Biodiversity
RECOVERY PLAN

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CHICAGO WILDERNESS™
A Regional Nature Reserve

Preface

This plan is the result of efforts by more than 200 people who participated in preparing background papers and in workshops to address scientific and policy issues. These have included taxonomic workshops that focused on groups of species (mammals, birds, amphibians, etc.) and ecosystem types (forests, prairies, wetlands, etc.) The plan has also been shaped by the work of the various Chicago Wilderness Teams (Science, Land Management, Education and Communications, and Policy and Strategy), as well as a wide variety of other workshops including the recovery plan review session during the 1999 Chicago Wilderness Congress.

While no portion of the plan is the product of any one person, members of the Recovery Plan Task Force served as editor / writers for one or more chapters or major chapter segments. Laurel Ross, of The Nature Conservancy, John Paige and Irene Hogstrom of the Northeastern Illinois Planning Commission (NIPC), Kent Fuller of the U.S. Environmental Protection Agency, Tim Sullivan, Keith Winsten and Elizabeth McCance of the Brookfield Zoo, Ders Anderson of the Openlands Project, Susanne Masi of the Chicago Botanic Garden and Jim Anderson of the Lake County Forest Preserve District and the Chicago Wilderness Science Team all served in this capacity. Steve Packard of the National Audubon Society provided valuable comments throughout and John Oldenberg of the DuPage County Forest Preserve District provided essential input on the perspective of Forest Preserve Districts.

Larry Christmas of NIPC created the first integrated draft of the plan. Barbara Hill served as technical editor. Special recognition is due to Elizabeth McCance and Tim Sullivan for their tireless work in organizing the many science workshops and the resulting work products. Also, recognition is due to Wayne Schennum of the McHenry Conservation District for his valuable contributions to virtually all of the science workshops together with his integrative perspective.

Initial funding for development of the recovery plan was provided through grants from the U.S. Environmental Protection Agency. Additional funding was provided by the Illinois Department of Natural Resources, the U.S. Forest Service, and the U.S. Fish and Wildlife Service. Matching funds were provided by the Illinois Chapter of the Nature Conservancy, NIPC, and the Brookfield Zoo.

A major strength of this plan lies in its creation through a participatory process that assembled a broad based consensus of expert opinion. If it is to remain valid and become implemented, it must continue to be refined, to grow, and to incorporate new information as it becomes available.

For up-to-date information on Chicago Wilderness activities and programs, visit the Web site at www.chicagowilderness.org.

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Table of Contents

Appendices

Tables and Figures

Chapter 1

Executive Summary

Chicago Wilderness and Its Biodiversity Recovery Plan

1.1 Introduction

1.1.1 Chicago Wilderness: who we are, what we are accomplishing.

“Chicago Wilderness” refers to nature and to the people and institutions that protect it. Chicago Wilderness is 200,000 acres of protected conservation land—some of the largest and best surviving woodlands, wetlands, and prairies in the Midwest. It is also the much larger matrix of public and private lands of many kinds that support nature in the region along with the people who protect and live compatibly with it.

Native Americans were part of the natural ecosystem here for thousands of years. Today, thousands of volunteers and hundreds of scientists, land managers, educators, and others are crucial to the survival of our natural ecosystems, as is the “Chicago Wilderness” work of the 88 member organizations. The geographic area covered by the Chicago Wilderness region includes northeastern Illinois, northwestern Indiana, and southeastern Wisconsin. The coalition’s membership includes local governments, state and federal agencies, centers for research and education, and conservation organizations.

The boundaries of the Chicago Wilderness region capture a spectacular concentration of rare ecosystem types. These ecosystems harbor a high diversity of species, including a large number of those listed as threatened or endangered in the states of Illinois, Indiana, and Wisconsin. Indeed, outside of the Chicago Wilderness region, levels of diversity drop off sharply. Boundaries of the watersheds containing the natural communities helped to define the region, as did the large concentration of natural preserves in the metropolitan area.

Many of the surviving natural communities of the Chicago region are of national and global significance for conservation. The region is blessed with both richness and opportunity for its conservation. Yet research indicates that we are experiencing a steady decline in both native species and communities. For example:

- In a review for this plan, the Chicago Wilderness Science and Land Management Teams found that more than half of the major community types of the region were at the highest level of conservation concern due either to the small amount remaining or to the poor ecological health of the remaining examples.
- A 1995 survey of DuPage County forest preserves revealed that 80% of its natural areas had declined to poor health (Applied Ecological Services 1995).
- A region-wide 1998 study by the Morton Arboretum (Bowles et al. 1998b) documented a significant change over the past 20 years in forest structure, including a decline in density and richness of shrub species, a loss of mid-size oaks, and an increase in smaller-size sugar maples. The study attributed these changes to increased shade owing to greater oak and maple canopy cover and, in some cases, to deer browsing.

While the community types in the region have in some cases almost vanished from the earth, this challenge is far different from other societal challenges we face in that we know what needs to be done to address it. The Chicago region’s farsighted leaders set up preserve systems that today support almost all of the species ever known to have occurred in the region’s vast prairies, savannas, woodlands, dunes, marshes, fens, and sedge meadows. Restoration ecology, a growing field for applied research, has provided proven techniques and tools to manage these fragmented natural areas. The Chicago region is a center of expertise and citizen involvement in the restoration and management of these rare natural communities.

The purpose of the Chicago Wilderness collaboration is to sustain, restore, and expand our remnant natural communities. Thanks to a great concentration of professional expertise and the contributions of thousands of volunteers, we have the ability to achieve this purpose, and in a cost-effective manner. In doing this, we are also enriching the quality of life for ourselves and our children. Now in its third year, our collaborative effort is starting to take larger strides to build something big, something that could some day transform this region into the world's first urban bioreserve, a metropolitan area where people live in harmony with rare and valuable nature.

1.1.2 What is meant by biodiversity and why is it important?

The terms *ecosystems, natural communities, biodiversity,* and *sustainability* are used throughout this plan. An ecosystem is the combination of living things and the physical systems (geology, topography, moisture, climate, etc.) within which they must live. A *natural community* is the mix of plants and animals found living together in a healthy ecosystem. *Sustainability* refers to our ability to enjoy and make use of natural communities in a manner that does not compromise future generations' ability to do the same.

Biodiversity is the totality of genes, species, and ecosystems in a region. For example, a healthy prairie community would normally include dozens of plant species as well as habitat for various species of birds, mammals, reptiles, amphibians, insects, mites, fungi, and bacteria. Within a region the size of the Chicago area, biodiversity can also be measured by the number and variety of natural communities that exist side by side in a given area, such as oak savannas, meadows, and wetlands. A high degree of biodiversity is normally an indication of a healthy, sustainable natural community, ecosystem, or region.

This plan identifies 49 different natural community types in the region. Of these, 25 are at least rare or uncommon at the global level, and as many as 23 are globally imperiled. Approximately 1,500 native plant species occur in the region, making the Chicago metropolitan area one of the more botanically rich areas, natural or otherwise, in the United States. This plan also finds that many of the region's animals, including grassland birds, woodland birds, savanna reptiles and amphibians, marsh reptiles and amphibians, prairie insects, and savanna and woodland insects, are globally important for conservation.

Around the world, people depend on biodiversity for the very sustenance of life. The living things with which we share the planet provide us with clean water and air, food, clothing, shelter, medicines, and aesthetic enjoyment, and they also embody our feelings of shared culture, history, and community. The nations of the world have signed a treaty calling biodiversity the common heritage of humankind and calling on all people to be custodians of the biodiversity found in their countries and regions.

In Chicago Wilderness, the value of biodiversity is not just at the global level, but most importantly for our own citizens. Natural communities and species are the basis of the region's environmental health. They provide ecological services in maintaining water quality, abating the impact of floods, supporting pollination of crops, and controlling outbreaks of pests. Equally important, biodiversity contributes immeasurably to the quality of life for the citizens of the region and to the region's long-term economic vitality. Recent polls and election results show that residents of the region strongly support protection of natural areas for the future. Only if we continue and expand upon the far-sighted conservation work of those who built the Chicago region, will we be able to pass these precious biodiversity values on to future generations.

Yet, there is overwhelming evidence that our projected development patterns and their unanticipated results will lead to diminishing economic benefits and degradation of the other services that we derive from our living resources. A further discussion of the benefits of preserving biodiversity and the implications of future growth in the region are contained later in the Recovery Plan.

1.1.3 What is the recovery plan?

The Biodiversity Recovery Plan is both a plan and a process guided by its many sponsors. It is intended as a living document, not a fixed roadmap, that will continue to evolve as new ideas and information arise. For that reason, it is a snapshot in time, presenting our best evaluation of the current situation and how we can address issues and capitalize on opportunities. The success of the plan depends on the responses of those who read it and incorporate its findings and suggestions into their own work. Likewise, its future usefulness depends on suggestions for improvement and new priorities from its readers.

The plan is intended to complement the many other planning efforts that are guiding the region toward a better and more productive future. Foremost among these are the plans of the three regional planning commissions; the Northeastern Illinois Planning Commission (NIPC), the Southeastern Wisconsin Regional Planning Commission (SEWRPC), and the Northwestern Indiana Regional Planning Commission (NIRPC). Other efforts are also contributing to the regional discussions, including the Campaign for Sensible Growth and the Metropolis 2020 Plan.

This recovery plan outlines the steps necessary to achieve the overall goal of the Chicago Wilderness collaboration. That goal, in summary, is *to protect the natural communities of the Chicago region and to restore them to long-term viability, in order to enrich the quality of life of its citizens and to contribute to the preservation of global biodiversity.*

To achieve this goal, the recovery plan identifies the following measurable objectives:

1. *Involve* the citizens, organizations, and agencies of the region in efforts to conserve biodiversity.

a. Obtain broad-based and active public participation in the long-term protection, restoration, and stewardship of the region's natural communities.

b. Strengthen local government support by communicating with and involving officials in planning efforts and conservation programs.

c. Build partnerships among organizations and agencies in support of biodiversity in the region.

d. Maintain and strengthen volunteer participation in stewardship and research.

e. Stimulate active private-sector involvement.

f. Integrate a broader range of stakeholders, including businesses and constituency organizations into biodiversity conservation efforts.

2. *Improve* the scientific basis of ecological management.

a. Increase knowledge of species, communities, and ecological relationships and processes.

b. Specify results to be achieved in biodiversity and increased sustainability, including reliable indicators, baselines, and targets.

c. Evaluate the results of restoration and management alternatives based on data in order to address those alternatives' effects on target species and communities.

d. Clearly identify conservation priorities.

e. Develop region-wide performance standards and monitoring techniques that can be implemented by land managers.

3. *Protect* globally and regionally important natural communities.

a. Identify priority areas and elements for protection based on an assessment of their contribution to conserving biodiversity at global and regional levels.

b. Protect high-quality natural areas in sufficient acreage to permit restoration and management for sustainability.

c. Maintain existing quality of publicly owned, high-quality natural areas.

d. Protect high-quality natural areas in private ownership.

e. Mitigate factors with negative impacts that occur outside of natural areas but within their watersheds or buffer zones.

4. *Restore* natural communities to ecological health.

a. Reestablish the ecological health of deteriorating high-quality natural areas.

b. Improve all natural areas, concentrating first on those that contribute most to global and regional biodiversity.

c. Provide corridors that link areas as needed.

d. Restore ecological processes that support sustainable systems.

e. Return natural communities to sufficient size for viable animal populations by restoring or recreating them. Fermilab and Midewin are examples.

5. *Manage* natural communities to sustain native biodiversity.

a. Attain greater capability for ecological management within public entities.

b. Encourage sharing of experience and resources among natural-area managers in different jurisdictions.

c. Monitor recovery progress and status of natural communities.

d. Demonstrate the feasibility of protection and restoration in fragmented, human-dominated landscapes, making use of such tools as prescribed burning, restoration of hydrology, and removal of invasive species.

6. *Develop* citizen awareness and understanding of local biodiversity to ensure support and participation.

a. Form educational partnerships among citizens, organizations, and agencies to promote awareness.

b. Build sufficient awareness of natural communities of the region and their global significance so that they become a recognized part of the culture of the region.

c. Develop educational programs to promote broad-based understanding of the global significance of the region's natural communities.

d. Design educational strategies to meet the needs of all audiences at all levels.

e. Reach those not traditionally involved with education in natural history or conservation.

7. *Foster* a sustainable relationship between society and nature in the region.

a. Integrate conservation of biodiversity into ongoing development and planning for land use, transportation, and infrastructure.

b. Encourage major land users to adopt practices that promote biodiversity and its sustainability by integrating the beauty and function of nature into our neighborhood, corporate, and public lands.

c. Encourage inclusion of biodiversity goals in local planning and implementation.

d. Identify and address factors that lead to sustainable use.

e. Regularly monitor indicators of biodiversity and sustainability throughout the region.

f. Support and encourage efforts of citizen scientists working to conserve biodiversity.

8. *Enrich* the quality of the lives of the region's citizens.

a. Enhance human health through improved air and water quality as well as protection from flooding by restoring and maintaining the ecological integrity of natural communities.

b. Increase opportunities for all citizens to experience the beauty and restorative powers of nature.

c. Identify strategies that promote economic growth while sustaining biodiversity.

1.1.4 Who are the plan's intended audiences?

One primary audience for the Recovery Plan includes the thousands of staff members and hundreds of thousands of members of Chicago Wilderness organizations. These organizations have accepted responsibility for helping to define and achieve the results contained in the plan.

Another primary audience is all persons who are responsible for making or shaping decisions that affect the region's land use, water-resource management, and biodiversity. Included here are local, state, and federal elected and appointed officials and private owners of large properties. Also included are key opinion shapers and recognized leaders in the region.

A third audience includes all concerned and active citizens. Those who vote, speak out publicly and privately, and make choices of many kinds are crucial participants in the Chicago Wilderness collaboration. This third audience will be reached primarily through the plan's components of public participation and education, rather than through the plan directly.

1.1.5 How should different audiences use the plan?

This recovery plan is intentionally broad in scope, outlining the full range of actions needed across the entire region to conserve biodiversity. As a consequence, the plan is best viewed as a tool that provides general direction and illustrates the types of actions that can be taken to conserve biodiversity. The plan is a blueprint for action and a reference source for ideas. Because each decision or action that affects biodiversity will be made in a specific local context, and at times local priorities or unavoidable constraints will suggest a different path than might be suggested as a priority for the entire region, the plan is not intended as a set of mandates.

Nonetheless, the priorities and actions in the plan represent a regional consensus on the most important items for progress on biodiversity conservation. To be effective, those making decisions at the local level in the region should consider carefully the issues discussed in the plan and attempt to address them in their own planning processes. One lesson from the plan is that the region as a whole can sustain biodiversity that is not sustainable through local action alone. Success in this regard will only come if all actors in the region incorporate a broader regional view in their own decision-making, and if we cooperate across local jurisdictions.

1.2 The vision

For the past 200 years, the south end of Lake Michigan has been the setting of a classic drama. While building its economic and cultural wealth, Chicago, one of the nation's largest metropolises, has partially preserved the natural communities that had developed here since the retreat of the last glacier, approximately 10,000 years ago. As the metropolis continues to expand, its natural riches decline. Hence the vision:

To establish a broad policy of beneficial coexistence in which the region's natural heritage is preserved, improved, and expanded even as the metropolis grows.

At the landscape level, the vision includes a network of protected lands and waters that will preserve habitat for a complete spectrum of the region's natural communities. More natural land—both public and private—will have been added to the current core areas and their management will be both active and adaptive. A critical mass of sites will be large enough to maintain a sustainable complex of interdependent species and natural communities. Carefully monitored habitat corridors will connect sites, both small and large, opening paths for ancient patterns of migration and dispersal. Fire will be used as a management tool in order to promote ecosystem renewal. Cycles of prescribed burning will continue the work of lightning and Native American cultures.

At the ecosystem level, water will regain its rightful place as a natural agent of renewal. Rainstorms will drain more slowly, with less damage to downstream properties and to the streams themselves, due to the capacity for temporary storage and absorption afforded by natural open lands. With appropriate management, preserved lands and water bodies will again host healthy communities of native plants and animals for future generations to study and enjoy.

At the species level, regional populations of animals and plants will be assured long-term viability. Size and connectivity of habitat will contribute to their survival; rare species will be protected from catastrophe. Whether native like deer or alien like purple loosestrife, problem species will be prevented from destroying the natural communities in which they live.

While our busy lives do not always provide enough opportunity to consider our increasingly precarious relationship with nature, we have reached the point where we must fulfill this vision to benefit one species more than all others—our own. The region's human communities will reclaim a cultural tradition of restoring, protecting, and managing the globally outstanding natural communities that enrich our lives. In the spirit of the far-sighted planners who created this region's earliest forest preserves, we will make our built environment compatible with the needs of our wild neighbors.

The foundation for this vision already exists in the region's extensive parks and forest preserves, in the regulations protecting wetlands, flood plains, and rare and endangered species, in the investments already made to improve the quality of water in the region's streams, rivers, and lakes, and in the public and private institutions whose missions include a concern for the region's natural environment. Even so, the fulfillment of the vision will require a greatly expanded level of public understanding and support. Indeed, this vision can only be realized if it becomes broadly shared.

1.3 Key findings and recommendations

The Biodiversity Recovery Plan contains a number of recommended actions at varied levels of detail and importance. Some of the more important ones are indicated below, either verbatim or in summary form, with chapter references.

1.3.1 Manage more land to protect and restore biodiversity.

Much of the region's legally protected land is not yet being effectively managed to preserve remnant native communities. Until recently, it was thought that most types of natural areas, if left alone, would preserve themselves. Studies have increasingly shown that the quality of our natural communities, including those protected by public ownership, is steadily degrading because natural processes have been interrupted and / or because of invasive or overly abundant species. (See Chapter 5.) The continuing degradation of existing preserves is a major threat to sustaining and enhancing biodiversity.

Ecological management practices are available to deal with these problems. Limited management is underway in certain forest preserves and parks and on some privately held lands. But current levels of management are, in most instances, far from adequate. *Therefore, this plan assigns the highest priority to establishing and maintaining the proper management of natural communities.*

- More resources need to be applied to the management of protected lands in the region. The shortage of dollars to manage lands and waters for biodiversity represents a major threat to the region's natural communities. In addition to the high-quality sites being managed today, medium- and lower-quality sites, particularly those containing higher-priority community types, need management efforts. (Chapter 5)
- State-of-the-art management practices should be applied more broadly to protected lands. This will require more qualified personnel, both volunteer and paid, than are presently available (Chapters 5, 9, 11). Land managers should apply a diversity of management practices in order to sustain natural communities. (Chapter 5)
- The expanded and more effective use of volunteers in land management, monitoring, and stewardship will be essential for maintaining the health of conservation lands. (Chapter 11)

- The use of prescribed fire needs to be greatly expanded. A regional training program should be developed for crew members and burn leaders. Outreach programs should be used to educate local governments in the use of prescribed fire in managing natural ecosystems. State agencies need to craft air-quality regulations that foster the expanded use of prescribed burns. Finally, a variety of burn strategies is needed. A single management regime, such as burning at the same intensity and same time each year, is unlikely to sustain biological diversity. (Chapters 5, 9)
- Planning for the management of natural communities should be carried out on a countywide or regional scale, allowing a diversity of management strategies and effects. For example, wetland management should be coordinated on a regional basis to assure that birds have appropriate habitat within the region regardless of local fluctuations in wetland conditions. (Chapters 5, 9)

1.3.2 Preserve more land with existing or potential benefits for biodiversity.

The Chicago region currently contains 200,000 acres of protected land in national parks, state parks, regional forest preserves, and open spaces owned and maintained by park districts, private institutions, and corporations. All of these lands contain important natural communities or else serve as buffers, protecting and supporting the natural areas. Over the past few years, local preservation agencies have steadily acquired land for a variety of purposes and they expect to acquire more in the years ahead. *This plan recommends that a high priority be given to identifying and preserving important but unprotected natural communities, especially those threatened by development, and to protecting areas that can function as large blocks of natural habitat though restoration and management. The plan recommends that these areas be preserved where possible by the expansion of public preserves, by the public acquisition of large new sites, or by the actions of qualified private owners.*

- Public and private agencies should act immediately to preserve those high-quality natural areas in the region that remain unprotected. High-quality remnants, even if small, are important reservoirs of genetic material for maintaining regional biodiversity. Emphasis should be on those community types of higher priority as outlined in this plan. (Chapter 4, 5)
- Chicago Wilderness and the regions' land-owning agencies should develop a priority list of areas needing protection based on regional priorities for biodiversity conservation. (Chapter 5)
- Federal, state, and local funding for land acquisition by county forest preserve and conservation districts and by other preservation agencies should be expanded with the preservation of biodiversity as a priority. Recognizing that public funds are limited, biodiversity conservation efforts should to the greatest extent possible also support the multiple-use missions of public agencies. (Chapters 8, 11)
- In Illinois, the state's imposition of property-tax caps makes the funding of further acquisition and management more problematic. Local governments should seek to pass referenda as necessary to obtain the revenues needed to achieve this plan. (Chapters 8, 11)
- State governments should increase funding to open-space grants programs, both for their own lands and for lands to be acquired by county forest preserve and conservation districts, park districts, and other eligible jurisdictions. (Chapter 11)
- Increased federal funding for preserving conservation land is a critical need. High priority should be given to applications by states and local governments that address critical needs for conserving biodiversity as outlined in this plan. (Chapter 11)
- Land-acquisition plans of public agencies should give consideration to the presence of endangered and threatened species. (Chapter 7)
- The granting of protective easements and other protective measures by private landowners for natural areas and buffer zones is an important tool for biodiversity protection and will increase in significance as acquisition of public lands becomes more difficult. More training and resources for the use of these techniques are needed. (Chapter 8)

1.3.3 Protect high-quality streams and lakes through watershed planning and mitigation of harmful activities to conserve aquatic biodiversity.

One of the most significant negative impacts of human settlement on the Chicago region's natural environment has been on streams, rivers, lakes, and wetlands. Draining and filling of wetlands, channelizing of streams, increases in storm-water runoff due to expanding impervious surfaces and resultant changes in the frequency and extent of floods, changes in groundwater levels, and the introduction of wastes, chemical products, and eroded soils into all of the region's water bodies have had disastrous consequences for virtually all forms of aquatic life.

As urbanization continues, programs, policies, and regulations to manage water resources should be developed and implemented with an eye to sustaining natural communities. The effectiveness of our efforts to manage water resources should be measured, in part, by the number and variety of native species found in aquatic habitats throughout the region.

- The highest priority for biodiversity conservation is to maintain the quality of the remaining high-quality streams and lakes, those that support high numbers of native and threatened species. (Chapter 6)
- State and local public agencies should protect high-quality streams and lakes through proper watershed planning and management, including plans for stormwater management. (Chapters 6, 8)
- Local agencies should promote natural drainage, create buffer strips and greenways along streams, and create or restore streamside wetlands. Attention should be given to changes in groundwater levels for terrestrial communities and wetlands. (Chapters 5, 6, 8)
- Local agencies and private landowners should consider restoring streams to their natural meandering courses, restoring riffles and other elements of stream habitat, and using bioengineering solutions to control streambank erosion. (Chapter 6, 8)
- Local agencies should avoid new or expanded wastewater discharges into high-quality streams. Alternatives include routing flows to regional facilities, using land treatment, and using constructed wetlands for improving treated effluent before discharging to streams. (Chapters 6, 8)
- Many dams in the region impede the movement of fish and other aquatic life up and down the waterway. Consequently, high-quality streams sometimes abruptly deteriorate above or below a dam. Where dams are not needed for water supply, flood control, or recreation, removal or modification with structures that effectively permit the passage of aquatic species would help to conserve biodiversity (Chapter 6).

1.3.4 Continue and expand research and monitoring.

While land managers use the best current knowledge about the management needs of natural communities and species, there is always opportunity and need to improve management techniques and learn more about the complexity of ecosystems and their functioning. Management and monitoring activities need to be organized so that they help evaluate the effectiveness of current techniques, and research projects need to be designed to answer questions relevant to management. There are distinct differences between research, monitoring, and inventory, yet if these activities are linked together in meaningful ways, the results can immediately be put to use by conservation practitioners and thus can improve biodiversity management. Management within an experimental framework, making use of results in future management decisions, is referred to as adaptive management. *Developing and implementing a regional monitoring program and pursuing a prioritized research agenda will provide significant contributions to conservation of biodiversity.*

- Compile a prioritized list of research needs. Support research projects that will help Chicago Wilderness scientists and land managers to better understand presettlement landscape conditions and processes, current landscape conditions and processes, the best techniques to restore communities to improved ecological health, and requirements for sustaining biodiversity over the long-term. Examples of specific areas of research needs are given in Chapter 5.
- Compile a thorough literature review of previous studies regarding management of natural communities and conservation of biodiversity relevant to efforts in Chicago Wilderness. (Chapter 9)
- Develop better links with academia and promote more research projects within the Chicago Wilderness region. This could be achieved through a number of approaches, including setting up a central location of priority research needs as a resource for graduate students. Another suggestion is to promote the Chicago Wilderness region as a research station. This would help students to identify appropriate sites and experts, as well as to receive permits. (Chapter 9)
- Develop and implement a regional monitoring protocol that emphasizes adaptive management for making progress toward selected management goals. (Chapter 9)

1.3.5 Apply both public and private resources more extensively and effectively to inform the region's citizens of their natural heritage and what must be done to protect it.

A precondition to the success of any important public endeavor is the understanding and support of a significant portion of the public. The topic of sustaining biodiversity, including an understanding of its importance to current and future generations, is just beginning to be taught in schools and conveyed through the local media. Many communities are not being reached through these efforts and even citizens who already have a strong environmental ethic are often unaware of the richness of our regional biodiversity and of local restoration successes.

Chapter 10 lays out two types of communications actions aimed at addressing the challenge described above. The long-term goals are necessary to build long-term capacity and understanding in the region, while the short-term goals address immediate issues of communication and public relations.

- Ensure that every student graduating from a school in the Chicago Wilderness region is "biodiversity-literate."
- Make topics relating to biodiversity and Chicago Wilderness a focus of local colleges and universities.
- Increase the number of communities receiving non-school-based biodiversity education programs.
- Gain a better understanding of the views of a broader segment of the Chicago-area population on restoration.
- Improve the public's understanding of the role of management in natural areas and communicate documented benefits of local restoration efforts, particularly those of most value to humans.
- Foster local grassroots communication and provide more opportunities for citizens to get involved in the decision-making process. Work with user groups affected by restoration efforts on issues of common concern.
- Improve the credibility and public perception of the people involved in restoration efforts.
- Engage advocacy organizations in our efforts. Put a structure in place to respond quickly to issues of perception as they arise.
- Assess the current state of biodiversity knowledge held by key decision-makers such as elected officials and their staff, land managers, and planners. Create programs to address their needs for biodiversity education.

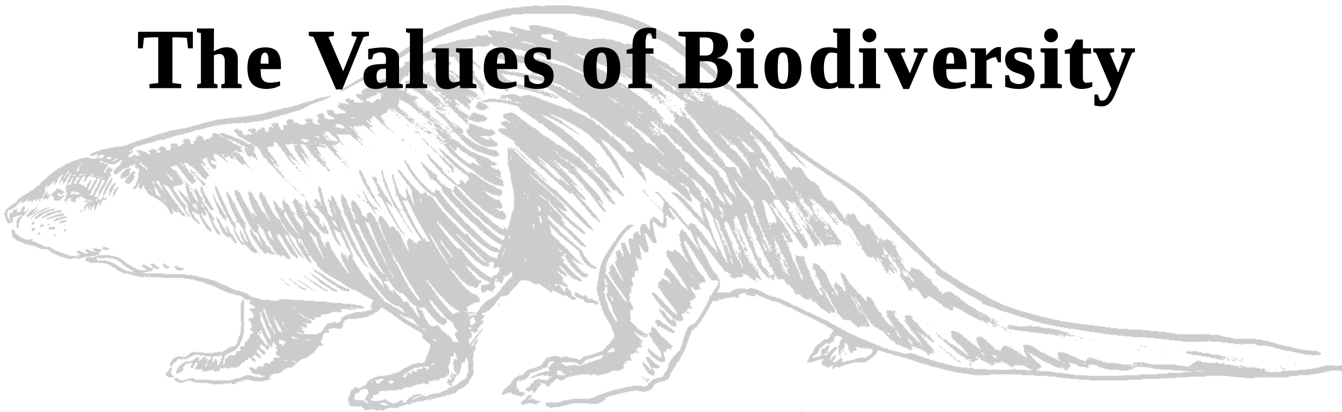
1.3.6 Adopt local and regional development policies that reflect the need to restore and maintain biodiversity.

In the course of regulating private development and expanding the public infrastructure in the three-state region, public officials have the opportunity to preserve and enhance biodiversity. This can be accomplished through the inclusion of biodiversity objectives within state, regional, and local plans and laws or ordinances governing the urban and suburban development processes.

- Counties and municipalities should amend their comprehensive plans, zoning ordinances, and other regulations to incorporate relevant recommendations contained in this plan. (Chapter 8, 11)
- The Illinois EPA should establish a process for reviewing and approving the expansion of wastewater service areas that takes into consideration the impacts on the total natural environment within affected watersheds. (Chapters 6, 8)
- State agencies responsible for major transportation infrastructure should incorporate biodiversity principles into their planning and implementation decisions. Further, when a state infrastructure investment such as a toll road or major airport is likely to trigger substantial residential, commercial, or industrial development, impacted state agencies and local governments should be required to enter enforceable agreements minimizing adverse environmental impacts including the loss of biodiversity. (Chapter 11)
- Support the Regional Greenways Plan for northeastern Illinois and the Natural Areas Plan for southwestern Wisconsin. These plans identify actions to protect and manage critical habitats for plants and animals and generally improve ecosystems. They complement and support the objectives of this Recovery Plan. (Chapters 3, 8)
- Participate in the discussions of the Campaign for Sensible Growth and Metropolis 2020. The Campaign promotes principles of economic development, redevelopment, and open space preservation. Metropolis 2020 has proposed actions to help the region develop in a manner that will protect its economic vitality, while maintaining its high quality of life. (Chapter 3)
- Support implementation of regional growth strategies by the Northeastern Illinois Planning Commission, the Southeastern Wisconsin Regional Planning Commission, and the Northwest Indiana Regional Planning Commission, insofar as these plans seek to reduce the region's excessive rate of land consumption, preserve important open spaces, and promote improved water quality. (Chapter 3)

Chapter 2

The Values of Biodiversity



2.1 Overview of the values of biodiversity

2.1.1 Biodiversity conservation as a global concern

Understanding the full value of biodiversity in the region is required in order to evaluate this plan's recommendations. Unfortunately, it is difficult to develop and apply neat economic measures for the current and future value of the region's biodiversity to its citizens. In addition, attempting to justify biodiversity conservation only in terms of its utilitarian benefits to people will inevitably underestimate its true value. There is, however, a wide range of recognized values of biodiversity, deriving from biodiversity at both the local and global levels. A strong case can be made not only that conservation of biodiversity makes good economic sense but also that it is important to the region's citizens in ways that go beyond adequate economic measures. This chapter outlines the various values associated with biodiversity and evaluates some of the costs and benefits of conservation actions in Chicago Wilderness.

The rapid decline of biodiversity around the world is a policy issue of major global concern. At the Earth Summit in Rio de Janeiro in 1992, most of the governments of the world signed a global Convention on Biological Diversity. By 1993, enough nations had ratified the Convention that it entered into force as international law. The Convention recognizes the conservation of biodiversity as a "common concern of humankind," due to its intrinsic values and its importance to people. The Convention asserts that governments are responsible for conserving their biological diversity and using biological resources in a sustainable manner.

While the connection between the region's forest preserves and parks and the lofty ideals of an international convention may seem slim, in fact, what we conserve here has direct bearing on the preservation of global biodiversity. Further, and more important, the loss of biodiversity and its associated values that motivated the nations of the world to develop the Convention is occurring right here in the Chicago region. The people who live here stand to lose as much as the people of tropical rainforests or old-growth forests.

2.1.2 The range of values of biodiversity

Direct-use values

Economists and biologists who measure the value of biodiversity categorize those values by how people benefit from them. In one such category are direct-use values, where people directly consume or use species for their benefit. Most of the significant direct-use values are associated with the great store of global biodiversity. These include the values of natural products for developing pharmaceuticals, for developing and maintaining the genetic basis for agriculture, and for supporting industries based on use species such as fisheries and timber extraction. (For more discussion, see World Resources Institute et al. 1992.) While most of these industries are not based directly on species in Chicago Wilderness, scientists recognize that it is the global store of biodiversity, to which Chicago Wilderness contributes, that maintains options for the future for these and other major economic activities. With the growth of the use of biotechnology, the economic value of genetic material from natural sources is likely to rise.

Ecosystem services

In a second major category of value associated with biodiversity are indirect values provided by ecosystem services. Ecosystem services are the conditions and processes through which natural ecosystems, and the species that constitute them, sustain and fulfill human life (Daily 1997). We could not survive without the basic services provided by natural systems. These include primary conversion of sunlight to energy, nutrient cycling and retention, recycling of organic wastes, soil formation, moderation of climate extremes, moderation and control of flood damage, control of insect pests, protection of water quality, and pollination of crops (Sullivan 1997, Daily 1997).

The link between ecosystem services and biodiversity is not always easy to demonstrate. While ecological theory predicts that biodiversity should be linked to improved ecosystem function, research at an ecosystem scale with appropriate controls is difficult to conduct. Some critics may argue that any green plant can fix carbon dioxide through photosynthesis, and that non-native species can play many of the roles that native species once played. While this is true to a limited degree, a review of available research indicates that many aspects of the stability, functioning, and sustainability of ecosystems depend on biodiversity (Mooney et al. 1995, Tilman 1996, Tilman et al. 1996). The conservation and management of natural areas that maintain diverse woodlands, prairies, and aquatic systems will help assure the sustained production of ecosystem services.

While life as we know it could not continue without these ecosystem services, their value can be considered infinite. However, it is possible to estimate the value they provide directly to our economy and the cost of replacing them with human-made substitutes. As a very rough approximation, economists have estimated that the value of ecosystem services and natural capital at the global level is $33 trillion per year, or approximately twice the global gross national product (Constanza et al. 1997). In the United States, Pimentel et al. (1997) estimate the annual economic benefits of ecosystem services at approximately $300 billion.

These global and national studies are difficult to directly connect to loss of biodiversity at the local level. Nonetheless, they do indicate that biodiversity is likely being grossly undervalued as we continue development patterns that lead to its loss. At the local level, we can measure some of the obvious costs associated with the past loss of natural areas and biodiversity. Flooding on the Des Plaines River alone costs local governments and property owners $20 million in an average year. In the late 1980s, two floods caused an estimated $100 million in damage (Illinois DNR 1998). Flooding in the region is directly associated with the loss of wetlands and other natural areas in the watershed that served to trap rainfall and store it, rather than dumping it in the river. Another measure of the same problem is the cost associated with developing human-made solutions to the problem. The Tunnel and Reservoir Plan, known as the Deep Tunnel, of the Metropolitan Water Reclamation District, is a multi-billion dollar undertaking to collect excess runoff and treat it before releasing it into waterways. These are the services that once were provided more extensively by prairies, woodlands, and wetlands.

Recreation and aesthetics

Important factors in calculating the value of biodiversity are the recreational use of natural areas and the value that people place on natural systems for aesthetics and as part of the cultural heritage. Not only are the protected lands that constitute Chicago Wilderness of global significance for biodiversity, but they are also of enormous value for the quality of life of the region's citizens. Public use of the forest preserves is staggering, with an estimated 40 million annual visits to Cook County lands alone (Forest Preserve District of Cook County 1994). In Lake County in 1998, 75% of residents reported visiting a forest preserve within the previous two years, with hiking the most common use (Richard Day Research 1998). Active nature-based activities enjoyed by millions of the region's residents include hiking, bird watching, fishing, and photography. In 1996, more than 3 million people reported engaging in wildlife watching in Illinois, contributing an estimated $1.6 billion to the economy (U.S. Fish and Wildlife Service and U.S. Bureau of the Census 1998).

The high levels of use of the region's natural areas indicate the importance of these areas and their biodiversity to the quality of life in the region. The attractiveness of the region as a place to live and work is also a critical factor in its future economic competitiveness (Johnson 1999). Healthy natural areas are the key for biodiversity, and they provide unparalleled opportunities for the outdoor recreation that millions of people in the region want.

Non-use values

A final type of value associated with biodiversity, and a type harder to quantify, is non-use value. This includes feelings of ethical obligation to protect other species from extinction, religious values associated with cherishing the Earth and its inhabitants, and the desire to leave for future generations that which we are able to enjoy. In some ways, these concerns are the core motives for protecting biodiversity. A national survey of public attitudes about biodiversity, a survey that included focus groups in Chicago, found that responsibility to future generations and a belief that nature is God's creation were the two most common reasons people cited for caring about conservation of biodiversity (Biodiversity Project 1998).

The importance of one's natural heritage cannot be estimated in dollars. Nonetheless, there is value in the sense of discovery that comes to each new generation as it learns the essential facts of what came before. If that history includes a richness of color, shape, and form, so much the better. The people of this region can learn to treasure remnant prairies, forests, lakes, and streams just as they have learned from their parents and others to treasure their cultural heritage of language, art, architecture, music, and religion.

2.2 Issues in evaluating the costs and benefits of protecting biodiversity

2.2.1 Protecting a public investment already made

This region has already made a substantial investment in preserving open space and in abating pollution in streams, rivers, and lakes. Sadly, these investments vary in their utility for sustaining biodiversity. In fact, natural communities are generally still declining, even on publicly owned, protected sites and in local streams and lakes. This is partly because the importance of biodiversity, and the means of preserving it, was only dimly understood when many of these public investments were made.

Investments in public open space helped protect natural communities from total destruction, but absent the measures called for in this plan, those investments will steadily lose their value. For example, 100 years ago it was a simple matter to walk through woodlands and, except in winter, enjoy flowering native plants. Today, the invasion of exotic plants such as buckthorn coupled with excessive grazing by deer make the same woodlands less accessible and much less appealing during most of the year.

Major investments have provided an important foundation for protecting the aquatic environment, including biodiversity, but much remains to be done. Public investments in wastewater treatment plants were intended to insure clean streams and lakes throughout the region, but other sources of pollution still prevail and even the modern local treatment plant can have adverse impacts on delicate and high-quality aquatic habitats.

Thus, a pragmatic argument for preserving biodiversity is that it protects and enhances the value of large public investments already made in public land and facilities.

Agencies seeking property for permanent open space, with traditional goals of outdoor recreation and conservation, will often find they can protect sites with biodiversity values at little or no additional cost. However, protecting lands only for recreational purposes will not suffice to protect biodiversity in the region or the full range of values it provides.

2.2.2 High replacement costs

One approach to placing a value on a natural community is to calculate its replacement cost. Much of this region's original flora and fauna and their corresponding habitats can be considered rare, a factor that normally influences the price of any commodity.

Consider whether it is even possible to replace the two most characteristic landscapes found in the region prior to European settlement: tallgrass prairies and wetlands in their various forms. Those few remnants that are in something close to original condition are rare indeed, making up less than one percent of the region's landscape. And though much has been learned about how to restore or replicate original prairies and wetlands, efforts thus far have been less than fully successful. The measures of success for such replications include both their natural sustainability and the extent of their biological diversity. To date, even the best manmade wetlands and prairies have fallen short, especially by the yardstick of species diversity. While this plan recognizes that restoration of degraded habitats can go a long way toward returning and protecting the values associated with the region's biodiversity, it recognizes that the costs of doing so are far more than protection would cost in the first place. Hence, protection of the region's remnant natural areas can be viewed as a prudent economic measure.

2.2.3 Value of competing uses

Although our remnant natural communities may be irreplaceable, the market value of the sites they occupy will often be dictated by what they can command on the private market for such purposes as residential or commercial development. Fortunately, at least some types of natural areas or habitats have not been considered highly suitable for suburban development or farming. These have included floodplains, some rural wetlands, and fragmented sites such as those found along rail lines. A good example is the floodplain of the Des Plaines River in both Cook and Lake Counties, much of which is now in forest preserves.

Conversely, lake and riverfront property not subject to flooding and sites with mature trees are often highly valued for urban development. Thanks to the foresight of previous generations, the tradition of preserving at least some of these most attractive sites for public use has been well established. The best example is the extensive shoreline of Lake Michigan in Chicago, which is largely in public ownership if not in its original, natural state. Another outstanding example is the greenway extending along most of the Fox River in Kane County. These two cases demonstrate that, in the public's mind, the preservation of important open space competes favorably with even the most expensive private development.

2.2.4 Costs of land acquisition

The two principal costs that would result from this plan's recommended actions are for further land acquisition and for increased site management. It is not possible to determine the exact costs of future acquisition because no exact target has been set and because prices will change over time, generally upward, as further suburban development takes place.

In the spring of l999, three of the member counties conducted successful referenda on acquiring additional open space. Together, the three counties won authorization to spend up to $175 million to acquire an estimated 15,500 acres.

Both federal and state grants are expected to be available to assist local agencies in their land acquisition efforts. Existing and potential grant programs are discussed in Chapter 11 of this plan. Land preservation by less than fee-simple acquisition can also reduce costs. Various land preservation techniques are described in Chapter 8.

The preservation and enhancement of biodiversity also involves lands that remain in private ownership. In such cases, there is little or no acquisition cost to the public.

2.2.5 Costs of managing lands and waters

The dollar costs of managing natural areas to sustain biodiversity vary with the type and condition of the site and with the availability of volunteers. These costs will also vary according to the phase or stage of restoration achieved. For example, the initial or remedial phase may last three to five years and cost substantially more than subsequent annual maintenance.

A consultant's report to the DuPage County Forest Preserve District prepared in 1995 estimated that the ten-year costs for restoring and maintaining the County's natural areas to good ecological condition would be about $20 million. The authors qualified their estimate by stating that it assumed no innovation or streamlining of processes for remediation and maintenance over a ten-year period. Two effective means of lowering management costs are to use volunteers as part of the management program and to protect and manage larger areas. The cost of not properly managing these same natural areas was suggested by the finding that 80% of the county's natural areas had declined to poor health since they had been originally studied 15–20 years earlier (Applied Ecological Services, Inc. 1995).

Lakes, streams, rivers, and wetlands can also be managed in various ways or left unmanaged. Traditionally, managing streams and rivers meant channelizing, dredging, and building various structures such as dams. This type of management carries a high initial price tag and high costs for maintenance and repair, yet it provides fewer benefits than management techniques that replicate natural processes. When streams and rivers are managed in ways consistent with the goal of sustaining and enhancing biodiversity, the benefits can include improved aesthetics, reduced flooding and flood damage, reduced soil erosion and sedimentation, improved fishing and other recreation opportunities, and the reduction of invasive, non-native species. These alternative methods also carry a smaller initial price tag and require less annual maintenance expenditure (Northeastern Illinois Planning Commission 1998).

Some sites will require substantial restoration efforts to sustain or improve biodiversity. While each case is apt to have unique aspects, many successful projects to restore lakes, wetlands, and prairies have already been undertaken within the Chicago Wilderness area, and the land-management agencies in the region can help provide general cost information.

2.2.6 Evidence of public support

Is maintaining biodiversity worth the cost? Both national and local surveys consistently suggest that most people think so. A study by the Brookings Institution reported that 72% of the referenda on the nation's state and local parks and conservation won voter approval in November of 1998. These measures will trigger an additional $7.5 billion in state and local conservation spending (Myers 1999).

The passage of three local county referenda allocating funds for land acquisition and management in the spring of l999 serves as the most recent direct evidence of public support for spending public dollars to increase protection of natural areas. The percentages of voters approving by Illinois county were: Kane County–65.6%; Lake County–65.8%; and Will County–57%.

Two years earlier, a $75 million referendum on behalf of the DuPage County Forest Preserve District passed by a margin of 57.4 to 42.6 percent.

Neither the Cook County Forest Preserve District nor the McHenry County Conservation District has held referenda in recent years. However, other evidence suggests that citizens in these counties would also support further efforts to preserve and restore natural areas. For example, in the fall of 1998, the American Farmland Trust sponsored a study of public attitudes pertaining to farmland and open space preservation in Kane, McHenry and DeKalb Counties (Krieger 1999). Among the findings were the following:

- Buying open space to protect it from development ranked equal to spending for improved law enforcement, crime reduction, and schools, and it ranked significantly higher than spending for roads, libraries, and more public recreational facilities.
- Of the actions offered to protect open space, enlarging forest / prairie preserves and wetlands / marshes far outranked buying farmland development rights or building more hiking / biking trails, more state parks or local park district parks, or more golf courses.
- The most common reason cited for valuing protection of open space was wildlife habitat.

In a l996 survey sent principally to residents of Cook County, more than 90% percent of the respondents said restoration of natural areas in around Chicago was good and beneficial (Barro and Bright 1998).

Finally, Chicago Wilderness sponsored its own survey of the public's willingness to spend public funds on behalf of biodiversity restoration. Kosobud (1998) summarizes the results:

> *The survey of a carefully selected, non-random sample of residents revealed a significant willingness to pay for new wilderness recovery and extension activities. The personal interviews were carried out in a manner to acquaint the respondent with the topic and to prepare the respondent for a thoughtful answer. The sample mean willingness to pay was a $37.80 per year increase in annual property tax payment, or equivalent increase in rent, all accruing to the appropriate government agencies for this effort. The mean adjusted for the non-random sample was $19.67. Applied to the close to 3 million households of the region, this estimate indicates that up to 59 million dollars per year could become available for land acquisition, soil preparation, weeding, seeding, maintenance, and other measures. A public well informed about such activities is an essential prerequisite for such a projection.*

Chapter 3

The Biodiversity Challenge in an Expanding Region

3.1 How we got where we are today

3.1.1 Natural history

The natural history of the Chicago region prior to the arrival of the European settlers in the 1800s is well told in the companion document to this plan, *An Atlas of Biodiversity*, published by Chicago Wilderness in 1997. It describes the geologic evolution of the Chicago region, emphasizing the impacts of past glacial periods, and the evolution of natural communities following the last glacial retreat about 13,000 years ago.

Of most significance for planning the recovery of the region's biodiversity is the fact that its early-history produced a variety ecosystems, each raising its own distinct set of challenges for preservationists and land managers. The current classification system, described in chapter 4, recognizes four main types of forested communities, two of savanna, two of shrublands, four of prairie, and six of wetlands, as well as cliffs and lakeshores. Each of these was largely shaped by a unique combination of geology (including soils), climate (including variations in both temperature and moisture), and frequent exposure to fire (whether triggered by lightning or by Native Americans), all of which had prevailed for thousands of years. Another important factor was this region's flat terrain, which made the area prone to surface and over-bank flooding. This flooding, in turn, produced intermittent streams and wetlands, each supporting its own unique complex of native species. While the terrain was generally flat, subtle variations in topography produced hydrologic differences that gave rise to different hydric regimes of prairies, wetlands, savannas, and forests. Wind patterns and the resulting water currents along the shores of Lake Michigan produced a highly specialized dune ecology.

3.1.2 Human history

The earliest evidence of human activity in the Chicago Wilderness area dates to approximately 12,000 years ago, when highly nomadic Paleo-Indian clans came primarily to hunt larger animals at upland bogs and sloughs. The Paleo era lasted until 8000 B.C. and was followed by the cultural periods called Archaic-Indian (8000 to 600 B.C.), Woodland-Indian (600 B.C. to A.D. 900), and Mississippian-Indian (A.D. 900 to1640). During these eras of prehistory, people gradually shifted from total dependence on hunting and gathering (Paleo and Archaic) to a more settled culture that incorporated agriculture (Woodland, and especially Mississippian). In these prehistoric periods, the peoples necessarily lived in total dependence on the local ecosystems. They helped shaped the character and health of natural communities through practices, such as setting fires, that supported their procurement of food, medicine, and materials important to their daily lives.

About 1640, European and French-Canadian trade goods were incorporated into local cultures. By the 1670s, French-Canadian trappers and traders used the area. The first recorded visitors were members of the Marquette and Joliet expedition in 1673, who were on their way back to Ft. Michilimackinac after "discovering" passages to the Mississippi via both the Wisconsin and Illinois rivers. In the 1680s, LaSalle and Tonti spent more time in the region and left the first extensive written description of its flora and fauna.

Although the region was visited in the 1700s by French and British military personnel, continuous settlement by cultures other than the Native Americans began only in 1779 with Du Sable. From this period until the early 1830s, many Pottawattomie, Sauk, and Winnebago people continued remnants of their previous, uninfluenced cultures. The incoming European-American-African culture absorbed much indigenous knowledge of the uses of plants, animals, and local materials. Throughout the 19th century, many vestiges of this knowledge were still in common use, but as agriculture transformed the landscape and native landscapes disappeared, most of it was lost or not in widespread practice.

In 1831, Cook County was incorporated. In 1833, 8,000 Native Americans were displaced to west of the Mississippi River. Between 1830 and 1835, the settlement around the mouth of the Chicago River grew from 200 to 3,265 people. By 1840, thousands lived in the city and an increasing number settled the countryside. In 1838, 100 bushels of wheat were shipped out; in 1842, this had grown to 600,000 bushels.

The settlement and growth of Chicago has been attributed largely to its location at a national transportation crossroads. Indeed, regional and national canals and railroad systems generated commercial activity and spurred settlements throughout the Chicago region. But a revolution in farming technology had an even greater impact on the vast surrounding prairies. During the 1840s, John Deere and others began to produce a steel plow that finally made it possible for farmers to break up the soils of the deep-rooted tallgrass prairies.

Farmers also felt compelled to suppress fires. They plowed firebreaks and mowed fields that might otherwise burn. Absent fire, woody plants and trees had the opportunity to spread into any lands not used for buildings, crops, or pasture. Livestock grazed in remnant wooded areas, further altering the local ecology.

The loss of prairies and forests through fire suppression and physical reduction by the plow and ax was accelerated by the introduction of Old World plant species. Species including buckthorn, honeysuckle, and multiflora rose successfully competed with native species, and the suppression of fire allowed some native species to expand into new areas. Prairies and savannas became filled with gray dogwood, hawthorn, and box elder; woodlands and forests became dominated by box elder, maple, ash, elm, and other fire-sensitive trees. The increase in both canopy and understory species greatly reduced the available sunlight reaching species growing at ground level, including oak and hickory seedlings. Graminoids and flowers also suffered as shade increased. As the composition of the vegetation changed, insect species were often adversely affected, in some cases causing losses in turn to both flora and fauna that depended upon specific insects. Finally, the loss of native, flammable undergrowth has even limited the ability of fire to effectively remove understory brush.

Farmers and their village cousins learned to drain or fill wetlands that would otherwise interfere with the planting of crops or the construction of buildings. This practice eventually led to the loss of over 95% of the region's wetlands. Meandering streams were viewed as a cause of local flooding and a waste of valuable land, a problem that could easily be solved by straightening or channelizing the streambed. Both techniques destroyed natural habitat.

Rivers, streams, and even lakes were considered part of a cost-free disposal system. Untreated sewage and toxic wastes were routinely discharged into waters that had previously supported abundant fisheries and numerous other aquatic species.

Harbors and rivers were dredged and, in 1836, the Illinois and Michigan canal project began, spurring another population boom. Even as the canal was beginning operations in 1848, the railroad industry was taking steps toward making Chicago the focal point for operations serving the entire middle and far western regions of the country.

The evolution of human interaction with natural communities has been paralleled by an evolution of understanding of that interaction. Settlers may not have intended to cause the local extinction of so many species, perhaps only wolves, bears, and other animals that posed a direct threat to their own lives or property. It took several decades of rapid decline of the native landscape before local leaders recognized the need for a system of forest preserves throughout Cook County.

In 1894, a nationally prominent landscape architect, Jens Jensen, began to prepare maps of what he thought should be preserved. In 1904, Cook County Board Chairman Henry Foreman, Jensen, architect Dwight Perkins, and others published *The Outer Belt of Forest Preserves and Parkways for Chicago and Cook County.* In 1913, the Illinois General Assembly passed enabling legislation authorizing the creation of forest preserve districts in counties other than Cook. In 1915, the General Assembly finally enacted legislation establishing a system of publicly owned preserves in Cook County. Another famous contributor to this campaign was architect and planner Daniel Burnham who, with fellow architect Edward Bennett, published the *Plan of Chicago.* Building upon the recommendations of Foreman, Jensen, and Perkins, this work proposed, among other things, an extensive system of regional parks. The motivation behind this plan is revealed in the following passage from the Plan of Chicago:

> *The grouping of manufacturing towns at the southern end of Lake Michigan, and the serious attempts that have been made (especially in Pullman and Gary) to provide excellent living conditions for people employed in larger operations,*

create a demand for extensive parks in that region; because no city conditions, however ideal in themselves, supply the craving for real out-of-door life, for forests and wild flowers and streams. Human nature demands such simple and wholesome pleasures as come from roaming the woods, for rowing and canoeing, and for sports and games that require large areas. The increasing number of holidays, the growing use of Sunday as a day of rest and refreshment for body and mind tired by the exacting tasks of the week, together with the constant improvement in the scale of living, all make imperative such means of enjoyment as the large park provides. Therefore, adequate provision for the growing populations that of necessity must live in restricted town areas requires that in the region south and southwest of Chicago all those marsh lands and wooded ridges which nature has thus far preserved from being taken for manufacturing purposes now should be secured for the parks that in the next generation will be required, but which will be beyond reach unless taken in the immediate future.

The development of a system of outlying large parks along the lines above indicated will give to Chicago breathing spaces adequate at least for the immediate future; the physical character of the lands to be taken will insure a diversity in natural features most pleasing and refreshing to dwellers in cities; and the acquisition of the areas entirely around the present city will afford convenient access for all the citizens, so that each section will be accommodated. Moreover, the development of especially beautiful sections, such as the region about Lake Zurich, will give marked individuality to Chicago's outlying park system. It is by seizing on such salient features of a landscape and emphasizing their peculiar features that the charm and the dignity of the city are enhanced.

Thus, the very process of metropolitan population growth during the early part of the 20th century established the demand and, not so incidentally, the tax base that were essential precursors to today's system of forest preserves and protection of the remnant natural communities they contain. It follows that the demands of a newly growing regional population for recreation, coupled with growth in the tax base and loss of open space (mostly to suburban development) make the attainment of this plan's goals most realistic.

While Perkins, Jensen, Burnham, et al. were making their plans, a professor, Henry Chandler Cowles, was initiating a new science of ecology at the University of Chicago. Christy (1999) writes:

Cowles's pioneering work over several decades established the concept that a native landscape is really a highly diverse group of plant communities, the "residents" of each community adapted to one another and the community as a whole requiring specific physical factors—water, light, drainage, fire—to survive and thrive. Cowles's work also revealed what has been confirmed ever since: that the Chicago region is one of the most biologically rich areas in America.

In the early 1900s, scientists, recreationists and nature enthusiasts recognizing the value and potential of the Indiana Dunes area, fought to have the region preserved. In 1925, Indiana Dunes State Park was established, protecting 2,182 acres of the dunes ecosystem. In the 1960s, Illinois Senator Paul H. Douglas, fearing that commerce would swallow the remaining lakefront and dunes, joined the crusade to save the dunes in northwest Indiana that had begun a decade earlier by Dorothy Buell. As a result of these efforts, the Indiana Dunes National Lakeshore was authorized by Congress in 1966. The National Lakeshore today includes approximately 15,000 acres.

By 1922, the Cook County Forest Preserve District had acquired 21,500 acres, roughly a third of its present-day holdings. Acquisition of preserves progressed more slowly thereafter until the national environmental movement of the l960s inspired a federal program of grants for open-space acquisition. All of the region's forest preserve and conservation districts took advantage of this program. Between l960 and l981, the inventory of state parks and county preserves in Illinois nearly doubled from 64,123 acres to 123,101 acres. The l999 total stands at 165,724 acres, plus the 19,000-acre Midewin preserve and various sites in northwest Indiana and southeast Wisconsin. One outcome of the generous federal matching grants for open space preservation, when combined with the rapid rate of suburban development, was that local districts assigned a higher priority to land acquisition than to land management. Moreover, the realization has only come recently that our natural communities deteriorate when left unmanaged.

In the 1940s, University of Wisconsin professor John Curtis began experimenting with the restoration of native plant communities. But it was not until l962 that Morton Arboretum biologist Ray Schulenberg launched the world's second major ecosystem restoration: a 100-acre prairie that today contains 350 species of native plants. Schulenberg notes that while the prairie is now self-sustaining, it still lacks a number of plant and insect species that would be found in a natural prairie.

The national environmental movement begun in the l960s also featured federal grants for the abatement of water pollution, a vital factor in preserving aquatic habitat throughout the region. It was also in the 1960s that local preservationists and planners began to explicitly evaluate potential preservation sites according to the number of benefits presented, thereby increasing the return on the taxpayers' investment. For example, a stream and its adjacent floodplain might offer opportunities for fishing while also recharging groundwater and precluding the flood damages that would have resulted from urbanization. A stream in its natural state would also offer aesthetic benefits and enhance the values of adjacent properties. A site containing all these features would clearly outrank a site containing only cultivated fields.

An example of this kind of analysis can be found in the report prepared by the Northeastern Illinois Planning Commission for the DuPage County Forest Preserve Commission in 1965. The report recommended adding 19 sites totaling 8,714 acres to the 2,350 acres of existing DuPage County forest preserves. Woodlands, marshes, and remnant prairies were among the landscape features identified in that plan. Yet, even in a report so recent, the further loss of biodiversity in this region was not recognized as an impending threat.

Another important step for our natural areas came with the establishment in 1963 of the Illinois Nature Preserves system. The first nature preserve designation was given to the Illinois Beach Nature Preserve in 1964. There are currently 105 designated sites in northeastern Illinois, many of which are lands owned by county forest preserve or conservation districts. Once a site is designated, the Illinois Nature Preserves Commission and the Department of Natural Resources provide technical assistance to the property owner to help preserve the natural communities contained therein. The identification of appropriate sites for designation has been an outcome of the Illinois Natural Areas Inventory, completed in its initial form in 1978.

In Indiana, a state-wide Natural Areas Survey commenced in 1967, with a two year study to locate, describe, and evaluate areas already in use as nature preserves and other natural tracts worthy of preservation by public agencies, conservation groups, or educational institutions. In that same year, the state legislature authorized the creation of the Indiana Nature Preserves System and established a Division of Nature Preserves in the Department of Natural Resources.

Americans have long expressed concern for the plight of African wildlife, the destruction of the Amazon rain forests, and the uncertain fate of the American wilderness widely thought to exist only in the remotest parts of the Far West and Alaska. Yet the history of this region throughout the twentieth century also demonstrates a prevailing public interest in preserving nature here, however that term has been understood.

3.2
Current status and future of metropolitan-wide development

3.2.1 Forecasts for growth in the Chicago Wilderness region

Although recent years have seen the increasing use of best management practices and best development practices to ease the negative impacts of metropolitan growth on our valued natural resources, the continuing expansion of human development in the Chicago Wilderness region still carries with it many threats to biodiversity. Foremost among these is the sheer paving over of open space by new development. Subsequently, the Chicago Wilderness metropolitan region has experienced increases in flooding, more contamination of streams due to urban runoff, and a continuing encroachment on wetlands and other natural habitats.

Official forecasts to the year 2020 by regional planning agencies paint a picture of substantial growth amidst uneven growth pressures in the Chicago Wilderness region. Table 3.1 presents these forecasts, developed by the regional planning commissions for Illinois, Wisconsin and Indiana. For the six-county northeastern Illinois area, the population is expected to increase by 25% while employment increases by 37%. The expected population growth rate in Kenosha County, Wisconsin, is nearly as great (24%), while the northwest Indiana counties should grow at a more modest level (9%). The forecasted employment growth in Kenosha County (39%) is even greater than that in northeastern Illinois. The northwestern Indiana region's employment growth is expected to be 19%.

It should be noted that LaPorte County, Indiana is included in the Chicago Wilderness region, as indicated on Table 3.1. Elsewhere in this plan, either on maps or in tables, if information is not presented for LaPorte County, it is because information was not available or time did not allow its inclusion. Any update of this plan will include providing the relevant, available information for LaPorte County, Indiana.

3.2.2 Past patterns of regional decentralization

The population of the six-county northeastern Illinois area between 1970 and 1990 increased by only 4% and employment increased by 21%, while the amount of land in urban uses increased by 33% during the same period.

Table 3.1

Growth forecasts for the Chicago Wilderness region[1]

POPULATION	1990	2020	1990–2020	% Change
Northeastern Illinois[2]				
Chicago	2,783,726	3,005,338	221,612	8%
Surburban Cook County	2,321,318	2,589,061	267,743	12%
Du Page County	781,689	985,701	204,012	26%
Kane County	317,471	552,944	235,473	74%
Lake County	516,418	827,564	311,146	60%
McHenry County	183,241	361,598	178,357	97%
Will County	357,313	722,794	365,481	102%
Total	7,261,176	9,045,000	1,783,824	25%
Southeastern Wisconsin				
Kenosha County	128,200	159,600	31,400	24%
Northwestern Indiana				
Lake County	475,594	509,229	33,635	7%
Porter Conty	128,293	157,828	29,535	23%
LaPorte County	107,066	111,000	3,934	4%
Total	710,953	778,057	67,104	9%

EMPLOYMENT	1990	2020	1990–2020	% Change
Northeastern Illinois[2]				
Chicago	1,482,381	1,745,495	263,114	18%
Surburban Cook County	1,293,652	1,773,881	480,229	37%
Du Page County	530,322	815,178	284,856	54%
Kane County	145,205	223,040	77,835	54%
Lake County	228,606	393,641	165,035	72%
McHenry County	65,526	106,336	40,810	62%
Will County	99,393	222,429	123,036	124%
Total	3,845,085	5,280,000	1,434,915	37%
Southeastern Wisconsin				
Kenosha County	50,900	71,000	20,100	39%
Northwestern Indiana				
Lake County	188,261	215,650	27,389	15%
Porter Conty	46,341	67,050	20,709	45%
LaPorte County	44,785	50,700	5,915	13%
Total	279,387	333,400	54,013	19%

[1] The source of the data in this table are the official forecasts of the regional planning agencies, the Northeastern Illinois Planning Commission (NIPC), the Southeastern Wisconsion Regional Planning Commission, and the Northwestern Indiana Regional Planning Commission.

[2] The NIPC forecasts shown in this table are one of two forecast files adopted by NIPC. The forecasts shown assume all aviation demand to be accommodated by existing airports. A second file, not shown, assumes the addition of a new airport in the south suburbs.

The northwest Indiana experience

The goals of biodiversity recovery in northwest Indiana reflect a region of contrasts, dilemmas and hope.[1] Rich and extensive natural resources such as dunes, marshes, and savannas are contrasted with an industrial complex whose pollution discharges were relatively unchecked for decades. The region faces the challenges of recovering from the loss of high paying jobs and the decline of a productive industrial economic base. It also faces the pressures of rapidly growing suburban communities at the same time that inner city neighborhoods are experiencing disinvestment and decline. Amidst these contrasts and dilemmas are a changing culture that highly values environmental protection and an industrial community which has become more willing to work to balance environmental and economic development objectives.

Northwest Indiana generally is bounded by the Kankakee River on the south, the Lake Michigan shoreline on the north, the Illinois State line on the west, and the Valparaiso Moraine on the east. The Calumet area in the west portions of northwest Indiana includes the watersheds of the Little Calumet and Grand Calumet Rivers. About one third of the 45 miles of Lake Michigan shoreline and its adjoining natural resources are publicly owned by the municipal, state or federal government. Included in this area are the Indiana Dunes National Lakeshore and the Indiana Dunes State Park which together preserve over 15,000 acres of shoreline and large sand dunes. Most of the dunes are covered by deciduous forest while the ones closest to the lake are grass-covered or bare and wind-blown. Behind the dunes are interdunal ponds, marshes and wooded swamps. More than 1,300 native plants grow in the Indiana Dunes National Lake Shore, which has the third largest number of plant species in the entire national park system. The varying habitat of the dunes area and the presence of Lake Michigan, with its influence on migration, provides regular resting, nesting and wintering areas for at least 271 species of birds.

Late in the 19th century, industry also found the lakeshore, rivers and land (inexpensive and non-agricultural) attractive for steel mills, refineries, chemical plants and hundreds of smaller fabricating and subsidiary industries. industrial development. In 1906, to build the U.S. Steel Gary Works on 9,000 acres of Lake Michigan shoreline, they moved as much dirt as was moved for the Panama Canal, diverted a river ½ mile from its natural course, laid a tunnel 80 feet deep and 9 miles out into Lake Michigan, and constructed a mile-long break-water that used mountains of concrete and 160,000 tons of steel. The National Steel Company Midwest Division and Bethlehem steel plants were built last in the 1960's. Because of the industrial pollution that resulted from this industrial concentration, the U.S. Environmental Protection Agency (EPA) considers this area to have the greatest concentration of environmental problems in the Midwest and initiated intensive enforcement action against violators of pollution control laws. The U.S. EPA has also designated eight Superfund sites (toxic contamination) in northwest Indiana. Unfortunately, there are far more concentrations of hazardous waste. For example, the Superfund sites do not include the Indiana Harbor and Ship Canal, where discharges of wastes by industry and municipal sewage treatment plants have built up a 20 foot layer of toxic sediment totaling 3.5 million cubic yards.

During the 1990's, through the efforts of both the federal, state, and local governments, with a strong participation of citizen environmental groups, there has been a fundamental shift toward a more cooperative relationship between the economic interests in northwest Indiana and those striving to protect and restore their natural resources. Rather than simply fining or penalizing industrial polluters, a process has been initiated whereby joint, cooperative and integrated solutions are pursued on a comprehensive ecosystem basis. Lee Botts refers to this as a "cross-media" approach. It is a shift away from individual penalties for water or air or groundwater pollution to one considering the total environmental effect of an action. Where a different industrial practice might curtail (as required) direct discharge, an alternative waste disposal method could increase air pollution. Alternatives to air pollution control practices might have led to increased ground water contamination. Instead, an approach of examining and investing in comprehensive solutions to pollution problems is being pursued as a joint process among the industries, the U.S. EPA and citizen environmental groups. Some are formalized in "Consent Decrees"

(Continued on next page.)

negotiated between enforcement agencies, the violators of pollution control laws and the courts. Today, more actions are voluntary because industries have learned that waste prevention promotes production efficiency. The first major consent decree in 1992, USX corporation agree to spend $33 million for pollution control and for pollution prevention needed to comply with environmental standards. In a second Consent Decree in 1996, USX committed to spend $90 million for cleaner coke oven processes, removal of contaminated sediments from the Grand Calumet River and other clean-up necessary because of past practices. This time another $100 million was committed to go beyond what the letter of the laws requires. With the growing agreement that prevention is cheaper than dealing with waste after it has been created and that production must become more sustainable, now more companies are forming partnerships with private groups and government agencies in voluntary restoration and preservation projects.

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[1] *The contrasts and dilemmas described here are well documented in The Environment of Northwest Indiana (PAHL's Inc., Valparaiso, Indiana, 1993). The facts about the Indiana Dunes and the industrial development impacts in the area were drawn mostly from The Indiana Dunes Story (Shirley Heinze Environmental Fund, Michigan City, Indiana, 1997). The hopes described here were derived from interviews in January, 1999 with Lee Botts (Indiana Dunes Environmental Learning Center) and Mark Reshkin (Northwest Indiana Forum Foundation, Inc. and former Chief Scientist at the Indiana Dunes National Lakeshore).*

Thus, while regional population growth was moderate, its impacts were substantial because of the way the growth was distributed. The population of the growing suburban areas in Illinois increased by 24% or almost 1 million, while the City of Chicago and 89 suburbs lost about 770,000 people. Similar patterns occurred in Wisconsin and Indiana.

Development in the Illinois six-county area from 1970 to 1990 converted over 450 square miles of agricultural and vacant lands to residential and employment uses. This high rate of land consumption, which also occurred in the Wisconsin and Indiana portions of the Chicago Wilderness region, reflected the generally larger lot sizes that have characterized residential, commercial, and industrial development and redevelopment throughout the region. It also reflected a high rate of household formation relative to population increase as household sizes declined. The overall pattern was one of a few more people occupying a lot more land.

3.2.3 The challenge of sustainability

Recent information suggests that the pattern of sprawling growth in the Chicago Wilderness region is continuing. The U.S. Census Bureau estimates that northeastern Illinois's population has increased by as much since 1990 as it had in the preceding twenty-year period (1970–1990). The outer suburban areas throughout the Chicago Wilderness region are developing rapidly, adding housing at unprecedented rates and employment-based development as well. At the same time, the City of Chicago and 65 close-in Illinois suburbs have lost population since 1990. If the trend towards sprawl is coupled with the population growth expected for the Chicago Wilderness region in the first two decades of the 21st century, we will see many more people occupying much, much more land.

Sustainability becomes a critical issue when looking to the future growth of this region. Serving an increasingly dispersed population while maintaining the social and economic fabric of established communities will require substantial and increasing levels of public investment. The threats to air, soil, and water quality implicit in this growth pattern are potentially severe. Both economic and environmental factors thus threaten the overall quality of life in northeastern Illinois. Failure to address traffic delays, mismatch between the locations of jobs and housing, environmental quality, and the costs of disinvestment will pose risks to the region's economic competitiveness. While not unduly limiting the choices of location that households and business make in the marketplace, the region must seek ways to preserve both the natural and built resources it already has and to encourage new growth to take more sustainable forms.

3.2.4 Region-wide efforts for meeting challenges from growth

Concomitant with this Biodiversity Recovery Plan, region-wide planning efforts are underway in each of the three states included in the Chicago Wilderness region. The Northeastern Illinois Planning Commission is pursuing a Regional Growth Strategy, which includes the development and support of public policy that promotes sustainable growth, with balanced development responsive to the limitations of the region's natural resources and the need to improve environmental quality. This growth strategy includes support for the Regional Greenways Plan, which preserves and enhances regional biodiversity with 4300 miles of environmental corridors throughout the six-county northeastern Illinois area.

In Wisconsin, regional plans for land use and for the protection and management of natural areas and critical species habitats, products of the Southeastern Wisconsin Regional Planning Commission, have outlined detailed strategies to moderate regional decentralization and to preserve environmental corridors and other areas. The Wisconsin plan specifically identifies 474 square miles for planned natural-area protection. The Northwestern Indiana Regional Planning Commission is developing a vision for the year 2020 that encompasses land-use patterns, the transportation system, the social and economic fabric of the area, and an environmental sensitivity that produces a high quality of life for the region. Other discussions underway and proposals for sustainable development in the Chicago Wilderness region include the 2020 Chicago Metropolis Project, the Strategic Open Lands at Risk Project, the Campaign for Sensible Growth, and the Illinois Growth Task Force. See sidebar describing northwest Indiana's struggle for environmental quality.

Recommendations

- ✔ Support the Regional Greenways Plan for northeastern Illinois and the Natural Areas Plan for southwestern Wisconsin. These plans identify actions to protect and manage critical habitats for plants and animals and generally to improve ecosystems. They complement and support the objectives of this Recovery Plan.
- ✔ Participate in the discussions of the Campaign for Sensible Growth and Metropolis 2020 as they relate to biodiversity conservation. The Campaign promotes principles of economic development, redevelopment, and open space preservation. Metropolis 2020 has proposed actions to help the region develop in a manner that protects its economic vitality, while maintaining its high quality of life.
- ✔ Support implementation of regional growth strategies by the Northeastern Illinois Planning Commission, the southeastern Wisconsin Regional Planning Commission, and the Northwest Indiana Regional Planning Commission, insofar as these plans seek to reduce the region's excessive rate of land consumption, preserve important open spaces, and promote improved water quality.

3.3
The impact of development on ecosystems

3.3.1 Introduction

Development of land for urban uses is the primary threat to the remaining unprotected natural lands of our region, and in some cases it is causing serious degradation of protected lands as well.

Impacts on biodiversity by the continuing growth and decentralization of the greater Chicago region can be visualized in several ways. One effective approach is to picture the ecosystem in three layers, as illustrated in Figure 3.1.

The top layer is ecological health of living communities, which can be measured by the long-term viability of the species and ecological communities of the region, their genetic diversity and ability to reproduce. This layer is reflected in discussions of the status of communities contained in chapters 5 and 6.

The second layer is the health of the supporting environment, which can be measured by the integrity of physical, chemical, and biological habitat and ecological processes. This environmental layer contains the elements that support life and also things that place stress upon life. For example, water is essential for living things, but too much water can be stressful and even fatal. The key stressors that threaten our ecological communities are discussed in chapters 5 and 6

The third layer is human activity that places stress on habitat and natural processes. For thousands of years, humans were a compatible part of the ecosystems of our region, but in the last 200 years, human activity has increased and is now so pervasive that no aspect of nature is left untouched. Nature can no longer freely take its course in our region. Our actions determine what will survive and what will not.

To understand what is happening to the region's natural communities, it is first necessary to understand the processes that supported them for thousands of years. Next it is necessary to understand how modern humans' activities have altered these processes and what can be done to restore them or compensate for the alterations.

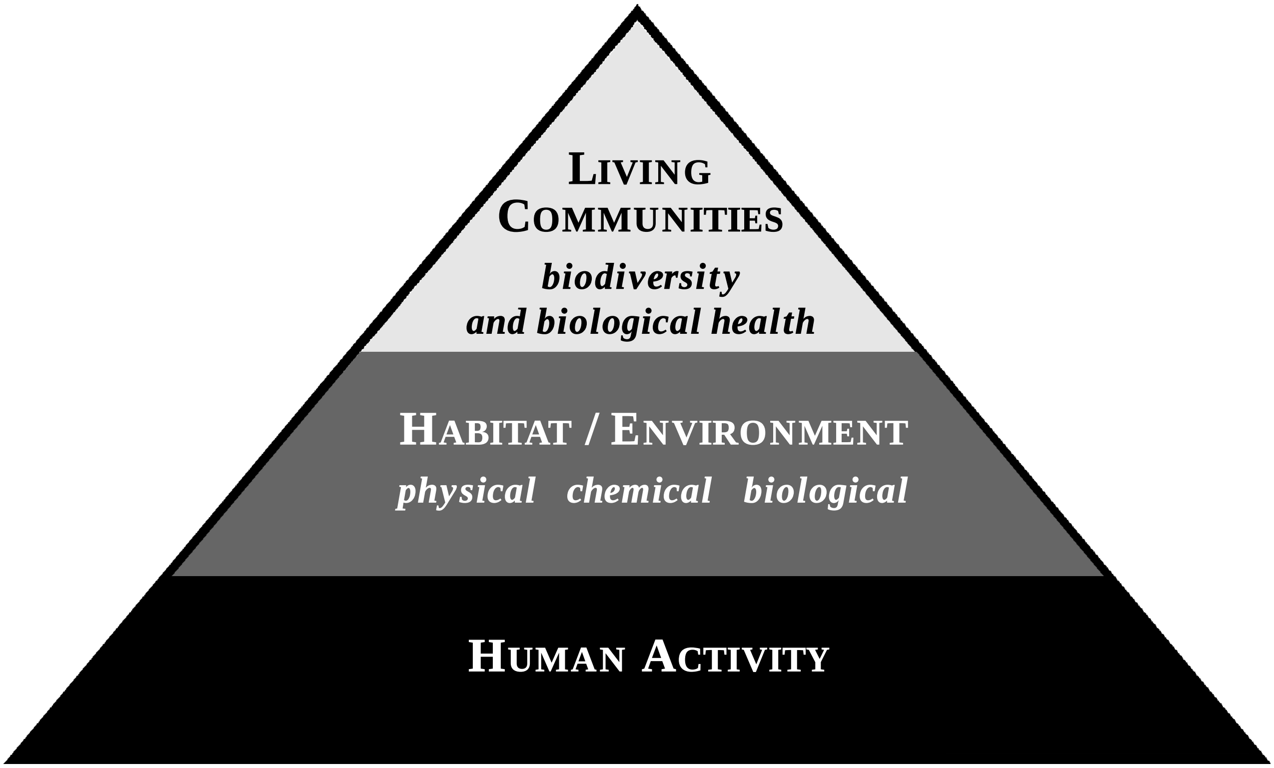

Figure 3.1 Ecosystem health and human activity

The health of the various living communities in our region is discussed in Chapters 5 and 6, together with the status of needed habitats and the factors that affect them. Chapter 9 describes management tools available to overcome problems discussed below.

3.3.2 Natural processes and habitats

The central theme of this plan is that truly durable and resilient populations of all living organisms inhabiting the Greater Chicago Region require, above all else, the protection and rehabilitation of ecological habitats and the natural processes that sustain them. These natural processes provide the dynamic mix of nurture and stress needed to maintain ecological health.

In the region, the key processes and related factors are:

- Water
- Groundwater and soil moisture
- Watershed and stream hydrology
- Floodplain processes of inundation, channel movement, etc.
- Water quality, including chemistry, nutrient content, clarity, etc.
- Soil: structure, fertility, permeability, erosion and sedimentation
- Sunlight and microclimates: shade, shelter, weather, and climate
- Fire: its inhibition or promotion of various species
- Competition and natural balances: food-webs, herbivory, and predation
- Habitat size and connectivity: genetic flow and survival, corridors for migration and dispersal, and habitat diversity
- Pollination and seed dispersal

Many of the above elements and processes have been substantially altered by human activity since European settlement. They all still support or adversely affect the remnant natural communities that survived conversion of our landscape to farming and urban uses. Of greatest importance today are continuing changes in *hydrology* and *water quality*, the suppression of *fire*, and changes in *competition*, primarily the impact of invasive species resulting from human alteration of the environment and natural processes.

3.3.3 Hydrology and groundwater

Each of the region's natural communities has, over the course of several millennia, adapted to its own moisture environment. The Midwestern seasonal weather patterns include sporadic heavy rains, drought, freezing, and thawing. The effect of rain or snow varies with the permeability of the soil as well as the local topography.

Little of the rainfall on the original landscape of the area ran directly into streams, because most of it was absorbed by the soil aided by the native vegetation. The landscape included many wetlands, seasonal ponds, and areas with high groundwater. The streams were wide and shallow, fed by groundwater. Flow varied seasonally and in many cases ceased altogether during dry seasons. Water drained slowly from the relatively flat and heavily vegetated landscape, and much of it was transpired by plants without reaching streams at all. Streams rose and fell slowly and did not cut deep channels. Aquatic plants were more abundant than they are today and aquatic habitat was diverse. Living components of the region were adapted to, and dependent upon, the varying patterns and degrees of wetness produced by the hydrology of the area.

Draining the land for both agricultural and urban purposes resulted in vast changes. Draining lowered water tables and eliminated wetlands, ephemeral ponds, sedge meadows, and wet prairies. The amount of groundwater available, its depth, and the timing of moisture cycles changed, altering both soil moisture and the flow of groundwater into streams. These changes reduced the diversity of both terrestrial and aquatic habitats.

As watersheds become urbanized, the increasing amounts of impervious surface and added drainage facilities make water flow "flashier." This adds to peak storm flows and adds erosive energy, which changes the physical form of the stream and its suitability as habitat. The prevention of natural infiltration reduces groundwater while increasing stream volumes. The addition of wastewater may also maintain stream levels during periods when they formerly would have been wetlands containing little or no flowing water. Urban runoff also has a negative effect on water quality, bringing with it increased nutrients, sediment, pesticides, and other toxic substances. Stream flows also have been substantially affected by construction of dams and dredging of channels, affecting both stream flows and groundwater levels.

Restoration and maintenance of groundwater and stream flows are essential to protecting natural areas and the few high-quality stream segments remaining in the region.

Urban wastewater disposal has also been a major factor in the degradation of the region's streams, rivers, and lakes. Current federal and state standards governing the quality of wastewater discharges from point sources have helped to upgrade conditions throughout the region by removing pollutants. However, increases in the quantity of wastewater due to growth can cause adverse effects on aquatic communities.

Pollution is a well-documented, major stressor of aquatic systems in the form of sediment, excess nutrients, and toxic substances. Sediments can create problems such as burying spawning areas, choking small organisms, interfering with feeding, and blocking light from aquatic plants. Excess nutrients can cause excess plant growth, followed by oxygen depletion when algae or plants decay. Toxic substances can have both acute and chronic effects ranging from poisoning to long-term endocrine disruption including feminization of male organisms. Improved sewage treatment has greatly reduced acute affects, but many chronic effects linger and storm water still washes toxins into our streams. Roadway salt spray and salt runoff cause problems and possible adverse effects. Pollution effects on terrestrial systems are less well known. Increasing nitrogen deposition from airborne sources is an important research issue.

Farming has had major adverse impacts on natural communities in the past, including increasing the amounts and rates of storm flow from cultivated fields. However, agricultural land use generally supports better water quality and stream habitat than urban uses, in large part because agriculture leaves stream buffers and creates fewer impervious areas. Pollution from agricultural sources has been reduced as a result of pesticide regulation and voluntary adoption of improved management practices. Good farm practices can help to protect stream quality while poor practices can result in degradation.

3.3.4 Soil formation, fertility, structure, permeability, erosion, and sedimentation

The soil of the region has formed since the melting of the Wisconsinan glaciation approximately 13,000 years ago. The raw material left by the glaciers consisted primarily of clay and sand from the bottom of glacial Lake Chicago and glacial till left in moraines and other glacial forms. The rich black soils of our area were formed by prairie plants with their deep and prolific root systems. Other soils formed under the influence of forests. Soil is formed over periods of time far beyond the reach of this plan, but changes in the soil caused by humans can occur rapidly. Soil compaction and loss of structure and permeability decrease the groundwater supply and increase runoff and flooding. Compaction can also destroy soil microorganisms, eliminate many native plant species, and make restoration difficult. Erosion is a visible problem in the form of new gullies in a few areas, but gradual loss of soil is a greater long-term concern because new soil forms so slowly.

Eroded soil causes major problems downstream, where it causes water turbidity and settles as sediment in wetlands, ponds, and rivers. Sedimentation is a major cause of habitat degradation in streams and wetlands. It clogs and buries essential habitat and makes restoration difficult. Also, invasive aquatic plant species often move into aquatic systems as a result of increased sedimentation.

3.3.5 Sunlight and microclimates

Each species is adapted to a range of intensity and duration of sunlight. Many of the native species of the region are adapted to the full sunlight of prairies or the scattered shade of open woodlands. Others are adapted to the heavier shade of closed forests. These various patterns of sunlight were maintained primarily by the forces of climate, fire, and browsing. The availability of sunlight at various levels within terrestrial communities and in aquatic communities is a powerful factor in their survival and is a key consideration in protection and restoration. Many management and restoration activities are aimed at ensuring the availability of the diverse mix of sunlight and shade needed to support the full range of species in each ecological community native to our region.

3.3.6 Fire

Fire is an essential force that shaped and sustained the natural ecosystems of the region. Whether started by lightning or native people, it favored vegetation that had evolved with fire and limited the extent of fire-sensitive trees, shrubs, and herbaceous plants, which would have otherwise out-competed most of the fire-adapted species. For example, most of the region's naturally dominant tree species need ample sunlight in their early stages. Their seedlings and saplings grow only when fire suppresses shade-producing vegetation. Sun-loving prairie communities also depend upon fire to suppress woody plants, which would otherwise produce ever-increasing shade. Fire also favors some species by providing conditions that stimulate their seed germination or growth.

The varying intensities and frequencies of natural fires contributed to the rich mosaic of the landscape. Virtually all of the regional landscape was influenced by fire to some extent and burned at least occasionally. Communities that are highly fire-dependent include prairies, shrublands, savannas, woodlands, and dry-mesic upland forests.

Fire suppression following settlement has greatly reduced the extent of fire-dependent communities and the former rich variety of habitats. Prairies, shrublands, and savannas have mostly disappeared, even from protected areas, while the surviving woodlands tend to be choked with brush and fire-intolerant trees, both native and exotic. The simplified and homogenized landscape offers little of the complex habitat needed by a wide variety of plants and animals native to the area. In woodlands and forests, secondary effects from fire suppression and invasion by "weedy" species include shading out of the ground flora and erosion where soil is exposed.

Fire suppression is obviously needed in non-natural areas to protect property, but wisely planned and managed fire is essential to restore and maintain the health of the fire-dependent communities of Chicago Wilderness. Returning fire to natural areas in the form of prescribed burns offers the opportunity to return an essential natural process and major force of nature to the landscape.

3.3.7 Competition and natural balance, food chains and predation

Each organism competes for habitat including the water, nutrients, light, and other ingredients necessary to growth and reproduction. The species found in the native communities of the region compete among themselves but are able to persist and even create conditions that are favorable for each other. Some species depend on the presence of others in a variety of relationships ranging from parasitism to symbiosis. Competition is seldom a matter of overwhelming advantage, but rather a matter of slightly better ability to make use of the habitat. Species within a community are usually in dynamic balance, changing in vigor and abundance as conditions change from year to year. In healthy communities, disturbance can be absorbed without permanent loss, although the diversity within the community may be reduced if some species no longer find the habitat they need. Over time, the needed conditions may reappear, allowing the missing species to return, or the new conditions may admit previously excluded species. In either case, complexity is restored. In this sense the communities tend to be self-organizing within a dynamic balance.

As species from outside of the region and around the world are introduced into the area, they compete for habitat. In most cases, they either fail to survive or find a niche without disrupting the native communities. In a few cases, they find major advantage over the native species and become invasive, choking out the native species and unbalancing the native community. This is the current situation with species such as buckthorn, garlic mustard, and purple loosestrife.

Invasive species, many of them exotic, are having a huge adverse impact on native flora and fauna in both unprotected and protected areas. In many cases, the effect is magnified by the disruption of natural processes, but some exotic species successfully invade even in the absence of major disruption, e.g., wood-boring beetles, Dutch elm disease, and carp. The short-term need is to control and eliminate invasive exotics before they become widespread. The long-term need is to prevent future introductions of new exotic species and to take quick action to control any new invasions.

Native species can also become invasive and have adverse impacts on natural communities if ecological processes are disrupted. A prime example is the spreading of fire-intolerant trees such as maples into oak groves and prairies as a result of fire suppression. Native species can also become invasive if natural predators are absent. Perhaps the best example of this is the white-tailed deer. In the absence of predators, the herds have grown far beyond the carrying capacity of the land and are adversely affecting native plant species and communities throughout much of the region. Raccoons, opossums, and cats are also abundant due to human activities and a lack of predators, and they are adversely affecting populations of small animals and ground-nesting birds.

The loss of a species can break a food chain, leaving other species without food or without a consumer to limit their spread. Loss of large predators has contributed to excessive populations of smaller predators and deer, as noted above. The endangered Karner blue butterfly is an example of a species that can be left stranded on a broken food chain. This butterfly relies exclusively on the wild lupine as a food plant during its larval stage, a factor that contributes to its rarity. Many other species depend on plants that occur only, or primarily, in remnant natural areas.

3.3.8 Habitat size

The size of available habitat is an essential factor for long term health and survival of species and ecological communities. The many aspects of habitat size are encapsulated within the concept of island biogeography. These aspects include patch size, habitat diversity, connectedness, genetic flow, migration, dispersal, and survival of keystone species. The theory of island biogeography has become well developed and reported in scientific literature. For an easily read, but thorough presentation, see Quammen (1996).

For long-term viability, a population must maintain genetic diversity. Otherwise, it can become inbred, losing its ability to adjust to change, to survive a disease, or to reproduce. A population must also be large enough so that it is not simply wiped out by an event such as an unusual storm. In addition to genetic diversity and size, a population needs access to diverse habitat. Some species need different habitats during different life stages. Also, habitat itself can vary from year to year due to weather or other disturbances. Partial compensation for small size can be made by connections between populations. However, corridors can also have disadvantages such as providing avenues for movement of exotic species.

Some species require a large area as a home range. In the Chicago Wilderness area, these included large predators such as bears and wolves and large herbivores such as elk and buffalo. The interactions among such animals and their food (plants or prey) are only partially understood, but the large animals no doubt had substantial effects on food chains, habitat, and species abundance. Some relatively large predators such as marsh hawks and short-eared owls are now rare, but could be restored by restoring needed habitat.

The study of island biogeography has brought clearer understanding to the limits of relatively small areas and populations. In many respects, knowledge of island biogeography applies to the remnant natural areas of the Chicago Wilderness region because they are an archipelago of biological islands. They have become islands as the land around them is used for agriculture or urban development. But they are also being further divided into smaller islands as essential habitat is lost due to interruption of natural processes and displacement by invasive species. From this perspective, the natural areas of Chicago Wilderness are not only islands that are losing species according to the natural laws that apply to islands; they are shrinking islands that will support progressively fewer species and biodiversity in the future. The realization that biodiversity is being lost due to fragmentation of habitats is relatively recent, as is the realization that management can restore natural communities.

Many aspects of island biogeography apply wherever habitat is shrinking or being divided. This includes even aquatic habitats. Although water connects stream habitats, both physical and chemical changes can act as barriers that divide streams into smaller pieces of habitat.

A major finding of this plan is that the remnant populations of native plants and animals of the region are in great danger of being lost, in part because critical habitats in our natural areas have become shrinking islands. This threat can be addressed through twin activities of protecting more natural areas and managing the land to restore habitat.

As discussed in Chapter 5, there is a great need for large sites with varied habitat. However, some of the need can be met by connecting fragmented habitats with corridors adequate for migration and dispersal.

3.3.9 Pollination and seed dispersal

For a plant population to survive, pollen must reach flowers and seed must be dispersed. Wind disperses pollen and seeds for some species, but many others rely on far more specific vectors, such as insects, birds, and mammals. For example, the prairie white fringed orchid relies on the rare sphinx moth for pollination. As another example, seeds of some plants need to pass through the digestive system of a bird or mammal in order to germinate.

3.3.10 Stresses on ecological communities

Section 3.3 has discussed both natural processes and the human activities that exert stress on natural communities. Chapters 5 and 6 discuss the status of each type of natural community in our region and the stressors that affect that community type. In considering how to protect and restore ecological communities and their species, it is often useful to analyze the processes involved, including stressors and their sources (which are often human activities). For example, the hydrological cycle (a process) now includes reduced groundwater (a stressor) and farm tiles (a major source of the problem).

Stressors are summarized below.

Ecological processes exert stress on populations, but native organisms have been subject to those stresses for such a long time that they are adapted to them. Such stresses may be beneficial and even necessary for some species and communities. By comparison, stresses from our industrial society have been present for decades rather than millennia. Where land has been developed for agricultural and urban uses all, but a few of the thousands of native species have been eliminated except in remnant natural areas. Even in the remnant areas, native species and communities will not survive unless natural processes are restored or simulated through management. Humans are part of the ecosystem, but unless we manage our activities intelligently, we will find ourselves in an impoverished landscape. Instead of the former rich tapestry of life, our surroundings will be a small number of weedy species that can survive frequent disruption.

Human activities that affect natural processes

Stressors from human activities that reshape natural processes and are most threatening to the sustainability of ecological communities include:

- Development that fragments habitats and isolates populations
- Urban development: soil compaction, accelerated runoff, erosion
- Poor farming practices: soil compaction, accelerated runoff, erosion
- Hydrological modification of streams and drainage of land
- Dredging and filling of wetlands
- Fire suppression and resulting excessive shade
- Introduction of non-native species
- Pollution by toxic substances, excess nutrients, and sediment
- Increase in animals favored by urban conditions, e.g., deer, raccoons and cats, leading to excessive browsing or predation
- Removal of native vegetation
- Excessive collection of plants, seed, and animals including reptiles and amphibians
- Nighttime lighting, which disrupts normal behavior and draws migrating birds to collide with structures
- Climate change: Climate change is of concern for the Chicago Wilderness area but differs from the other stressors in time and spatial scale. It occurs naturally over very long periods of time, usually measured in terms of millennia. During the slow process, living systems respond by gradually moving to areas best suited to their survival and through selection of traits best suited for survival under the new conditions. Atmospheric changes due to human activities now appear to be causing changes in climate far faster than natural processes and probably faster than natural communities can respond. A complicating factor is that because of habitat fragmentation, the movement of at least some organisms will be blocked. The stress of climate change may also reduce the ability of native communities to resist invasion by plants from other parts of North America and the world. Maintaining a full stock of genetic variability is one way in which the species of the region can be aided in surviving changing climate. Larger protected areas, and functional connections between natural areas will also help species and communities respond to changes in climatic factors.

Direct loss of natural areas

The most direct threat to many natural communities remains the common bulldozer. While many of the remaining natural communities are located on protected lands, others are still subject to development and typically lack adequate protection, whether by cooperative agreements or by local, state, or federal authority. The identification of still-unprotected natural communities and arrangements to protect them are work in progress. Once identified, the preservation of unprotected sites will merit very high priority.

3.4 Urban biodiversity

The seeming oxymoron of "urban biodiversity" lies at the heart of the situation and the opportunity in the Chicago Wilderness region. Treasures remain, yet the treasures are at risk. The greatest risks are the result of human activity, yet the means of protection lie in the resources of the urban population and its institutions.

While development has had widespread adverse impact on natural communities and biodiversity, it has also provided the financial and human resources for protecting and restoring what remains. The question is whether the people and institutions of the region will take the needed action. There are reasonable yet powerful ways of getting this done and this plan has nearly 150 recommendations for doing this. In particular, county and municipal governments are specifically directed (Section 8.3) to use their development review and implementation processes for limiting impacts of development on the natural habitats needed to sustain biodiversity.

Forest preserves and other passive recreational areas, together with natural areas left undeveloped for a variety of reasons, have provided a refuge for native biodiversity. The biodiversity surrounding Chicago far exceeds that found in the Midwest's agricultural areas, where essentially all land is used for crop production. It was the urban economy and value system that made protection of natural areas possible. Now we must ensure that essential further acquisition and management take place.

Although the remnants of the original Chicago Wilderness are declining, it is not too late to restore and protect their beauty and biological integrity; it is not too late to ensure survival of a complete spectrum of the original natural communities of the region. The heritage of investments made during earlier development, together with the vast resources of the urbanizing region, provides the platform enabling us to make a choice.

Chapter 4

Overview of Assessment Processes and Findings for Natural Communities and Species of the Region

4.1 Terrestrial communities

4.1.1 Terrestrial classification

An important step in developing creating a recovery plan for the region's biodiversity was the development of a system for classifying the region's natural communities. While many of the region's land managers were using community classifications based on one developed by the Illinois Natural Areas Inventory (INAI) (White 1978), there were some differences among the many systems. The primary shortcoming of the INAI system is that it does not identify woodlands as a separate community type, whereas scientists today recognize this community's distinctiveness and importance. Scientists and land managers within Chicago Wilderness worked together to develop a standardized system for the region to serve as a tool for region-wide efforts, although classification systems in place at the local level are still used for specific management actions.

The classification scheme includes seven basic community classes. Within each community class are several community types, and often there are subtypes within types. Table 4.1 gives the complete listing of terrestrial community types. Complete scientific descriptions of the various communities can be found in the Chicago Wilderness Community Classification System (Appendix 1). Summarized descriptions may be found in the Chicago Wilderness *Atlas of Biodiversity* (www.epa.gov/glnpo/chiwild) and at the beginning of each of the sections in Chapter 5. This classification system was developed for regional purposes. It should be noted that the region is part of three natural divisions: Morainal, Lake Plain, and Grand Prairie. Natural divisions are units of landscape defined by a combination of geology, physiography, soils, hydrology, pre-settlement vegetation, and characteristic fauna (Swink and Wilhelm 1994).

While the Chicago Wilderness classification system was the basis for this plan, it is important to be able to relate this system to national efforts to classify community types. Appendix 2 includes a cross-reference to the prevailing national standard for community classification (Grossman et al. 1998, Anderson et al. 1998, Federal Geographic Data Committee 1997). One benefit of this translation is that it allows comparison of Chicago Wilderness community classifications to The Nature Conservancy's database of globally threatened community types (Faber-Langendoen 1996). Table 4.2 shows the natural communities in the Chicago Wilderness region that are ranked as critically imperiled, imperiled, or rare at the global level. See Appendix 2 for an explanation of the entries in this table.

While natural communities are defined mainly according to plant associations, each community has associated animal species. Chicago Wilderness scientists and land managers developed a list of the major animal associations found in the terrestrial communities (Table 4.3). The animal assemblages do not coincide exactly with plant communities, and some differences in nomenclature arise from this. Some animal assemblages occur in more than one community type. This plan evaluates these animal assemblages in terms of their status and the importance of the Chicago region to their global conservation. Considering animal assemblages, rather than just individual species, allows a better understanding of trends due to widespread habitat loss and degradation. The region's mammal species, for the most part, use a range of habitats and do not aggregate readily into different habitat-based assemblages. We have not yet described

Table 4.1
Terrestrial community types in the Chicago Wilderness classification system

Forested communities

- Upland forest
  - Dry-mesic
  - Mesic
  - Wet-mesic
- Floodplain forest
  - Wet-mesic
  - Wet
- Flatwood
  - Northern
  - Sand
- Woodland
  - Dry-mesic
  - Mesic
  - Wet-mesic

Savanna communities

- Fine-textured-soil savanna
  - Dry-mesic
  - Mesic
  - Wet-mesic
- Sand savanna
  - Dry
  - Dry-mesic
  - Mesic

Shrubland communities

- Fine-textured-soil shrubland
  - Dry-mesic
  - Wet-mesic
- Sand shrubland
  - Dry-mesic
  - Wet-mesic

Prairie communities

- Fine-textured-soil prairie
  - Dry
  - Mesic
  - Wet
- Sand prairie
  - Dry
  - Mesic
  - Wet
- Gravel prairie
  - Dry
  - Mesic
- Dolomite prairie
  - Dry
  - Mesic
  - Wet

Wetland communities

- Marsh
  - Basin
  - Streamside
- Bog
  - Graminoid
  - Low shrub
  - Forested
- Fen
  - Calcareous floating mat
  - Graminoid
  - Forested
- Sedge meadow
- Panne
- Seep and spring
  - Neutral
  - Calcareous
  - Sand

Cliff communities

- Eroding cliff
- Dolomite bluff

Lakeshore communities

- Beach
- Foredune
- High dune

or evaluated animal assemblages associated solely with aquatic communities, although key species and features of concern were part of the evaluation process for these communities.

Full reports from the animal workshops are available on-line at www.chiwild.org. Scientific names for the species mentioned in this plan are listed in Appendix 3.

4.1.2 Overview of existing information on natural-area extent

Originally based on the Illinois Natural Areas Inventory, the Illinois Natural Heritage database includes information about amounts and quality of remaining high-quality sites for each community type. These data provide a good representation of the high-quality sites in the Illinois portion of the region (Table 4.4). These sites may be publicly protected or they may be on private land. Similarly, the Indiana Natural Heritage database provides information on the quantity and quality of community types found in Indiana, but the coverage is not nearly as complete as it is in Illinois. For many sites, the quantity and quality are not known.

To develop a more complete picture of the remaining extent of natural communities in the entire Chicago Wilderness region, we compiled data on protected land of each community type from a variety of sources (Table 4.5). While these data represent the best available compilation, the method of collection imposes many limits to their interpretation. The Forest Preserve and Conservation Districts vary greatly in the extent and type of information they have on their lands.

Table 4.2
Crosswalk[1] between Chicago Wilderness communities and national standard for community types for those communities which are globally rare[2]

Chicago Wilderness name	The Nature Conservancy name	G-rank
Dry-mesic fine-textured-soil savanna	North-central bur oak openings*	G1
Mesic fine-textured-soil savanna	North-central bur oak openings*	G1
Wet-mesic fine-textured-soil savanna	Bur oak terrace woodland	G1
Dry-mesic fine-textured-soil shrubland	Hazelnut barrens	G1?
Wet-mesic woodland	Swamp white oak woodland	G1
Wet-mesic sand shrubland	Hardhack shrub prairie	G1
Northern flatwood	Northern (Great Lakes) flatwood	G2
Mesic fine-textured-soil prairie	Central mesic tallgrass prairie	G2
Mesic sand prairie	Mesic sand tallgrass prairie	G2
	Midwest dry-mesic sand prairie*	G3
Wet sand prairie	Lakeplain wet-mesic prairie	G2
	Central wet-mesic sand tallgrass prairie	G2G3
	Lakeplain wet prairie	G2G3
	Central cordgrass wet sand prairie	G3?
Dry gravel prairie	Midwest dry gravel prairie	G2
Mesic gravel prairie	Midwest dry-mesic gravel prairie	G2
Dry dolomite prairie	Midwest dry limestone-dolomite prairie	G2
Dry-mesic sand savanna	Lakeplain mesic oak woodland	G2
	Black oak/lupine barrens*	G3
Sand flatwood	Pin oak-swamp white oak sand flatwood	G2?
Mesic dolomite prairie	Midwest dry-mesic limestone-dolomite prairie	G2?
Wet dolomite prairie	Midwest wet-mesic dolomite prairie	G2?
Panne	Interdunal wetland	G2?
Sand seep	Midwest sand seep	G2?
Dry fine-textured-soil prairie	Midwest dry-mesic prairie	G2G3
Wet fine-textured-soil prairie	Central wet-mesic tallgrass prairie	G2G3
	Central cordgrass wet prairie	G3?
Dry sand prairie	Midwest dry sand prairie	G2G3
Beach	Great Lakes sea-rocket strand beach	G2G4
Dry sand savanna	Black oak/lupine barren*	G3
Dry-mesic sand shrubland	Midwest dry-mesic sand prairie*	G3

[1] Based on community descriptions, The Nature Conservancy community types have been matched to Chicago Wilderness Community types. It should be noted that this is not a simple one to one match; often a Chicago Wilderness type covers more than one TNC type and vice versa.

[2] The Nature Conservancy has developed a system to reflect global rarity of the communities. The first three categories here are defined as follows:
G1 = Critically imperiled globally (typically 5 or fewer occurrences)
G2 = Imperiled globally (typically 6 to 20 occurrence)
G3 = Vulnerable (typically 21 to 100 occurrences)
G#G# = range of ranks; insufficient information to rank more precisely
? denotes inexact numeric rank

* Signifies that the TNC community type corresponds to more than one Chicago Wilderness community type and therefore is found elsewhere in the crosswalk.

Table 4.3
Terrestrial animal assemblages identified for conservation planning

Birds

Moist grassland birds (with and without shrubs)
Dry grassland birds
Savanna birds
Open woodland birds
Hemi-marsh birds
Shoreline birds
Closed upland woods birds
Closed bottomland woods birds
Pinewood birds

Reptiles and amphibians

Savanna reptiles and amphibians
Sedge meadow, fen, and dolomite prairie reptiles and amphibians
Forest and woodland reptiles and amphibians
Grassland reptiles and amphibians
Sand savanna and sand prairie reptiles and amphibians
Marsh reptiles and amphibians
Panne reptiles and amphibians
High gradient stream reptiles and amphibians
River, lake, and pond reptiles and amphibians

Insects

Dry and mesic blacksoil prairie insects
Dry and mesic sand prairie insects
Dry and mesic gravel prairie insects
Wet prairie insects
Dry blacksoil savanna and woodland insects
Wet blacksoil savanna and woodland insects
Sand savanna insects
Fen insects
Marsh insects
Sedge meadow insects
Bog insects
Floodplain forest insects
Upland forest insects
Foredune insects

Mammals

The mammals of Chicago Wilderness do not aggregate into assemblages. Mammals of concern are listed in Table 4.8.

The McHenry County Conservation District (1998) recently conducted a natural-areas inventory for the entire county. This report provides information on each site's community types and its quality but does not include any acreage for the community types. Total acreage of each site is given. This study is useful in that it covers the entire county, not just Conservation District lands, but it is limited in that it does not include amounts of land for each community type.

The DuPage County Forest Preserve District has a complete database covering all of its holdings, which includes both quality and quantity of each community type on each of its sites. The DuPage community-classification system differs more than any other from the Chicago Wilderness system, and a comparison of the types was required before the data could be compiled with those from the other counties.

For the Recovery Plan process, the Lake and Kane County Forest Preserve Districts estimated the number of acres of each community type from aerial photographs of their sites. Lake County Forest Preserve District staff outlined each community type on the photographs and used a planimeter to calculate the areas. For Kane County, the areas were roughly estimated from the photographs. In both cases, the land managers assessed quality based on their experience with the lands in question, not on quantitative surveys.

Both the Cook and Will County Forest Preserve Districts have data on quantity and quality only for certain sites. These sites include Nature Preserves and a few sites for which there are detailed management schedules. The data come from the original Illinois Natural Areas Inventory, nature-preserve dedication proposals, and county management schedules. The data do not portray the complete picture of the natural areas in either county.

To add to the data available at the beginning of the Recovery Plan process, a current Chicago Wilderness project is using satellite imagery to develop a vegetation map for the entire region, including unprotected lands. From the satellite images, it is possible to identify vegetative cover for eleven land-use categories, including eight natural or semi-natural categories. The accuracy of these classifications is adequate within protected lands in Illinois to produce preliminary results (Table 4.6). These data help provide a more complete picture of the natural communities currently included in our preserve system. A next step in the process will be to improve the accuracy of the classifications of lands outside the preserves and in Indiana. Ultimately, remotely sensed data will provide a baseline for monitoring progress toward achieving the goals of this recovery plan, for measuring amounts and quality of natural communities, and for assessing the impacts of fragmentation and increased suburban development.

Table 4.4

Sum of acres from Illinois natural areas inventory by community type and grade

(Data are from Illinois Natural Heritage database for six county area of northeastern Illinois)

CW category	INAI community type	Total no. of acres	% Grade A	% Grade B	% Grade C
Lakeshore……………………	Beach	63	76	24	0
	Foredune	102	84	16	0
Cliff …………………………	Dolomite cliff	7.5	73	27	0
	Dry-mesic barren	6	0	0	100
	Eroding bluff	11.4	91	9	0
Forested……………………	Dry-mesic upland forest	1236.5	15	46	25
	Mesic floodplain forest	243	2	29	63
	Mesic upland forest	980	19	50	26
	Northern flatwood	92.9	0	93	2
	Sand flatwood	261	0	8	87
	Wet floodplain forest	32	0	100	0
	Wet-mesic floodplain forest	34	0	76	24
	Wet-mesic upland forest	50	0	100	0
Prairie………………………	Dry gravel prairie	29	10	31	10
	Dry sand prairie	179.2	68	9	23
	Dry-mesic dolomite prairie	27	7	10	56
	Dry-mesic gravel prairie	3	33	33	33
	Dry-mesic prairie	19	26	53	21
	Dry-mesic sand prairie	370.3	63	12	17
	Gravel hill prairie	5.6	0	100	0
	Mesic dolomite prairie	18	11	33	56
	Mesic gravel prairie	22	41	41	14
	Mesic prairie	417.9	9	44	39
	Mesic sand prairie	477.1	22	18	39
	Wet dolomite prairie	5	0	100	0
	Wet prairie	214.1	7	33	57
	Wet sand prairie	293	27	25	33
	Wet-mesic dolomite prairie	91	0	16	65
	Wet-mesic prairie	277.5	11	22	58
	Wet-mesic sand prairie	69.4	25	12	63
Shrubland…………………	Shrub prairie	78.5	0	38	12
Savanna……………………	Dry sand savanna	277	40	4	23
	Dry-mesic sand savanna	388	11	27	42
	Dry-mesic savanna	3	0	0	100
	Mesic savanna	20	0	100	0
Wetland ……………………	Acid gravel seep	7	0	100	0
	Calcareous floating mat	169	62	36	2
	Calcareous seep	19.1	63	11	0
	Forested bog	107	29	64	0
	Forested fen	22.5	0	64	36
	Graminoid bog	7	71	29	0
	Graminoid fen	277.8	24	26	32
	Low shrub bog	34	62	24	0
	Low shrub fen	0.4	100	0	0
	Marsh	2098	14	70	13
	Panne	67	81	4	15
	Sedge meadow	1018.3	16	31	42
	Seep	28.6	41	35	10
	Shrub swamp	12	42	8	50
	Tall shrub bog	16	0	88	13

Table 4.5
Sum of acres in protected or other significant natural areas by community type

(Data are from Illinois and Indiana Departments of Natural Resources and County Forest Preserve/Conservation Districts)
(Only includes lands that have been identified to community type. These data are not complete and lack of acreage in a column does not imply zero acreage of a community type in a county.)

	LAKE, IL[2]	COOK[1]	DUPAGE[2]	KANE[2]	LAKE, IN[3]	MCHENRY[1]	PORTER[3]	WILL[1]
FORESTED COMMUNITIES								
Upland forest								
Dry-mesic	739	374		101	5		20	496
Mesic	1157	350	452		18	22	75	350
Wet-mesic	32	10						30
Unclassified					30.0			946
Total	1928	734	452	101	53	22	95	1822
Floodplain forest								
Wet-mesic		34	59	10	20			304
Wet	544	80	766					43
Unclassified	605			78				179
Total	1149	113	825	88	20			526
Flatwood								
Northern	480	213	389	40				
Sand		135						
Unclassified	33							
Total	513	348	389	40				
Woodland								
Dry-mesic	386	428	1368	3		83		
Mesic	318	214		1308				
Wet-mesic	127							
Unclassified	909	76		103				55
Total	1740	719	1368	1414		83		55
TOTAL	5330	1913	3034	1642	73	105	95	2403
SAVANNA COMMUNITIES								
Fine-textured-soil savanna								
Dry-mesic	140	1111		44		20		24
Mesic	224	9		45	34			
Wet-mesic	14							
Unclassified	381		2362	10				35
Total	759	1120	2362	99	34	20		59
Sand savanna								
Dry	277				18		200	
Dry-mesic	142	202			450		31	60
Mesic								
Unclassified					130			79
Total	419	202			598		231	139
Unclassified savanna				457				31
Total				457				31
TOTAL	1178	1321	2362	556	632	20		229

	LAKE, IL[2]	COOK[1]	DUPAGE[2]	KANE[2]	LAKE, IN[3]	MCHENRY[1]	PORTER[3]	WILL[1]
SHRUBLAND COMMUNITIES								
Fine-textured-soil shrubland								
Wet-mesic fine-textured-soil	1							
Unclassified shrubland	2		410					44
TOTAL	3		410					44
PRAIRIE COMMUNITIES								
Fine-textured-soil prairie								
Dry	82		203	2				
Mesic	329	377	974	83	73	23		33
Wet	96	170	315	10	5	19		5
Unclassified	198			58		3		59
Total	705	547	1491	153	78	45		97
Sand prairie								
Dry	179				22			25
Mesic	603	147			27		33	95
Wet	375	178			183			26
Unclassified					141			30
Total	1157	325			373		33	176
Gravel prairie								
Dry		28	6	9		30		
Mesic		21						
Unclassified								
Total		49	6	9		30		
Dolomite prairie								
Dry				1				2
Mesic								118
Wet			49					14
Unclassified				2				115
Total			49	3				249
TOTAL	1862	921	1547	165	451	75	33	522
WETLAND COMMUNITIES								
Marsh								
Basin	1375					554		
Streamside	965					190		
Unclassified	913	120	2481	377	301		100	471
Total	3253	120	2481	377	301	744	100	471
Bog								
Forested	149							
Graminoid	4					8		
Low shrub	12					10		
Unclassifed								
Total	165					18		

	LAKE, IL[2]	COOK[1]	DUPAGE[2]	KANE[2]	LAKE, IN[3]	MCHENRY[1]	PORTER[3]	WILL[1]
Fen								
Calcareous floating mat	76					51		
Forested	6		120	23			10	1
Graminoid	65	44	78	10		63		2
Unclassified	8			37	35		27	1
Total	155	44	198	70	35	113	37	4
Sedge meadow	355	317	520	254	40	417		89
Panne		67		73		1		
Seep and spring								
Neutral						4		
Calcareous		11		7		1		
Sand		1						
Unclassified	10			12			3	
Total	10	12		19		5	3	2
TOTAL	4003	493	3272	719	377	1297	140	566
CLIFF COMMUNITIES								
Eroding bluff	5							
Dolomite		2		6				
TOTAL	5	2		6				
LAKESHORE COMMUNITIES								
Beach	63							
Foredune	102							
TOTAL	165							
CULTURAL COMMUNITIES								
Cropland	2258		1071	854		5		149
Tree plantation	469	3	677	146				
Turf grass	243	14		251				10
Unassociated growth–grass	2934	601	2432	1608		28		291
Unassociated growth–shrub	604	16	2331			39		
Unassociated growth–tree	794		2278	60				
Unclassified unassociated growth			508					65
Unclassified cultural						140		
TOTAL	7301	634	9297	2919		212		515

[1] Data do not represent all natural areas in county.
Data include INAI sites and some forest preserve/conservation district sites.

[2] Data include all FPD sites and INAI sites.

[3] Data do not include all natural areas in county.

Table 4.6
Sum of acres in protected areas in Illinois counties by community type
(Data are from Satellite Imagery; sites include Forest Preserve/Conservation Districts, IL DNR, and INAI Sites)

Community Type[1]	Cook	DuPage	Kane	Lake	McHenry	Will	Total
Savanna (oak woodland)	5,832	1,707	577	3,087	850	1,610	13,663
Floodplain forest	5,686	956	589	1,757	678	2,061	11,727
Upland forest/woodland	12,178	3,667	740	2,160	714	4,718	24,177
Prairie	5,411	1,989	158	2,207	267	3,890	13,922
Wetland	5,512	3,236	1,095	8,307	4,801	3,576	26,527
Open water	5,136	1,139	283	4,240	750	1,837	13,385
Unassociated woody	11,609	1,772	523	255	913	2,425	17,497
Unassociated grassy	11,773	7,222	2,683	4,448	2,682	14,900	43,708

[1] These community types are not strictly parallel to those in other tables. They represent the level of detail for which there is confidence in the correlation between satellite image classifications and ground-truthing and the knowledge of land managers.

4.1.3 Methodology for community assessment

To generate information for this Recovery Plan, the Science and Land Management Teams developed a two-stage process to assess the status of biodiversity in the region and to make recommendations for conserving regional biodiversity.

The first stage in this evaluation process was to examine the status and conservation needs of the region's animal assemblages. This assessment was conducted in a series of four workshops, each focusing on a major taxonomic group (birds, mammals, reptiles and amphibians, and invertebrates). These workshops brought together experts on these species to develop consensus on the identification of the species assemblages, their status, and the region's contribution to the global conservation of the species.

The second stage in the process was to examine the status of each terrestrial community type, its biological importance, and the region's contribution to its global conservation. In four workshops, using a consensus-building process, land managers and scientists covered the four main community groupings: forested, savanna, prairie, and wetland. Prior to the workshop, we gathered data from the Illinois Natural Heritage Database, the Indiana Department of Natural Resources, and the Forest Preserve or Conservation Districts of the six northeastern Illinois counties, as described in section 4.1.2. There are still major gaps in the data on how much of each natural community type exists in the region. Thus, the information available for the development of this plan only allowed relative assessments across community types. The workshops relied primarily on the expert knowledge of the scientists and land managers from the region.

The community-status evaluation in this second stage had two parts. The first part developed a measure or level of concern about how much of the community type currently remains in the region, using the following criteria:

- Number of acres remaining
- Percent remaining from extent before European settlement
- Number of occurrences

- Number of sufficiently large occurrences
- Amount under formal protection

The second part developed a measure of level of concern based on the condition of the remaining examples and used the following criteria:

- Percentage remaining of good quality
- Degree of fragmentation and isolation
- Extent and effectiveness of current management efforts

Each community type received a relative ranking for each factor and a combined ranking to represent an overall level of conservation concern (very high, high, moderate, or low). It is important to stress that there are insufficient data for any of these criteria to allow a quantitative assessment. The criteria, and available data, were used only as guides in reaching consensus among Chicago Wilderness scientists and land managers about the relative status of the communities. A high priority for work in Chicago Wilderness is to continue to develop more precise assessments of the quantity and quality of natural areas in our region.

Relative biological importance for each community type was determined with the criteria of species richness, numbers of endangered and threatened species, levels of species conservatism, and presence of important ecological functions (such as the role of wetlands in improving water quality in adjacent open waters). Information from the workshops focusing on major taxonomic groups provided the basis for this discussion.

Workshop participants then judged the role of the Chicago Wilderness region in the global conservation of each of the community types. For some communities, the Chicago Wilderness region is on the edge of the range; for some, the region contains important examples but the community type is also well-represented in other regions; and for others, the region is central to the community's global conservation.

In addition to these assessments, the workshops discussed threats to species and communities, and opportunities and needs for action. A third series of workshops, organized by major community class, helped to refine vision statements for each of the communities. These visions help to define what scientists say the landscape should look like fifty years from now if we are to conserve all of the region's current biodiversity. All of these discussions together provided a basis for identifying recovery needs and actions for the community types presented in Chapter 5.

4.1.4 Overall priorities and condition

The assessments conducted in the workshops have been used to rank each of the community types and each of the species assemblages. The rankings on status, biological importance, and contribution to global conservation have been combined together for each community type to come up with a tiered ranking of conservation targets for the region (see Table 4.7). These tiers represent relative priorities for increased conservation attention to the community types. Those in the highest tier are of the highest concern, because these communities are at high risk of loss (due to the small amount remaining or its degraded condition), have high biological importance, and represent some of the best opportunities in the world to conserve the community type. Lower tiers have some combination of these factors, but are not at a high level of concern or importance in all categories. This tiered system does not imply that efforts in place to protect and manage those communities falling in lower tiers should be halted or diminished. Often, it means the opposite: these conservation measures are having the desired effect and these communities are at less risk of complete loss. All the community types are important components of the region's biodiversity, and all are at some risk of being lost. Those in the higher tiers are more likely to be lost or degraded substantially if they do not receive more conservation attention. In no way should lower rankings in this scheme be used to justify non compliance with existing laws, rules, and regulations designed to protect these communities and parcels of land.

The rankings in Table 4.7 should not be the sole basis for determining priorities for land management and land acquisition. As discussed in chapter 5, there are several other factors to consider in prioritizing actions for biodiversity. These include the need to address threats that affect many species and communities, such as the impacts of fragmentation or the disruption of natural processes at the landscape level. Further, the plan clearly recognizes the functional value of mosaics of different community types in sustaining biodiversity. The targets in Table 4.7 should be one element in developing management plans and monitoring plans.

The workshops evaluated each terrestrial animal assemblage in terms of whether it was declining or of concern for other reasons, as well as in terms of the Chicago region's contribution to the global conservation of the species involved. The results are presented in Tables 4.8 and 4.9. Again, assemblages of greater global significance or of greater concern due to their status should be a priority for increased conservation attention, but all current conservation efforts should be maintained.

Table 4.7

Conservation targets for recovery based on status, importance, and distribution

First (highest) tier

Woodland (all moisture classes)
Fine-textured-soil savanna (all moisture classes)
Mesic sand savanna
Sand prairie (all moisture gradients in dune and swale topography)
Dolomite prairie (all)
Panne
Graminoid fen
Fine-textured-soil prairie[1] (all moisture classes)

Second tier

Dry sand savanna
Gravel prairie (all)
Basin marsh[2]
Calcareous floating mat
Calcareous seep
Sand prairie (other than those in dune and swale topography)
Northern flatwood
Streamside marsh[3]

Third tier

Sand flatwood
Dry-mesic sand savanna
Forested fen
Sedge meadow

Fourth tier

Upland forest (all)[4]

Fifth tier

Floodplain forest (both)
Bogs (all)
Sand and neutral seep

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[1] Fine-textured-soil prairie is in the highest tier because 1) CW has so many relatively large high quality examples and so much adjacent land that is restorable, and in many cases being restored, 2) that CW has so many and such large restoration areas, 3) that this community type has suffered the highest proportional loss of high quality acreage, and 4) this community type is especially important as a gene pool for agriculture, since it produced the soils which are probably the Midwest's long term most important natural resource.

[2] Basin marsh has been placed in a higher tier than would be the case based on status and importance alone, because it is receiving significant conservation attention in the region and there is great opportunity to do more.

[3] Streamside marshes are very difficult to restore in the current altered hydrological conditions. Therefore, the priority is to research ways to improve their condition before undertaking extensive restoration actions.

[4] Though not separated in the CW Classification system, upland forests dominated by oak stands are of higher concern than those dominated by maple stands. In addition, certain features of upland forests, particularly vernal ponds, are of high concern from a conservation perspective.

Table 4.8

Terrestrial species assemblages (or species in the case of mammals) of concern or in an overall declining condition

Birds

Poor condition
Moist grassland birds (without shrubs)

Suboptimal conditions
Moist grassland birds (with shrubs)
Dry grassland birds
Savanna birds
Open woodland birds
Hemi-marsh birds (without shrubs)
Shoreline birds

Reptiles and amphibians

Declining
Savanna reptiles and amphibians
Sedge meadow, fen, and dolomite prairie reptiles and amphibians
Forest and woodland reptiles and amphibians
Grassland reptiles and amphibians
Sand savanna and sand prairie reptiles and amphibians
High gradient stream reptiles and amphibians

Insects

Of concern
Dry and mesic blacksoil prairie insects
Dry and mesic sand prairie insects
Wet prairie insects
Sand savanna insects
Fen insects
Dry and mesic gravel prairie iInsects
Marsh insects
Dry and blacksoil savanna and woodland insects

Mammals

Of concern
Eastern mole
Pygmy shrew
Least shrew
Little brown myotis
Indiana myotis
Northern long-eared bat
Eastern pipistrelle
Evening bat
Least weasel
Badger
Gray fox
Franklin's ground squirrel
Southern flying squirrel
Woodland vole

Table 4.9
Terrestrial species assemblages which are critical or important to the global conservation of the assemblages

Globally critical

Moist grassland birds (with and without shrubs)

Globally important

Savanna birds (with and without shrubs)
Open woodland birds (with and without shrubs)
Savanna reptiles and amphibians
Marsh reptiles and amphibians
Sedge meadow, fen, and dolomite prairie reptiles and amphibians
Dry and mesic blacksoil prairie insects
Dry and mesic sand prairie insects
Wet prairie insects
Sand savanna insects
Wet blacksoil savanna and woodland insects (??)
Dry blacksoil savanna and woodland

Table 4.10
Summary of the aquatic community types in the Chicago Wilderness classification system

Streams

Headwater streams
- Continuous flow
  - Coarse substrate
  - Fine substrate
- Intermittent flow
  - Coarse substrate
  - Fine substrate

Low order
- High gradient
- Low gradient

Mid order
- High gradient
- Low gradient

Lakes

- Natural lakes
- Lake Michigan
- Glacial
  - Kettle
  - Flow through
- Bottomland
- Vernal pond
- Manmade
  - Naturalized
  - Other

Appendix 4 includes lists of the rankings on different factors that led to the overall rankings on conservation concern for the communities. The findings are discussed in detail in Chapter 5. More detailed reports on natural communities and animal assemblages are available online (www.chiwild.org).

4.2 Aquatic communities

4.2.1 Process for assessing aquatic communities

A classification system for the aquatic communities was developed, using primarily physical characteristics. A summary is presented in Table 4.10 and the complete version is in Appendix 5. Two different groups of Chicago Wilderness scientists and land managers evaluated the aquatic communities of the region. One group looked at rivers and streams and the other at inland lakes. While the two groups used different methods for evaluating the communities, both used various criteria to place specific lakes, rivers, and streams into different categories. In both cases the emphasis was on the existing quality of these bodies of water. The categories used inform the reader of the relative quality of the lake, river, or stream, and they also give an indication of what some of the recovery goals should be. In both cases, as more information becomes available and or conditions change, the lakes, rivers, and streams will move between categories. A full description of the assessment process is in Chapter 6.

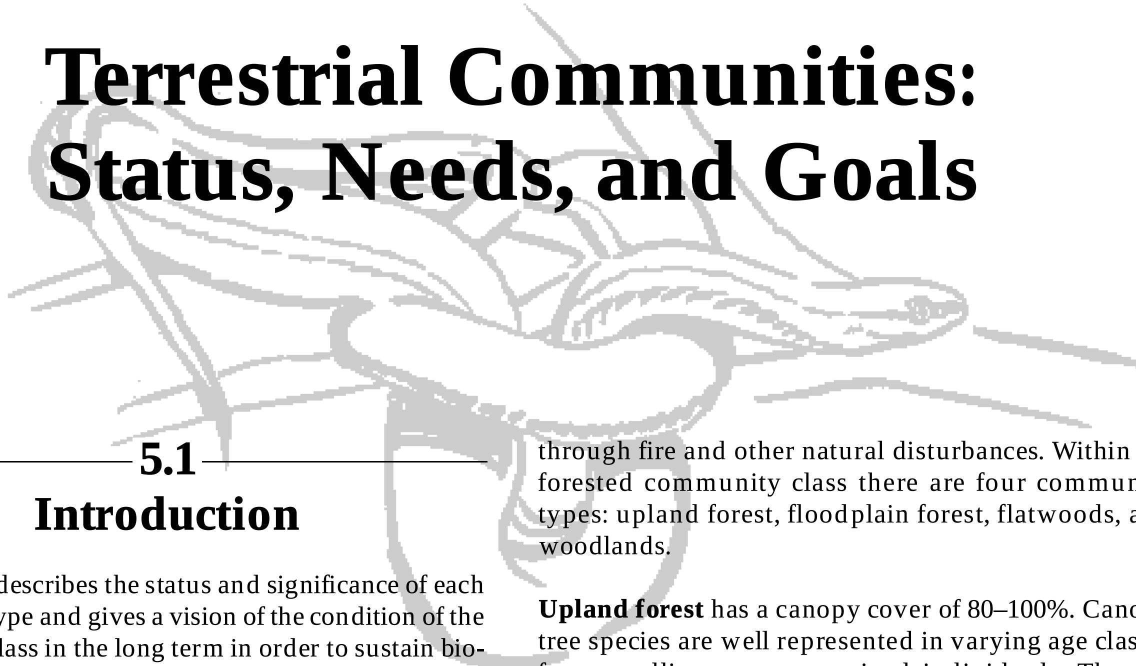
4.2.2 Overall priorities

Each stream has a recovery goal based on its current condition or the presence of features of special concern. The recovery goals are protection, restoration, rehabilitation, and enhancement. The streams with goals of protection and restoration are of higher quality and are of very high and high priority respectively for conservation action. Complete results for the streams assessed are included in Figure 6.1. Of the streams assessed, 37% are of high or very high priority.

The lakes were organized into the following four categories: exceptional, important, restorable, and other. Again, priority is placed on the exceptional and important lakes, which are currently of higher quality. Twenty-three lakes were identified as exceptional lakes and twenty-five as important lakes. The results are shown in Tables 6.1 and 6.2.

Chapter 5

Terrestrial Communities: Status, Needs, and Goals



5.1 Introduction

This chapter describes the status and significance of each community type and gives a vision of the condition of the community class in the long term in order to sustain biodiversity. Following this are sections on threats, recommended actions, and research needs. Many community types suffer from similar stressors, and actions are needed at the landscape level. For this reason, discussions on threats, actions, and research needs are grouped together for all community types.

The information presented in this chapter is based on the opinions of Science and Land Management Team members, gathered through a number of workshops and review processes. Many statements are based on professional experience, rather than published literature, and are presented to give an indication of priority and direction for future conservation work. Complete workshop reports from which this chapter was written can be found on the Chicago Wilderness Web site (www.chiwild.org).

5.2 Forested communities—status and recovery goals

5.2.1 Description of communities

The forested community class includes all the community types that are dominated by trees, with an average canopy cover of greater than 50%. Forested communities have a multi-layered structure composed of the canopy, sub-canopy, shrub, and herbaceous layers. Historically, this multi-layered structure was maintained through fire and other natural disturbances. Within the forested community class there are four community types: upland forest, floodplain forest, flatwoods, and woodlands.

Upland forest has a canopy cover of 80–100%. Canopy tree species are well represented in varying age classes from seedling to canopy-sized individuals. The fire return period is presumed longer for this community type than for woodlands or savannas. The longer fire return period and lower fire intensities would result from fire barriers provided by woodlands, savannas, and large rivers or lakes on the south and west sides of these communities. Three subtypes of upland forest are based on soil moisture: dry-mesic, mesic, and wet-mesic.

Floodplain forests are located on the floodplains of rivers and streams. These communities are shaped by the frequency and duration of flooding, by nutrient and sediment deposition, and by the permeability of the soil. The canopy cover (80–100%) is similar to that of upland forests, but the understory is more open due to the frequent flooding. The subtypes, based on soil moisture, range from wet-mesic to wet.

Flatwoods have a canopy cover of 50–80% and occur on level or nearly level soil that has an impermeable or slowly permeable layer that causes a shallow, perched water table. Because soil moisture fluctuates so widely by the season, the moisture gradients do not define the subtypes. Rather, the two subtypes are defined by geography and soil type. Northern flatwoods are associated with the Valparaiso, Tinley, and Lake Border morainal systems, while sand flatwoods have a meter or more of acidic sand over silty clay and are found in the more southern parts of the region.

Woodlands developed under a canopy cover of 50–80%, intermediate between that of savanna and forest. Today, many original woodlands have canopy cover greater than 80% due to years of fire suppression. Such sites can be recognized by the failure of the canopy tree species to reproduce, with few, if any, canopy species represented in the seedling or sapling layer. Based on soil moisture, woodland subtypes are dry-mesic, mesic, and wet-mesic.

More detailed descriptions of the forested community types may be found in Appendix 1. Associated animal assemblages may be found in Table 4.3.

5.2.2 Findings and priorities

Of the forested community types, the woodlands are of the highest conservation concern. All moisture classes of woodland are in the first tier of conservation targets for the Chicago Wilderness region. Wet-mesic woodland is considered critically imperiled at the global level (G1) by The Nature Conservancy (which calls this community swamp white oak woodland). A substantial number of acres of woodlands remain, providing opportunities for their conservation, but remaining sites are generally in very poor condition. The healthy woodlands in the Chicago Wilderness region tend to be species-rich, indicating that they are biologically important. The Chicago Wilderness region also has a unique landscape setting of woodlands, including those originally interspersed with prairies.

The flatwoods of the region are of high concern, because the remaining examples are both degrading rapidly and disappearing due to development or conversion to other land uses. In The Nature Conservancy's global ranking system, both northern flatwoods and pin oak-swamp white oak sand flatwoods, which correlate to Chicago Wilderness's sand flatwoods, rate as imperiled globally (G2). The primary conservation concern for upland forest and floodplain forest is their current degraded condition. All of the forested communities are important as wildlife habitat, and they are key areas for human recreation. The primary requirement for their conservation is significantly increased management efforts.

FORESTED COMMUNITIES
Conservation targets in top tiers

First tier
Woodland (all subtypes)

Second tier
Northern flatwood

Third tier
Sand flatwood

5.2.3 Status

Upland forests

Upland forest, particularly areas not dominated by oak, was probably much less common historically than woodland, savanna, or floodplain forest (Bowles et al. 1998a).

There are comparatively greater amounts remaining of dry-mesic upland forest than of other subtypes. Dry-mesic upland forest is mostly fragmented, but some large blocks still exist, such as in Busse Woods. There has been much less loss of both dry-mesic and mesic upland forest than of other community types.

Upland forests are more secure because a relatively high percentage of their original acreage has been protected. Mesic upland forest was an initial target of the Forest Preserve Districts when they first started acquiring land. However, many occurrences are still in private hands, and others are threatened by development. Management options are more limited on upland forests on private property.

In general, drier upland forests are considered to be in better condition than wetter upland forests due to less impact from invasive species. There are few or no remaining high-quality examples of wet-mesic upland forest. However, the quality of drier sites is declining rapidly, primarily through the ongoing loss of the shrub layer. Many of the remaining acres of mesic upland forest have significantly impaired ecosystem function, including quality of wildlife habitat. Different types of upland forest are affected differently; oak stands are currently deteriorating more rapidly than maple stands (Bowles et al. 1998b). In some parts of the region, both are rapidly deteriorating. It would be valuable to have more inventory and monitoring to determine the full extent and rate of degradation. Significant threats to upland forests include lack of fire, fragmentation, browsing by deer, and invasive species, particularly buckthorn.

Historically, moisture gradients and community types varied with subtle changes in the landscape. Today, we mainly have fragmented remnants that do not incorporate these landscape-scale variations. Complexity in the landscape is important for animals, as they respond to structure and community mosaics, not to one community type. Succession toward more closed forests is occurring due to the lack of fire, and species diversity is being lost in the process. In the remaining fragments, most animal communities are not doing well, primarily due to the effects of isolation and loss of key habitat features. Amphibians, in particular, are doing very poorly and are declining precipitously in places, due to fragmentation. Individual populations are at risk because they are no longer functioning as part of metapopulations, with gene flow between separate subpopulations (Mierzwa 1998).

Floodplain forests

Floodplain forests have always been relatively rare in the Chicago Wilderness region, occurring along the major river courses. The region has lost some original floodplain forests to conversion to agriculture and other development, but many acres are protected in forest preserve holdings. Because of lack of fire, trees are appearing in some floodplains that were sedge meadow and wet prairie historically. Additionally, with increased hydrological inputs, areas along rivers now experience longer and more frequent flooding. This combination of hydrological change and lack of fire has allowed certain species to become more abundant, changing the structure and species make-up of floodplains. These more recently developed floodplain forests do not seem to have high levels of floristic diversity, although they do have some limited wildlife values.

The quality of original floodplain forests suffers from altered hydrology and increased sedimentation. The sensitive amphibian species have been lost, and those that remain are tolerant of flooding. Further study of the cause-and-effect relationships in the development and degradation of floodplain forests would lead to a better assessment of their status.

Flatwoods

Both types of flatwoods occurring in the Chicago Wilderness region, sand and northern flatwoods, are extremely rare and are considered globally imperiled (G2). Unlike the other forested community types, the differences between the two subtypes are substantial and are not based on moisture. Overall, both flatwood types are in fair condition compared to other forested communities, but they are degrading rapidly in the absence of management. Lack of fire, invasive species, and overabundant deer are primary threats. Flatwoods have a very delicate moisture balance, so their condition is sensitive to changes in hydrology. Surrounded by development, flatwoods can experience raised water levels, which damages them through excess flooding. Thus, the lower-lying flatwoods are more prone to loss. Conversely, in some areas, flatwoods are drying up as water in their watershed is diverted away from them.

Most sand flatwoods in the region occurred in southeastern Cook County and in Indiana around the edge of Lake Michigan. Occurring primarily in the Lake Plain Division, sand flatwoods are naturally rare in the region. Many sand flatwoods have been lost to agriculture, and others have succumbed to development and drainage.

A few good-quality examples of northern flatwoods remain today, and more remnants are of degraded quality. Northern flatwoods are generally found in and amongst upland forests and woodlands and occur in the drainage ways and depressions associated with glacial moraines. Therefore, northern flatwoods survive better when they are imbedded in a large preserve. In the smaller preserves, altered hydrology will remain a significant problem.

Woodlands

In the absence of fire, canopy cover in woodlands increases and biodiversity declines. Before large-scale suppression of fire, woodlands were extensive in the region. Unfortunately, good-quality examples are hard to find today. All of the woodland subtypes are suffering the same threats, most significantly lack of fire, invasive species, impacts from overabundant deer, and loss due to development.

A fairly large amount of degraded woodland still remains on protected land, providing opportunities for restoration and conservation. The woodlands that were originally interspersed with prairies in the southern and western areas of the region have been lost to a greater extent than woodlands more closely associated with forest communities. Woodlands, along with forests, are found more often in protected areas than other community types, because originally they were a focus of Forest Preserve District acquisition. However, much woodland that was not protected has been lost to development. Historically, across the landscape, woodlands were a part of a shifting mosaic of communities; this dynamic has been lost in our fragmented landscape.

Virtually all of the woodlands remaining in the Chicago Wilderness region are in very poor condition. In some areas, considerable management is devoted to woodlands, and in these areas their condition is improving. However, the majority of woodland acres are not managed. The last twenty years have seen significant improvement in management attention for these communities, but considering the significance of this community type to the region's biota, and its rarity elsewhere, there is still a long way to go.

Woodlands can maintain some of their values better than upland forests in a fragmented state, since they have always occurred in smaller patches interspersed with other community types. This provides greater opportunities for successful restoration of this important community type.

5.2.4 Biological significance

Upland forests

Because of the degraded state of upland forests, it is likely that the current richness of plant species is comparatively low, although comparisons to historical conditions have not been made. In most upland forests, much of the original floral diversity has certainly been lost, especially the summer and fall herbaceous species, the shrubs, and the graminoid fuel matrix. Oaks historically dominated most of our upland forests, but now maple and ash are becoming more common.

For the region's mammals, upland forests and woodlands are the most important community types, although these mammals benefit most from a complex of different communities in an area. Many mammals depend on both forests and woodlands. Mammals of concern found in forests include the federally endangered Indiana bat, the eastern pipistrelle (a type of bat), and the woodland vole.

Upland forests, along with the other forested community types, provide important habitat to amphibians and reptiles, including the eastern box turtle, the eastern newt, the eastern rat snake, and the spring peeper. The overall assemblage of forest and woodland reptiles and amphibians is considered to be in decline. Upland forests also serve a critical need as migratory pathways for migrating birds. The remaining forest blocks in the region are likely too small to sustain viable breeding populations of forest-interior birds. This is due to greatly increased rates of predation (from raccoons, feral cats and other animals) and nest parasitism (from brown-headed cowbirds) in the fragmented forests of the region (Robinson et al. 1995). It is most important to protect the largest blocks of remaining forest from additional fragmentation to increase the chance of some successful reproduction by these species.

Floodplain forests

Floristic diversity in floodplain forests is maintained by regular patterns of flooding. Floodplain forests have always been dominated by disturbance-tolerant species. Along with other forest types, floodplain forests are important for mammals, particularly as feeding areas, and they serve as important migratory corridors for birds. Breeding birds, including Cerulean warbler, red-shouldered hawk, American redstart, and prothonotary warbler, also depend on floodplain forests.

Floodplain forests of the Chicago region are important as insect habitat because of the rich assortment of plants. Pawpaw, yellow birch, black walnut, sycamore, and many others are typically found only in high-quality floodplain forests. Insect species depending on these trees for food will, therefore, be dependent on remnants of high-quality forest. Examples include the zebra swallowtail butterfly, the sycamore sallow moth, and the pawpaw sphinx moth.

Floodplain forests also provide benefits to river systems by trapping sediment and improving water quality, as well as slowing floodwaters.

Flatwoods

Flatwoods are key amphibian breeding grounds. In particular, the blue-spotted salamander is abundant in good-quality flatwoods. Additionally, massasauga and Kirtland's snake may rely on flatwoods, although both species occur only in the more open parts. Flatwoods provide habitat for a number of endangered and threatened plant species. Plant species of concern include purple-fringed orchid and dog violet. Good-quality flatwoods generally have higher levels of plant diversity than other forests and harbor a number of conservative species. As for insects, species such as the mouse-colored lichen moth, fern moths, the royal fern borer, sensitive fern borer, the northern fern geometer, and a variety of millers and cutworms appear to be associated with flatwoods. The temporary ponds have unique communities of aquatic invertebrates since they are fishless and seasonal.

Woodlands

Woodlands are particularly important for biodiversity. The larger and better examples of woodlands can be species-rich in amphibians, reptiles, birds, and mammals. The more diverse sites are those in larger savanna / woodland / forest complexes or woodland / wetland complexes. Woodlands provide important habitat for many species of conservation concern, such as the declining red-headed woodpecker. Forest and woodland reptiles and amphibians are in decline overall.

For birds, the woodlands are the most important of the region's forested communities. Sensitive bird species include yellow-billed cuckoo and whip-poor-will. The open-woodland bird assemblage is in suboptimal condition and is considered globally important. Woodlands, like the other forested communities, also serve as important pathways for migratory birds.

Woodlands harbor a number of endangered and threatened plant species of concern, including northern cranesbill, shadbush, false bugbane, pale vetchling, and buffalo clover.

The woodland and savanna insect communities are potentially globally significant, yet more remains to be learned about these communities. The insect assemblage of dry blacksoil savanna and woodlands is of concern. Sensitive insects found in woodlands and savannas include Appalachian eyed-brown, silvery checkerspot, hobomok skipper, silvery blue, and pipeline swallowtail.

5.2.5 Global significance and conservation importance

According to The Nature Conservancy's global ranking system, both types of flatwood communities are globally imperiled (G2). The Chicago Wilderness region contains a number of good-quality examples of flatwoods. The region might include the majority of remaining high-quality northern flatwoods. The upland forests of Chicago Wilderness are unusual in their pattern of occurrence on the landscape. These forested communities were once naturally fragmented by prairies and other community types, creating a unique mix of species. Chicago Wilderness has the best and possibly the only extensive examples of this landform—oak forests in the middle of the prairie. Floodplain forests are found along most of the major river valleys, but in general they are rarer than other forested community types. Although woodlands are widespread, this region is very important for two reasons: 1) much conservation attention has been and is being paid to woodlands here, and 2) the dynamic interaction of prairie and forest that creates woodlands could be restored here.

5.2.6 Long-term vision and recovery goals

This plan's vision for the region's forested communities is to improve conditions and restore natural processes to allow canopy tree species to regenerate (in viable numbers) and to maintain an appropriate continuum of canopy cover across the region to sustain viable populations of rare species and community assemblages. A focus for achieving this goal will be on natural areas where disturbance is essential for ecological health and for allowing natural regeneration to occur. Natural disturbances include fire, disease, storms, and sustainable levels of animal browsing. Viable management options, including prescribed burns and selective or patch cutting, should mimic natural disturbance. Forested sites should be managed to maximize structural and biological diversity and to maintain a continuum of canopy from open to closed, reflecting historical proportions of canopy cover. An important goal, and an indicator of system health, will be to restore understory layers of shrubs and saplings and ground layers of native herbaceous species throughout all forested communities.

Large-scale planning and restoration should attempt to create opportunities for landscape-scale processes that create healthy forested communities. These efforts should also seek to maintain a variety of juxtapositions between woodland and forest, and between woodland and grassland, to sustain the species dependent on these dynamic interactions. Flatwoods, for example, are always contained within other forested community types. A goal is to move forested communities into more self-sustaining conditions, which will reduce the management effort needed over time. Some forested community types, such as flatwoods and true floodplain forests, are rare, and a goal should be to sustain the rare species they support through appropriate management and additional land protection where still possible.

Additional indicators for evaluating the long-term health of the forested communities are the reptile and amphibian assemblage and some wide-ranging mammal species, such as the gray fox. The region's woodlands should support sustainable populations of woodland amphibians and reptiles with opportunities for gene flow among separate sub-populations. Because amphibians have complex life cycles, conservation of this assemblage requires a variety of breeding wetlands within woodland sites. Amphibian species of concern associated with forested communities include spotted salamanders, spring peepers, and wood frogs, which are currently threatened by fragmentation of upland forests and the lack of breeding wetlands within forested blocks. It should be a goal to properly protect and manage flatwoods to sustain large populations of blue spotted salamanders.

Maintaining viable populations of woodland bird species, particularly sensitive species such as the red-headed woodpecker, is another goal. Due to habitat types and shapes of habitat occurrences, the Chicago Wilderness region has never provided major breeding grounds for most forest-interior bird species. However, a goal should be to maintain a number of locations that provide the structural habitat required for these species. Chicago Wilderness's forested communities play a significant role for migrating birds, and these communities should be maintained to provide these fundamentally important stop-over sites.

Another goal is to expand populations of rare plant species to ensure their continued existence on our landscape. Flatwoods, in particular, harbor a large number of rare plant species, and more open-canopy examples are needed for their continued existence. Recovery plans for key species are needed to identify priority actions.

In total, it is thought that approximately 50,000–100,000 acres of healthy forest and woodland complexes are needed in the region to meet these goals. To maintain the diversity and richness of amphibian species, it is recommended that we maintain enough sites to provide for a wide range of quality breeding habitat. Ideally, as many as 20 good-quality sites larger than 500 acres would provide a rich diversity of amphibians and other species. Several 800- to 1000-acre sites, with appropriate landforms (slope, soils, and hydrology), are needed to maintain a variety of plants and woodland types.

While size is more important than quality for some species, most species that depend on forests and woodlands need good-quality sites for their survival. To achieve a healthy state of the forested communities in the region, it is recommended that at least 90% of the highly fire-dependent communities be managed with prescribed burns on a rotating schedule. In addition, the density of deer should be reduced to a level that, in combination with prescribed burns, will allow the herbaceous and understory layers to return to a healthy condition. Active restoration, including cutting, burning, weeding, and planting, should take place on many more sites to increase the overall health of forested communities in the region.

5.3

Savanna communities—status and recovery goals

5.3.1 Description of communities

Savannas are wooded communities with a graminoid groundcover and with an average tree canopy cover of less than 50% but greater than 10%. A savanna may have shrubby areas, and the tree canopy may locally be greater or less than the above limits. Savannas often have soils that are transitional between forest and prairie, and they have distinctive plants and animals. These communities were maintained by fire before European settlement. They were among the most widespread and characteristic communities in Illinois and Indiana, but few high-quality stands remain. Most remnants have changed extensively. The least-disturbed remnants are on sandy land that still is frequently burned and on the very driest slopes, where woody encroachment has been slowest. The two different types of savanna are fine-textured-soil savanna and sand savanna. Savanna subtypes are distinguished by soil moisture. The subtypes of fine-textured-soil savanna are dry-mesic, mesic, and wet-mesic. The subtypes of sand savanna are dry, dry-mesic, and mesic. A more complete description of savanna communities is in Appendix 1. Associated animal assemblages are shown in Table 4.3.

5.3.2 Findings and priorities

Savannas were once common across the landscape in the Chicago Wilderness region. Today, much of the savanna has been lost, although of greater concern is the poor condition to which the region's remaining savannas have degraded. Due to their degraded condition, and their global conservation significance, savannas are one of the highest priorities for additional conservation attention in the region. The Nature Conservancy considers fine-textured-soil savannas critically imperiled at the global level (G1). Mesic sand savanna is also a first-tier conservation target for Chicago Wilderness, due to the small number of remaining examples. Dry and dry-mesic sand savannas and are in the second and third tiers of conservation priority, as remaining examples are in somewhat better condition overall. Many acres of savanna are so degraded that they are barely recognizable as savannas. At the same time, savannas are very important due to their biological richness. Savannas are often a transitional community between woodlands and prairies or wetlands, which leads to their high diversity of species.

SAVANNA COMMUNITIES
Conservation targets in top tiers

First (highest) tier
Fine-textured-soil savanna (all subtypes)
Mesic sand savanna

Second tier
Dry sand savanna

Third tier
Dry-mesic sand savanna

5.3.3 Status

For all types of savanna, the region has lost most of what was once here, but across the region more fine-textured-soil savanna has been lost than sand savanna. In Indiana, very little fine-textured-soil savanna remains. In Illinois, mesic and dry-mesic fine-textured-soil savannas are still the most common types of savanna. Much of the savanna in the region was lost in the conversion of land to row crops and pasture. The wetter savannas of both types are the rarest today. Many of the wetter fine-textured-soil savannas were drained through tiling and converted to agriculture.

Of the remaining savanna, most of the known high-quality sites are protected. Savannas were often included in the original public land purchases along with woodlands. Due to the aesthetic appeal of savannas, many have been incorporated into golf courses and college campuses, which has helped to protect them to a certain extent, although such examples have lost most of their original species diversity. Sand savannas, particularly in the eastern and southern parts of the region, have been preserved in moderately large blocks, whereas the fine-textured-soil savannas have been severely fragmented.

Of the sand savannas, most of what remains in the region is dry-mesic sand savanna, particularly in southern Will County, in Lake County, Illinois, and in Indiana. In these areas, management is being applied to good-quality sites. Due to these efforts, dry-mesic sand savanna is in the best condition of all the savanna community types. Yet, possibly as much as 50% of the remaining dry-mesic sand savanna is not being managed and is declining in quality.

Little of the dry sand savanna remains. With lack of management, these areas become overgrown, which alters the moisture gradient and leads to a loss of community structure and diversity. Mesic sand savanna has always been extremely rare in this region, because it occurs in a specific type of hydrology within a specific topography. The remaining examples in the Chicago Wilderness region are at Illinois Beach State Park and Indiana Dunes National Lakeshore.

There is a high level of concern about the amount of remaining mesic and wet-mesic fine-textured-soil savanna and its fragmented condition. The hydrology of wet-mesic fine-textured-soil savannas has very rarely been left intact, and hydrological change is a threat to all savannas. If the hydrology is lost, it is extremely difficult to restore this community type to original condition.

Savannas are fire-dependent communities, and the lack of burning leads to their rapid degradation. Many acres of fine-textured-soil savanna are not managed at all. A natural, healthy savanna is as easy to manage as a prairie or woodland, and much easier to manage than a lawn or garden. Invasive species are a significant threat to savannas, and degraded savannas often require large-scale mechanical management at first, which can be expensive. During restoration, some species of trees, shrubs, and herbaceous plants may need to be reduced in number or eliminated. Additional threats to savannas include overabundant deer and recreational pressures.

5.3.4 Biological significance

All types of savanna are biologically significant due to their species richness and numbers of rare species. Savannas were once very widespread and now generally occur only in small pockets, which raises concerns about the genetic viability of some remaining savanna species.

Sand savannas in the region have high species diversity, since the dunes systems where many occur contain a mosaic of community types. The species richness in fine-textured-soil savannas is also very high, because they contain a mixture of woodland, prairie, and wetland species. Many species, particularly plants and insects, depend on savannas. State-listed endangered and threatened plant species found in savannas include redroot, savanna blazing star, pale vetchling, and veiny pea.

The assemblages of insects found in fine-textured-soil savannas differ from that of sand savannas, and there are differences depending on moisture gradients as well (Table 4.3). All of the savanna insect assemblages appear to be in decline and are of conservation concern (Table 4.8). Additionally, the sand-savanna insect assemblage of the region has been identified as globally important (Table 4.9). The fine-textured-soil insect communities may also be globally important, but not enough is known about these species.

Characteristic insects associated with sand savannas include the federally endangered Karner blue butterfly and American burying beetle. The phlox flower moth, originally described from the dune-and-swale complexes of northwest Indiana, was thought to have been extirpated from Indiana until its recent rediscovery. Additional globally rare, but often overlooked, species include the persius duskywing skipper, the cobweb skipper, the Indian skipper, the frosted elfin butterfly, Grote's dart moth, and numerous other moths and leafhoppers. Grasshoppers, bees, wasps, beetles, and flies also have many species restricted to sand prairies and open sand savannas.

Insect species of concern recorded from fine-textured-soil savannas include the rare silvery blue, which feeds as a larva exclusively on the equally rare veiny pea. Various additional woodland and wetland butterflies and skippers are found primarily (or in greatest numbers) in high-quality remnants of these savanna types. These include the silver-bordered fritillary, silvery checkerspot, and Appalachian eyed-brown.

The savanna bird assemblage is in suboptimal condition and is considered globally important. The red-headed woodpecker is found predominantly in savannas and responds well to management of the habitat. Some other savanna bird species, such as eastern kingbird, are declining.

Assemblages of reptiles and amphibians differ between fine-textured-soil and sand savannas. The amphibians and reptiles of fine-textured-soil savanna appear to be declining due to lack of management of their habitat. Plains leopard frog and smooth green snake are sensitive species. The Chicago Wilderness region is very important to the conservation of this assemblage. The reptile and amphibian assemblage of sand savanna and sand prairie also includes declining species. Sensitive species belonging to this assemblage include Fowler's toad, eastern racer, bull-snake, and western ribbon snake. Finally, it is difficult to determine the habitat requirements of the endangered massasauga and Kirtland's snake, as a number of factors are contributing to their decline. Savannas are, however, potentially important to these species.

5.3.5 Global significance and conservation importance

Fine-textured-soil savannas are in as much trouble throughout their range as they are in the Chicago Wilderness region. Fine-textured-soil savannas are fragmented throughout their range and are considered critically imperiled (G1). Chicago Wilderness is very important for the global conservation of these savannas, because large amounts of restorable savanna remain. It is possible that the Chicago Wilderness region has the best chance anywhere of conserving the fine-textured-soil savannas.

There are significant biological differences between the sand savannas that occur in the Lake Plain Division and those that occur elsewhere. The Chicago Wilderness region is very important for the sand savannas in the Lake Plain Division. Sand savannas along Lake Michigan are ranked as globally threatened in The Nature Conservancy's system. Lake County, Illinois, and Porter and Lake Counties, Indiana, have the best examples of this type of sand savanna.

5.3.6 Long-term vision and recovery goals

This plan's vision for the region's savannas is to dramatically improve the condition and integrity of remaining savanna communities within the region. This globally imperiled ecosystem can again be a vibrant component of the region's natural landscape and can contribute significantly to the survival of all the species existing within the mosaics of prairie, savanna, woodland, and wetland that constituted the original landscape of the region. As part of this goal, Chicago Wilderness members recognize North American savanna communities as among the rarest community types on earth and will aim to fulfill a responsibility and opportunity to significantly contribute to their global preservation. Goals for savannas should focus on the health of the communities, their ability to regenerate, the restoration of natural ecological processes, and their role in a matrix of other natural community types. Savannas should function as structurally and compositionally dynamic communities in time and space, especially in conjunction with shrublands and woodlands.

With restoration of fire and other natural disturbances as a goal, sites need to be large enough that landscape-scale processes can occur. Development of relatively complete savanna communities will be most cost-effective on larger sites, though smaller sites are also valuable and can be healthy if well managed. The Karner blue butterfly is a sensitive species and, where it occurs, it can be helpful in defining management goals for sand savannas. The Karner blue depends on large, fire-maintained savannas or on complexes of smaller, high-quality savannas without much distance between them. The key to long-term survival for insect species that depend on sand savanna lies in the quality of the habitat and how it is managed over time.

While fewer animal species depend only on savannas than depend on other community types, savannas do have distinctive inhabitants, particularly birds, reptiles, and amphibians. These species serve as a target for conservation. Savanna birds require appropriate structural conditions. Currently, the region has many savannas in poor condition. Management should be undertaken in these savannas in order to improve their quality and structure. Based on a general understanding of the habitat requirements of reptiles and amphibians, it appears that viable amphibian populations require sites of 200 to 500 acres in size. As with all amphibian and reptile assemblages, multiple sites with functional connections for dispersal to sustain metapopulations are recommended.

5.4 Prairie communities—status and recovery goals

5.4.1 Description of communities

Prairies are communities dominated by grasses on organic or mineral soils. Trees may be present, but less than 10% of the area has tree cover. Four natural communities are recognized based on soil type: fine-textured-soil prairie, sand prairie, gravel prairie, and dolomite prairie. Soil moisture gradients for each of these prairie types range from dry to wet (except that gravel prairies range only from dry to mesic). More complete descriptions of all types are in Appendix 1. Associated animal assemblages are shown in Table 4.3.

5.4.2 Findings and priorities

Given how much has been lost and the generally poor condition of what remains, we regard all prairie types with a high level of concern. The region's fine-textured-soil prairies, dolomite prairies, and the sand prairies in the dune-and-swale topography are in the first tier of conservation targets. Gravel prairies, some subtypes of sand prairies, and dolomite prairies are considered globally imperiled (G2). Prairies once dominated the landscape but now mainly exist in small, isolated remnants. Few high-quality prairies remain. More examples of fair- to poor-quality prairie exist, but as of yet they are receiving little management attention and thus are degrading. Prairie communities have high biological importance, and the prairie communities within the Chicago Wilderness region are important to global prairie conservation, because the region contains some of the best remaining examples. The dune-and-swale topography is rare for sand prairies elsewhere, and therefore this region is important to the global conservation of this type of sand prairie.

PRAIRIE COMMUNITIES
Conservation targets in top tiers

First (highest) tier
Sand prairie (all subtypes in dune and swale topography)
Dolomite prairie (all subtypes)
Fine-textured-soil prairie (all subtypes)

Second tier
Gravel prairie (all subtypes)
Sand prairie (other than those in dune and swale topography)

5.4.3 Status

Along with fine-textured-soil savannas, fine-textured-soil prairies were once the most widespread community type in the Chicago Wilderness region. They were certainly the most extensive of all the prairie types, although all prairie types occurred in a mosaic at the landscape level. Unfortunately, a tremendous amount of these prairies has been lost, more than any other community type. Historically, the threat was conversion of prairie to agriculture; this threat has shifted to development. Development, particularly suburban sprawl, severely affects hydrology and limits the amount and types of management that can be done. Both of these factors threaten prairies and other natural communities.

Only one one-hundredth of one percent (0.01%) of Illinois' original high quality prairie survives (Critical Trends Assessment Project 1994). Although most of the fine-textured-soil prairie has been lost, there are still some good-quality remnants of up to 100 acres. Very few large examples of fine-textured-soil prairie, such as Goose Lake Prairie, remain. However, there is opportunity, particularly at Midewin National Tallgrass Prairie, to create more large prairies. Most of the remaining prairie is in public ownership. In addition to the remnants, there are now a number of re-creation projects, which one hopes will someday become higher-quality prairie.

Of the fine-textured-soil prairies, the dry subtype is probably the rarest today, as it was originally. The region has lost proportionately more mesic fine-textured-soil prairie since European settlement than dry or wet. Wet fine-textured-soil prairie was often drained for agriculture, so today there is less available for restoration unless the hydrology can be restored.

Sand prairies were probably never large and occurred in complexes with dunes and other sand communities. Relatively large remaining examples of these sand prairie complexes can be found at Illinois Beach State Park, Chiwaukee Prairie, and the Indiana Dunes National Lakeshore. Despite these remaining examples, most of the sand prairies have been lost since European settlement. For instance, the Lake Calumet region has lost almost all (95%) of its sand prairies. Lake County, Illinois, today has approximately 20% of the sand communities that once occurred along its portion of Lake Michigan.

The patches of sand prairie were always smaller than the fine-textured-soil prairies. However, there is concern about the increased isolation of sand prairies due to human activities. Sand prairies were interwoven with other sand communities. This loss of community mosaics has affected the diversity of remaining sand prairies. In Indiana, the drier sand prairies have been damaged more than wetter ones, because these areas were developed first. Changes from development have pushed drier conditions into the originally wetter areas. Drier sand prairies do recover with appropriate management.

Gravel prairies are naturally small and rare; this community type has never occurred in the Indiana portion of the Chicago Wilderness region. However, the region has lost almost all of the gravel prairies that were once here. Those that remain today are very small, and very few have been protected. Because gravel prairies are so small, some may still exist that have not yet been identified and protected. They are also favored sites for housing or sand and gravel mining. In the past, when conversion to agriculture was a large threat to prairies, gravel prairies were somewhat protected because they occur on slopes that are difficult to plow. But today these same slopes are targets for housing developments. Once the gravel hills are lost, there is little chance of restoring a gravel prairie.

Dolomite prairie has always been the rarest prairie type, and the region has suffered a tremendous loss. Across the United States, dolomite prairie is a very rare community type. Most of the Chicago Wilderness dolomite prairies occur by the lower Des Plaines River. Dolomite prairies occur as patches within other prairies and thus tend to be very small. It is possible to restore the remaining poor-quality dolomite prairies around the Des Plaines River, because the area has not been plowed. However, most of the other dolomite prairies have been lost to mining and other development.

The overall condition of prairies remaining in Chicago Wilderness is a complex subject for two reasons. First, most measures of quality primarily consider floristic quality, and therefore they may not adequately reflect overall quality, including faunal components. Second, the prairies today have lost a number of their ecological processes, and this compounds the threats facing them. We will now discuss each of these points in turn.

The INAI survey's quality ratings may give a biased picture of the condition of prairies, because it did not rank the status of the faunal communities. For example, there are some places where grassland birds are doing well, but there is poor floristic quality. There may be sites of grade D quality according to INAI that have thriving insect communities, as insect richness does not necessarily correlate to floristic quality. This is probably not a problem unique to prairies, and a different system is needed to measure faunal or overall quality. A system that evaluates the condition of a number of different taxonomic groups would inform management goals for different sites. For instance, in Indiana the largest fine-textured-soil prairie is only about 30 acres, which is not large enough to manage for birds, but this site could be managed for important plant communities. Certain factors cannot be improved with management alone, particularly size and functionality at the landscape level. These factors should be taken into account when assessing conservation value. Even just looking at floristic quality, the number of acres remaining of high-quality prairie is extremely small for all prairie types.

Today, several ecological processes are missing. Some, such as fire, can be returned through management, others can not. Historically, grazers recycled large amounts of biomass in prairies. Parts of the biomass-recycling process are missing today, and it is unclear how this may affect various organisms. An important research problem is identifying the role grazers once played in maintaining structure, because some species, notably birds and insects, rely on short-structured prairies.

Fragmentation and the small size of the remaining remnants are specific problems for fine-textured-soil prairie. Other significant threats include invasive species and lack of fire. In places where prairie remnants are receiving intense management, they are showing signs of improvement. More management and restoration are needed than land managers currently have the financial and human resources to do. For all prairie types, much more land is not being managed than is. In general, land-managing agencies are focusing their resources on the higher-quality sites. More than half of the high-quality prairie remaining in the region is being managed. However, of the low-quality prairie of all types, perhaps as little as 10% is being managed.

Once prairies have reached the point of maintenance after restoration efforts, they are relatively easy to maintain. Regular burning is the only major management need, provided there has not been significant build-up of brush.

5.4.4 Biological significance

Some have referred to prairies as a tropical rainforest turned upside-down, as the underground portion of a prairie has a tremendous amount of biodiversity. Not only are prairies very rich in species, but they are also among the most endangered ecosystems in North America. The Nature Conservancy ranks almost all of the prairie types that occur here as globally imperiled (G2), because most examples have been eliminated through conversion to other land uses or have become woodier areas due to lack of fire.

Prairies contribute significant ecological benefits to humans. Prairies are able to retain considerable moisture on site, thus dampening extremes in hydrological cycles and minimizing flood damage. Grasslands also store more carbon per acre than most other ecosystems. Ninety percent of the biomass is underground, and therefore the carbon is locked underground.

All types of prairies rate very high in biological importance, due to their high levels of diversity, particularly of plants and insects. Of the prairie types, mesic prairies have higher diversity than wet or dry prairies. However, species richness is affected by scale; larger sites harbor more diversity.

Prairies have high plant-species richness and high plant-species conservatism. Species conservatism is particularly prominent in the dolomite prairies. Many local prairie plant species are important either because they are globally rare or because their critical range lies within or includes the Chicago Wilderness region. These species include the prairie bush-clover, eastern prairie fringed orchid, leafy prairie clover, globe mallow, pale false foxglove, shore St. John's wort, Kalm's St. John's wort, Hill's thistle, and Hall's bulrush. Of these species, the first three are threatened at the federal level.

The prairies within the Chicago Wilderness region have long been known to harbor rare insect species as well as insect species dependent on good-quality prairie remnants. Every prairie type has a distinctive insect fauna, a subset of which it does not share with other types. All of the prairie insect assemblages are of concern. Sensitive prairie insects include the regal fritillary, Belfrag's stinkbug, the red-veined prairie leafhopper, and the rattlesnake master borer moth. Important remnant-dependent species associated with prairie habitat include the dusted skipper, silver-bordered fritillary, silvery checkerspot, two-spotted skipper, ottoe skipper, eyed brown, great grey copper, byssus skipper, Acadian hairstreak, aphrodite fritillary, and a variety of moths, leafhoppers, and grasshoppers. Many of these insects are tracked as species of concern throughout the Midwest. Some are at the eastern and southern extremes of their ranges, while others appear to be regional endemics. The insect assemblages of dry and mesic blacksoil prairie, dry and mesic sand prairie, and wet prairie are of global importance.

Various reptiles and amphibians depend on prairies as habitat. Three reptile and amphibian assemblages are associated with prairies, specifically with the fine-textured-soil, sand, and dolomite types. All three assemblages are in decline. The sedge meadow, fen and dolomite prairie assemblage is globally important. The species in these assemblages rely on other habitat types in addition to the prairie communities. Sensitive prairie species include the smooth green snake, plains leopard frog, queen snake, spotted turtle, bull-snake, eastern racer, eastern hognose snake, and Fowler's toad.

In their number of bird species, the prairie communities have fewer than other community types, but prairies do harbor many bird species of concern. Of all the bird assemblages, grassland birds have the highest percentage of threatened species and species of concern. Birds do not distinguish specifically between types of prairie, although habitat use does vary according to moisture gradient, and different bird species use different prairie structures. Moist-grassland bird populations in the Chicago Wilderness are critical to the global conservation of this assemblage. Sensitive species in this assemblage are willow flycatcher, yellow-breasted chat, Bell's vireo, American bittern, northern harrier, sandhill crane, king rail, short-eared owl, Henslow's sparrow, and bobolink. Important species in the drier areas are loggerhead shrike, lark sparrow, upland sandpiper, and western meadowlark.

5.4.5 Global significance and conservation importance

The Chicago Wilderness region is very important for the conservation of all its prairie types. The one possible exception is gravel prairie, for which less information is available.

This region is very important for dolomite prairie conservation, as it contains some of the best remaining examples. Similar plant communities called alvars grow on dolomite substrate around the Great Lakes, but these differ from the dolomite prairies of Chicago Wilderness.

The Chicago Wilderness region is also very important for sand prairies. The sand prairies of the Lake Plain Division, with its dune-and-swale topography, are globally rare. There are a few similar sand prairies around Toledo and Detroit, some of which are of high quality and large, but otherwise very few are situated in this topography. It is the flora of the dune-and-swale communities that are distinctive. This type of sand prairie occurs as part of a mosaic, typically with a narrow band of wet-mesic sand prairie, then a band of mesic sand prairie, then dry-mesic sand prairie.

Even though fine-textured-soil prairies stretch across the Midwest, plant communities gradually change between Illinois and Nebraska, with no obvious line splitting this prairie into distinct types. Nonetheless the prairies of the Great Plains are very different from the prairies of the Chicago region. For the conservation of fine-textured-soil prairies occurring east of the Mississippi, the Chicago Wilderness region is important. The Chicago Wilderness region has a high concentration of fine-textured-soil prairie remnants, particularly of high-quality remnants. Additionally, because much restoration work on these prairies is taking place in the Chicago Wilderness region, this region has added significance for their conservation.

Gravel prairies were created on glacial deposits, which were never abundant in the Chicago Wilderness region or elsewhere. Gravel prairies range into southern Wisconsin and other areas where gravel glacial deposits occurred, but they have always been rare. Through quarrying, most of gravel prairies have been destroyed in the Chicago Wilderness region. However, it is unclear how well they are surviving in other locations. Possibly this region has some important remaining examples.

5.4.6 Long-term vision and recovery goals

This plan's vision for the region's prairies is to manage and restore prairies on the landscape so that they sustain viable populations of all area-limited species and all formerly common species, and to protect multiple viable examples of all the region's prairie types. In addition, it is a goal to have landscape-scale natural processes, such as fire, hydrology, and gene flow between populations, play a significant role in maintaining the ecological integrity of prairies. Achieving these goals requires: (1) active protection of all high-quality prairie remnants that are large enough to sustain native species far into the future; (2) greatly increased and improved levels of management of all prairie remnants and other natural communities in a matrix of restored prairie and unrestored grasslands; and (3) far more acreage of restored prairie.

Prairies in the Chicago Wilderness region vary by substrate type and moisture level, and efforts should be made to protect and manage all prairie types. All are important components of the region's biodiversity, and all are considered rare or imperiled at the global level. A goal for prairie conservation in the region should be to protect viable populations of all currently endangered and threatened plant species that were historically widespread throughout the region. While some plants and insects rely on high-quality remnants, the region's grassland birds depend on large expanses of grassland. One of this plan's goals is to maintain stable or increasing populations of all grassland bird species that occur or historically occurred in the region. In addition to the birds that depend on pure grassland, a distinct set of birds relies on grassland with shrubs. Several species of reptiles, such as smooth green snake, are restricted to grassland habitats, and a goal is to conserve all of these species.

Of all the elements of the prairie community, the grassland birds are the most area-sensitive and are declining regionally and nationally. Focusing on the needs of these species will be necessary to fulfill this plan's goals for prairies. The region is fortunate to have a very large protected site for grasslands at Midewin. Efforts to manage and restore the most area-dependent species should focus on this site. However, no single site is sufficient to ensure stable populations of grassland birds. It is thought that ten to twelve large sites throughout the region, each approximately 3000–4000 acres in size, are needed to sustain viable populations of grassland birds and other prairie species.

These large sites should consist of native vegetation in mosaics of grasslands, savannas, and wetlands, in order to contribute to the conservation of all prairie-community elements. Both within and among sites, there should be variation in structure and moisture to provide a full range of habitats. Fire with different effects across the landscape would help to restore this diversity of habitats. Core areas of high-quality remnants need to be included in larger sites to provide a basis for recolonization by prairie plants and insects. Additionally, translocation and reintroduction may be essential to establish prairie invertebrates successfully. Watersheds containing key sites should be managed to allow hydrological restoration.

Viable populations of prairie reptiles and amphibians need a metapopulation structure. Reptile and amphibian assemblages appear to require a minimum of 200 acres to maintain most of the species. Therefore, to conserve all of the region's reptiles and amphibians, it is recommended that we create as many medium-sized (500- to 1000-acre) grassland sites as possible. These sites should consist of core natural areas within a landscape that allows them to function as breeding habitat. A priority should be to expand as many existing 80- to 200-acre prairie remnants as possible into 500- to 1000-acre sites. When given the opportunity, mobile species will recolonize functioning habitats. These sites should be managed with a diversity of processes to create the variety of habitats needed by different species.

As there are so few examples of gravel and dolomite prairies, all remaining examples should be protected, no matter how small. Beyond the rare prairie types, all remaining good-quality prairie sites (such as INAI grade C or above) should be protected and improved where possible. These sites will serve as important seed sources, and they will also play significant roles in conserving specific endangered and threatened plants and remnant-dependent insects.

Because the condition of prairie communities is currently declining due to lack of sufficient management, all prairie remnants under protection should be vigorously managed and, where possible, expanded to make management more efficient.

5.5 Wetland communities—status and recovery goals

5.5.1 Description of communities

The Chicago Wilderness region has one of the most diverse collections of wetlands in North America. The Chicago Wilderness community-classification system recognizes six major categories of wetlands: marsh; bog; fen; sedge meadow; panne; and seeps and springs. In addition, wet prairie is often considered a wetland type (although it is classified under prairie in this document). All wetlands are inundated or saturated by surface or groundwater for a sufficient part of the year to support vegetation that is adapted to life in saturated soil. Their vegetation, the amount of water they hold, and the chemistry of their soil and water define the different wetland types. For a more complete description of the different wetland types, see Appendix 1. Associated animal assemblages are shown in Table 4.3.

Marshes are cyclical wetlands dominated by emergent reeds and grasses and other aquatic plants. Vegetation and wildlife composition varies spatially with water depth. The stages of the marsh cycle form a continuum from a ponded state in which open water covers all but the marsh's shallow edges to a closed, 100% cover by emergent vegetation. Maximum structural diversity of importance for wetland birds is reached where the surface is approximately 50% open water and 50% emergent vegetation. This is called the hemi-marsh stage, and in it these two structural features are completely interspersed to maximize the internal interface between water and vegetation. There are two subtypes of marshes. Basin marshes occur in glacial kettles, potholes, and swales. They are most often found with savannas or prairies. Streamside marshes are restricted to the floodplains of creeks and rivers. They border the streams themselves or occupy connected backwaters and abandoned oxbows.

Bogs are glacial-relict wetlands restricted to hydrologically isolated kettles. Precipitation, naturally nutrient-poor, is the sole source of water. This factor, the cool basin microclimate, and the nutrient- and water-absorption properties of its dominant ground cover, sphagnum moss, combine to create a highly anaerobic, cold, nutrient-deficient acidic substrate of sphagnum peat with little biochemical decay. Three developmental stages in bog succession are recognized as distinct subtypes (graminoid, low shrub, and forested), but all are characterized by relict boreal wetland vegetation, which is now rare in the Chicago Wilderness region.

Fens are created and maintained by the continuous internal flow of mineral-rich groundwater from bordering upland rock formations and other recharge areas. An impervious layer of till or other water barrier forces cold, oxygen-deficient, mineralized groundwater to seep out at the bases of upland slopes. Fens support many plants adapted to high concentrations of dissolved alkaline minerals. There are three subtypes of fen: calcareous floating mat, graminoid fen, and forested fen.

Sedge meadows are sedge-dominated grasslands that include wet-prairie grasses. Groundwater seepage and/or shallow flooding are the principal hydrological factors, and frequent fire is needed to retain their open structure. Sedge meadows often grade into fens, marshes, or wet prairies.

Pannes are unique interdunal wetlands on calcareous, moist sands of the lake plain, generally within one mile of Lake Michigan. Sedges and sedge relatives dominate this open-structured wetland, which has considerable floristic overlap with fens and calcareous seeps.

Seeps and springs occur where groundwater flows to the surface. A *seep* is an area with saturated soil caused by water flowing to the surface in a diffuse flow. Seeps may have local areas of concentrated flow, and the water usually collects in spring runs. Seeps are usually smaller than 0.1 acre and are most common along the lower slopes of glacial moraines, ravines, and terraces. The three subtypes of this community (calcareous, neutral, and sand) are separated on the basis of water chemistry. A *spring* has a concentrated flow of groundwater from an opening in the ground.

5.5.2 Findings and priorities

All types of wetlands in the Chicago Wilderness region have declined in quantity and quality. Conservation of the remaining examples, restoration of degraded sites, and creation of new wetland areas are priority activities within Chicago Wilderness due to the high value of these communities both for species diversity and for ecological processes of functional value to people.

Graminoid fens are in the first tier of priority for additional conservation action, due to their rarity, degraded condition, and the global significance of the remaining examples in the Chicago Wilderness region.

Pannes are also a first-tier conservation priority due to their rarity and the loss of natural nourishment processes. Pannes have high biological importance, and the region has some of the best remaining examples.

Basin marshes are a relatively high priority for additional conservation attention. Basin marshes have high biological importance, particularly as habitat for wildlife. They merit particular consideration for additional conservation effort, because restoration efforts have proven successful in recreating their functional values, particularly when compared to the other wetland types.

There is a high level of concern about streamside marshes, because so few remain and they are in poor condition. Unfortunately, it will be difficult to design effective conservation actions for these areas without addressing substantial problems arising from changes in the hydrology of the region's streams and rivers. Bioengineering techniques are showing limited success, but more effective watershed practices and ways to restore streamside marshes must be found.

Calcareous floating mats are more numerous and in better condition than graminoid fens. Calcareous floating-mat fens rate as a relatively high priority for additional conservation attention due to their biological importance and the significance of the Chicago Wilderness region to their global conservation.

Sedge meadows are of slightly lower priority for additional conservation attention. Their status is somewhere in the middle of the continuum of concern, as a fair amount of this community type remains. Managed sedge meadows are improving in condition, and there is opportunity to improve further by bringing more sedge meadows under management.

Bogs are of lower priority than other wetland types for additional conservation attention, because, for the most part, the remaining bogs are well protected and receive high levels of management. Additionally, the Chicago Wilderness region is at the edge of their range, and they are of less overall biological importance due to their small size, although they do harbor a high number of locally rare plant species.

Calcareous seeps are of higher priority than neutral and sand seeps, because they have higher biological importance. There is concern about the rarity and the poor condition of all seep types. Due to their small size, however, they are difficult to target for additional conservation attention without focusing on the surrounding communities.

WETLAND COMMUNITIES
Conservation targets in top tiers

First (highest) tier
Graminoid fen
Panne

Second tier
Basin marsh
Calcareous floating mat
Calcareous seep
Streamside marsh

Third tier
Forested fen
Sedge meadow

5.5.3 Status

Marshes

Since the time of European settlement, the Illinois has lost nearly 90% of its wetlands, and Indiana has lost more than 85% of its wetlands (Critical Trends Assessment Project 1994, Bennett et al. 1995). Today, the Chicago Wilderness region continues to lose acres of marsh due to development. Protection measures are in place largely through the Federal Clean Water Act, and, thanks in great part to these measures, fairly large amounts of basin marsh remain. The wettest marshes in particular have survived, because they are the most difficult to drain for conversion to other uses. Although most of the largest examples of basin marsh have been lost in the region, it is still the most common of the wetland community types found within Chicago Wilderness.

The remaining marshes have undergone general degradation across the entire region, and most are considered to be of low quality. The main threats are invasive species, salinization, siltation, nutrient loading, and hydrological change. While all of the largest remaining complexes are in public ownership, many basin marshes are neither protected nor managed. Many of the marshes that exist on public land are not receiving proper management. The stressors are very large and widespread and are difficult to control.

A larger percentage of streamside marshes than basin marshes has been lost since European settlement, and very few good-quality examples remain today. Cook County has no known streamside marshes larger than one acre. Over the years, streamside marshes have been lost to channelization, siltation, or hydrology modification, or they have been cut off from their rivers by levees. Because the flow of a stream can be altered by changes anywhere in its watershed, streamside marshes are threatened even when they are in public ownership.

Sedimentation is a significant problem for streamside marshes, and they are vulnerable to invasive species whose propagules are carried by floodwaters. Nonpoint-source pollutants that degrade marsh systems are increasing.

Bogs

Bogs are a very rare community type in the Chicago Wilderness region, with fewer than 20 documented occurrences. Most of the remaining bogs are protected. Because bogs have small watersheds, they are the least threatened of the wetland community types by outside impacts, although development of surrounding land leading to changes in hydrology is a threat. Even though the bogs appear to be in better condition than other wetland community types, there is still cause for concern about their long-term maintenance. The remaining bogs are surrounded by development and are therefore difficult to manage.

Fens

Of the fen community types, forested fens and graminoid fens are at a higher level of concern (both for quantity remaining and for condition) than the calcareous floating mat. Forested fens are the rarest of all the fen types, with only nine known occurrences in the Chicago Wilderness region. There may have been more forested fens before European settlement. While forested fens are very rare, some exist that are not officially protected. Remaining forested fens are in urban areas and are suffering from road run-off and other pressures of development. Their quality is believed to be declining, as they are losing species, but not enough is known about how to best measure the long-term health of forested fens.

Although there are more graminoid fens than other type of fen, they are being lost at an alarming rate. Unprotected graminoid fens have been identified recently, and experts think more are still to be discovered in the region, although their condition is likely declining. Hydrological changes, invasive species, and cattle grazing threaten graminoid fens. Although the full effects of these threats have not been seen yet, there is a high potential for further degradation of the graminoid fens. In general, graminoid fens are in poorer condition than calcareous floating mats and, of the fens, are the most sensitive to groundwater changes.

Current investigations, such as the McHenry County Wetland Advanced Identification study, are still finding a few previously unknown calcareous floating mats. It is probable that the region has suffered historical loss of this community type, but there are no data on pre-settlement amounts. Because calcareous floating mats are difficult to reach, they tend to be better protected than the other fen types. Like other fens, calcareous floating mats are associated with their groundwater, and therefore are subject to issues of water quantity and quality. In addition, calcareous floating mats are subject to inundation by surface water. Invasive species, particularly purple loosestrife, are also a threat.

Sedge meadows

A fairly large number of sedge meadows remain in the Chicago Wilderness region, and many are officially protected. Nevertheless, very large amounts have been lost since the start of European settlement, when this community occurred throughout the region. Sedge meadows are susceptible to draining and to flooding as well as to the suppression of fire. Sedge meadows have been severely degraded by past grazing. Currently, most sedge meadows are of fair quality. Approximately half are being managed, and management appears to be improving their quality. The rest are degrading and in danger of being lost as they are overgrown by brush and invasive exotic species.

Pannes

Very few pannes remain in the region, with only twelve known occurrences covering less than 40 acres. Due to physical impediments on beaches, the natural processes by which pannes were created are almost totally blocked. Thus, while they appear stable and in good quality in the short term, pannes are threatened in the long term. The lack of littoral drift of sand due to hardening of shorelines in Wisconsin, Chicago, and other areas of the region has led to the lack of sand replenishment in the pannes. Without management in the form of adding sand to the beach system, the pannes will be eventually lost. Even though the remaining pannes are mainly protected, there is a high possibility of complete loss. Even in a protected state, pannes are threatened by succession, lake erosion, and elevation changes of Lake Michigan.

Seeps and springs

In general, seeps and springs are very small, and many are not being managed. They are invaded by a number of plants including buckthorn, reed canary grass, cattail and Impatiens. Often there is limited burning of the woodland community surrounding seeps and springs, and this lack of burning contributes to their poor condition. Many of the seeps and springs are not on protected lands, and these are in poor condition. There is only one known sand seep in the region, making this community type extremely rare.

5.5.4 Biological significance

Marshes

Marshes are of high importance to this region because they are so widespread and provide habitat to a number of species. Some plants are restricted to this community type, and marshes play an important role for a number of animal species. For example, many birds rely on the marshes in this region during migration. State-listed endangered or threatened plant species of concern that occur in marshes include American bur-reed and greenfruit bur-reed.

The region’s marsh reptile and amphibian assemblage, which includes the western chorus frog, green frog, northern leopard frog, painted turtle, Blanding’s turtle, Graham’s crayfish snake, and western ribbon snake, is considered globally important. The assemblage seems relatively stable, although it includes some species that are declining. For marsh reptiles, Blanding’s turtle, Graham’s crayfish snake, and the western ribbon snake are the species of special concern either because they are in decline or because they are restricted to a declining habitat. In general, marsh reptiles and amphibians suffer from management regimens that prevent the natural cycling of water. Development of surrounding lands, purple loosestrife invasion, and loss of plant diversity also threaten marsh reptiles and amphibians.

The region’s marsh insect assemblage is considered to be in decline. In particular, purplish copper, great copper, broad-winged skipper, and Dion skipper have been identified as sensitive marsh insects. Water-table alteration, siltation, and the invasion of cattails threaten the marsh insects.

The community of birds found in hemi-marshes without shrubs, which includes black tern, marsh wren, and yellow-headed blackbird, is considered to be in sub-optimal condition. The Lake Calumet complex was a very important site for hemi-marsh birds, but it is now greatly degraded through pollution, habitat loss, invasion by aggressive plants, and disruption of hydrology. Elsewhere, small- to medium-sized marshes that maintained significant populations have also been badly degraded.

Bogs

Bogs have a large number of distinctive plant species, as well as a distinctive insect fauna. State-listed endangered or threatened plant species that occur in bogs include water arum, few-seed sedge, and round-leaved sundew. There is a possibility that bogs have a distinctive reptile and amphibian assemblage, but this has not been confirmed. Because they were never a significant component of the landscape, bogs are of relatively less biological importance than the other wetland types in this region.

Fens

Fens in general have high overall diversity as well as distinctive plant communities, and they are of high biological importance to the region. Priority plant species dependent on fens include marsh valerian, a candidate for federal listing, American burnet, and queen of the prairie.

Forested fens tend to be rich in amphibians. It is possible that, in this region, the four-toed salamander is only found in forested fens. The reptile and amphibian assemblage of sedge meadow, fen, and dolomite prairie includes western chorus frog, green frog, northern leopard frog, pickerel frog, Blanding's turtle, smooth green snake, northern water snake, and queen snake. This assemblage in the region is considered to be globally important. Across the region, this assemblage is declining, although there is a north/south division. In the northern part of the region (Lake and McHenry Counties in Illinois), the assemblage is doing better, perhaps even increasing, due to management and protection. In the southern part of the region, the species that are specialists are declining, with only a few species hanging on. This is primarily due to fragmentation and isolation. Purple loosestrife poses a threat to these species over time.

The fen insects are of conservation concern with many rare species. Sensitive species, which are rare and habitat-restricted, include Baltimore checkerspot, swamp metalmark, and bluebell dragonfly. Hydrological alteration and invasion by common reed and cattail threaten fen insects.

Sedge meadows

Sedge meadows are extensive and important at the landscape level. While they do not harbor many rare plants, they harbor great diversity. Additionally, they are important for several animal species and as water-cleansing agents. Sedge meadows partially support the globally important reptile and amphibian assemblage of sedge meadow, fen, and dolomite prairie; this assemblage is discussed above under "Fens."

Pannes

Pannes are of high biological importance because they harbor some narrowly endemic species. While the panne reptile and amphibian assemblage is presently stable, its species are of conservation concern due to their rarity. Sensitive species include Fowler's toad, northern cricket frog, and Blanding's turtle. These species are affected by human disturbance, including collection, air pollution, and invasion by alien plants, mainly purple loosestrife.

Seeps and springs

Calcareous seeps are biologically important because they maintain many restricted plants, including the federal candidate species forked aster. In general, because seeps and springs are so small, they do not harbor many species, and they have no distinctive associated faunal communities.

5.5.5 Global significance and conservation importance

Both basin marshes and streamside marshes are widespread throughout the country. Good examples of both these community types occur within the Chicago Wilderness region, as well as elsewhere. The region does have a significant opportunity to create complexes of marsh, prairie, and other community types that does not occur anywhere else. Marshes are very important locally.

Pannes are globally imperiled and many of the best examples exist in the Chicago Wilderness region. The Chicago Wilderness region is important to the global conservation of this community type.

Both calcareous floating mats and graminoid fens range up into southern Wisconsin and further north but do not occur south of the Chicago Wilderness region. The Chicago Wilderness region contains many good examples of both graminoid fens and calcareous floating mats and is in a good position to contribute to their global conservation.

The forested fens of the Chicago Wilderness region are not significant to the global conservation of this community type. Similarly, most bogs are located to the north of the Chicago Wilderness region, and thus we are on the edge of the range.

The Chicago Wilderness region occupies a central part of the midwestern range of sedge meadows and contains a number of good examples of this community type, although other good examples can be found elsewhere.

Neutral seeps are widely distributed and are common in eastern forests. Chicago Wilderness is on the edge of the range of sand seeps, which occur where there are sandstone outcroppings, beach ridges, or dunes. Good examples of calcareous seeps occur in the region, but they are distributed elsewhere as well.

5.5.6 Long-term vision and recovery goals

This plan's goal for the region's wetland communities is to preserve all wetland types in viable examples and to expand the amount of some wetland types for wildlife habitat and for the sake of other ecologically important functions. The floristic diversity of wetlands should be maintained by managing most wetlands to good quality for natural species, eliminating or aggressively controlling invasive species. Hydrological regimes for most wetlands should be improved by managing surrounding lands in a manner that protects wetland integrity, and by planning management at the watershed level. A goal should be to look at planning for wetlands at a landscape level, recognizing that having complexes of wetlands in close proximity and embedding wetlands in a matrix of other natural areas is essential to their functioning.

Chicago Wilderness's wetlands represent an array of diverse community types (marshes, bogs, fens, sedge meadows, pannes, and seeps), all of which should be protected as unique contributors to the region's biodiversity. Due to their complex life cycles, amphibians rely on several different habitats. Therefore, conserving habitat mosaics, particularly including wetlands with varying hydrologic regimes, is important if we are to have demonstrably secure populations of amphibians. Serving as a good indicator species for marsh reptiles and amphibians, Blanding's turtle is a sensitive reptile for which habitat conditions should be improved. Many birds species, both breeding and migratory, depend on the region's wetlands. We need to increase the breeding populations of wetland birds and improve wetland management to be able to sustain populations through droughts. Within wetland complexes and across the region, different wetlands should be at different stages at the same time. Wetland plants depend on hydrological cycling of wetlands, yet the birds need open water during droughts. Some particularly sensitive species include American bittern, sandhill crane, king rail, and black tern. Requiring a diversity of habitats, including mudflats, high water, and low and high vegetation, amphibians also depend on a number of wetlands in a variety of hydrologic phases.

The above elements along with the overall goal help to define some specific requirements for protection and management. To maintain viable populations of marsh breeding birds, reptiles and amphibians, the region needs more large marsh complexes. Based on scientific knowledge of habitat requirements of wetland birds, reptiles, and amphibians, a natural-area complex of approximately 1000 acres, with several marshes of 100 acres or more and with smaller wetlands and ephemeral pools, appears to be appropriate. There is the potential to create and restore around fifteen of these large wetland complexes in the region, and this number should allow sufficient acreage and diversity of condition to meet the habitat needs of breeding and migratory waterfowl. Management of large wetland complexes across the region should be coordinated to ensure a diversity of conditions at all times.

In addition, many more relatively small wetland complexes are needed throughout the region, but particularly in the southern and western parts, to connect existing wetlands. These connections help species disperse. These complexes would protect the full range of wetland types, particularly as smaller wetland types do better when managed as part of a larger complex. In particular, fens, sedge meadows, bogs, pannes, and seeps require continued protection of currently designated natural areas and protection of newly identified sites. Wetlands, particularly those fed by groundwater, require protection of their recharge areas as well as protection of their plants. Natural hydrology needs to be restored in many areas as well as protected in others. Invasive species and other threats, such as salt and nitrates, need to be controlled in order to maintain healthy communities.

5.6 Minor community types

5.6.1 Shrubland communities

At the time of settlement, the woody vegetation matrix of the Chicago Wilderness region is thought to have included three vegetation types: oak savanna, woodland, and forest. This vegetation occurred across a landscape fire gradient, with forest having the greatest level of fire protection and savanna the least (Moran 1976, Hanson 1981, Anderson 1991, Bowles and McBride 1998, Bowles et al. 1994). However, a fourth community type, shrublands or barrens, was also a component of this landscape, but it has been overlooked or misunderstood. Most historic accounts describe shrublands as maintained by fire (Bowles and McBride 1994, White 1994). Illinois shrublands represented a late stage of fire-caused forest degeneration characterized by four- to five-foot sprouts of scrub oak, hazel, and wild plum (Gleason 1922). They were most common in uneven or rolling topography and in stream valleys, which reduced fire effects, or they developed on the west sides of forests attacked by eastward-moving prairie fires driven by prevailing winds (Gleason

1913). Shrublands appear to have been strongly allied floristically with savanna (Packard 1991, Anderson and Bowles 1999). However, savannas were formerly widespread, while shrublands may have been much less frequent, occurring in a linear pattern bordering the western flanks of prairie groves. For example, less than 1% of the DuPage County landscape comprised barrens or shrublands at the time of European settlement, while savanna may have covered about 18% (Bowles et al. 1999).

Shrubs and fire-stunted oak grubs appear to have been structurally dominant components of shrublands. Historic descriptions (reviewed in Bowles and McBride 1994) identify more than 30 shrub species that may have characterized barrens, including hazel, New Jersey tea, dogwood, wild crab, wild plum, sumac, rose, prairie willow, and prickly ash. Shrublands that formed along the western flanks of forests were dominated by hazel, forming a margin for the interior forest (Gleason 1913). Hazel is an important source of wildlife habitat and browse, and its nuts are among the richest wildlife food sources (Stearns 1974). Thus, hazel may have been a keystone species in the historic continuum of vegetation from forest to prairie. In addition, historic descriptions list more than 30 forb species occurring in barrens (Bowles and McBride 1994).

Due to their instability without fire, few, if any, high-quality shrublands exist (Packard 1991, Anderson and Bowles 1999). No high-quality shrublands remain in the Chicago region (Bowles and McBride 1996). With advancing settlement and fire protection, many authors described the instability and disappearance of shrublands (White 1994). Thus, large areas of shrublands were converted into forest "as by magic" when the fires that had maintained them were stopped and the oak sprouts became trees (Gleason 1922).

Because of the apparently total loss of intact shrublands or barrens, restoration of degraded land will be required to recreate this community. Perhaps the best potential site for shrubland restoration is the Hickory Creek Barrens Nature Preserve, which is part of the Hickory Creek Forest Preserve in Will County. Because of fire-management and introduction of prairie grasses at Hickory Creek and other sites, the process of restoring shrublands will differ from natural shrublands development. Hazel is a fire-sensitive, yet fire-dependent species. Burning kills back hazel canes, which require three to five years to reach reproductive size from root sprouts, and severe or growing-season fires can reduce stem density or cause mortality. However, without fire, trees replace hazel. Thus, the establishment and maintenance of hazel barrens must incorporate burning frequencies and intensities that are concordant with the life history of hazel. Competition from grass appears to hamper the establishment of hazel clones within a restored graminoid matrix (Bowles et al. 1993). To accelerate development of large hazel clones, fire protection may be needed for several years. How fire or fire protection affects establishment of barrens species is not clear, and may vary with species.

5.6.2 Cliff communities

Dolomite cliffs

Exposures of dolomite containing plant and animal assemblages in pre-settlement condition are very rare, due primarily to the lack of exposed dolomite and to the historic commercial extraction of the substrate. Most natural occurrences of dolomite have been quarried, resulting in serious loss of ecological value. Most of the remaining high-quality examples of this community type have been protected. Protected areas, however, are prone to a variety of conditions that may result in their degradation. Additional areas with degraded examples of dolomite cliffs are unprotected and under private ownership.

Dolomite cliff communities provide areas for primary colonization on highly alkaline, sterile substrates, which are unlike the vast majority of more common communities in the region. Undisturbed exposures of dolomite provide ecological conditions suitable for a variety of plants and animals with very narrow ranges of ecological tolerance, and these species are limited to dolomite cliffs and the large blocks of dolomite talus that result from natural erosion of these cliffs. Four groups of organisms in this category are ferns, lichens, other herbaceous plants, and land snails. Springs and seeps at the base of dolomite cliffs add a great deal of diversity to these communities, as do the perennial or intermittent streams that flow through dolomite canyons.

The primary ferns found on dolomite cliffs are purple cliff brake, walking fern, bulblet bladder fern, and slender rock brake. All four species are found only on dolomite cliffs or boulders in our region and are limited to communities with high ecological quality.

The lichen population of dolomite cliffs is not completely known, but it contains crustose, foliose and fruticose lichens. Many species in this habitat are restricted to bare rock that remains free of external disturbance for long periods of time. Several species previously unknown in this region were found in the Sagawau Canyon Nature Preserve in 1990. Numerous other species most likely remain to be discovered at this and other sites, and little is known of their ecological requirements.

Several herbaceous species also require the highly alkaline substrate. The hairy rock cress only grows on small ledges of cliff faces where a small amount of soil has formed. Other primitive plants such as mosses and liverworts are well represented on undisturbed dolomite cliffs and on the talus at the bottom of the cliffs but have restricted distribution elsewhere.

Narrow ledges covered with soil, small herbaceous plants, and plant detritus harbor a few species of land snails that are restricted to these habitats. Additional faunal species restricted to this habitat may also exist.

Other organisms with wider tolerances, but with an affinity for dolomite or limestone, may be quite abundant on dolomite cliffs but be fairly rare elsewhere in this region.

Eroding bluffs/ravines

The ravine bluff ecosystem occurs along the Highland Park moraine from approximately Wilmette to North Chicago, Illinois. Although much of this system is in private ownership, the finest examples and highest-quality remnants occur on publicly owned property in Lake Forest, Highland Park, and other North Shore communities. These remnants include McCormick Ravine in Lake Forest, and Rosewood Park and Ravine Drive Park in Highland Park. These sites contain examples of the rich diversity of the eastern deciduous hardwood forest intermixed with northern boreal forest relics that botanists theorize are left behind from the post-glacial ecosystem. Two such plants, buffalo berry and dwarf scouring rush, are only in these ravine bluff ecosystems. Thirty-eight percent of the ravine bluff flora grows in no other Lake County plant community (Wilhelm 1991). Many typically northern species occur in relative abundance in the ravines. A staggering 367 species of plants have been found in these ravine bluff ecosystems. Unfortunately, many of the more rare species have been extirpated from the ravine landscapes.

In addition to the rare plant community harbored within the ravine bluff complex, the geologic features are quite dynamic and unique. The relative geologic youth of this system results in dramatic change due to erosion and mass wasting events. The glacial till includes ancient rock and rocks otherwise not found in Illinois that were carried down with the glacier from Canada, Wisconsin, and Michigan.

5.6.3 Lakeshore communities

Beach communities

Many beaches still exist, at least in terms of substrate presence, although a large majority is unable to function naturally. Most remaining beaches are very damaged or altered by continual disturbance caused either directly or indirectly by people, and they only harbor a tiny fraction of their natural biota. However, some moderate- to large-sized stretches of beach in Indiana and Lake County, Illinois, are in relatively good condition.

For their nourishment, beaches rely on a continuing supply of sand transported by currents along the shore to replace sand lost to areas further along the shore. Unfortunately, the supply is being cut off or deflected into deep areas by construction or dredging. In some cases, this has made it necessary to import sand to maintain beaches. The beach community is one of the few natural communities where natural, periodic, catastrophic disturbance is a healthy part of the community. These disturbances occur as the result of storms and natural changes in lake levels.

Beaches and immediately adjacent foredune communities serve as virtually the only habitat for several specialized plant species, some of which are regionally rare, including beach pea (endangered in Illinois), marram grass (endangered in Illinois), sea rocket (threatened in Illinois), and dune thistle (threatened federally and in Illinois). It appears that beaches can serve as colonization zones for plants that specialize in beaches and foredunes and that can migrate over fairly large distances around the edge of the lake during storms or ice movement.

Beaches are important stops for migrating shorebirds. Migrating species include ruddy turnstones, buff-breasted sandpipers, and semipalmated plovers. Beaches are the only possible local nesting habitat for the piping plover (endangered federally and in Illinois), which now probably no longer nests in the area.

Foredunes

The foredunes in the Chicago Wilderness region are the first vegetated dunes formed adjacent to the Lake Michigan shoreline. They still exist in portions of northwest Indiana and north of Chicago, but they have largely been destroyed around the city as fill has extended development into the lake. Few high-quality, dynamic foredune systems remain because the construction of harbors and jetties and the hardening of the coastline to prevent erosion have cut off littoral drift of sand. The nearshore foredunes are dominated by marram grass with scattered cottonwoods. Secondary dunes and blowouts are dominated by little bluestem, bunchgrass, sand reed grass, sand cherry and numerous scattered forbs: hairy puccoon, sand cress, bugseed, and horizontal juniper.

Foredunes are important as buffers between the shore and the lake. Linear foredunes form with the interaction between lake level, sand supply, and vegetation establishment by marram grass in many years and cottonwood in cool, moist years. They formerly harbored the federally threatened Pitcher's thistle and other rare plants. Foredunes at Illinois Beach State Park harbor a larger element of western prairie than do those in northwest Indiana.

High dunes

High dunes occur in the southeast shoreline of Lake Michigan where post-Nipissing winds piled up large sand dunes. High dunes in Miller, Ogden Dunes, Dune Park, Dune Acres, and Beverly Shores in Indiana have been altered or destroyed by residential and industrial development, leaving about half of what existed in presettlement times. The best unfragmented examples occur in the Indiana Dunes State Park, but Indiana Dunes National Lakeshore has high-quality examples as well. High dunes harbor a mesophytic community on the north / northeast slopes and in the deep valleys, called mesophytic pockets. Here, climatic extremes are moderated by Lake Michigan, in contrast to the barrens and savannas that occur on the south and west slopes. High dunes are often interrupted by large blowouts whose origins are controversial. Some believe the blowouts are the result of post-settlement disturbance, and others believe they represent past movement of sand when lake levels were high or decreasing from a high level. Dominants in the high dunes can include jack and white pine, basswood, white and red oak, ash, tulip tree, and dogwood. Further from the lake, high dunes have black oak forests or white oak flatwoods.

These are important transitional communities between the unforested foredunes and the savanna and forested portions of the dunes. They harbor mesophytic and boreal elements including winged polygala, hepatica, trailing arbutus, ivory sedge, rice grass, bellwort, and black oat grass. Red-headed woodpeckers and white-footed mice are common.

5.6.4 Urban and rural open spaces

A significant portion of the open space in the region —parks, golf courses, industrial sites, and agriculture— does not contain natural communities as discussed in this chapter. These areas can still contribute to biodiversity conservation and should be considered in future planning. Chapter 11 contains suggestions on how corporate campuses, agricultural lands, and other private open spaces can help conserve biodiversity.

A particular focus for such planning, as noted by participants in this recovery plan, should be the lakefront parks along the shore of Lake Michigan. Although most of these urban parks are built space, in many cases the landscape architects have used the natural setting as their model. These and other urban open spaces can provide habitat for wildlife and plants. In particular, the lakefront parks are a critical element in maintaining habitat for birds that migrate though the region between breeding and wintering grounds.

The Chicago Wilderness region is an important area for migrating birds because Lake Michigan constitutes a key part of one of the major flyways in North America. Most birds do not fly over the Lake itself, but instead fly along its edges as they travel north or south. Westerly prevailing winds push more birds up against the Lake so great concentrations end up traveling in a narrow corridor adjacent to the shoreline. As a result, shoreline parks are excellent resources for migrating birds, and are an invaluable resource to the bird watchers of the region.

Migrants will benefit significantly from greater vegetation cover, and greater variety of food sources along the entire lakeshore, such as seeds and insects associated with native vegetation. Urban greening in general, particularly in the City of Chicago, would provide cover and food for migrating birds. Use of native plants in landscaping parks and other spaces will increase the value of these areas as habitat for migrating birds. Limiting mowing and spraying of pesticides in lakeshore parklands during migration will also help protect birds during this vulnerable period. Another urban issue related to migratory birds is collision with buildings during night migration in the spring and fall. Tall buildings that are substantially glass should, where possible, turn off lights during these periods. Finally, as discussed in Section 9.2.6 of this plan, public education to encourage people to keep house cats indoors is an important action to protect both migrant and resident songbird populations.

5.7 Threats and stressors to terrestrial communities

5.7.1 Hydrological change

Altered hydrology is a severe threat to a number of communities, including wetlands, prairies, flatwoods, and dolomite cliffs. There are a number of sources of hydrological change. Urban and suburban development with associated draining, paving, and topography changes often alters the hydrology of nearby natural communities, either increasing or decreasing the quantity of water flowing into the community. Low-lying communities, particularly marshes, flatwoods, and seeps, are threatened by the development of associated uplands.

The other significant cause of altered hydrology is tiling. Tiles were often used to drain lands for agriculture. In many cases the land has returned to natural vegetative cover, but tiles remain and stress the natural community. This is particularly a problem in prairies, sedge meadows, and fens.

Streamside marshes are dependent on the streams with which they are associated, and thus a number of the threats to streamside marshes are linked to stream issues. Extreme water-level fluctuation is a significant problem, due to the increasing amount of paved surfaces in the region. Another major stressor is the downcutting and channelization of streams resulting in substantially lowered water table in riparian wetlands. The hydraulic connection between stream and riparian wetland is virtually eliminated, except during flood flows. Alterations to the quantity and quality of stream flow also disturbs the talus and gravel areas of dolomite cliffs, resulting in widespread changes to plant communities.

Other threats associated with altered hydrology include increased sedimentation in floodplain forests due to flashier floods. Additionally, gravel mining and paving of recharge areas threaten communities dependent on groundwater flow, including fens, sedge meadows, and seeps. Changes to the subsurface water flow affect the distribution of liverworts and some mosses in dolomite-cliff communities. Some marshes suffer from a different type of hydrological change, in that they are often managed for one hydrological state and not permitted to go through the normal hydrological cycling.

In addition to altered hydrology, deteriorating water quality might be damaging a number of communities. The effects of toxins on wetland and other plants are not fully known.

5.7.2 Fragmentation

Fragmentation particularly threatens the communities that were once more widespread: prairies, savannas, woodlands, and upland forests. Fragmentation is a lesser threat in the naturally small communities, although populations of some species may suffer loss of genetic variability if migration patterns are disrupted. Fragmentation is caused by many forms of human development. Roads and areas of human occupation divide up the community, affecting it in a number of ways, including altering gene flow (possibly leading to loss of genetic diversity and increased inbreeding), increasing predation, and increasing opportunities for invasive species. In some cases, fragmentation occurs in less obvious ways. For instance, a power line through an upland forest or a trail through a prairie may fragment that habitat for insects and other small organisms.

The effects of fragmentation include not only the partitioning of sites but also what happens in the remaining small, isolated patches. Development surrounding a natural area limits the amount and types of management that can be done. For instance, in some cases new development has limited the opportunities to burn prairies due to prevailing wind direction. Fragmentation is a particular problem for animal species, most notably grassland and forest birds, that can only breed successfully in large, contiguous habitat blocks.

5.7.3 Altered fire regimes

Fire was once a natural disturbance across the entire Chicago Wilderness region. While pockets of the region were protected from fire by landscape features, all of the community types evolved in the presence of fire. Therefore, the lack of fire and altered fire regimes lead to the degradation of most community types. Altered landscape patterns and the suppression of natural fires in the region have eliminated natural disturbances, and prescribed burns are therefore necessary to maintain the condition of the region's natural communities. Lack of fire is most threatening to the forested, prairie, and savanna communities. Fire is being used as a management tool at a rate far below that which is necessary to sustain healthy natural communities. This is due to a number of factors, including lack of human and financial resources and lack of public understanding of the importance of fire. Management with fire is often constrained by necessary precautions to protect nearby houses. This is particularly true with prairies, which for the most part remain only in small patches. In forested communities, invasive species, particularly once they are well established, can also alter fire regimes and make it more difficult to manage with fire alone.

The lack of fire in forested communities, particularly those with shorter fire-return periods such as woodlands, can lead to canopy closure. This causes overshading, which limits growth in the understory and the herbaceous layer. The health of the herbaceous layer depends on light penetrating the canopy and periodic control of shrubs and saplings by fire. Some species, such as oaks, are more fire-tolerant and have seedlings and saplings whose survival is aided by periodic fire. For some communities, the lack of fire has meant a shift in major type of disturbance from external forces to internal disturbance, such as canopy-gap processes from disease and windthrow. However, these internal disturbances are not sufficient to maintain the long-term health or viability of the communities. The exception is upland forests, which have always operated under canopy-gap processes.

A particular problem with the absence of fire is the invasion of exotic species and fire sensitive native species into savannas, which were once dominated by oaks.

5.7.4 Loss of structural diversity

For many animals, the structure of the community is very important. "Structure" refers to the spatial arrangement of the community elements. Loss of structural diversity results from the loss of natural disturbances and then lack of management to mimic these processes. Fire was the main disturbance process creating structural diversity in the prairies, but grazers also contributed. In some cases, monotypic management fails to achieve the desired structural diversity. For example, limitations on prescribed burns often mean that the management does not create the structural diversity that natural fire once did, because the location and intensity of burns are controlled. Natural prairie fires varied in intensity and skipped areas as they moved across the landscape, leaving structurally varied grassland behind.

In the forested communities, a loss of structural diversity occurs with the loss or degradation of the herbaceous layer. Lack of fire, invasive species, and overabundant deer all threaten the herbaceous layer in today's forested communities.

5.7.5 Nutrient loading

Excess nutrients in a system are often a stress to the plants adapted to that system. Many native plants do not compete well against invasive plants at higher nutrient levels. Excess nutrients enter communities through agricultural run-off, urban and suburban run-off, and air pollution. In this region, excess nutrient loading particularly threatens the prairies, marshes, bogs, and floodplain forests. Airborne pollutants, such as nitrogen and even carbon dioxide, can also contribute to excess nutrient loading, and are potential problems in the future.

5.7.6 Increased salinity

Increased salinity is a possible threat in all communities, but is recognized primarily in the wetter ones, including certain prairies, marshes, and floodplain forests. The specific effects of increased salinity on the plant communities still require further study. The primary source of increased salinity is road salt, both airborne and dissolved.

5.7.7 Erosion and increased sedimentation

Excessive erosion and sedimentation are caused by a variety of problems. The greatest source of sediment is from urban and suburban development and from agriculture. Quantities from development can be very large, but typically occur for only one or two years from any one parcel of land. Agricultural cultivation tends to produce substantial quantities annually unless conservation measures are adopted. In natural areas, invasive species can cause the loss of herbaceous plants, leaving exposed soil that may lead to increased erosion, particularly where other human disturbances help create gullies. The extent to which loss of the herbaceous ground layer in the region's forested communities contributes to large-scale sheet-erosion is a topic for continued study. Excessive sedimentation is of greatest threat to streams, lakes, and low-lying areas including wetlands, floodplain forests, and vernal ponds in flatwoods and other forested communities.

Along the lakeshore, erosion and sedimentation are natural processes, which provide sand to nourish beach and dune communities. However, when these natural processes are disrupted, erosion becomes a threat, as in the case of pannes. Erosion in pannes is caused by recreational pressures and storms, and because the natural processes have been disrupted, there is a lack of natural sand replenishment.

5.7.8 Invasive species

Altering the species composition of the community, invasive species are a threat to almost every community type in the Chicago Wilderness region. Invasive species are usually non-native species that have been brought to the region intentionally or unintentionally by human actions. They become established in natural habitats, threatening native biodiversity. Most non-native species are not invasive, but the few that are, are often aided by having few if any predators or diseases that held them in balance in their native habitat. Species native to the region can also be invasive when they move into habitats that did not originally contain them, as a result of human disruption of natural processes and lack of management. Species are often able to invade a community of which they are not naturally a part when the community is suffering under other stresses. In many communities, this stress is a lack of fire, but other stresses enabling invasion include nutrient loading, hydrological change, and soil compaction. Sometimes non-native species can out-compete native species even when the system is not under stress.

Forested communities in the region are particularly threatened by invasion by buckthorn, Asiatic honeysuckle, and garlic mustard. Regular fires often prevent the establishment of invasive species, but some invasive species are adapted to fire and cannot be controlled after they are established, even with the reintroduction of fire. In these cases, mechanical or chemical control is needed to balance the system so that less severe management practices will become sufficient. Floodplain forests are also threatened by the invasion of reed canary grass. As demonstrated by the recent urban occurrence, there is potential for invasion by a substantial forest pest, the Asian longhorned beetle, as well.

Because savannas are more open and have more light, they are more susceptible to invasive species than forests or woodlands. Buckthorn is extensively invading fine-textured-soil savanna. Other significant invasive species include garlic mustard, bush honeysuckle, and reed canary grass in the wetter savannas. Mesic sand savannas have problems with purple loosestrife and common reed invasion. Species such as Norway maple, Amur maple, and Japanese hedge parsley are also invading. In the absence of fire in savannas, many native tree species behave as invasive species, especially those with wind-disseminated seed such as ash, maple, and elm.

Prairie invaders, which may or may not be controlled by fire, include crown vetch, sweet clover, reed canary grass, teasel, and leafy spurge. These non-native grassland species can alter species composition and eventually structure and soil chemistry. A whole host of additional plant species is beginning to invade prairies. As discussed earlier, lack of fire in prairies leads to invasion and major degradation by brush, both native and non-native. Knapweed is invading dolomite prairies, and wet prairies of all types suffer from invasion by purple loosestrife.

Wetlands are also threatened by invasive species. Basin marshes suffer from the invasion of giant reed, purple loosestrife, glossy buckthorn, narrow-leaved cattail, reed canary grass, and carp, among others. Carp is the primary invasive species threatening streamside marshes. Buckthorn and purple loosestrife are the invasive species of particular concern for bogs. Lack of fire in graminoid fens and calcareous floating mats leads to invasion by brush and non-native species. A very significant threat to sedge meadows is the invasion of reed canary grass, which might be correlated with increased siltation. Purple loosestrife is another threat to sedge meadows.

Dolomite cliffs are being invaded by garlic mustard, which is resulting in a serious decline of native species. Red and Austrian pine and Lombardy poplar are frequent invasive species in foredune communities. Garlic mustard, Asiatic bush honeysuckle, winged euonymus, and oriental bittersweet are occasionally a problem in high dunes. Although it is a secondary threat, beach communities are also subject to problems from invasive species.

5.7.9 Overabundance of deer and other animal species

A major concern for forested and savanna communities is deer overabundance. Deer overabundance results from the absence of natural predators, the shrinking of available habitat due to development, and lack of management. The primary effects of overabundant deer are reduction or elimination of some herbaceous plants and selection against certain woody species, including oaks, with consequent increases in less-palatable species such as maple, white ash, and ironwood. Deer often harm species of conservation concern, typically monocots (lilies, orchids), which are usually the most difficult to restore because of their rarity, and legumes, which may be important for soil fertility (Etter 1998). Deer also create a corridor for invasive species to move into quality areas by disturbing the soil along their trails. These trails can also serve as an avenue for animal predators. The interactive relationship between deer overabundance and fire, or lack of fire, is an important topic for further study to improve management techniques. Although deer favor forests and woodlands over savannas, the effects from deer are the same in savannas as they are in forests. Deer numbers generally decrease with successful savanna restoration. Overabundant deer are also a severe threat to high-dune communities and a concern in prairie restoration and management.

The density at which deer cause permanent damage to ecosystems varies by community type and specific site conditions. Studies in eastern forests (deCalesta 1994, Alverson et al. 1988, Tilghman 1989) indicate that damage to ecosystems occurs at densities exceeding 10–15 per square mile. However, excessive damage from lower densities has been observed, and lower densities may be required for communities to recover from their current degraded state. Current research in Chicago Wilderness is assessing the local situation, and the results will be important for future management efforts.

Not enough is known about the natural population sizes of various other animal species, or about the effects of changes in relative population sizes, to fully understand the negative impacts they may be causing. For instance, nest-predation rates are currently high for grassland and forest birds due to small predators such as raccoons and house cats. Raccoons are abundant due to development and the absence of large predators. Forest fragmentation also leads to high nest parasitism by brown-headed cowbirds. In grasslands, the specific causes of nest predation are less clear, and more research is needed.

5.7.10 Other threats

Many communities are threatened by other, less pervasive human activities. Forested, savanna, and lakeshore communities are threatened by human over-use and abuse. Activities of concern include bike and horseback riding off trails, foot trampling, off-road vehicles, and the dumping of grass clippings. Beaches are frequently raked and bulldozed by municipalities in order to sculpt them for recreational purposes. This abruptly terminates beach substrate succession and plant succession so that nothing beyond the earliest successional stage can be reached. Recreational activities including hiking, rock climbing, and rappelling, along with fossil and plant collecting, seriously degrade dolomite cliff communities.

Beach health includes successional periods of stabilization when there is a rough balance between sand deposition and erosion. But major public works projects such as harbors and piers interfere with the original patterns of lake-water movement, often leaving sand deposition too low at some beaches and too high at others. Some structures divert sand into deep water, where it is lost as beach nourishment. Shoreline erosion is a threat to high dunes and foredunes.

Basin marshes are often used as a dumping ground for grass cuttings and other wastes, and humans and dogs often disturb marsh wildlife. Mosquito abatement is also a potential threat to wildlife. Cats are a threat to many birds and mammals. In some places, commercial collection of snakes and turtles is an increasing problem. With the growing popularity of mushrooms, mushroom collecting in savannas, woodlands, and forests is a potential problem. If collection harms a mushroom population, this may affect the habitat negatively for other species as well. For example, some mushrooms are the fruiting bodies of symbiotic fungi, whose presence is necessary for the survival of oak trees.

5.8 Recommended actions

✔ Increase number of acres under management on public lands

Many of the natural communities, even when they are protected, are degrading, because natural ecological processes have been disrupted and the communities are not being adequately managed to compensate for the loss. Depending on the community type, required management includes controlling invasive species, controlling water levels, conducting prescribed burns, and carrying out other activities to improve the habitat for plants and animals. When communities are not managed, they degrade and lose biodiversity. All of the community types need more management attention. For the forested community types, marshes, and fens, the most important action is to increase the amount being managed. Because of the apparently total loss of intact shrublands, restoration of degraded land will be required to restore this community. Lack of human and financial resources, and public resistance to certain management practices, often hinder current management.

Across the region, probably less than 10% of forested land is being actively managed. The DuPage County Forest Preserve District is actively managing approximately 30% of its forested communities, but this is likely the highest of all counties. The Cook County Forest Preserve District is actively managing about 15% of its forested communities.

While some high-quality sites still require further management and they are a priority where they are not managed, a much greater general effort needs to be placed on managing fair- and low-quality sites. Priority should be placed on sites with important species and on sites with the highest species diversity. In managing more fair-quality sites, one goal is to reconnect remnant high-quality pockets. Priority should also be placed on managing and restoring areas that have multiple community types.

The top priority for wetlands is to manage those where the associated uplands are protected in order to maintain the proper hydrology of wetlands and to mitigate the threat of invasive species. In general, it is best to restore a community within a complex of existing natural communities, because source populations will be there, increasing the likelihood of reconstructing a high-quality community.

An important area for continued and expanded management efforts is that of deer. The overabundance of deer is causing significant harm to forested communities and is also a threat to savanna and other natural community types. Chapter 9 includes further discussion of deer and other wildlife-management issues.

Some specific actions include:

- Allocate more funds to management activities
- Apply generally accepted management techniques, as discussed in Chapter 9, including prescribed burning, hydrological restoration, reintroduction of native species, control of invasive species, and management of deer and other problem wildlife.
- Train more people in management techniques
- Make more effective use of volunteers in management activities

- Educate the public to build support for needed management practices

✔ Increase management and biodiversity planning outside preserves

While the recommendations described above generally apply to sites owned by public land-managing agencies, local parks, private land, and land held by agencies not charged with protecting natural resources also require ecological management in order to conserve biodiversity. For some community types, such as the forested, substantial amounts are on private lands. And for all community types, although particularly wetlands, biodiversity concerns need to be incorporated into other, broader planning efforts. Since the degradation of marshes and other wetlands is so widespread and the stressors so large, the best way to improve the quality of wetlands is for watershed planning to integrate biodiversity concerns.

Strategies need to be developed to work with various landowners to protect and manage communities on their property. One goal is to work more cooperatively with state and local transportation agencies, utility companies, and railroads in managing prairies and other communities that exist in their rights of way. Corporate and college campuses provide another opportunity for cooperative management. These sites can be managed for hydrology and some biodiversity values, and, possibly more importantly, they can serve as demonstration sites. Corporate land could be used for broad-scale linkages or corridors to public land.

Some specific actions include:

- Develop and implement strategies to work with landowners
- Work with state and local transportation agencies, utility companies, and railroads to manage communities in rights of way
- Implement Best Management Practices (BMPs) for water quality and water management in ongoing development
- Integrate a biodiversity component into existing BMPs
- Integrate a biodiversity component into watershed planning

✔ Increase public understanding of land-management needs

Management of natural communities is often limited by poor public understanding of their significance and of what actions are needed to keep them healthy and save biodiversity. Public resistance may inhibit certain management activities that are essential to the protection of biodiversity. Greater emphasis needs to be placed on informing and educating the general public. In particular, the importance of disturbance in natural communities needs to be better explained to create support for a wider range of management activities. The best example of a social barrier to management is objection to burning.

A first step is to identify all of the barriers to the effective use of fire and other management practices in the region. Then, appropriate education and training of both the public and land managers should be incorporated into overall regional planning.

Some specific actions include:

- Identify all barriers to the effective use of fire
- Inform/educate the public about disturbance and appropriate management
- Train/educate land managers about social barriers and appropriate approaches to sharing information with the public

✔ Communicate information about the effects of management

Considerable knowledge about the effects of management on communities and specific animal populations exists, but not all of it is easily accessible. Chicago Wilderness members should facilitate compilation and communication of such information to the land managers, scientists, and the public throughout the region. This information will not only help land managers in their work, but should also be used to inform the public about the benefits of restoration.

Some specific actions include:

- Compile information on techniques and effectiveness of management
- Disseminate to land managers and researchers
- Summarize and communicate to the public

✔ Increase the number of people qualified to manage land

Limited human resources are one barrier to managing more. One goal is to develop a region-wide standardized training program for burning that would give the public confidence in the oversight of burns and increase the number of people trained to conduct burns. In particular, a burn-training course specific to our urban context should be developed and implemented in the Chicago Wilderness region. Illinois is establishing statewide burn-leader standards, which should be supported in the Chicago Wilderness region.

Some specific actions include:

- Develop a region-wide standardized burn-training program
- Implement the training program
- Support Illinois statewide standards for burn leaders
- Publicize the training process

✔ Implement adaptive management, linking goal setting, implementation, monitoring, and research

To recover biodiversity and achieve greater diversity, management techniques should be improved and diversified through knowledge currently available and through additional research. This can be achieved by implementing adaptive management across the region. Adaptive management is the practice of conducting management within an experimental framework and using the results in future management decisions. Adaptive management allows testing and diversification of management strategies. Diversified management is needed for everything from learning how to better manage communities to learning more about various elements and processes in the system. Experimental approaches to improving existing techniques should be developed for prescription burns, control of invasive species, and other management practices.

A specific action is to:

- Develop and implement a region-wide monitoring program based on conservation design, as discussed in Chapter 9.

✔ Increase the variety of management approaches to better simulate the effects of natural processes

In order to restore biodiversity, the types and effects of management need to be diversified. Management is used in large part to mimic natural disturbances that once maintained the region's communities. However, today's management tends to be somewhat narrow in its effects and thus does not fully mimic the variety of natural processes. For example, the limited diversity in fire regimes reduces the diversity of habitat conditions and structures necessary to maintain a full complement of biodiversity. Many animal species rely on structural diversity within a given community type, and this diversity is often achievable under current management constraints. Also, some natural processes, such as elk grazing, have been lost but are not yet being mimicked adequately.

Some specific actions include:

- Increase the variety of burns through space, time, and intensity
- Manage for short-structured grasslands
- Explore how haying and other mechanical techniques can mimic loss of biomass consumption by grazers

✔ Create and manage large preserves

To conserve biodiversity at all scales, the ideal condition is to have large sites that contain a variety of community types. Large preserves are important for a number of reasons. Small remnants have been shown to lose species. To maintain viable populations, larger areas are needed. The exact size needed depends on the species. Large preserves also allow landscape-scale processes to occur. These processes are important for maintaining healthy and diverse communities. Buffer zones around natural areas are also recommended because they help to mitigate threats and to make management easier and more effective. Creating large sites also makes economic sense, as it is much more expensive to maintain small preserves than large, functioning ecosystems.

Knowledge of habitat needs of various taxonomic groups provides some clues to the preserve sizes needed to support viable populations. The various workshops convened to compile information for the recovery plan produced some rough estimates of minimum size requirements for various target species and groups. Based on scientific knowledge of habitat requirements of wetland birds, reptiles, and amphibians, a natural-area complex of approximately 1000 acres, with several marshes of 100 acres or more and with smaller wetlands and ephemeral pools, appears to be appropriate.

At least 500 acres are needed to support a full community of birds in a wet-mesic grassland. A few very large grassland sites (1000 to 3000 acres) are needed in the area to support species such as harriers that require relatively large expanses to breed. These larger grasslands are also needed to act as anchors for the grassland-bird community in the region. Although smaller areas (100 to 500 acres) will lack a few of the species normally found in a full community, as long as there are enough of these blocks spread throughout the region, most species should be present.

Forest and woodland amphibians need good-quality sites of at least 500 acres to maintain a complete suite of sensitive species. Forested sites as large as 10,000 acres may be needed to maintain viable populations of sensitive larger mammals such as gray fox. These figures are all rough planning guides, and additional research in this area will be needed to understand the conditions that ensure long-term population viability. The vision statements for community classes found earlier in this chapter provide additional information on the goals for creating large preserves, based on our current best knowledge.

Some specific actions include:

- Acquire buffer zones around existing preserves
- Protect and restore natural communities adjacent to existing preserves to connect and enlarge preserves
- Continue research to determine how large a site must be to maintain target species
- Direct Section 404 mitigation funds and land-acquisition funds to sites near existing preserves
- Protect recharge areas for groundwater-fed wetlands and other wet communities

✔ Create and manage community mosaics

Historically, natural communities occurred in mosaics with a heterogeneous mix of different habitats depending on soil type, moisture, aspect, fire patterns, and other factors. As a result, many species and processes depend on the close interconnections between community types. In particular, many animals rely on multiple habitats for their various life stages, and these habitats need to be managed together. For example, wetland insects, reptiles, and amphibians require integrated management of uplands and wetlands, as well as integrated management of multiple wetland types. Wetlands themselves do much better when managed together with their associated uplands. The large preserves discussed above do not need to be of a single community type. In fact, large mosaics of different community types are preferable in most cases, because the interconnection of communities allows more ecological processes. The one caution, however, is that mosaics should not be created on sites too small to support them. In addition, some species, notably grassland birds, need large areas of one structural community type.

Some specific actions include:

- Manage associated uplands with wetlands
- Mange communities as part of a large system
- Manage whole watersheds to conserve ecosystem processes
- Restore communities as part of mosaics

✔ Protect priority areas

A region-wide viability assessment is recommended to determine which sites would give the biggest return for the investment, thus helping to prioritize regional protection efforts. The three protection priorities are: 1) remaining high-quality sites, 2) land that will connect or expand existing natural areas, and 3) any large sites with some remnant communities (see next action). High-quality sites are important because they are genetic reserves. It is very difficult to translocate plants and insects, and thus protecting remaining high-quality areas is the best conservation action. Remnant communities in larger areas are important because they serve as the basis for reconstructing larger natural communities.

Some community types found in the Chicago Wilderness region have always been rare, but nevertheless are an important part of the region's biodiversity. Some of these communities are rare because they are on the edge of their range here. However, these examples are important to the global conservation of the community type, because areas at the edge of the range often harbor high genetic diversity. Many of Chicago Wilderness's rare community types, such as bogs and pannes, are currently well protected, but their need for protection is worth highlighting because we cannot afford to lose any examples of these community types. The rare lakeshore communities (beaches, foredunes, and high dunes) and dolomite cliffs need protection from recreational pressures.

Some specific actions include:

- Use existing inventories, such as INAI, the Regional Greenways Plan, and ADID, and conduct additional inventories, to identify priority areas for protection.
- Assess acquisition opportunities
- Prioritize opportunities
- Develop protection strategies for priority areas
- Look to protect remaining remnants of particularly rare community types, including dolomite and gravel prairies, forested bogs, dolomite cliffs, and pannes.

✔ Identify potential large complexes

Opportunities still exist in the Chicago Wilderness region to create large protected areas with a variety of community types, through either expanding existing preserves or connecting several together. This current opportunity to acquire large blocks of undeveloped land to reconstruct into natural communities or to provide buffers, however, will not last long. In the near future, this opportunity will be lost as open space is developed. Land-owning agencies should take advantage of this opportunity now (as recommended earlier), even if they do not have the capacity to restore the land immediately. It is particularly important to acquire more buffer zones around existing woodlands, as there is little opportunity to protect any additional woodland areas, and the buffer zones will improve the condition of existing woodlands.

There is also the likelihood of increased funding for land acquisition in the near future from state and federal sources. As a priority action, the Chicago Wilderness Science and Land Management teams should help to identify possible areas for large mosaics. A list of criteria, including size, current condition, diversity, presence of conservative species, and estimated cost, would need to be developed to prioritize sites for restoration and acquisition. This assessment would maximize the contribution of each land-owning agency. The Chicago Wilderness teams should help to identify areas where preserves could be expanded if connected together to form larger preserves.

The region-wide assessment would help to identify opportunities to create more large complexes. Some counties, such as DuPage and Lake Counties, are already working to map out potential complexes, but this would be more beneficial if done on a regional scale. Specifying exactly which blocks of land and how big the blocks need to be requires further investigation. These questions require immediate attention because acquisition should start as soon as possible. The Illinois Department of Natural Resources has started this work with its “large grasslands ecosystem project,” which aims to identify large grassland sites remaining in Illinois. A study of hydric soils could help to identify areas where large wetland complexes could be created. The Lake Calumet area and Midewin may provide opportunities to restore and create some large complexes. The regional vegetation map prepared through the recent NASA Chicago Wilderness project can serve as a very important tool for planning and identifying opportunities.

Some specific actions include:

- Use tools—hydric soil maps, GIS, large grassland areas project—to identify potential sites
- Develop criteria to prioritize sites for restoration and acquisition
- Chicago Wilderness members should facilitate acquisition and management of sites that cross political borders.

✔ Understand and mitigate urban threats to metapopulations and gene flow

Genetic diversity may not be maintained in fragmented landscapes, because many things act as barriers to dispersal. Therefore, in the urbanized context of Chicago Wilderness, it is important to learn more about genetic neighborhoods, gene flow, and barriers to dispersal. Given the number of small sites, strategies to maintain genetic diversity need to be researched, developed, and implemented. Gene flow studies on plants are particularly needed.

One possibility for plants is to introduce seed from small, high-quality sites to larger, degraded sites. Good techniques to do this type of translocation with reptiles and amphibians have not been developed, and past attempts have often degraded the source population. More is known about genetic management in mammals, although the specific effects of fragmentation in this region have not been studied, and strategies for genetic management for mammal species of concern should be developed.

To aid gene flow, it might be better to think in terms of connections rather than artificial colonization. The effectiveness of narrow corridors is still not clear, and they may have some negative aspects by facilitating movement of invasive species and predators. A better strategy might be understanding and removing barriers to dispersal. For instance, the intervening space between blocks of forest or woodland can be a significant barrier to woodland wildlife dispersal. Planting oak trees in this space can diminish the barrier, even if the full community type is not restored. Other barriers need to be removed as well. For instance, a road can be a significant problem because it increases the mortality of wildlife and acts as a complete barrier to some species. Also, gradients rather than abrupt shifts should be maintained between habitat types. These gradients are of particular importance for birds.

Some specific actions include:

- Research , develop, and implement strategies to maintain genetic diversity
- Study gene flow in plants including the role of dispersers and pollinators
- Translocate plants or seeds from high-quality areas to larger fair-quality sites
- Improve translocation techniques for amphibians and reptiles

- Develop strategies for genetic management in mammals
- Study barriers to dispersal
- Plant oaks in space intervening between forest or woodland blocks
- Remove or mitigate barriers such as roads in key areas
- Maintain gradients between community types

✔ Manage a portfolio of sites

In our urban landscape, a portfolio approach to management and protection is necessary. Protecting a wide variety within each community type ensures proper habitat for the broadest array of species. Likewise, diversity in management spread across sites allows a greater diversity of habitats.

As prairies are quite varied and only small remnants remain today, a variety of sites is needed to provide appropriate habitat for the region's fauna. Very few sites, if any, provide all things for all birds, and therefore a collection of sites is needed to capture a wide range of habitats.

The natural fluctuations in the hydrology of wetlands are important in maintaining species diversity, and wetland management should therefore be considered at a regional scale. Marshes and other wetlands will not provide good habitat for birds in all of their stages. However, birds will move from site to site. So long as there is a diversity of hydrological states within wetlands of the region, the birds can find suitable habitat. Land managers should communicate with each other about planned fluctuations in their wetlands to promote hydrologic variability at the regional level.

Currently, management is being conducted mainly on a site-by-site basis. However, it would be better for management planning to occur on a broader scale, at least at the county level, as is already occurring in some counties. A range of effects from management strategies should be distributed across sites, rather than using a narrow range of management prescriptions on every managed site. It is difficult to implement a broad-scale management strategy because many high-quality remnants contain rare species, for which these sites are and need to be managed specifically.

Some specific actions include:

- Communicate across the region about planned fluctuations in wetlands
- Vary management from site to site

✔ Increase seed supply of local genotypes

One current limitation to management is the limited availability of seeds of local genotypes. The growing demand for native species depletes the supply of seeds for restoration projects, and nurseries and garden centers often stock non-local genotypes. Native species of non-local genotypes can cause genetic deterioration of the local genotypes if they spread into local natural areas. Native plantings in gardens and on corporate campuses should be encouraged, but an adequate supply of seeds from local genotypes is needed. Potentially, corporations could increase the pressure on garden centers to carry local genotypes by increasing the demand.

- Land-managing agencies should create nurseries to increase supply for seed
- Increase demand on nurseries and garden centers to supply local genotypes

✔ Mitigate the threat of salinization

Salinization of wetlands and other wet community types due to road salt is a growing problem. Alternatives to road salt in sensitive areas need to be investigated, as well as ways to keep excessive salt and water out of wetlands. The full impact of salt on plant communities is not understood and should be researched.

Some specific actions include:

- Search for alternatives to road salt
- Investigate the full impact of salt on plant communities
- Look for ways (especially in the design of road drainage) to keep excessive salt and water out of wetlands

✔ Mitigate the threat from hardening of shorelines and prevent further hardening

With the hardening of shorelines in some portions of the Chicago Wilderness region, a continuous supply of additional sand is needed to resupply natural beach ecosystems including pannes, beaches, foredunes, and sand prairies. Sand needs to be deposited at strategic locations at Illinois Beach and the Indiana Dunes National Lakeshore and littoral drift allowed to carry the sand along the lakeshore. Coastal protection funds (from the Conservation and Reinvestment Act) should be allocated to ensure a continued, adequate source of sand to maintain coastal ecosystems. These funds should be used to obtain and transport clean dredge sand from harbors and local quarries, and they could be used to clean minor amounts of contaminants from closer sources of sand. In addition, agencies should discourage additional hardening of the shoreline, which ultimately starves the down-drift beaches and other communities of sand.

5.9

Research needs for maintenance and recovery of biodiversity in the Chicago Wilderness region

5.9.1 Introduction

Continuing to increase our knowledge about biodiversity and how to maintain it is an important recommendation of this plan. Suggestions for increasing the amount and effectiveness of research are included in Chapter 9. Ten areas of research concern have been identified through several workshops that brought together scientists and land managers in the region. These concerns can be grouped into two broad categories of Natural History / Ecological Process and Management / Stresses. Providing answers to some or all of these questions will greatly improve the effectiveness of preserving biodiversity in the Chicago Wilderness region. Below are listed examples of some of research issues for terrestrial communities.

5.9.2 Research needs on natural history and ecological processes in terrestrial communities

Ecological process

In considering biodiversity conservation, the number of species of plants and animals is usually foremost in people's minds. Equally important, however, is the preservation of the diversity of ecological processes (decomposition, pollination, herbivory, predation, etc.). Preserving the pieces without considering the processes that formed them and tie them together would fall short of long-term, sustainable conservation. To guide management, it is important to understand both former and current processes at work in a community and how the community responds to these processes. To obtain a better understanding of these processes, the following examples are representative of the research needed in this area:

- Examining the role of grazers in prairie systems and how best to mimic their effects today
- Examining how fire functions in natural systems, and how it can best be used in restoration and management
- Studying below-ground processes to improve long-term success of restoration
- Understanding the return of soil structure to more natural conditions when previously cultivated land is restored to natural communities

Hydrology

Historically, most of the plant communities of the Chicago region were dependent on ground water. Today, surface water is the predominant source. This water is often irregularly abundant and of poor quality. Understanding the hydrology of healthy systems and how to restore this critically important function is of tremendous importance to maintaining the biodiversity of the region. Examples of research issues in hydrology include:

- Studying the relationship of vegetation cover to amount and quality of runoff water
- Looking at the long-term impact of water quality on reptile and amphibian populations
- Monitoring effects of restored hydrology in natural communities
- Identifying methods of managing ground-water-fed systems under changing hydrological conditions

Soils

Soil is a valuable resource for ecological restoration in several ways. It is an archive of ecological information and may help managers better understand the vegetation and ecological history of their sites. This knowledge may assist the manager in choosing historically appropriate management objectives, where such considerations are important. Soil provides the rooting medium of plants, and soil characteristics may provide an important criterion when selecting species for reintroduction. While the micro-biota of soil is poorly understood, soil microbes represent the greatest concentration of biological diversity within terrestrial ecosystems. Soil provides direct benefits to the public and is a resource to be protected and developed. Public benefits include carbon storage; rainwater absorption and storage; and adsorption of toxins on soil particles, preventing their movement into surface and ground water.

The soils of natural areas in the Chicago Wilderness region are poorly known. Our understanding of soil in the Chicago area and elsewhere has focused primarily on the manipulation of soil for agriculture, horticulture, and development. Scientific understanding of soil and its role in Chicago Wilderness ecosystems needs to advance in at least five major areas:

- Describing soils for the entire region, including local variations in properties, and extensively ground-checking existing soil maps
- Examining relationships between soil and ecosystem, starting with less disturbed ecosystems. Knowledge gained here then can be applied to situations in which the biota has been greatly or completely disrupted.
- Investigating soil function, particularly as it relates to hydrology and nutrient regimes.
- Studying soil biodiversity, particularly comparing the diversity and composition of organisms in remnant natural soils to those in the highly disturbed and manipulated soils of agricultural and developed landscapes
- Monitoring the short-term and long-term effects of ecological restoration on the soils of natural areas

Distribution, abundance, and status

Knowing where species and communities are, how many individuals are in populations, and whether these populations are increasing or decreasing are essential pieces of information to effectively preserve biodiversity. As more work is done, once-rare species are found to be more common, new species for the region are discovered, and species previously thought to be extirpated are rediscovered. All of this information helps in planning and directing resources and effort. Inventories are also important as a baseline against which to compare the impacts of management techniques. Examples of research needed on this topic include:

- Mapping the distribution of specialized and rare communities such as gravel prairies
- Determining the distribution of understudied faunal species, such as bats
- Identifying taxonomic groups that have key remnant-dependent species
- Developing baseline inventories for understudied groups such as soil fauna

Life history and habitat needs

Basic information on life history is lacking for many species. This is particularly true of difficult-to-study organisms such as nocturnal species and invertebrates. The habitat needs of many species are also poorly understood. Different community types may be necessary for different parts of an organism's life cycle. For threatened and endangered species, it is necessary before developing recovery plans to know basic information on their life histories, phenology, and reproductive biology, as well as their ecological and habitat requirements. Research needs here include:

- Ascertaining habitat requirements relevant to the entire life history of priority reptiles and amphibians
- Determining the habitat needs of bats for foraging and roosting
- Documenting the effects of coyotes on other native species
- Investigating relationships between species of concern and the effects of overabundant species
- Determining the habitat and other ecological needs of endangered and threatened species

Genetic studies

Many once-common species have been isolated in small, fragmented pockets. This isolation may have led to loss of genetic variability in species that were once genetically diverse and widespread. Genetic considerations also are important in determining sources for propagules to reestablish lost populations or to bolster severely fragmented ones. Knowing the best method to increase and to restore these populations depends on a good understanding of their genetic make-up, especially for species that have always been rare or that survive in drastically reduced populations. Examples of research topics relating to genetics are:

- Determining the genetic relationships between populations of priority reptiles and amphibians to identify management needs
- Evaluating the significance of genetic drift in plants in fragmented habitats
- Determining habitat and population dynamics needed for viable populations and communities

5.9.3 Research needs on management and stresses

Restoration and effects of management techniques

Restoration is being carried out currently on many sites using a variety of management methods. Although specific goals and objectives direct this work, many unanswered questions present themselves about how these methods affect various pieces or processes within the communities being restored. Many of these questions may require long-term investigation. Therefore, due to imminent threats to the communities, restoration often proceeds without having all the information in hand and without setting up controls to measure the impacts of management. No one realizes the importance of obtaining pertinent management information more than the restorationists themselves do. Land managers are continually looking for ways to improve their management, and so they require an experimental framework to examine options. Research issues in this category include the following:

- Determining how restored habitats accommodate all major life forms of those communities
- Looking at the impacts of restoration on soil properties
- Investigating the effects of timing, frequency, and intensity of fire on biodiversity and habitat quality
- Determining which species will move from remnants into restored areas and under what conditions
- Evaluating whether management to a presettlement condition maximizes biodiversity

Human effects and effects of urban environments

Growing human populations and changing land-use practices have shifted the relationship between human and non-human communities into one of instability and unsustainability. Understanding our relationship to the land will be critical to maintaining biodiversity in the region. Examples of research in this area include:

- Examining the effects of adjacent land-use practices on natural communities and determining how adverse impacts can be best mitigated
- Studying the impact of materials such as road salt on plant populations
- Determining the effects of mosquito-abatement programs and pesticides on native species
- Determining the effects of fragmentation on metapopulations, and determining effective mitigation strategies
- Developing a better understanding of the cumulative effects of stressors in the urban environment

Preserve design

Knowing how species interact with their habitat is critical to designing effective preserves for conservation. The preserve's size and shape, the diversity of communities within it, and its connectivity to other similar habitats are all important factors in preserve design. Examples of research concerns in this area include:

- Examining the dispersal of reptiles and amphibians
- Studying how species use corridors, and under what conditions corridors promote biodiversity conservation
- Understanding barriers to dispersal for different species
- Determining the conditions under which nearby isolates function as a complex for species viability

Further research is not necessary to understand that most of the natural communities in the Chicago region are in a degraded condition, are losing ground, and are in need of human action. The need for research should not be seen as a reason to fail to take positive action based on best current knowledge. However, research is necessary to refine and improve land-management methods to achieve the desired goals of these practices. As restoration of natural communities progresses, more questions will be generated. Research into those questions, in addition to the examples provided above, will serve to inform the restoration process. More details on the interaction between conservation planning, monitoring, and research are presented in Chapter 9.