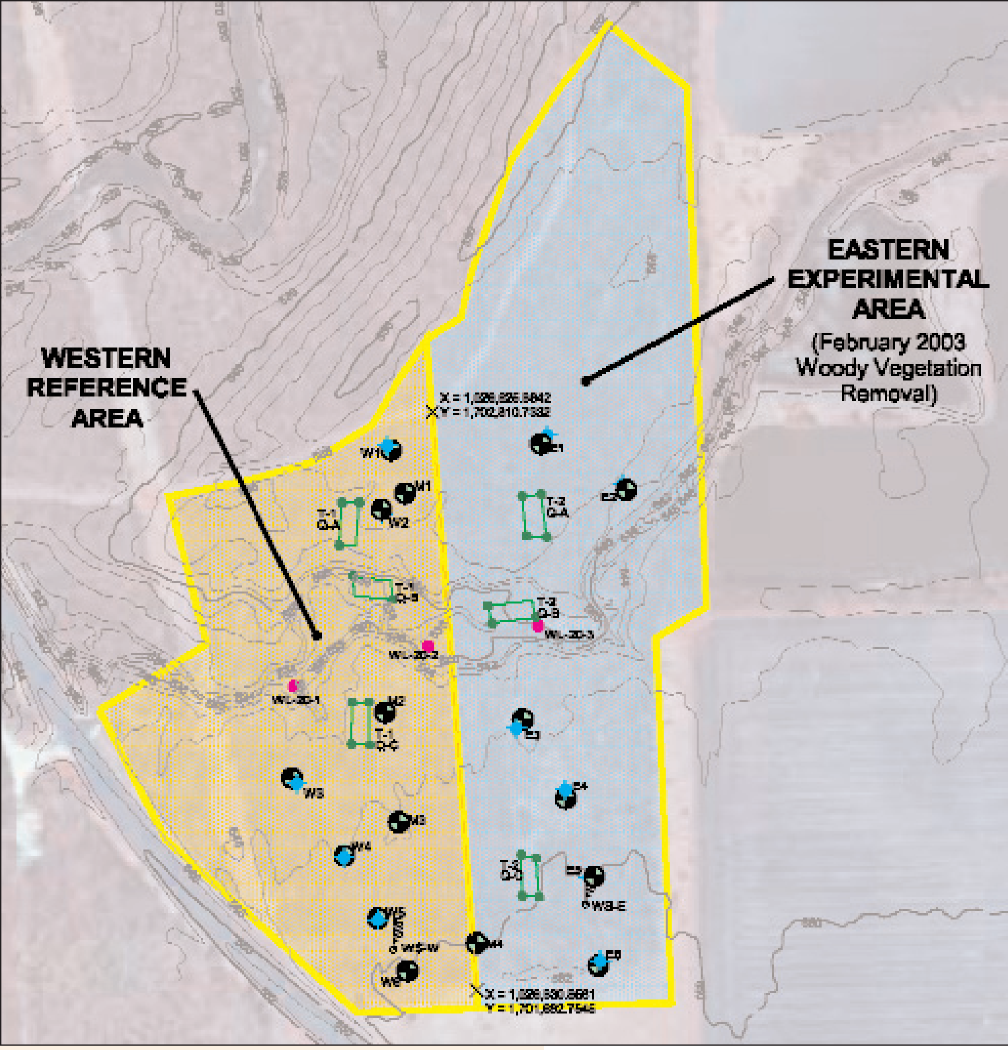

Figure 1: Site map showing the locations of the vegetative monitoring, weather stations, ground water wells and soil moisture monitoring stations.

The impact of woody invasive species on the water table has been noticed empirically by land managers for many years. For example, Wayne Lampa, formerly of The Forest Preserve District of DuPage County, has personally witnessed the return of a fen after the clearing of buckthorn. (Wayne Lampa, pers. comm. 2001). However, the impact of phreatophytes[3] on the water table in natural areas in the Chicago region has not been rigorously documented, although the implications of their effect on the ground water to sustainable ecosystems could be profound.

The impact of woody invasive species on hydrology was documented in a study conducted by Bosh and Hewlett (1982). The result of 94 basin experiments on the impact of vegetation removal in basin surface water yield were reviewed and analyzed. It was their conclusion that changes in basin yield, as measured by stream flow, were predictable at a reasonable level of accuracy. Of the 94 basin experiments reviewed, 93 had increased water yield with reduction in forest vegetation. The authors inferred that there was a generally increasing trend in effect from grass, to brush, to deciduous hardwoods, to coniferous forest resulting from cover manipulations. Since the surface water components of the water balance were altered by vegetation removal, it was reasonable to infer that soil moisture and ground water levels would also change with changes in vegetation.

Objectives and Methods

The objective of the investigation was to determine if removal of invasive woody vegetation resulted in measurable differences in soil moisture and ground water levels. Based on an inspection of site conditions that included vegetation, topography, drainage patterns, and proximity to the stream,

[3] *Phreatophytes are common in riparian habitats. Term literally means water-loving plants.*

the project area was considered to be sufficiently homogenous to allow for subdividing the project area. Members of the investigative team divided the project into an eastern experimental area and a western reference area based on similar site conditions and total acreage. Transect lines were positioned with monitoring points in both the undisturbed area (western reference half) and in the proposed area of initial woody plant removal (eastern experimental half). The investigative activities consisted of detailed soil mapping, a vegetation inventory, and the establishment of two north-south transect lines to monitor meteorological conditions, soil moisture, and ground water elevations prior to removal of the non-desirable woody vegetation (Figure 1).

The monitoring equipment was installed within the Prairie Creek 1 Project Area during June-July 2002. Sixteen ground water monitoring points were installed along the two north-south transect lines and a center dividing line. Three data logging shallow ground water well points were installed near the edges of the creek within the study area. Twelve soil moisture monitoring stations were installed along the two north-south transect lines. Each soil moisture station was equipped with three probes to record moisture content within different soil horizons. Two portable weather stations were also installed within the project area. One weather station was located in the eastern experimental area and a second weather station was positioned in the western reference area.

Six different soil series have been mapped within the limits of the Prairie Creek 1 Project Area by the United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS 1980). These soil series include the Drummer, La Hogue, Milbrook, Plainfield, Roby and Rodman. A detailed soil survey was completed within the study area during June 2002. The purpose of the soil survey was to confirm the presence of the soil series previously mapped on the site by the NRCS and to ascertain the level of variability within the mapped units. In addition, soil samples were collected from twelve soil moisture-monitoring locations. Twenty soil borings were advanced to varying depths ranging from 30 to 60 inches below ground surface. The varying depth of each boring was due to auger refusal caused by high percentages of coarse fragments (gravel and cobbles) within the soil profile. In addition, two soil pits were excavated to depths of 50 and 43 inches.

Results

The initial vegetation survey documented baseline data that may be useful to monitor changes in the structure and composition of the plant communities. The brush-cutting activities selectively removed the green ash and box elder, leaving behind oaks and hickories, as well as the shrubs amur honeysuckle, multiflora rose, and common buckthorn. During monitoring visits to the brush cut area in 2003, several young oak seedlings were observed to have germinated following the reintroduction of light and available soil moisture.

The results of the detailed soil survey indicate that changes to the existing NRCS soil map were warranted based upon a detailed field investigation. Primarily, these changes involved "lumping" the project area's differentiated soil-mapping units in the general concept of a Roby fine sandy loam. This was done even though the textures of the soils described on the site have a higher clay content than that defined within the range of characteristics for the Roby series. More importance was placed on the drainage condition, landscape position, and soil color in interpretation of

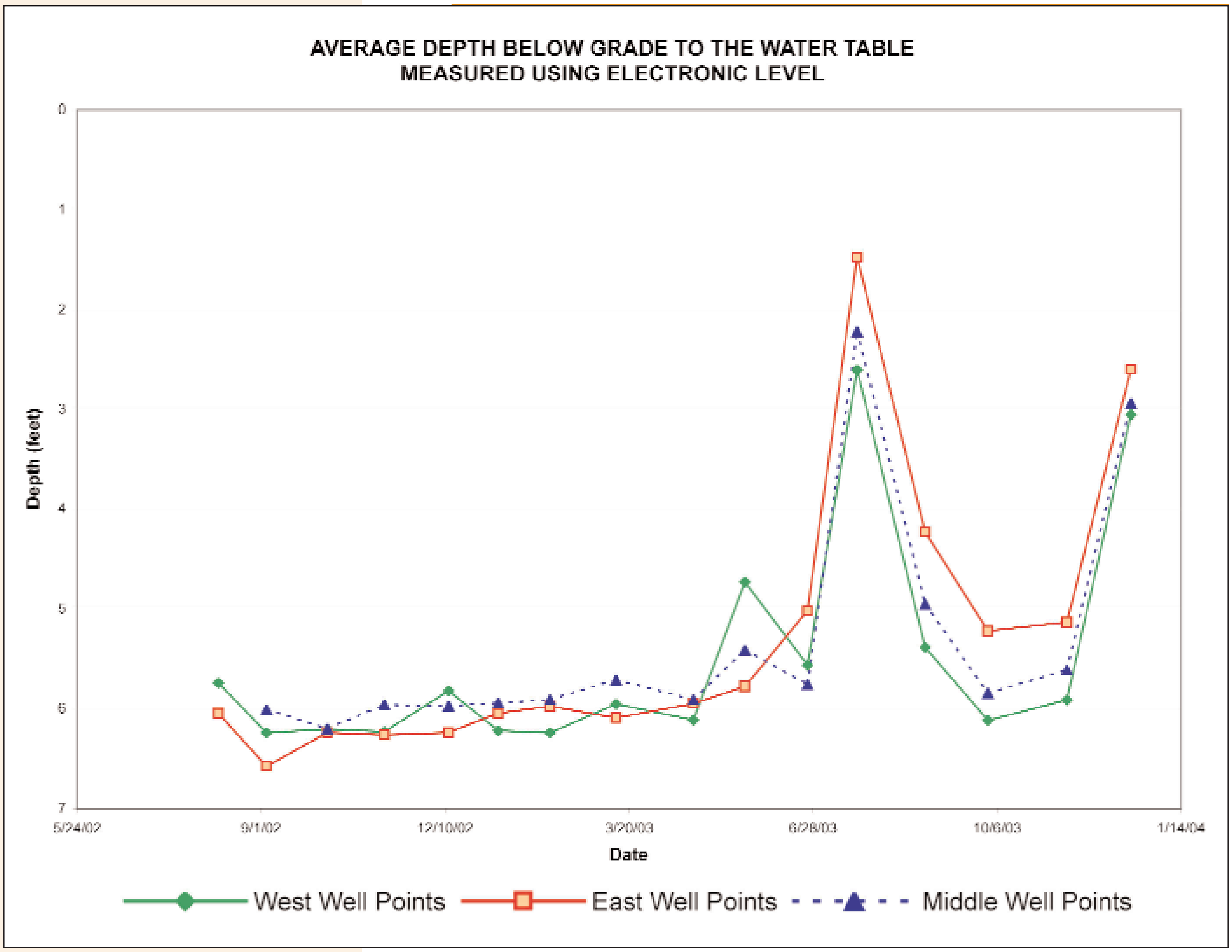

Figure 2: Average depth to the water table below ground surface in the treated side wells, control side wells and wells midway between. Water levels were notably different after treatment during the active growing season.

appropriate soil mapping. Slight changes have been made to the limits of the Drummer mapping unit as well. However, the major changes in this mapping unit were made so that its boundaries more accurately follow the floodplain. The soil moisture probes located in the eastern experimental area and western reference area are within similar soil series and both areas can be classified as Roby fine sandy loam. Potential changes in soil moisture between the eastern and western portions of the study area should be closely related to changes in vegetative cover and not influenced by varying soil series.

Ground water levels were from 5.5 to 6.5 feet below ground surface for August 2002 through April 2003. Water levels generally declined throughout the summer and fall, and began to rise in early winter. Before woody vegetation removal and during the early part of the growing season, the water depths in the eastern experimental area were not statistically different from the western reference area. However, during the second year, from July 2003 through November 2003, water levels in the eastern experimental area monitoring wells appeared to reflect the effects of the removal of the woody vegetation (Figure 2). The ground water levels within the eastern

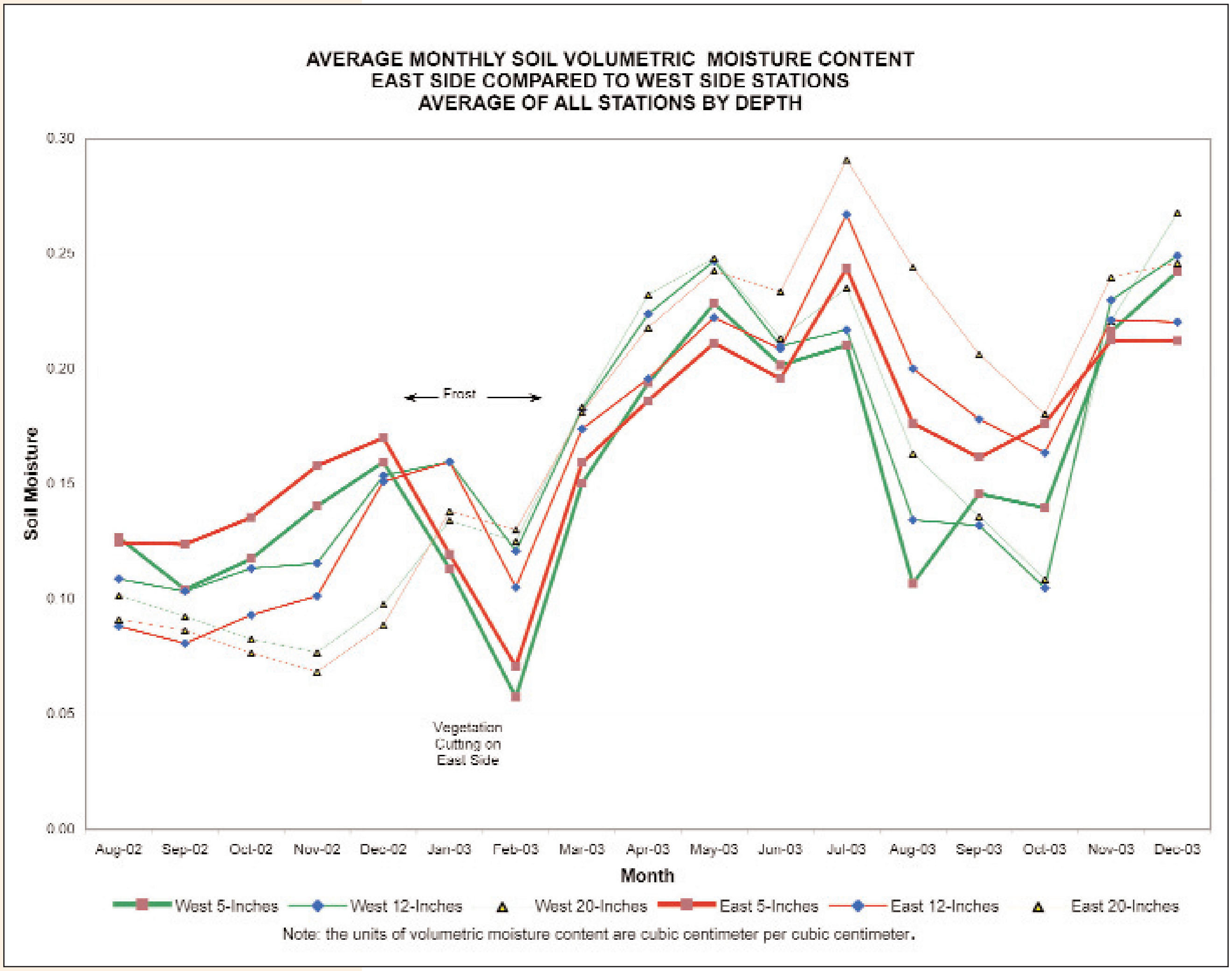

Figure 3: Monthly volumetric soil moisture content averaged by depth. The treated and control side averages were not significantly different before vegetation treatment. Following invasive removal, the averages were statistically different during the latter half of the growing season.

experimental area wells were consistently higher than the ground water levels within the western reference area wells, and were statistically different at greater than a 95 percent confidence level. Water elevations recorded during the 2003-growing season from the eastern experimental area were approximately 6-14 inches higher when compared to the western reference area for the same timeframe. Prior to woody vegetation removal, there was not a consistent pattern to the relative water levels. Following the onset of vigorous summer growth and elevated levels of evapotranspiration in July, the eastern well average was always highest, the middle wells average was intermediate, and the western well average was the deepest.

The monthly average volumetric soil moisture contents were calculated for each probe. The eastern and western data sets were compared statistically using the Student's t-Test. The statistical comparisons were calculated for the months of August through November in both 2002 and 2003 and showed statistically significant differences in the eastern and western data sets in three of the four months during 2003. The average monthly soil volumetric moisture contents were similar before the vegetation cutting and during the winter and spring following the cutting (Figure 3). When compared by probe depth, both sides displayed similar patterns of soil volumetric moisture content. In summer and early fall of 2003, following the woody vegetation removal there were marked differences between the east and west sides. For all the probe depths, the average monthly soil moisture contents were higher on the eastern side than on the western side. In late fall 2003 the moisture levels were again similar.

In summary, statistical comparison of the 2002 eastern experimental area to the western reference area monthly average volumetric soil moisture data resulted in either inconclusive or statistically similar data sets. The monthly average volumetric soil moisture contents during the growing season in 2003 confirmed dissimilar conditions in August, September and October. Following the 2003 growing season and the reduction of transpiration in November the monthly average volumetric soil moisture contents were similar at a statistically significant level of 90 percent.

From the above data, it can be inferred that the 2002 soil moisture regimes on the eastern experimental area and western reference area sides were somewhat similar. However, by the end of the growing season in 2003 there were statistically significant differences between the two sides with increased soil moisture content documented within the eastern experimental area during the months of August–October. Therefore, it can be inferred that the observed change in soil moisture content can be directly correlated to the removal of the woody vegetation from the eastern experimental area.

On-site meteorological conditions were altered with removal of woody vegetation from the eastern experimental area during February 2003. Temperature, solar radiation, and peak wind speeds increased within the eastern experimental area when compared to the western reference area. Decreased relative humidity was recorded within the eastern experimental area and was attributed to increased wind speed, solar radiation, and a decrease in canopy cover and shrub species. The recorded change in meteorological conditions within the eastern experimental area between the 2002 baseline data and 2003 monitoring data was directly related to removal of the non-desirable woody vegetation.

Conclusion

The magnitude of the change in soil moisture suggests that woody invasive species may seriously reduce the water available to other plants. This adds to the long list of reasons for the removal of invasives from remnant lands. It also suggests that invasives on adjacent degraded lands may cause off-site drawdowns in the water table of the remnant. Buffers may need management at the same level of intensity as remnant lands in order to prevent these subtle but potentially very destructive changes.

Another interesting implication is that the distinction used by regulatory agencies between "restoration" and "enhancement" may be specious. "Restoration" typically refers to the restoration of hydrology, while "enhancement" applies to vegetation management. It appears that vegetation management is, in fact, as much hydrologic restoration as is a more mechanical action such as ditch filling or tile removal.

Although the study evaluated the changes over a limited range of soil conditions, it is anticipated that woody vegetation removals in other soil types would affect the soil moisture and ground water levels as well. The magnitude of the change is anticipated to vary, in part, with the material properties of the soils and the density of the vegetation removed.

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Valuing Ecosystem Services in the Chicago Region

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What is the economic value of services provided by natural ecosystems in the Chicago region and what are the potential costs incurred when they are lost? Ken Bagstad explores these questions by using economic tools and land cover maps to calculate the overall monetary value of ecosystem services in the Chicago region.

Abstract
Natural ecosystems provide critical economic value to the human economy, yet their full value is rarely appreciated. In this study, economic value transfer methods were used to estimate the value of ecosystem services associated with mapped land cover types. Natural ecosystems are conservatively estimated to contribute $1.69 billion per year in economic value to the six-county Chicago region. Based on recent rates of land use change, approximately $53 million (2.7% of the region's total) in economic value provided by ecosystems is lost yearly to poorly-planned growth. Ninety municipalities in the region were classified as facing extreme pressure on their natural resource base, with "critically endangered", "endangered", and "threatened" natural capital, based on high rates of population growth and ecosystem service values per square mile. Implications of these findings for regional conservation efforts are discussed.

Introduction: Why value ecosystem services?
The objective of this study was to estimate the value and distribution of natural capital in the Chicago region. The Green Infrastructure Mapping Project concluded "the region's green infrastructure…has immense economic value…provid(ing) millions of dollars worth of benefits to the region each year" (Center for Neighborhood Technology 2006a). This study is a first attempt to quantify these benefits. Data were summarized by counties, municipalities, and for protected areas in the six-county region (Cook, DuPage, Kane, Lake, McHenry, and Will counties). As the first study of its type, this overview will provide a baseline for further studies in ecosystem service valuation in the Chicago region and other parts of the Midwest that face similar land use pressures.

Development decisions take place daily, yet rarely include a full accounting of their economic costs and benefits. Planners and economists list many external costs of poorly planned development—excessively expensive infrastructure, increased air pollution, and loss of farmland and open space (Esseks et al. 1999; Burchell et al. 2005). However, the costs of lost ecosystem services associated with the depletion of open space have only recently been appreciated (Farber 2005). Wetlands, forests, and other ecosystems form part of humanity's endowment of natural capital, which provides ecosystem services that interact with built, human, and social capital to provide human well-being. At the global scale Costanza et al. (1997) estimated the value of ecosystem services as at least $33 trillion annually. At the regional scale, the state of Massachusetts is losing $200 million per year in ecosystem services as a consequence of poorly planned development (Mass Audubon 2003). Kreuter et al. (2001) also found that urban growth around San Antonio caused declining ecosystem service values. If sprawling growth of the economic sector comes at such a high cost to natural capital, such growth may prove uneconomic in the long run.

Services provided by ecosystems vary widely; however, they are rarely traded in the open market, are non-excludible, and cannot be easily charged for, making it difficult to estimate their value. However, improved economic methods in recent decades have bettered our ability to assign value to non-market goods and services. These methods include avoided cost, replacement cost, net factor income, travel cost, hedonic pricing, and contingent valuation (Fausold and Lileholm 1999).

Valuing Ecosystem Services in the Chicago Region

Table 1. Annual ecosystem service values (per acre) by land cover type*

Ecosystem Service	Agricultural	Beach	Forest	Grassland/ Shrubland	Open Water	Riparian Buffer	Urban open space	Wetland
Climate regulation			$11.95	$19.88			$336.37	
Disturbance prevention		$27,276.10				$87.87		
Freshwater regulation				$20.16			$5.63	$5,957.20
Water supply					$408.85	$2,468.55		$1,161.26
Waste assimilation				$6.99				
Nutrient regulation								
Habitat refugium			$442.71			$3.19		$5.04
Recreation								
Aesthetic & recreational	$25.77	$14,847.26	$129.82	$0.03	$337.34	$1,369.89	$2,130.59	$1,571.32
Cultural & spiritual		$23.54				$3.98		
Soil retention & formation				$5.83				
Pollination	$8.24							
TOTAL	$34.01	$42,146.90	$584.48	$52.89	$746.19	$3,933.48	$2,472.59	$8,694.82

* Ecosystem service values of $0 are assigned to barren and urban land cover types.

Table 1

Although precise values are still difficult to assess, ignoring ecosystem service values in the economic decision making process can lead society to assign them an explicit value of zero. This typically leads to a decision to eliminate natural capital in favor of economic growth. By accounting for the economic value of natural capital, better decisions can be made about the desirability of sacrificing the economic value provided by ecosystem services.

Methodology

No past work has attempted to comprehensively estimate ecosystem service values in the Midwestern U.S., and a full valuation study of all land cover and ecosystem service types was beyond the scope of this project. As an initial effort to assess values for the Chicago region, I used value coefficients from an ongoing project at the University of Vermont to estimate ecosystem service values for the state of New Jersey (Table 1). Although clearly located within a different ecoregion, New Jersey has a roughly similar climate, growth pressures, and land use patterns as the Chicago region. It is important to note that many of these values are conservative estimates, and that although imprecise, the fact that no studies are available for many services (zero value assigned) means that overall ecosystem service values are more likely underestimated than overestimated. These studies were collected from across the U.S., with the most appropriate local values selected based on professional judgment.

Because of the local significance of prairie ecosystems and the lack of previous valuation work on grasslands, I attempted an initial valuation estimate for prairie land cover. To estimate the value of grassland/shrubland ecosystems, I used the aesthetic and soil formation values for pasture provided by the New Jersey study, and added values for soil carbon sequestration (using Chicago Climate Exchange estimates and values from more mature European carbon markets) and groundwater infiltration (using values provided for green infrastructure by Center for Neighborhood Technology 2006b).

GIS data used for this project came from the data archive from the *Natural Connections: Green Infrastructure in Wisconsin, Illinois, and Indiana* Web site (Center for Neighborhood Technology 2006a) and Illinois Department of Natural Resources' Geospatial Data Clearinghouse (Illinois State Geological Survey 2006).

The Green Infrastructure mapping project split land cover in the region into eight types, which I reclassified using GIS to create two additional classes—beaches adjacent to Lake Michigan and riparian buffers located within a 100-foot buffer of all streams. I calculated land cover by type for each county, municipality, and protected area within each county. Finally I multiplied the area of each land cover type by the dollar value per acre for ecosystem services to obtain dollars per year estimates, calculated in 2004 dollars. All dollar figures are flow values (value per year)—to obtain a one-time total (stock) value, a calculation of net present value would be required.

Results

Total economic value provided by the region's ecosystems

Using the approach described in the previous section, I estimate that ecosystems provide approximately $1.69 billion per year in economic benefits to the six-county region (Table 2). Extending this to a broader 14-county region of northeast Illinois, northwest Indiana, and southeast Wisconsin yields an economic value of approximately $4.3 billion, about 1% of the estimated Gross Regional Product (GRP), the sum value of goods and services produced, per year for the same area (World Business Chicago 2005).

Table 2. Land cover types in the Chicago Region

Cover type	Acres	Value per acre	Total annual value
Agricultural	638,366	$34.01	$21,710,811
Barren	7,887	$0	$0
Beach	203	$42,146.90	$8,548,712
Forest	276,563	$584.48	$161,644,476
Grassland/Shrubland	258,927	$52.89	$13,694,627
Open water	56,752	$746.19	$42,347,447
Riparian Buffer	29,625	$3,933.48	$116,530,069
Urban	719,896	$0	$0
Urban Open Space	359.400	$2,472.59	$888,647,746
Wetland	49,907	$8,694.82	$433,929,747
TOTAL	2,397,524		$1,687,054,635

Table 2

Distribution and protection of ecosystem services by county reveals interesting patterns (Table 3). Total value depends somewhat on land area; Cook County is the largest and also has the highest value for ecosystem services. Cover types also influence values, though, as Lake County's abundant open water and wetlands contribute to its high ecosystem service values. Roughly 5-12% of each county's area is protected as open space, with a total of 8.6% region-wide. Protected land contributes a disproportionately high value of ecosystem service values, though, with about 10-25% of ecosystem services per county (18% regionally) provided by protected land. Protected

Table 3. Total and protected lands ecosystem service values by county

County	Total value	Protected lands value	Percent natural capital protected	Percent land area protected	Protected lands value (large landholders)
Cook	$413,136,425	$104,531,954	25.3%	11.8%	$90,804,956 (FPDCC) $13,726,998 (CPD)
DuPage	$216,181,506	$47,040,957	21.8%	11.3%	$47,040,957 (FPDDC)
Kane	$153,230,287	$16,098,040	10.5%	5.3%	$16,098,040 (FPDKC)
Lake	$355,299,170	$58,704,566	16.5%	9.7%	$30,832,130 (FPDLC)
McHenry	$228,616,983	$22,413,293	9.8%	5.2%	$20,032,326 (MCCD)
Will	$320,590,263	$54,970,183	17.1%	7.7%	$21,513,362 (FPDWC)
TOTAL	$1,687,054,635	$303,758,992	18.0%	8.6%	

Table 3

lands contribute over $300 million per year in economic benefits; individual Forest Preserve Districts provide $16-90 million per year in economic value to the region. It is important to note that protected land estimates are all low, as GIS data were not available for many city parks, conservation easements, and other protected lands, and for some large protected areas including The Morton Arboretum and Fermi National Accelerator Laboratory.

Ecosystem services at the municipal level

Ecosystem service values were also calculated for 286 cities, villages, and unincorporated Census Designated Places (CDPs) within the 6-county region. Due to its sheer size, Chicago had the greatest annual value of ecosystem services with over $48 million. Other municipalities with high annual ecosystem service values are clustered along the Fox and Lower Des Plaines rivers. Sixteen municipalities had values per year of over $10 million; another 40 had values per year of $5-10 million; while another 70 had values per year of $2.5-5 million.

Values can also be adjusted on a size (per square mile) and population (per capita) basis. Twenty-two municipalities had values in excess of $1 million per mi2; 50 had values of $0.75-1 million per mi2, while 95 more had values of $0.5-0.75 million per mi2 (average value $547,362 per mi2 per year). Generally, municipalities with the highest value per mi2 were found in northern Cook, Lake, and McHenry counties, largely due to their greater concentration of wetlands and open water. Small municipalities with abundant open space had the greatest ecosystem service values per capita. Four municipalities had per capita values of over $10,000; an additional 30 had values of over $1,000; another 38 had values of $500-1,000 per capita; and 50 more had values of $250-500 per capita (average value $129). High per capita annual values were generally found on the urban fringe in Will, Kane, McHenry, and Lake counties.

Municipalities with high per capita ecosystem service values get a large quality of life contribution from natural capital. Unfortunately, these are often the fastest growing municipalities where natural capital is being destroyed to accommodate growth. To find areas with a high risk of losing natural capital to poorly planned growth, I compared ecosystem service values per mi2 (excluding urban open space, which is usually protected as parks) to the Northeastern Illinois Planning Commission's 2030 population growth figures. I classified natural capital as "critically endangered" for municipalities undergoing extremely fast growth (greater than 100% gain in households from 2000-2030) and ecosystem service values (minus urban open space) of more than $250,000 per mi2. Twenty-four municipalities fit this designation. I classified another 40 municipalities as having "endangered" natural capital, with projected household growth of greater than 50% and ecosystem service values of more than $125,000 per mi2. Finally, I classified 26 municipalities as having "threatened" natural capital, where projected household growth was greater than 25% and ecosystem service values exceeded $125,000 per square mile . Not surprisingly, municipalities in fast-growing Kane, Lake, McHenry, and Will Counties are among the most endangered in terms of natural capital, especially those with abundant wetlands and open water along the Fox and Lower Des Plaines Rivers (Figure 1).

Recent land use change: effects on ecosystem services Chicago Wilderness' State of the Region Report Card tracked land use changes from 1995 to 2000 in the six-county region. Major changes included loss of agricultural lands (22,849 acres), rural grassland (84,267 acres), and wetlands (56,799 acres). Land cover growing in extent included

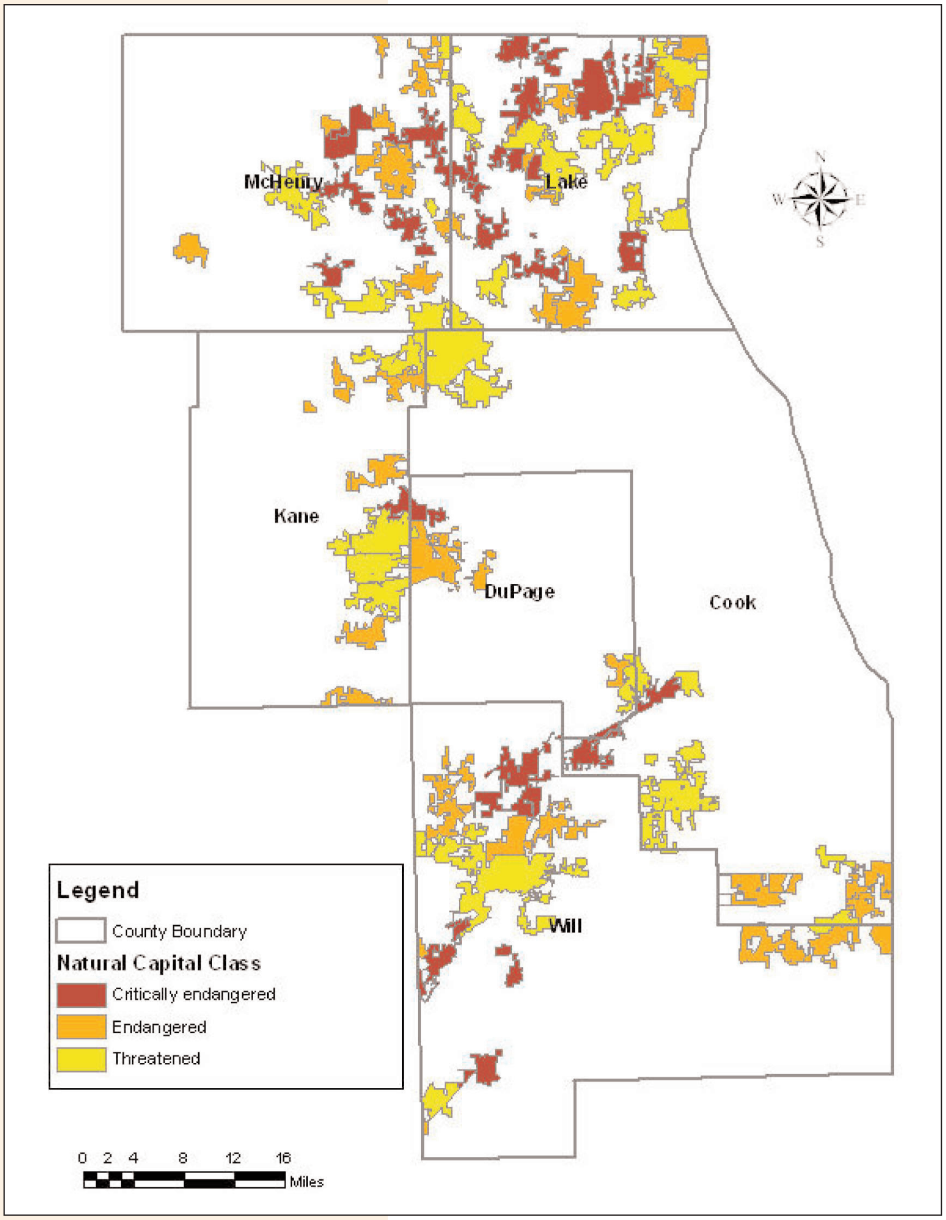

Figure 1: Threatened & endangered natural capital

urban (44,450 acres) and urban open space (93,989 acres). Using ecosystem service values, I estimate that the region lost $265 million in natural capital during this 5-year period, or approximately $53 million each year. This decline from $1.95 billion to $1.69 billion amounts to a loss of 13.5% of the region's natural capital over just five years, an average loss of 2.7% per year. If these trends continue, loss of natural capital will continue to reduce the region's economic, social, and environmental well-being.

Discussion: Study limitations and future research

Several limitations should be noted when interpreting this study's results. First, economic value figures are most useful when considering small versus large scale land use changes, as large changes in quantity of open space lead to a change in scarcity and value regionwide. Also important is the need for more ecosystem- and regionally-appropriate valuation studies. To improve the economic value transfer methods used here, future research should estimate values based on Midwestern ecosystems, demand characteristics, and land use patterns, rather than relying on the data from other parts of the country. Several Chicago-based studies, including Croke et al. (1986), Kosobud (1998), and Coursey and Noonan (2000) are a starting point in providing local ecosystem service values. For example, Coursey and Noonan (2000) estimated an annual value of almost $250 million in enhanced housing values and $80 million in recreation (2004 dollars) from Forest Preserves in the Palos-Orland region alone. Additionally, grassland/prairie ecosystems are "undervalued" in the economic literature; given their local importance, additional studies of their economic value would greatly improve these estimates.

Other research is needed to show more precisely how ecosystem services vary by context. Degraded or fragmented ecosystems are expected to provide more limited functions and values than pristine systems, so research into how ecosystem health relates to ecosystem service value provision would be useful. The relationship between scarcity, demand, and willingness to pay for ecosystem services is also poorly understood. An improved understanding of how scarcity or abundance of natural capital, affluence, and lifestyle influence valuation of ecosystem services would produce a more realistic picture of how ecosystem services are distributed across the landscape from urban to rural communities. Lastly, expanding this research into the next ring of collar counties would be valuable since they face growing development pressures and the prospect of liquidating their natural capital in the near future.

Implications for regional conservation

Two important conclusions are suggested by the findings of this study. First, economic value measured in the billions suggests that society badly under funds conservation efforts relative to their importance. Second, although ecosystem services contribute only about 1% of the region's total economic activity, this 1% forms the foundation on which the entire economy depends. As a mental exercise, try to imagine running the regional economy with no raw materials (soil, ground and surface water, construction materials), no sinks (air, water, or land) to safely dilute waste, no agricultural production, no flood control from rivers and wetlands, no recreational opportunities from Lake Michigan or other open space. Although small compared to the "conventional" size of the region's economy, ecosystem services contribute enormously to the region's quality of life.

Stakeholders in proposed developments should be aware of the concept of ecosystem services in debating a project's benefits and costs. While small developments may not impact a high dollar value of ecosystem services, the cumulative impacts of large projects can be great. For example, highway expansion projects can consume thousands of acres of land through direct construction and accompanying development. When these projects value ecosystem services at zero, the outcome is economically inefficient.

Government and regulatory agencies at all levels should be aware that as open space disappears, valuable ecosystem services and residential quality of life are lost. Municipalities that sacrifice natural capital may face higher tax rates as governments are forced to spend money on costly structural replacements ("gray infrastructure"). Municipalities seeking to protect natural capital have several alternatives. The cost of lost ecosystem services could be passed on to developers in the form of an impact fee (a "stick" approach). Alternatively, a "carrot" approach, such as density bonuses or an expedited permit process could be used to reward efforts to preserve or enhance open space (e.g., through conservation development). By careful inventory of open space, value provided to residents at the municipal level can be assessed. Chicago and Schaumberg have taken the lead in this respect, producing the *Chicago Nature and Wildlife Plan* and *Schaumburg Biodiversity Recovery Plan*, respectively (City of Chicago 2006; Applied Ecological Services 2004). Ultimately governments that account for and protect natural capital, and citizens who demand that they do so, will improve quality of life for residents, balancing economic development with the basic human and environmental benefits provided by nature.

Chicago Wilderness' Green Infrastructure Vision has recommended protection of 1.8 million acres of open space in the region in the coming decades, a substantial increase over the 360,000 acres currently protected (Dreher 2004). The value of ecosystem services and natural capital should be considered in building support for this goal. The initial cost to acquire and restore such huge acreages of public and private lands is likely to be high, but given the enormous value provided by ecosystem services, and the risk of their loss in the face of inaction, it can be seen as a very reasonable investment.

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Trees used by Foraging Migrant Birds

Doug Stotz, The Field Museum
Judy Pollock, Karen Glennemeier, Audubon Chicago-Region
Jody Zamirowski, Study Participant

Can you guess which trees migrant birds in the Chicago area like to visit? See if you're right, and learn more about the habits of migrant birds, in this article by Doug Stotz, Judy Pollock, Karen Glennemeier, and Jody Zamirowski.

Background

The Migrant Bird Habitat Study was designed to determine the tree preferences of foraging spring migrant birds as they pass through the Chicago region. A better understanding of how migrants use trees in the spring would help in understanding which plants most sustain birds during migration. Monitoring was done in both managed and natural settings so that the results could inform both urban tree planting initiatives and natural areas restoration projects.

The study was sponsored by the Urban Conservation Treaty for Migratory Birds partners. In 2000, the protocol was developed by a group of local scientists, including Doug Stotz of The Field Museum, Jim Steffen of the Chicago Botanic Garden, and Rickie White of Audubon Chicago Region. Scott Robinson of the Illinois Natural History Survey and Chris Whelan of the U.S. Forest Service served as advisors.

Thirty-one volunteers were recruited and trained to collect data at 18 different sites. Steve Frankel, of Audubon, and Suzanne Malec, of the City of Chicago Department of Environment, organized and trained the volunteers. Monitoring took place in April and May of 2001, 2002, and 2003. Doug Stotz and Karen Glennemeier analyzed the data in the winter and spring of 2004, with help from Fred Ramsey, Jeff Brawn, Jim Steffen, and Dave Ewert. Judy Pollock organized the project.

Objectives

Migrant birds pass through the Chicago region, relying most heavily on insect and/or nectar for food. The timing and species composition of migrants varies across the region. Due to the earlier warmer spring weather in Chicago's lakefront microclimate, migrant birds tend to appear in lakefront areas earlier than in inland areas. This study identifies the attributes of highly used stopover sites and can guide efforts to protect these important areas.

Field Methods

Monitors chose routes in either landscaped or wooded areas, using their prior knowledge to select a transect with a variety of trees that would be likely to be used by numerous varieties of birds. The species and size of the trees were recorded for trees greater than 4 inches in diameter within five meters of the transect. This study did not consider shrubs, which are also an important resource for migrant birds, because of the difficulty of recruiting a large enough cadre of volunteers who could identify all the shrubs.

Volunteers were paired, one trained in tree identification and the other in bird identification. They walked the transect together, observing the birds in each tree. The volunteers made at least three visits per year in late April, early May, and late May and recorded: bird species and tree species for all migrant birds observed foraging in trees; growth cycle of all tree species (flowering, fruiting, budding, size of leaf, etc.); weather; time spent in the field; and site proximity to water.

Data Analysis

Data were analyzed by comparing the observed and expected frequencies with which birds were found in particular tree species. Analysis was done site-by-site and by combining all data.

Results

Foraging choice was observed for 1,925 individual spring migrants. The volunteers recorded 89 bird species in 44 tree species at 19 sites in the Chicago region. The most abundant tree species varied by site, but oaks made up 33 percent of the tree sample with red oak (*Quercus rubra*) being the most abundant. Trees used by individual bird species were compared, to identify any affinity certain bird species might have for particular tree species. Highly preferred tree species included the american elm (*Ulmus americana*), sugar maple (*Acer saccarum*), hawthorns, and bur oak (*Quercus macrocarpa*).

Tree species underutilized were consistent across sites. These include: norway maple (*Acer platanoides*), pin oak (*Quercus palustris*), eastern cottonwood (*Populus deltoides*), black locust (*Robinia pseudoacacia*), silver maple (*Acer saccarinum*), basswood (*Tilia americana*), and green ash (*Fraxinus pennsylvanica*). Exceptions to this are black locust which appeared to be used more heavily late in the season and ashes which seemed to be variable across year, site and season, without a clear pattern. Most consistently underutilized were basswood and silver maple. Buckthorn (*Rhamnus*) was rare at most sites and was typically underutilized.

The bird species found to use oaks most heavily included: Rose-breasted Grosbeak (*Pheucticus ludovicianus*), Blackburnian Warbler (*Dendroica fusca*), Bay-Breasted Warbler (*Dendroica castanea*), Palm Warbler (*Dendroica palmarum*), Baltimore Oriole (*Icterus galbula*), Blue-gray Gnatcatcher (*Polioptila caerulea*), Tennessee Warbler (*Vermivora peregrina*) and Black-throated Green Warbler (*Dendroica virens*). These are all forest breeders.

[4] *Note that the preferential use of Sugar Maple is due to data from one site from which 80% of the maple observations came.*

Species observed infrequently in oaks included: Wilson's Warbler, American Redstart, Yellow Warbler, Chestnut-sided Warbler, Magnolia Warbler, Canada Warbler, Ruby-crowned Kinglet, and Yellow-rumped Warbler. These are generally secondary habitat breeders.

From a regional conservation perspective the "oak preferring birds" are important, as they are not especially abundant and are more specific in their needs.

Two variables that appeared to affect bird tree selection included the blooming of the tree and the weather conditions. As spring progresses, trees leaf out and flower, with the timing of these changes varying from species to species. Migrant birds respond to these changes by altering the number of visits they make to a particular tree species. For example, oaks were observed to be used by migrant birds in greater numbers in May as the trees leaf out.

Weather conditions also impact tree use. When the weather is cool and windy, birds tend to concentrate near water and utilize surrounding shorter vegetation. Flowering trees are important early in the season and under poor weather conditions. Crabapples, ohio buckeye (*Aesculus glabra*), and horse chestnut (*Aesculus hippocastanum)* are flowering trees best used by migrants in this study. Various prunus (*cherries, plums,* etc.) and hawthorns are important as well.

Conclusions and Recommendations

A study by Gabbe et. al. in Southern Illinois found that two varieties of hickory (*Corylus*) and silver maple (*Acer saccharinum*) were the trees used most frequently by foraging migrants in floodplains in Southern Illinois. The results of this study suggest that as birds move north, they use different trees to forage in. One of the motivations for this study was the idea that birds may need different types of plantings in different areas, and the study supports that idea.

Timing of bird migration in the Chicago area is based primarily upon the need to reach breeding grounds when the maximum food supply is available to feed the young. Migration peaks in early May at the same time that dominant oaks in Illinois woodlands are leafing out. In the Migrant Bird Habitat Study, one of the strongest patterns noted was the high degree of variation across the migration period in which tree species were used most by migrants. This may be due to landscape-level influences or transect-specific factors. Weather conditions also affect foraging location. Planting a diversity of tree species is strongly supported by this study.

Planting and maintaining a diversity of tree species and structures is the best strategy for ensuring that plantings will most benefit migrating birds. Specific recommendations are as follows:

1. Elms and oaks appear to be the most important genera for migrant birds in the Chicago area. Trees that flower during the migration period, especially hawthorns, are also used heavily.
2. Other trees that are used heavily enough to recommend their inclusion in planting are: ashes, hickories, hackberry, and honey locust.
3. In natural areas management, the most important recommendation is to reverse the maple takeover in our natural areas by restoring woodland health so that oak reproduction can occur.
4. In creating or enhancing plantings for migrant habitat, plan for a high diversity of

trees. In general, the more kinds of trees at a site the more options that migrant birds will have in response to variable and unpredictable conditions.

5. Use maples and lindens sparingly for purposes of attracting migrant birds in spring.

Recommendations from other Great Lakes area studies that may also be appropriate for our region and that were generally supported by our observations during the study:

1. Forested riparian corridors are important habitat for migrant birds.
2. As much as possible, plantings should be designed to provide different layers of vegetation, including a shrub layer (below 5 feet), a small tree layer (5-25 feet), and a canopy layer (25 feet +). The different layers attract a variety of species, and are used in different ways depending on weather conditions. Having the layers in close proximity allows the birds to move between layers easily.
3. Any wooded area within one mile of the lakefront is likely to be important for sustaining spring migrants, and riparian corridors anywhere in the Chicago Region will also likely play an important role.

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The complete study is available on line at
http://bcnbirds.org/greenpapers_files/migranthabitatstudy.pdf

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Do you have important research or a great success story that you believe your Chicago Wilderness colleagues would find interesting and useful? These guidelines explain what we're looking for and how to submit an article.

Chicago Wilderness Journal Guidelines to Authors

About the *Chicago Wilderness Journal*

Mission of the *Chicago Wilderness Journal*:

1. Facilitate the sharing of results and lessons learned from member-initiated projects and activities, including consortium-funded projects, team activities or the work of individual member organizations that would be useful to the wider membership;
2. Through easily consumable articles discuss practical implications, interpret data, and/or make recommendations about issues within the areas of science, land management, sustainability, education, and communication in the Chicago region;
3. Foster a sense of community among Chicago Wilderness members and improve members' ability to communicate with diverse audiences.

This journal is:

- A forum for sharing important results and lessons learned through biodiversity conservation work,
- An interdisciplinary publication that features a mix of articles in each issue from the fields of science, land management, education, communication, and sustainability,
- An online journal, published three times a year, guided by an editorial board made up of Chicago Wilderness members and consortium staff.

This journal is not:

- A peer-reviewed journal,
- A forum of advocacy or political positions,
- A newsletter with event announcements,
- A means of presenting biodiversity issues to the general public.

What we're looking for in an article

Submissions will be considered from the volunteers and employees of Chicago Wilderness member organizations, and from participants in Chicago Wilderness Teams and projects. Articles should report on the results of a Chicago Wilderness project, workshop, roundtable, or the results of such work performed by an individual Chicago Wilderness member organization. While the emphasis of this publication is on Chicago Wilderness members and affiliates, submittals from outside the membership that are relevant to the Chicago Wilderness audience will also be considered. The topic should pertain to biodiversity conservation in this region. Articles should emphasize the lessons learned and interpretation of data, rather than methodology or simply reporting of results.

Questions to answer in the article include:
- Why did you undertake the project and what did you do?
- What did you learn from the experience? What do your results tell you?
- What are the practical or applied implications of the work—both in your field and in other fields?
- Based on what you learned what do you recommend to Chicago Wilderness members?

Note that articles don't necessarily need to tell a success story; if valuable lessons were learned from an unsuccessful project, please consider submitting an article.

Target audience

The target audience for this journal is the volunteers and employees of Chicago Wilderness member organizations, and participants in Chicago Wilderness Teams and projects. To meet the needs of this broad audience, articles should:
- Emphasize practical implications,
- Be easy to read and interesting, not overly technical and full of jargon,
- Be short but refer to additional sources of information for interested readers,
- Help readers feel connected to other Chicago Wilderness members,
- Offer readers information and resources that will help them carry out their jobs.

Article format

Please submit your article as a Microsoft Word or WordPerfect file. Articles should be three to five pages in length (approximately 450 words per page). Pictures and graphics are welcome and encouraged, but the editorial staff will make final selections! Graphics files can be submitted at 72 dpi, actual size or larger. JPG files are the preferred format for graphics. The journal can accommodate sidebars, so please indicate if there are quotes or charts that you would like set out from your article.

All articles must include the following components:
- A short abstract of several sentences that will quickly capture the reader's attention,
- A description of the work you did and why you did it,
- Results and implications for Chicago Wilderness partners.

Beyond these requirements, articles may follow a variety of outlines as suggested by these examples:

Traditional scientific research format:
- Abstract
- Objectives
- Methods
- Results and Discussion
- Conclusion/Recommendations/Implications
- References

Report on outcome of a workshop:
- Abstract
- Rationale for workshop; reasons to learn more about topic
- Main points made at workshop
- Insights gained from talks and discussions
- Conclusions and final recommendations

Description of the development of educational tool or product:
- Abstract
- Rationale for project
- Brief description of final product (e.g. curriculum, model policy)
- Lessons learned from development process
- Recommendations to others attempting similar work
- Recommendations on use of product

Submission procedures

Authors can submit either an article or a query to Catherine Bendowitz at cbendowitz@chicagowilderness.org. Queries should include a thorough abstract of the intended topic. Articles and all accompanying graphic files should be submitted electronically to Catherine. Be sure to include the author's contact information. Submissions can also be saved on a disc and mailed to Catherine at 8 South Michigan Ave., Suite 900, Chicago, IL 60603.

Although articles will be accepted on an ongoing basis for consideration in all upcoming issues, a rough schedule of deadlines follows:
- For March issues: first drafts will be due the second Friday of the preceding December,
- For July issues: first drafts will be due the second Friday of the preceding April,
- For November issues: first drafts will be due the second Friday of the preceding August.

Authors are welcome to submit articles that have already been published, as long as the article contains specific implications for Chicago Wilderness, and the author observes copyright law and has obtained the appropriate permissions for reprinting. If your submission has been published elsewhere, please indicate where and when it was published so we can note this in the journal.

The journal's editorial board recommends that if possible, authors should work with their internal PR departments for assistance in translating specialized information into material that is accessible to a more general audience. In addition, members of the journal's editorial board will partner with authors to adapt the style and format of articles to be most useful to the broad Chicago Wilderness audience.

For more information, contact Catherine Bendowitz at (312) 580-2137.

About the *Chicago Wilderness Journal*

The CW Journal is published by the Chicago Region Biodiversity Council (Chicago Wilderness) on its web site (www.chicagowilderness.org) three times per year: in March, July, and November.

An editorial board composed of scientists, sustainability professionals, education, and communication specialists from Chicago Wilderness member organizations guide the production of each issue in accordance with the mission of the journal and the goals of Chicago Wilderness. The opinions expressed in this journal, however, are solely those of the authors.

Mission of the Chicago Wilderness Journal:

1. Facilitate the sharing of results and lessons learned from member-initiated projects and activities, including coalition-funded projects, team activities or the work of individual member organizations that would be useful to the wider membership;
2. Through easily consumable articles discuss practical implications, interpret data, and/or make recommendations about issues within the areas of science, land management, sustainability, education, and communication in the Chicago region;
3. Foster a sense of community among Chicago Wilderness members and improve members' ability to communicate with diverse audiences.

For information about how to submit articles please refer to the Guidelines to Authors posted on the journal's home page. For other inquiries about this publication, please contact Catherine Bendowitz at cbendowitz@chicagowilderness.org

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