

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 bioserve, 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 enjoy-

ment, 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 Metro- polis 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)
- 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)

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 through 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)

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 storm-water 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 pre-settlement 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 envi-

ronmental 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 associ-

ated 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 conser-

vation, 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 shore-

line 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 1999, 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 1999 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.

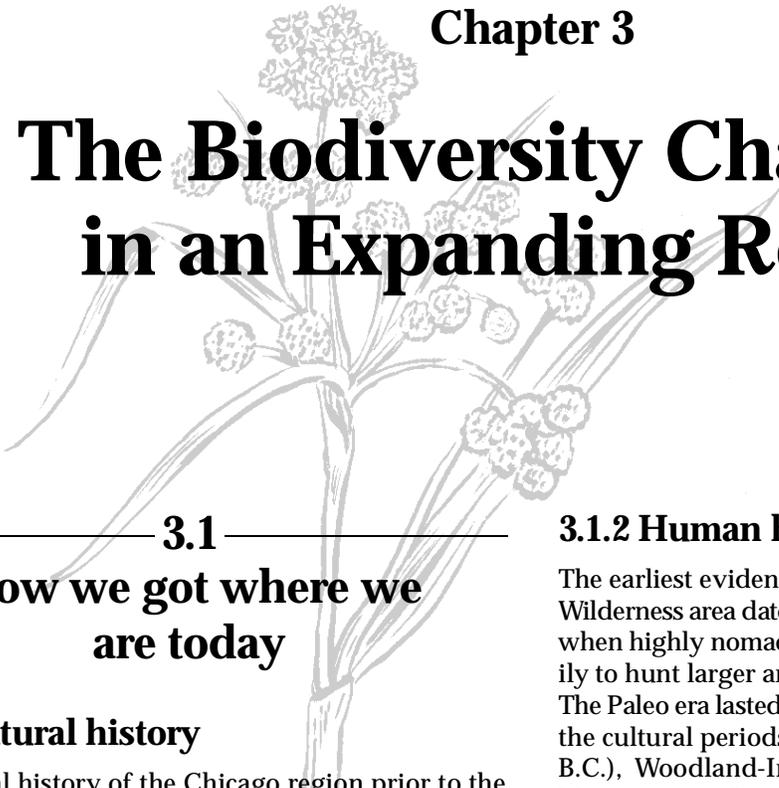
Neither the Cook County Forest Preserve District nor the McHenry County Conservation District has held referenda in recent years. However, other evidence suggests that citizens in these counties would also support further efforts to preserve and restore natural areas. For example, in the fall of 1998, 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 1996 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 to 1640). 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 multi-flora 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 plant-

ing 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 1960s 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 1960 and 1981, the inventory of state parks and county preserves in Illinois nearly doubled from 64,123 acres to 123,101 acres. The 1999 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 1962 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 1960s 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 region¹

POPULATION	1990	2020	1990–2020	% Change
Northeastern Illinois²				
Chicago	2,783,726	3,005,338	221,612	8%
Suburban Cook County	2,321,318	2,589,061	267,743	12%
DuPage 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 County	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 Illinois²				
Chicago	1,482,381	1,745,495	263,114	18%
Suburban Cook County	1,293,652	1,773,881	480,229	37%
DuPage 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 County	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 Wisconsin 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. 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.

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.

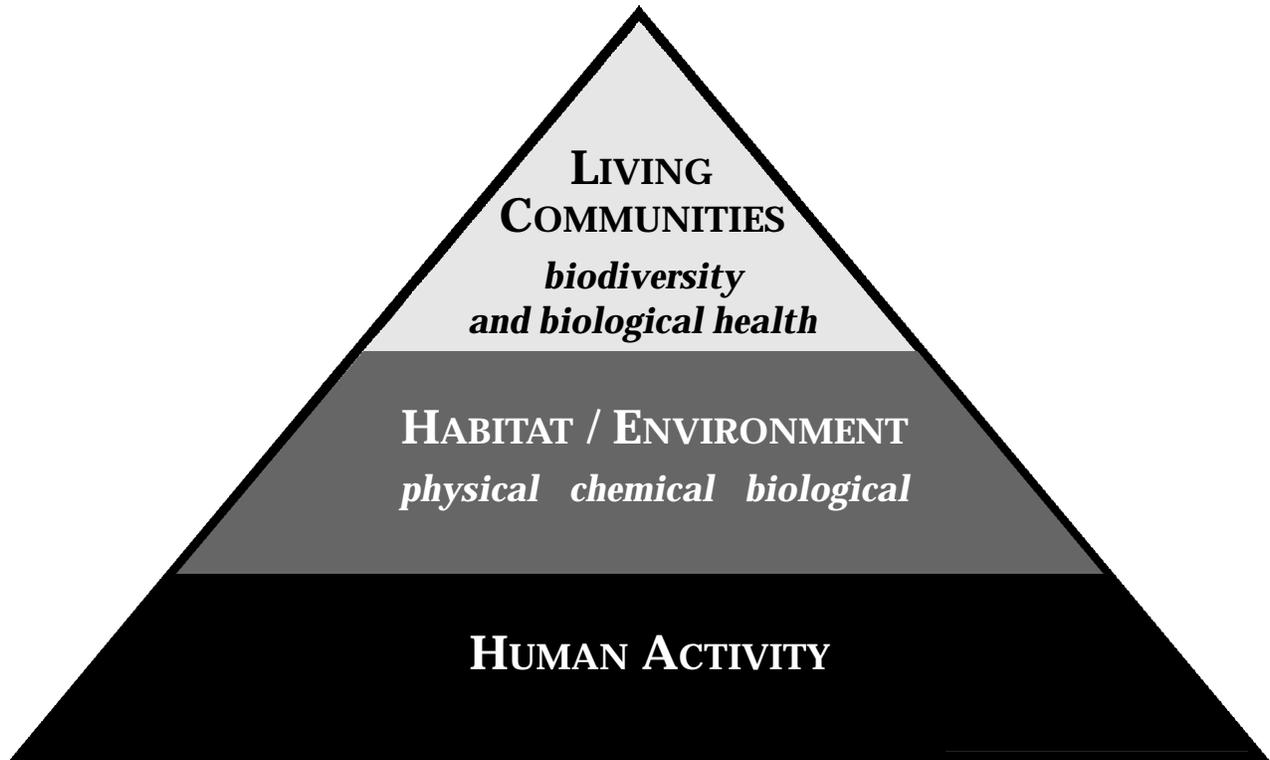


Figure 3.1 Ecosystem health and human activity

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 effects, 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 per-

meability 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

<p>Forested communities</p> <ul style="list-style-type: none"> • Upland forest <ul style="list-style-type: none"> Dry-mesic Mesic Wet-mesic • Floodplain forest <ul style="list-style-type: none"> Wet-mesic Wet • Flatwood <ul style="list-style-type: none"> Northern Sand • Woodland <ul style="list-style-type: none"> Dry-mesic Mesic Wet-mesic <p>Savanna communities</p> <ul style="list-style-type: none"> • Fine-textured-soil savanna <ul style="list-style-type: none"> Dry-mesic Mesic Wet-mesic • Sand savanna <ul style="list-style-type: none"> Dry Dry-mesic Mesic 	<p>Shrubland communities</p> <ul style="list-style-type: none"> • Fine-textured-soil shrubland <ul style="list-style-type: none"> Dry-mesic Wet-mesic • Sand shrubland <ul style="list-style-type: none"> Dry-mesic Wet-mesic <p>Prairie communities</p> <ul style="list-style-type: none"> • Fine-textured-soil prairie <ul style="list-style-type: none"> Dry Mesic Wet • Sand prairie <ul style="list-style-type: none"> Dry Mesic Wet • Gravel prairie <ul style="list-style-type: none"> Dry Mesic • Dolomite prairie <ul style="list-style-type: none"> Dry Mesic Wet 	<p>Wetland communities</p> <ul style="list-style-type: none"> • Marsh <ul style="list-style-type: none"> Basin Streamside • Bog <ul style="list-style-type: none"> Graminoid Low shrub Forested • Fen <ul style="list-style-type: none"> Calcareous floating mat Graminoid Forested • Sedge meadow • Panne • Seep and spring <ul style="list-style-type: none"> Neutral Calcareous Sand <p>Cliff communities</p> <ul style="list-style-type: none"> • Eroding cliff • Dolomite bluff <p>Lakeshore communities</p> <ul style="list-style-type: none"> • Beach • Foredune • High dune
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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 online 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
 Crosswalk¹ between Chicago Wilderness communities and national standard
 for community types for those communities which are globally rare²

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								
Total				457				31
				457				31
TOTAL	1178	1321	2362	556	632	20		229

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	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		
Unclassified								
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 prairie¹ (all moisture classes)

Second tier
 Dry sand savanna
 Gravel prairie (all)
 Basin marsh²
 Calcareous floating mat
 Calcareous seep
 Sand prairie (other than those in dune and swale topography)
 Northern flatwood
 Streamside marsh³

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

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 insects
 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,

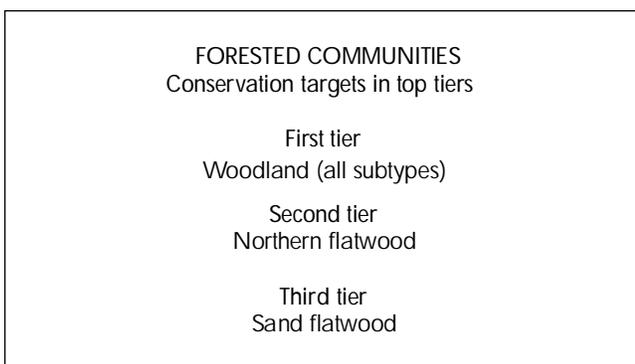
many original woodlands have canopy cover greater than 80% due to years of fire suppression. Such sites can be recognized by the failure of the canopy tree species to reproduce, with few, if any, canopy species represented in the seedling or sapling layer. Based on soil moisture, woodland subtypes are 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.



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 sawfly 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 cranes-bill, 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 glob-

ally 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 wood-

lands 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

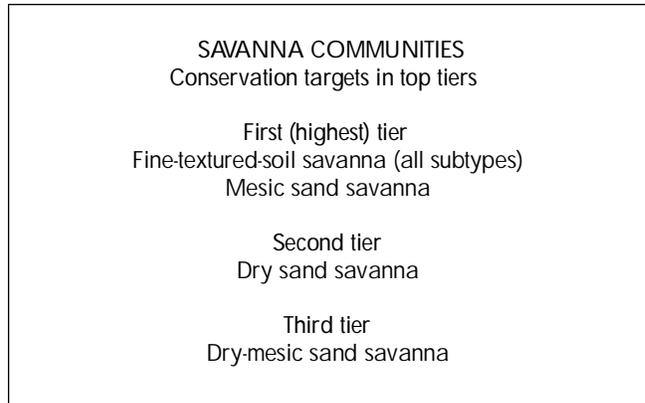
5.3.1 Description of communities

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.



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

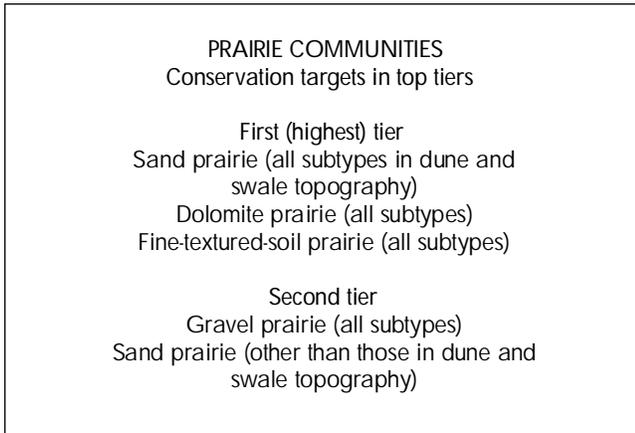
5.4.1 Description of communities

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.



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 pri-

ority 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 sur-

face 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. Bio-engineering 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.



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. Non-point-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. Unpro-

tected 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 green-fruit 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. Else-

where, 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 knowl-

edge 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 establish-

ment 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 frac-

tion 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 north-west 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 pre-settlement 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 overshadowing, 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 establish-

ing 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 cur-

rent 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
- Manage 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:

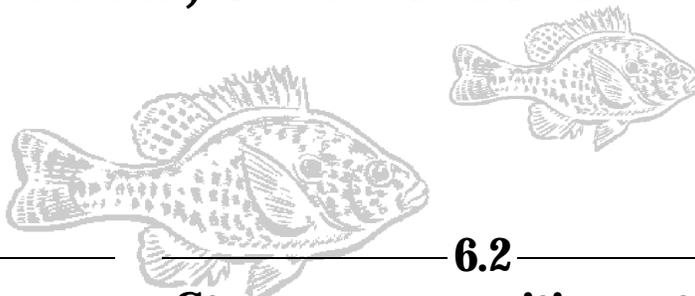
- Examining the dispersal of reptiles and amphibians
- Studying how species use corridors, and under what conditions corridors promote biodiversity conservation
- Understanding barriers to dispersal for different species
- Determining the conditions under which nearby isolates function as a complex for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



Chapter 6

Aquatic Communities: Status, Needs, and Goals



6.1

Introduction

This chapter describes and assesses aquatic communities—those of rivers and streams, of inland lakes and ponds, and of Lake Michigan. It reports on the status of the communities and their habitats in terms of their condition and problems, defines goals, and identifies actions needed.

The information presented in this chapter is based on the knowledge of participants in the expert workshops and reviewers of the resulting working papers. Much of the content is based on professional experience, rather than the published literature, and is provided to give an indication of priority and direction for future conservation work. Workshop reports on which this chapter is based can be found on the Chicago Wilderness web site (www.chiwild.org). Each of the aquatic communities was examined by a different assessment process, as described in each section.

The Illinois Environmental Protection Agency lists 76 streams within the Illinois portion of the Chicago Wilderness region (IEPA 1996). In addition, there are approximately 20 streams in the Indiana and Wisconsin portions. Each stream's watershed boundary can be mapped to help delineate important water resource areas for biodiversity protection and recovery planning. These watersheds are the basic management units for determining recovery goals and actions for aquatic biodiversity.

The following sections describe the streams of Chicago Wilderness in terms of their general descriptive classification, protection and recovery goals, quality assessment, prioritization, threats, and recommended actions.

6.2

Stream communities—status, recovery goals, and recommended actions

6.2.1 Stream classification

Stream ecosystems within watersheds of the Chicago Wilderness region fall into three general categories: headwater, low-order, and mid-order. Within these groups are subcategories defined by flow, gradient, and substrate. The following is a brief description of each class and examples of streams within those classes.

Headwater streams

Continuous-flow headwater streams are first-order streams¹ with small drainage areas and little or no pool development. They are characterized by relatively stable, cool temperatures and consistent levels of dissolved oxygen. They have low habitat heterogeneity and low trophic complexity. Indicator fish species include sculpins and dace. Invertebrate indicator species include caddis flies and stone flies. Plants include watercress, chara, water parsnip, and berula. There are two general types of continuous-flow headwater streams: those with coarse substrates (e.g., Black Partridge Creek and Silver Creek) and those with fine substrates (e.g., Rob Roy Creek).

Intermittent-flow headwater streams are first-order streams with highly variable flows and temperatures. They are inhabited by colonizer species with high reproductive rates or are largely abiotic. Indicator fish species include bluntnose minnow and striped shiner. Intermittent-flow headwater streams can also be divided into those with coarse substrates and those with fine substrates.

¹ A first-order stream is a headwater stream without any tributaries. When two streams of the same order unite, the resulting stream is raised one level. Thus, when two first-order streams unite, the resulting stream is a second-order stream. When two second order streams unite, the resulting stream is a third order. The order of a stream is not increased when a lower-order stream enters it.

Low-order streams

High-gradient low-order streams are second- to fourth-order, small- to medium-sized creeks, often with distinct riffle and pool development. They have more complex habitats and trophic characteristics than headwater streams. High-gradient low-order streams fall more than three feet per mile and have coarse substrates, mostly cobble, gravel, and sand with some silt. Indicator fish species include darters, stonerollers, hornyhead chub, and juvenile suckers. Examples include Tyler Creek, Buck Creek, and Long Run Creek.

Low-gradient low-order streams are second- to fourth-order creeks that fall less than three feet per mile and have predominantly fine-textured substrates. Indicator fish species include creek chub and bluntnose minnow; plants include sago pondweed, water star weed, and American pondweed. Examples include Lily Cache Creek, Skokie River, Plum Creek, and Mill Creek.

Mid-order streams

High-gradient mid-order streams are fifth- to eighth-order, large creeks to medium-sized rivers with relatively stable flows, temperatures, and high habitat diversity. They have the most complex habitats, are highest in species diversity, and harbor abundant predators. High-gradient mid-order streams fall more than three feet per mile and have coarse substrates. Indicator fish species include smallmouth bass, northern hogsucker, and redhorse. Examples include Kankakee River, Kishwaukee River, and the Lower Fox River.

Low-gradient mid-order streams differ from high-gradient mid-order streams in that they fall less than three feet per mile and have finer substrates. Indicator fish species include largemouth bass, pike, and channel catfish. Examples include the Upper Fox and the Upper Des Plaines River.

6.2.2 Functions of streams

Streams and rivers are familiar features in the Chicago Wilderness region. They perform many important functions, some obvious and some not so apparent.

Drainage is their most obvious function. Streams convey runoff from the land, most noticeably during floods, when even the least conspicuous drainageway can become a raging torrent. Streams also convey the treated and untreated wastes of our urban and agricultural lands. In fact, during the drier times of the year, treated wastewater constitutes virtually the entire flow in some of our more urban streams.

Streams also are valued for recreation because of their potential to support fishing, swimming, wildlife obser-

vation, and boating. Healthy streams provide habitat for diverse communities of fish, amphibians, insects, and aquatic plants. Stream and river corridors also are viewed as aesthetic amenities for residential development and public open space, and they provide travel corridors for wildlife.

Historically, however, conflicts have arisen between the various uses and functions of streams. In particular, increased reliance on streams as conduits for storm water and wastewater has greatly diminished their ability to provide benefits of recreation, habitat, water quality, and aesthetics.

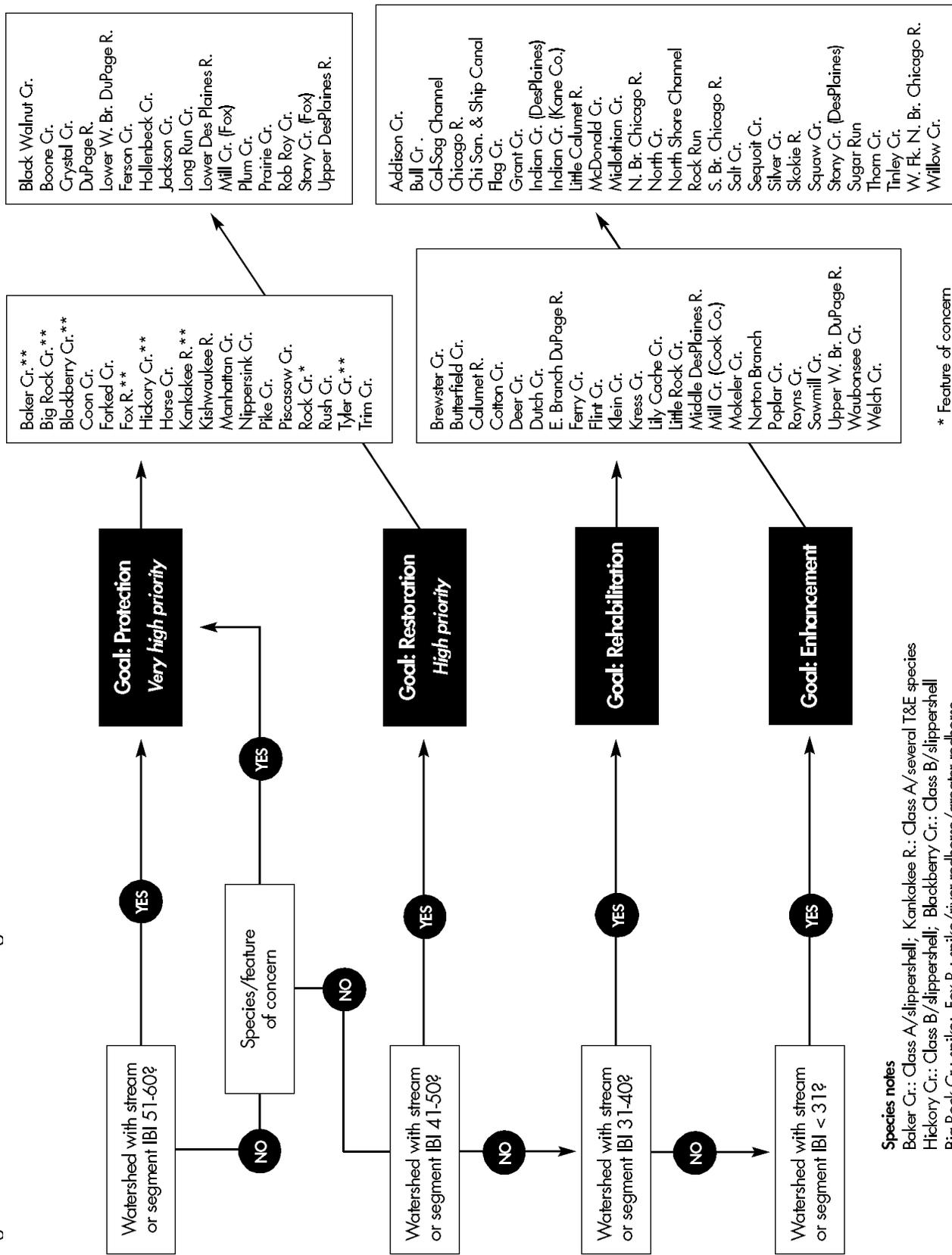
There are two principal causes for these conflicts. The first is the alteration or destruction of the stream channel and its adjacent corridor, or *riparian zone*. Activities such as stream channelization or straightening destroy critical habitat and upset the natural balance between a stream and its floodplain that has developed over thousands of years. The second cause is the alteration of the stream's watershed. For example, the conversion of farmland to subdivisions and shopping centers increases the impervious land surface. This can result in adverse changes to both the quantity and quality of stream-flow. These changes can upset the natural equilibrium of a stream, often resulting in channel erosion, lost habitat, degraded water quality, and frequent flooding.

6.2.3 Stream assessment and prioritization

One of the goals of the biodiversity recovery plan is to build consensus on the protection and enhancement of streams that provide a high degree of biological function. Watersheds of streams that have exceptional aquatic biological integrity, or have the potential to be restored, should be identified in order to establish priorities for future efforts in protection and recovery.

The information in this section results from a Chicago Wilderness project called "Stream Biodiversity Recovery Priorities." As a first step, the project identified perennial streams that support or have the potential to support native fish and aquatic life populations in the six-county northeastern Illinois region (Cook, DuPage, Kane, Lake, McHenry, and Will Counties) were identified. The project developed a stream prioritization method that classified streams into four categories according to the following recovery goals: protection, restoration, rehabilitation, and enhancement. Streams for which the goals are protection and restoration are considered of very high priority and high priority respectively. (See Figure 6.1.) The streams were classified by the following criteria:

Figure 6.1 Flow chart for determining stream and watershed status



- Index of biotic integrity (IBI)
- Species or features of concern
- Macroinvertebrate Biotic Index (MBI)
- Abiotic indicators

The following describes each of these criteria and discusses their use and limitations in determining priorities for protection and recovery in the Chicago Wilderness region.

Index of Biotic Integrity (IBI)

The IBI uses fish-sampling data to indicate the overall health and integrity of a stream. The IBI assesses the health of fish communities using twelve different metrics. These twelve metrics fall into three categories: species composition, trophic composition, and fish abundance and condition. Data are obtained for each metric at a given site, and a number rating is assigned to each metric. The sum of the twelve ratings yields an overall site score, with scores in Illinois ranging from 12 for exceptionally poor quality to 60 for exceptionally high quality. The IBI integrates information about individuals, populations, communities, and the ecosystem into a single ecologically based index of water-resource quality (Karr 1981, Karr et al. 1986, IEPA 1996).

IBI data from Illinois were used to characterize streams. Streams with an IBI score of greater than 50 were designated as very high priority, with a primary goal of protection. Streams with an IBI score of 50 or less, but with species or habitat features of concern (described in the next section), were also designated as very high priority. Streams with IBI 41–50 that lacked species and habitat features of concern were designated as high priority, with a goal of restoration. Streams with IBI 31–40 that lacked species and habitat features of concern were assigned a goal of rehabilitation. Streams with IBI less than 31 that lacked species and habitat features of concern were assigned a goal of enhancement. Figure 6.1 shows the method for developing stream and watershed priorities and gives examples of watersheds for each category.

Species or features of concern

These include state threatened and endangered species as well as other unique aquatic habitat and biological characteristics. Professional experience and judgement were used in cases where fish and invertebrate data were unavailable, where unique cold-water habitats exist, or where unique fish and invertebrate communities were believed degraded because of point and non-point sources of pollution. Streams that contained species or features of concern were designated as very high priority, with the goal of protection. Table 6.1 gives a provisional list of stream-based species and features of concern.

Macroinvertebrate Biotic Index (MBI)

MBI values, based on pollution-tolerance ratings for macroinvertebrates, were compiled for streams where data were available. Streams with IBI scores of less than 40 and with MBI scores of less than five may indicate good-quality, healthy stream ecosystems that have some potential for restoration, rehabilitation, or enhancement. However, until a relationship between MBI and IBI values can be verified, other criteria must be used to assign goals for recovery and protection.

Abiotic indicators

For streams where biological data are extremely limited (for example, almost all headwater streams), abiotic watershed variables need to be considered in order to predict biotic potential and assign a recovery or protection goal. Abiotic watershed variables are frequently components of both aquatic *and* terrestrial ecosystems. Land-use patterns, percentage of impervious land surface, stream-flow obstructions, in-stream habitat, degree of erosion and sedimentation, degree of alteration and channelization, stream width, and substrate are all examples of abiotic factors affecting streams. Until these conditions can be adequately described and a prioritization method established, the assignment of recovery priority goals will rely primarily on professional judgement.

6.2.4 The relationship between stream quality and urban development

The biotic quality of streams and rivers in the Chicago Wilderness region is highly variable. As in other parts of the country, there is clear evidence that watershed urbanization has adverse impacts on the ecological integrity and beneficial uses of downstream bodies of water. In northeastern Illinois, this impact is reflected in a relationship between urbanization, as measured by watershed population density, and stream quality, as measured by the fish-based Index of Biotic Integrity (IBI). The assessment of over 40 northeastern Illinois streams and rivers shows that nearly all streams in urban and suburban watersheds (that is, with population densities exceeding roughly 300 people per square mile) exhibit signs of considerable impairment of their fish communities, with conditions being described as fair to very poor. In contrast, most rural streams support fish communities that are rated good or excellent.

6.2.5 Status of streams in northwest Indiana

A recent study provides details on the structure and function of fish communities in the Lake Michigan watershed of northwest Indiana (Simon and Stewart 1999). There are three functioning riverine watersheds in northwest

Table 6.1
Stream based species features of concern

Mussels	Fish	Amphibians and reptiles
Slippershell	Iowa darter	Spotted turtle
Spike	Western sand darter	Smooth softshell turtle
Ellipse	Rainbow darter	Blanding's turtle
Creek heelsplitter	Pallid shiner	
Elephant-ear	Mottled sculpin	
Rainbow	Blacknose shiner	Mammals
Wavy-rayed lampmussel	Pugnose shiner	River otter
Snuffbox	Greater redhorse	
Higgins eye	Banded killifish	
Salamander mussel	Ironcolor shiner	Plants
Sheepnose	Blackchin shiner	Heart-leaved plantain, <i>Plantago cordata</i>
Pondhorn	Weed shiner	Water marigold, <i>Bidens beckii</i>
Spectaclecase	Longnose dace	
	Brook lamprey	
	Pugnose minnow	
Insects	Starhead topminnow	Other features
	Banded darter	Streams with > 8 species of mussels
Hine's emerald dragonfly	Bowfin	Other conditions that are known to harbor unique biological characteristics
	Spottail shiner	
	Brassy minnow	
	Largescale stoneroller	
	Creek chubsucker	
	Pirate perch	

Indiana, the Little Calumet River, the Grand Calumet River, and Trail Creek. In addition, there are creeks draining the area of the Great Marsh in the Indiana Dunes National Lakeshore. The natural hydrology of this part of the Chicago Wilderness region has been greatly changed from natural conditions by human actions over the past 200 years, beginning with changes in drainage patterns by Native Americans (Indiana DNR 1999).

There are no high quality reference sites for streams remaining in this region, and few areas qualify even as "least-impacted." The Trail Creek watershed is the only one with a significant percentage of species that are intolerant of degradation in water and habitat quality. The fish community in each watershed is composed of at least ten-percent exotic species, with the Grand Calumet River fish community having nearly 60 percent exotic species. Improvements in native species richness and the biological integrity of these streams will require extensive habitat restoration, as even the protected lands in the area are not functioning as high quality fish habitat (Simon and Stewart 1999).

6.2.6 Long-term vision and recovery goals

The goals in this chapter focus on achieving a desired biotic integrity and biological diversity for streams of the Chicago Wilderness region. The goals provide the basis for actions, such as best management practices, information and education activities, land acquisition, and other initiatives that would promote stream biodiversity, capacity, and resiliency.

We use the terms *protection*, *restoration*, *rehabilitation*, and *enhancement* to describe the recommendations for managing streams and watersheds. The following goal statements help define the terms as they are applied to watersheds throughout the region (see Figure 6.1 and Figure 6.2).

Protection is used for high-quality streams that fully support their potential biological integrity and diversity. Controlling point- and non-point-source pollution, channelization, impoundment, and other threats to biological integrity and diversity is necessary to assure that

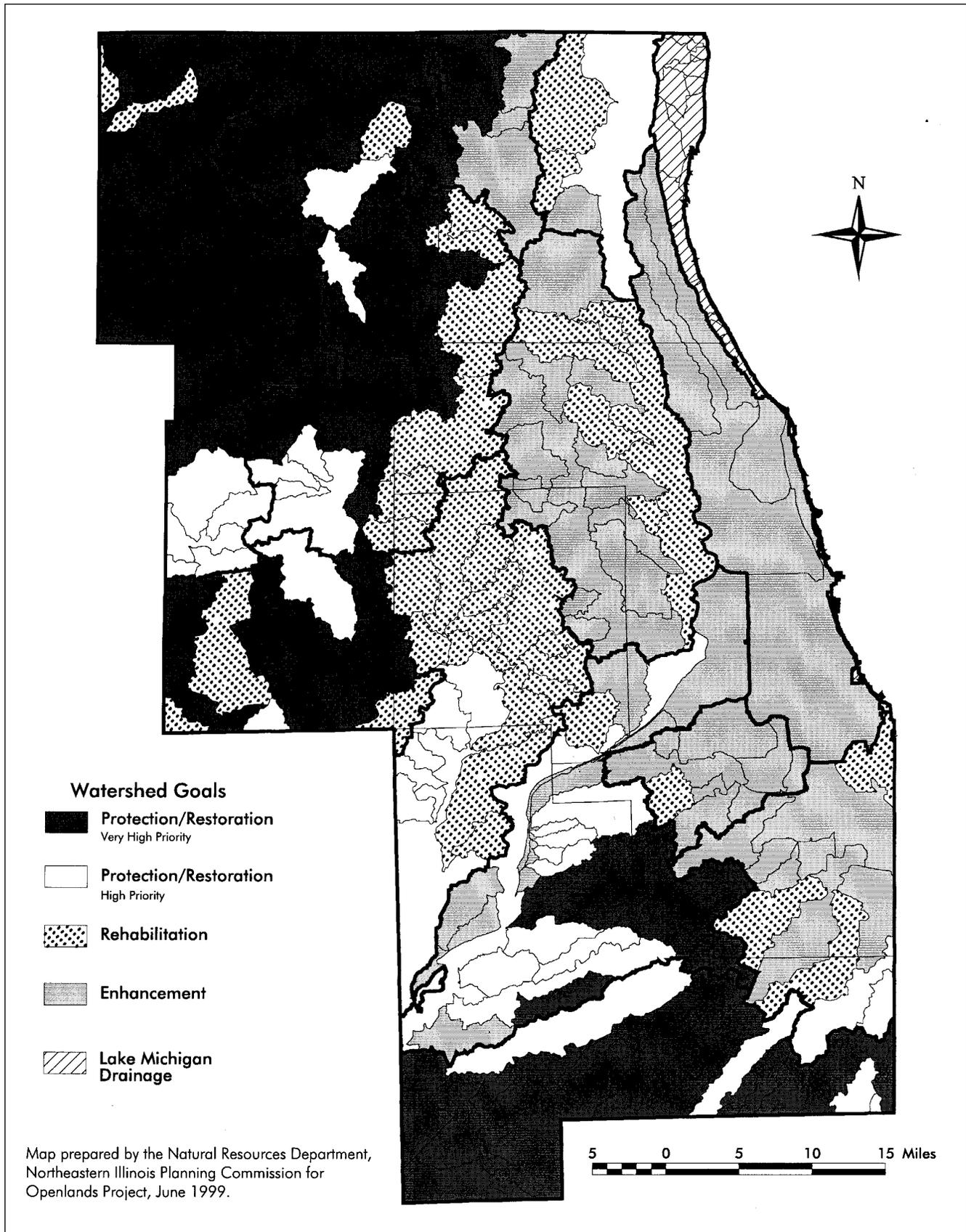


Figure 6.2 Priority watersheds in northeastern Illinois

stream quality is maintained and *not degraded*. For example, if a stream is supporting a high-quality fish community or an endangered species, the goal is to protect those conditions.

Restoration is used for streams that are moderately degraded and only partially meet their potential biological integrity and diversity. Restoration seeks to replace lost or damaged biological conditions, restoring ecological processes and linkages (such as energy flow, dispersal mechanisms, and succession). For example, if a stream is supporting a moderate-quality fish community and is directly linked to a viable source of species recolonization, as is the Kankakee River, the goal is to restore the stream to a more diverse fish community by restoring lost habitat and improving degraded water quality.

Rehabilitation is used for streams that are more severely degraded and do not meet their potential biological integrity and diversity. The goal here is to replace some of the lost or damaged biological functions and linkages of the stream. For example, if a low-quality fish community retains some functional linkage to a viable source of recolonization, the goal is to re-establish some biological integrity by partially restoring some habitat or water-quality components.

Enhancement is used for streams that are the most severely degraded. The goal is to reclaim severely damaged ecosystems. For example, if a very poor fish community has no functional linkage to a source of recolonization, the goal is to mitigate the sources of degradation in the stream, but to recognize that this will only have a limited effect on biological functions.

6.2.7 Threats

As watersheds undergo development, land is covered with impervious materials (such as pavements and rooftops) or surfaces that limit infiltration (such as cultivated fields and areas with shallow-rooted plants). As a result, stormwater collects on or near the surface. Groundwater recharge areas are restricted and surface runoff becomes the principal source of stream flows. The result is “flashier” streams that are prone to flooding and severe erosion. Watersheds with greater than 10%–15% impervious surface area tend to produce degraded stream habitat and biodiversity (Center for Watershed Protection 1998a). In addition, drainage of wetlands and other low-lying storage areas and channelization of streams alter a watershed’s hydrology and reduce aquatic biodiversity.

Based on watershed assessments of impaired streams, both point and non point sources of pollution are major contributors to impairment. While point sources, partic-

ularly municipal wastewater-treatment plants and combined sewer overflows, generally contribute the greatest pollutant loads to most urban rivers and streams, dramatic reductions in the concentration of pollutants in discharges have occurred in the last two decades. Impairments from non-point-source pollution are substantial and are actually increasing in many watersheds due to expanding suburban development in the region. Thus, a major challenge is to better control the impacts of development-related non-point-source pollution to protect the region’s remaining high-quality streams.

Runoff from residences, businesses, construction sites, and industries carries sediment, nutrients, pesticides, metals, grease, oil, bacteria, salts, and debris to nearby streams. Runoff from agricultural areas carries similar pollutants but at different rates and concentrations. Losses in dissolved oxygen and thermal pollution are other water-quality problems associated with human impacts on streams and watersheds.

As development occurs, streams are often impounded, straightened and channelized, the banks sometimes armored with concrete or stripped of native vegetation—all to accommodate buildings, roads, flood control and stormwater conveyance systems. The resulting stream habitat degradation severely limits aquatic life, encourages exotic species, and reduces healthy biodiversity.

6.2.8 Recommended actions

- **Reduce hydrological alteration**

- ✓ **Continue to identify watersheds with streams that have exceptional aquatic biological integrity to inform planning efforts and set priorities.**

This chapter describes a technique, using well-established indicators, for classifying streams according to their biological integrity and suggests priority goals for protecting or restoring their biodiversity. This process has been applied to the streams in the Illinois portion of the Chicago Wilderness region but should be extended to cover the entire region, so that priorities can be set at the regional level.

- ✓ **Limit development in some high-priority subwatersheds.**

Recent research has shown that the amount of impervious cover in a watershed can be used to project the current and future health of many headwater streams. There also is strong evidence suggesting that impervious cover is linked to the quality of other water resources such as lakes, reservoirs, and aquifers (Center for Watershed Protection 1998b).

✓ **Direct development into areas that limit hydrological alteration.**

Many model land-development principles have been documented to limit adverse stormwater impacts and to benefit both the stream environment and the community. These principles involve the careful location and design of residential streets, parking lots, building footprints, and conservation areas (Dreher and Price 1994).

✓ **Promote cluster development.**

Cluster development uses smaller lot sizes and less pavement to minimize impervious area, reduce construction costs, conserve natural areas, provide community recreational space, and promote watershed protection. Relaxing side-yard setbacks, allowing narrower frontages and shared driveways, and providing shared parking arrangements are all techniques for cluster development.

✓ **Require stormwater detention that effectively controls the full range of flood events.**

Local standards for stormwater ordinances are usually intended to prevent increases in flood damage. Drainage and detention facilities should be designed to minimize runoff volumes and rates, so that the natural hydrologic and water-quality functions of streams, wetlands, and floodplains are protected.

✓ **Promote natural drainage as an alternative to storm sewers.**

Where density, topography, soils, and slopes permit, open vegetated swales and constructed wetlands should be used to temporarily detain, convey, and treat runoff from a range of storm events. New stormwater outfalls should not discharge unmanaged stormwater into jurisdictional wetlands, aquifers or sensitive areas.

✓ **Create buffer strips and greenways along streams.**

Riparian stream buffers are variable-width strips of land continuously vegetated with native plants. They encompass environmental features such as wetlands, steep slopes, the 100-year floodplain, multiple-use greenways and trails, wildlife corridors and additional safety widths adjacent to high-impact, high-density development. Buffers should be maintained throughout the stages of plan review, construction, and post-development.

✓ **Acquire additional land for conservation.**

Results of open space referenda in several Chicago Wilderness counties showed that the public gener-

ally supports acquisition of new parks and forest preserves for multiple benefits, including recreation, aesthetics, wildlife habitat, clean air, and clean water. Additional open space, with its protection of trees and other deep-rooted vegetation, enhances stormwater infiltration and groundwater recharge, and it can help to mitigate damages caused by flashy stream flows.

✓ **Develop stormwater management plans.**

Stormwater management plans establish a framework of standards for minimizing storm damages to structures, public health, and safety. They should identify, protect, and improve waterways and groundwater recharge areas by requiring all new development to minimize or reduce stormwater damages. The plans should protect and improve water quality, promote public awareness of stormwater issues, and identify revenue sources for the adopted program.

✓ **Enforce erosion-control measures on new construction.**

Many effective practices for controlling erosion and sediment have been developed specifically for use on construction sites. Developers and local officials should work together to choose the best techniques to minimize off-site sedimentation. For this to happen, building inspectors, contractors, and engineers must all understand the principles, benefits, and limitations of best management practices for erosion and sediment control.

✓ **Create or restore streamside wetlands.**

Streamside wetlands are complex ecosystems that provide many ecological functions beneficial to their adjoining streams. They are biologically productive systems that provide fish and invertebrate habitat, water pollution control, sediment control, water supply, floodwater storage, and barriers to erosion. In addition, streamside wetlands provide habitat for threatened and endangered species such as the spotted turtle and river otter.

✓ **Educate decision-makers about development patterns and the effects of land uses on streams.**

Elected officials and local governments should be aware of model watershed-development principles and how they apply to their watersheds. Officials should evaluate their zoning codes and subdivision ordinances based on those principles. The Center for Watershed Protection (1998a), NIPC (1992) and Dreher and Price (1997) give details on model development principles.

- **Reduce deterioration of habitat quality**

- ✓ **Remove unnecessary dams.**

Many dams in the region impede the movement of fish and other aquatic life up and down the waterway. Dams can cause degradation of habitat in upstream areas and can have dramatic negative effects on water quality. Consequently, high-quality streams sometimes abruptly deteriorate above or below a dam. Where dams are not needed for water supply, flood control, or recreation, they should be removed or fitted with structures that effectively permit the passage of aquatic species. By removing a dam, the owner can often eliminate the cost of repairing the dam while improving the stream's biodiversity. State and federal agencies should develop guidelines and policy for dam removal activities, which at a minimum should require study of a removal alternative for any dam repair or rebuild proposal, including economic and environmental analysis.

- ✓ **Retain or restore emergent and near-shore vegetation.**

A thriving, diverse vegetative community is an important component of a functioning stream or streamside wetland. If a degraded stream's hydrology and water quality can be stabilized, vegetation can be re-established by planting seedlings, root stocks, bulbs, or transplants. Native plant species should be used in riparian buffer areas to protect and restore important functions such as bank stability, wildlife habitat and forage areas, runoff filtering, and shading. The choice of native plants depends on local needs and conditions. The USDA (1997) has published information on local species that are best adapted for stream conditions.

- ✓ **Re-meander channelized streams.**

Meanders are naturally occurring bends in a stream that help dissipate energy of flowing waters. They create a variety of flow velocities and provide important habitat features for some aquatic species. There are many opportunities to recreate meanders in artificially straightened streams in the Chicago Wilderness region.

- ✓ **Restore riffles, pools, sandbars, and other elements of in-stream habitat.**

A riffle is a shallow rocky area that separates deeper pools in a stream. Riffles enhance water aeration while providing habitat for many aquatic species such as darters and stoneflies. In channelized streams, riffle sequences are typically diminished or eliminated altogether. Sandbars and mud flats provide valuable habitat for a variety of birds and invertebrates.

- ✓ **Study the effects of riparian management.**

Unfortunately, relatively little monitoring has been conducted on managed riparian lands. Experimental model projects, such as the one at Melody Farm Nature Preserve on the Middle Fork of the North Branch of the Chicago River, should be carefully studied to evaluate the biodiversity benefits to the stream.

- ✓ **Survey how people use aquatic resources and study the economic impacts of uses such as fishing and recreational boating.**

Surveys, like the one conducted by the Chicago River Demonstration Project, should be taken to help describe and understand how user and interest groups currently perceive and use streams of Chicago Wilderness, and how they would like to see the corridors improved for recreation and related values.

- ✓ **Use bioengineering solutions to control streambank erosion.**

Bioengineering methods combine live plant materials with built structures to stabilize eroding stream banks, resulting in a living and sustainable erosion-control system. By using native plant species and with considerable care and maintenance in the first few years, bank stabilization can become self-sustaining and, to an extent, self-repairing since the plants are adapted to growing and reproducing in the stream environment.

- **Reduce deterioration of water quality**

- ✓ **Rigorously enforce non-degradation standards.**

Pollution-control agencies such as the Illinois Environmental Protection Agency (IEPA) have been criticized for failing to adequately enforce rules that prohibit adverse impacts of discharges on streams as called for in the Clean Water Act. Effective anti-degradation policies and enforcement procedures will ensure that pollutant levels in wastewater and stormwater discharges do not exceed levels that are damaging to stream biodiversity, especially in high-quality streams.

- ✓ **Develop and implement best management practices to control soil erosion, sedimentation, and storm water runoff.**

Effective efforts to protect streams and their watersheds usually include the use of best management practices. These are actions or structures that are needed to control runoff pollution and flooding. Examples of some commonly used practices are use of vegetative buffers, streambank stabilization,

wetland creation or restoration, use of grassed swales or waterways, sediment basins, diversions, keeping streams above ground, remeandering streams, and wildlife plantings.

✓ **Find alternatives to new and expanded effluent discharges to high-quality streams. For example, route sewage flows to regional facilities and use land treatment.**

Organic matter, nitrogen, phosphorus, and micro-nutrients in storm water and wastewater are generally harmful when discharged to high-quality streams and lakes. Land treatment systems and detention facilities should be designed to ensure that pollutants do not reach streams, especially high-quality streams.

✓ **Re-examine standards and practices for sewage treatment.**

There is a need to establish sewage-treatment policies that ensure protection for high-quality streams and that allow restoration of low-quality streams. While improvements to sewage-treatment plants have improved quality in degraded urban streams, the same standards and discharge limits are proving insufficient to protect high-quality streams in non-urban areas. Aging sewage-treatment facilities eventually develop structural problems or worn-out mechanical systems that are difficult or uneconomical to replace. Plant managers should, to the extent of their authority, assess downstream aquatic biodiversity when determining how to meet permit limits and water-quality standards for pollutant removal and when establishing policies for new plants and updated equipment.

✓ **Promote effluent polishing through constructed wetlands for all discharges to moderate- and high-quality streams.**

Wastewater effluent should not be directly discharged to streams, especially high-quality streams. Instead, treatment trains should include tertiary constructed wetlands or provide reuse options such as irrigation, industrial processing, groundwater recharge, fire protection, and/or limited-contact recreation.

✓ **Encourage pollution-control regulators to use biocriteria for water quality standards.**

Biocriteria are measures of the quality of streams based on living organisms. Standards for pollution discharges are based on the impact of the discharge on these living elements. Water-quality metrics used by the Illinois Environmental Protection Agency, for example, do not recognize the graded continuum of stream systems and do not give

recognition to unique areas of biodiversity. The state of Ohio, on the other hand, has developed a set of metrics that have given a higher measure of protection to many of the high-quality streams there.

✓ **Gain community support for watershed management.**

Watershed planning and management are perhaps the most important stream-protection tools. Management plans should be developed with community consensus on the goals for water resources and the techniques and practices needed to meet those goals. Techniques may include overlay zoning, cost-share incentives, growth boundaries, and conservation easements. See Section 0 (especially 8.3.3) for further discussion.

✓ **Evaluate aquatic insects as indicators of water quality.**

The presence or absence of indicator organisms is an indirect measure of water pollution. Benthic macroinvertebrates, including aquatic insects (such as mayflies, stoneflies, caddisflies, midges, and beetles), snails, worms, freshwater clams, mussels, and crayfish are sensitive to changes in a stream's ecological integrity. However, the relationship between benthic macroinvertebrates and other water-quality indicators, such as fish and water chemistry, has not been clearly established.

✓ **Evaluate the need for improved water quality standards.**

The state of Illinois does not have numerical standards for two major causes of stream degradation: phosphorus and sediment. The State should evaluate and develop appropriate standards that are protective of designated stream uses.

✓ **Encourage volunteer monitoring.**

In the State of Illinois, the goal of the Critical Trends Assessment Program to track changes in stream habitats over time can only be met with a combination of volunteers and scientists working in collaboration. Volunteer monitors enable the state to collect large amounts of information economically, and this information is providing an important bank of knowledge about local conditions in streams and other ecosystems. Currently, there are unlimited opportunities for volunteer monitors to become trained citizen scientists through the Illinois EcoWatch Network. The Conservation Foundation also participates in these monitoring programs. In Indiana, a similar program entitled Hoosier Riverwatch involves citizens in efforts to care for and monitor the health of streams and rivers.

The Northeastern Illinois Planning Commission’s “Restoring and Managing Stream Greenways” (1998) further explains some of the actions described above. This handbook addresses landscape buffers, channel maintenance, stream bank stabilization, and techniques for restoring in-stream habitat.

6.3

Lake communities—status, recovery goals, and recommended actions

6.3.1 Lake classification

In addition to Lake Michigan, three types of natural lakes occur in the Chicago Wilderness region: bottomland lakes, vernal ponds, and glacial lakes. *Bottomland lakes* are shallow lakes adjacent to large streams and are seasonally flooded. There is seasonal recruitment of species in bottomland lakes. *Vernal ponds* are small, seasonally inundated depressions that have no fish species. *Glacial lakes* are divided into two types: kettle and flow-through. *Kettle lakes* are isolated basins, while *flow-through lakes* are connected to a stream system. Glacial lakes are the most biologically diverse of the lake types. In addition to the natural lakes, the region has a number of manmade lakes.

In planning for biodiversity recovery, the classification system for lakes is less useful than the terrestrial classification system. The glacial lakes are the most ecologically important of the lakes, and are thus the primary focus for conservation attention, although other lakes do contribute to the region’s biodiversity. To help establish priorities for conservation efforts and recovery goals, a working group for lake recovery plans developed a system to assess the status of the lakes’ biodiversity.

6.3.2 Lake assessment and prioritization

The method to assess the current condition of biodiversity in the region’s lakes is in part based on Vermont’s system (Garrison 1994–1995). This system defines four categories for lakes. The categories are intended to be operational and to promote various conservation actions for the region’s lakes, rather than to be rigid or restrictive. The four categories are *exceptional*, *important*, *restorable*, and *other*. The criteria used to place various lakes in a category are driven solely by the biodiversity in the lake. We recognize that other features of lakes such as water quality are important indicators of environmental qual-

Table 6.2
Preliminary assessment showing exceptional lakes

County	Lake name	No. of native fishes	No. of E/T species
Cook	Wolf Lake	28	5
Lake	Bangs Lake	22	5
Lake	Cedar Lake	27	9
Lake	Cross Lake	>14*	5
Lake	Deep Lake	18	5
Lake	Deer Lake-Redwing Slough	>14*	1
Lake	East Loon Lake	23	5
Lake	Fourth Lake	>14*	2
Lake	Gray’s Lake	15	2
Lake	Timber Lake	>14*	1
Lake	Lake Catherine	21	1
Lake	West Loon Lake	23	8
Lake	Mud Lake	>14*	1
Lake	Petite Lake	17	1
Lake	Sullivan Lake	>14*	2
Lake	Sun Lake	>14*	1
Lake	Turner Lake	22	1
Lake	Wooster Lake	>14*	3
McHenry	Crystal Lake	23	2
McHenry	Elizabeth Lake	19	6
McHenry	Lake Defiance	18	1
McHenry	Lake Killarney	19	2
McHenry	Lily Lake	16	2

* For these lakes, data on number of native fishes was not available, but experts at the workshop expect high native fish diversity based on overall lake condition.

ity, but we believe that biodiversity provides the most direct measure.

The criteria for the lake status assessment are as follows:

Exceptional lakes

- Must have threatened or endangered species of flora or fauna
- May have other watch species
- Have more than eight native plant species and more than 14 native fish species.

Table 6.3
Preliminary assessment
showing important lakes

County	Lake name	No. of native fishes
Cook	Axehead Lake	14
Cook	Beck Lake	16
Cook	Busse Woods Lake	22
Cook	Maple Lake	15
Cook	Marquette Park Lagoon	16
Cook	Midlothian Reservoir	15
Cook	Tampier Lake	18
DuPage	Mallard Lake	18
DuPage	Pickeral Lake	18
DuPage	Silver Lake	18
Lake	Channel Lake	22
Lake	Diamond Lake	20
Lake	Fox/Nippersink	23
Lake	Gages Lake	22
Lake	Lake Marie	22
Lake	Lake Zurich	22
Lake	Long Lake	21
Lake	Old School Pond 2	20
Lake	Pistakee Lake	18
Lake	Sand Lake	14
Lake	Sterling Lake	25
McHenry	Griswold Lake	18
McHenry	Lac Louette	16
Will	Braidwood Lake	38
Will	Lake Milliken	19

Important lakes

- Have more than eight native plant species and more than 14 native fish species
- May have exotic species present, but not dominant
- May have watch species
- According to historic records, have had threatened or endangered species of flora or fauna

Restorable lakes

- According to historic records, have had threatened or endangered species of flora or fauna
- Are glacial lakes with physical characteristics that would support reintroduction of endangered and threatened species

- May be currently dominated by exotics that could be controlled with appropriate management

Other lakes

- Are unlikely to support sensitive species and may be better managed for purposes other than biodiversity conservation.

We conducted a preliminary assessment of the region's lakes. Tables 6.2 and 6.3 show preliminary results for exceptional and important lakes. Information used for this assessment includes data from the Illinois Natural Heritage Database, the Illinois Department of Natural Resources, The Nature Conservancy, and the McHenry ADID study, as well as expert opinion. It should be noted that the data used did not include information on native plant species present, and in some cases numbers of native fish species are not recorded. In cases where complete information was not available, scientist and land managers made a determination based on what they did know about the lake. As new information becomes available, the status of the lakes may change.

6.3.3 Long-term vision and recovery goals

Exceptional lakes: The vision for these lakes is to manage all of them for maximum aquatic biodiversity. This will include allowing native vegetation to dominate shorelines and keeping littoral-zone disturbance to a minimum. A goal is for no exceptional lake to lose any native species, particularly endangered or threatened species. Over time, the number of exceptional lakes should increase due to improvement in the condition of important lakes, yet none of the exceptional lakes should decline in condition. A goal is to manage exceptional lakes as part of their watershed. To achieve this, watershed plans should be developed, implemented, and changed as needed to maintain the exceptional status of a lake. To help achieve these goals, all historical biodiversity data should be retained. Additionally, the state laws on endangered and threatened species should be strengthened to provide adequate protection for these aquatic species. More research is needed on the life histories of endangered and threatened aquatic species. For priority species, specific recovery plans should be developed and implemented.

Important lakes: The goals for these lakes are similar to the goals for exceptional lakes. The vision for important lakes is to improve their condition so that most of the important lakes move up to the category of exceptional lakes. Management plans need to be implemented not only to improve the conditions of these lakes but also to prevent them from falling into a lower category. A goal

is to have landowners value the natural state of a shoreline and play an active role in conserving and preserving lakes.

Restorable lakes: For these lakes, the goal is to control invasive species and sources of impairment effectively. Many of these lakes can and should be restored to the point where endangered and threatened species can be reintroduced. With proper restoration efforts, native species should be surviving the challenge of exotics. A goal is for most restorable lakes to move up to the category of important lakes through restoration efforts. Demonstration projects that clearly show how it is possible to restore a lake to exceptional condition should be conducted as part meeting this goal. The goal of restoration efforts is to return lakes to a condition in which they can retain their historical native species.

Other lakes: Lakes that are not viewed as restorable (from a biodiversity perspective) should provide recreational and cultural services that do not jeopardize the biodiversity goals of other lakes. These lakes may serve important educational purposes, and natural habitats should be encouraged in these lakes. A goal for these lakes is to have all of them contribute positively to their watershed's overall quality, either through water-quality or stormwater management. Fisheries management needs to be better understood, and anglers and other recreational users should have a better understanding of the importance of biodiversity. The goal is for the public to understand the limitations of a finite resource and to adjust their expectations accordingly.

6.3.4 Threats

The most severe threats to lakes are invasive species, nutrient loading, sedimentation, loss of native submerged and emergent vegetation, and management actions focused on only a narrow range of species (such as game fish). While invasive species, hydrologic change, and loss of native vegetation are common threats to both aquatic and terrestrial systems, aquatic communities are much more sensitive to sedimentation, toxic substances, and excess nutrients.

Problematic invasive species include Eurasian water milfoil, carp, and zebra mussels. Species most often invade lake communities either through human introduction (knowingly or not) and through hydrological connections. Therefore, lakes without significant public access and with few or no hydrological connections are more resistant to invasion than other lakes.

Nutrients enter lakes through a variety of sources. These sources include effluent from sewage-treatment plants, agricultural runoff, lawn fertilizers, and waterfowl.

Causes of erosion resulting in turbidity and sedimentation include carp, shoreline development, upland development, agricultural runoff, and other man-made disturbances.

Submerged and emergent vegetation can be lost either through turbidity and siltation, deliberate removal, shading by excess algae caused by nutrients, or from the effects of invasive species. The loss of submerged vegetation is particularly important, because of its value as habitat for fish and other organisms and its role in settling sediments.

Different from terrestrial communities, which are significantly threatened by the lack of management, lakes often suffer from narrowly focused management activities, which are generally not aimed at protecting biodiversity. Lakes are often "managed" for recreational purposes or for particular species of game fish. This type of management tends to disregard biodiversity and hence becomes a threat to the region's lake communities. For recreational reasons, native aquatic plants are often removed either through harvesting or herbiciding, which can be extremely detrimental to biodiversity. These activities are particularly damaging to the littoral zone. Water-level manipulation and dredging, if done solely for recreational purposes, are also very damaging to the lake biodiversity. Recreational motor boats and jet skis are also problems because they create waves and turbulence in excess of natural frequency and intensity. This affects both shore erosion and the bottom in shallow areas. Additionally, motor boats and jet skis disrupt lakebed and shoreline soils, require large open-water areas that are often created by removing emergent vegetation, and harm the vegetation that does remain.

When fisheries are managed for a few particular species or when there are uncontrolled levels of stocking, the overall lake biodiversity often suffers. Not all management for game species conflicts with biodiversity goals, and lakes important for biodiversity can also support recreational fishing activities. The challenge is for managers to explicitly consider and address biodiversity issues in sports fisheries management activities, particularly in high-quality lakes.

Lakes also face several other threats. Lake hydrology is often interrupted through disconnection between lakes and other hydrological breaks. The introduction into lakes of contaminants, such as heavy metals, pesticides, and salt, has detrimental effects on the biodiversity. Finally, the loss of vegetation and overhanging canopy around a lake can lead to loss of essential habitat and fish species.

6.3.5 Recommended actions

Lakes are very different from the terrestrial communities in Chicago Wilderness, in that most lakebeds are largely in private ownership. Consequently, conservation of lake biodiversity cannot be focused just on the efforts of the Forest Preserve and Conservation Districts and other land-owning public agencies. Some specific actions can be taken to manage directly for biodiversity. Some management needs will require additional research and an adaptive management approach. However, the fate of lakes lies more directly in the hands of the private citizen. Therefore, there are numerous recommendations to improve conservation of lake biodiversity through both regulations and volunteer activities by the public. Both regulation and incentive tactics will require better knowledge of the laws and issues by the general public. Creating a balance among the multiple uses of lakes is an overarching need and goal of many recommended actions. Progress can be made in reaching this balance through better guidelines and laws regarding human activities around and in lakes. Most important, extensive public education and communications are needed to create a heightened awareness of issues affecting lake biodiversity. All of the preceding recommendations in 6.2.7 for protecting the hydrology and water quality of streams also are appropriate for lakes.

Recommendations

- ✓ **Develop specific recovery plans for species and lakes of concern**
It is recommended that recovery plans for specific species be developed and implemented. Some priority species for specific recovery plans include pugnose shiner, fern pondweed, white-stemmed pondweed, water star grass, grass-leaved arrowhead, and water celery. Of all the fish species, pugnose shiner serves as a good indicator species; if recovery actions restore viable populations of pugnose shiner, then other species will be helped as well. In addition to specific species, recovery plans for specific lakes are recommended. A first step is to develop criteria to identify priority lakes for lake-specific recovery plans.
- ✓ **Develop better mechanisms to control the invasion of exotic species**
Better control mechanisms are needed for invasive species, particularly Eurasian water milfoil and carp, and this will require research. Biological controls such as beetles and weevils to control Eurasian milfoil hold promise as the best long-term solutions, but great care must be taken to prevent introduction of controls that could themselves become problems.
- ✓ **Plan, protect, and manage lakes at the watershed level**
For exceptional and important lakes, opportunities for public acquisition of shoreline and upland areas should be identified and prioritized. Critical watershed areas also should be identified. In general, lakes should be managed as part of their watershed, and watershed-planning efforts should account for the biodiversity needs of lakes.
- ✓ **Develop a region-wide process to track and study threats to lakes**
A region-wide recording system should be developed that collects information about the types of pesticides being used in the region and specifically where they are applied. The system should also track the status of lakes. These records are needed to better understand the threats to lakes and to adapt management and policy accordingly.
- ✓ **Conduct research to better understand habitat requirements of aquatic species**
To better manage for fish diversity, more research is needed on environmental partitioning by fish species. There is more to learn about how fish use their habitat. Additionally, very little is known about the status and habitat requirements of many invertebrate and algae species. To manage for biodiversity, more information is needed on these poorly understood species.
- ✓ **Investigate and mitigate the threat of salinization**
While salinization is a known threat to lake communities, more research is needed on the specific effects and impact thresholds of salt on lake biodiversity. Until more is known about the effects of salt, the general practice should be to minimize loading of salt to lakes, especially those not having outlet flows that relieve accumulation.
- ✓ **Investigate and prepare for the possibility of reintroduction of native species**
As conditions of restorable lakes are improved to the point where they can support a variety of species, it is recommended that species be reintroduced to these lakes. However, protocols and models should be developed to ensure that reintroductions will be effective and efficient.
- ✓ **Strengthen laws protecting species and their habitats**
Laws on endangered and threatened species need to be strengthened and enforced to provide adequate protection for these species. Another recommended action

is to strongly encourage naturally vegetated shoreline zones, particularly in critical watersheds. The exceptional lakes are of particular importance to the conservation of the region's aquatic biodiversity. Therefore, rules and regulations to limit uses of the exceptional lakes and mitigate negative impacts warrant additional discussion.

✓ **Integrate biodiversity concerns into laws, policies, and guidelines**

State laws, particularly those dealing with the use of pesticides and herbicides, need to be improved to integrate biodiversity issues. State policies on aquatic-plant management should ensure that plant management both respects property rights and encourages diverse plant communities. Guidelines for land-use planning that recognize biodiversity and improve water quality should be developed. In general, biodiversity concerns need to be much more broadly incorporated into land-use and wastewater-treatment plans. Model ordinances for alternative development around lakeshores should be enhanced and promoted, and conservation easements around shorelines should be promoted. In short, alternative methods that reflect biodiversity needs should be enhanced and presented to the public. Additionally, Chicago Wilderness should work directly with municipal governments in lake areas.

✓ **Clarify ambiguous laws relating to lakes and their management**

One particularly problematic legal issue is Illinois's water law. How this law relates to water use, ownership, and management is unclear and inadequate. There are numerous legal interpretations of the law, and this confusion currently stands in the way of restorative issues and actions. It is recommended that Chicago Wilderness take a leading role in working to help resolve this issue.

✓ **Increase public understanding of lake biodiversity issues**

For the conservation of lake biodiversity, the most important action is to balance human uses with ecosystem constraints. Public recognition of the value of lake biodiversity and appreciation that lakes are a limited resource will be important to achieving conservation goals. Recreational and other human uses must not exceed what lakes can support. As a first step, the negative environmental impacts of development, recreation, and misuse should be documented, as well as the positive effect of management practices. Public information and education should make these well known, particularly to lake association members

and other potential supporters. Revisions to incentives, programs, laws, and regulations should then follow together with appropriate public hearings.

✓ **Increase public involvement in lake management and protection**

There are already a number of volunteer lake monitors and stewards, but their numbers should be expanded, not only to increase the amount of data collected and the number of lakes monitored, but also to create a broader network of people knowledgeable about lakes. It is recommended that Chicago Wilderness promote cooperation and communication among lakefront owners and users. Active lake users need to learn the full impacts of their collective uses of the lakes on biodiversity and realize the ecological limits to their uses. Lake-use plans that offer a range of recreational uses consistent with a balanced, diverse ecosystem need to be developed. Development of these plans will require the input of knowledgeable citizens and consumers. Additional funding for biodiversity conservation and non-consumptive uses should be generated, at least in part, from consumptive uses of the lakes.

6.4

Near-shore waters of Lake Michigan

Lake Michigan is a vast aquatic ecosystem in its own right, and its near-shore waters in the Chicago Wilderness region function primarily as part of that system. However, they are an important part of Chicago Wilderness, both in their impact on adjacent ecological communities and intrinsically as an important ecological community. Lake Michigan provides climatic diversity and supplies sand to nourish its changing beaches and dunes. The seasonal and year-to-year changes in water level support lakeshore wetland communities. Its near-shore waters provide habitat for many fish and other aquatic species and are used by migrating waterfowl and shorebirds.

Much of the shoreline in the Chicago Wilderness area has been filled for buildings, parks, and marinas, eliminating coastal wetlands. The areas that remain in near-original condition tend to be beaches with relatively high-energy wave systems and relatively little organic substrate to support ecological communities. Structures installed to protect harbors and lakefront development have in many cases interrupted movement of sand or deflected it into deep water where it is lost from the beach-nourishment process.

The fish communities are in a state of flux due to many changes throughout Lake Michigan. Major factors include:

- historic invasion by lamprey and alewife and introduction of Pacific salmon
- excessive fish harvest
- recent invasion by zebra mussels, which are changing abundance and species mix of algae and zooplankton (including algae that create taste problems in drinking water)
- ongoing invasion by gobies and other species

Historic problems with excessive nutrients, acute toxicity, and floating materials have been solved, but problems with persistent toxic substances that bioaccumulate in fish are still a problem for human health, although effects in the ecosystem are not apparent.

Wanton filling of shallow areas and gross pollution has ended, but care must be taken not to allow additional filling and not to allow structures that interrupt currents and supplies of sand. A major current fishery problem is the decline of lake perch, which is being addressed by the fish-management agencies in the respective States.

There are opportunities that should be addressed locally to restore aquatic habitat and biodiversity in some sheltered areas such as harbors, river mouths, and lagoons. Even intensely urban settings offer opportunities to create incidental habitat while designing projects focused on other purposes such as shore stabilization or brown-field redevelopment.

Recommended actions

- Identify information gaps concerning the Lake Michigan shoreline in the region with respect to surviving habitat, and opportunities for habitat restoration, so that practical goals can be developed.
- Identify key site-specific aquatic habitat restoration opportunities to support local and lake-wide biodiversity.
- Identify site-specific opportunities to provide shoreline protection that also provides improved habitat.

Chapter 7

Status of Endangered and Threatened Species: Assessment and Recommendations



7.1

Importance of endangered and threatened species to the Chicago Wilderness recovery plan

This plan is concerned with the conservation of biodiversity at all levels—natural communities, species, and genes. The process of assessing this nested diversity seeks to answer basic questions about its status: how much is there or how much remains, what is its quality and viability, what are the trends—stable, increasing, or decreasing? The ultimate goal of assessment is to develop programs that ensure recovery of all the elements of biodiversity. Except for the few species that have been the subject of intensive research or recovery programs, usually those on the federal list of endangered and threatened species, we are just beginning to answer these questions for individual species.

Endangered and threatened species are recognized by federal or state governments as being in danger of extinction or being sufficiently compromised that they are at risk of becoming endangered, either nationally or in a state. Some states, including Wisconsin and Indiana, also categorize species as rare or of special concern.

Because of their rarity, endangered and threatened species possess an aesthetic appeal to the public that cannot be overestimated. In general, rare organisms are valued, the sight of them is genuinely thrilling, and their loss is mourned. A beautiful and conspicuous endangered plant like the eastern prairie fringed orchid can serve as a symbol to enlist public support for all rare species. The recovery of a species can be a success for all to celebrate. A spotting of the rare upland sandpiper can bring birders

from considerable distances simply for the opportunity to view it. (However, caution must be used in providing public access to these organisms so as not to create additional threats to their survival.)

Some species are of special interest because they are relicts, surviving in the region after climatic change. Many more plant species are regionally significant because they are members of characteristic, and often imperiled, natural communities of the region. Additional species are significant because they play key roles in local ecosystems (such as canopy trees or obligate food plants for insects) or simply add to the direct human value of such systems.

Endangered and threatened species make up a substantial component of the region's biodiversity. For example, the 237 plant species listed as endangered or threatened at the state level represent nearly 15% of the region's native plant species. Twelve of these species occurring within Chicago Wilderness are ranked as globally significant, because they occur only within the region and adjacent regions (called "near endemics") or because they are highly rare and imperiled. Of these, five are currently recognized by the US Fish and Wildlife Service as threatened or endangered at the national level.

Among the mammals, birds, reptiles, amphibians, and fish there are 114 state level endangered or threatened species. Five of these are federally listed and several more are federal candidate species.

Quantitative data are available for some aspects of the status of endangered and threatened species, such as numbers of occurrences of populations or subpopulations (known as element occurrences), amounts and types of monitoring being done, and levels of protection. Much of the assessment of their status and future viability is qualitative; nevertheless, it is based on the com-

bined best judgement of researchers and land managers experienced both in studying and managing these taxa. As part of the recovery plan process, the Science and Land Management Teams Endangered Plants Task Force developed a list of endangered and threatened species meriting additional conservation attention. This list is in Appendix 6.

7.2

Endangered and threatened species within a community context

In Illinois, the 1978 Natural Areas Inventory found that less than 1% of the original Illinois landscape (forests, prairies, savannas, wetlands, lakes, and ponds) remained in relatively high-quality, undisturbed condition. Indiana and Wisconsin lands have suffered similarly. This level of community disturbance has had a direct impact on animals and plants. Instead of being dispersed across the landscape, these organisms have retreated to—or survive in—the few remnant areas. Once widespread, native species have become scarce and naturally rare species have become increasingly rare if not extirpated.

This plan focuses on the assessment and appropriate management of communities in order to preserve and enhance the biodiversity occurring within them. The majority of endangered plant and animal species fall within this overall community perspective. The sound management of communities outlined in the Recovery Plan will, therefore, work toward their preservation and eventually their recovery. However, special considerations and concerns arise for endangered and threatened species. This chapter addresses those considerations.

7.3

Why are organisms rare?

Some plant and animal species were always rare in our region because of geographic distribution, narrow habitat requirements, and low-density populations. It is important to ensure that the conditions that support these species persist despite radical changes in land and resource usage.

Many species were once widespread, but have become rare because of habitat loss or fragmentation, fire suppression, encroachment of invasive species, and other

human disturbances. Their plight mirrors that of region's biodiversity in general. Many more native species are also dwindling—the more common species of today could well become the threatened species of tomorrow. By documenting and researching the region's endangered and threatened species, we can learn about the biological and ecological needs of a broad spectrum of flora and fauna. This information also contributes overall to the field of conservation biology.

Many plant species are rare because of their dependence on specialized biological or environmental factors such as specific pollinators, soil microorganisms, hydrological conditions, soil chemistry, or soil parent materials. Many of these factors have been adversely affected over the last century of intensive development. In the case of self-incompatible plants, small, isolated populations lack the pollen from other populations needed for reproductive success. In some cases, rare animals are dependent on a common plant for food, or a rare plant may parasitize another more common plant. Understanding the complex interdependence among organisms is critical to a full understanding of regional biodiversity and its recovery. Recognizing these specialized life histories and the requirements that vary from species to species can help in creating effective plans for their recovery within a community context.

Many species are rare because they are restricted to and are sometimes characteristic of rare and regionally or globally significant habitats such as fens, bogs, seeps and springs, pannes, dunes, dolomite and sand prairies, oak savannas, and shrublands. Some of these habitats may be remnants from earlier climatic or geophysical regimes such as glaciation. The continued presence of healthy populations of these rare species and their associates reflects the quality of these areas today.

Some species are rare within a region because they are at the limits of their range here, but they may be abundant or stable in other areas. These species contribute to biodiversity in important ways, but have less priority in a Chicago Wilderness Recovery Plan because they are less at risk throughout their range.

Some rare plant species require early successional habitats or natural disturbances, such as fire, grazing, drought, soil disturbance, or periodic flooding. These disturbances cause their appearance in sporadic and random ways and give them a niche within high-quality areas. These disturbance requirements must be understood and incorporated into management plans and practices to ensure the survival of these species.

7.4

Threats and stresses to endangered and threatened species

By definition, endangered and threatened species are at risk of being lost from the region. Both state and federal governments recognize the plight of these species and their need for special attention and protection by placing them on endangered and threatened lists. As outlined above, a variety of causes lead to rarity, some of them intrinsic to the biological nature of the species. However, many threats and stressors are strongly correlated with human impacts, which have greatly escalated over the past several decades. Most of these factors negatively affect the region's natural biodiversity, both at the community and species levels. In general, threatened and endangered species are the first to be at risk under these pressures. Threats are imminent problems that have potential to radically change or eliminate a habitat or population. Stressors are the chronic problems that erode diversity and quality of habitats and species over time. As described in Chapter 3, threats and stressors include loss of habitat, fragmentation, fire suppression, invasive species, imbalances of native species, collecting pressures, hydrological change, and other environmental and abiotic factors, including pollution, erosion, and contaminants. Often, rare species have declined due to an interaction of factors. For example, habitat loss multiplies the problems of habitat fragmentation. Fire suppression leads to habitat alteration, invasion of exotic species, and finally to habitat loss. In conjunction with these general threats to communities, individual rare organisms may have additional stressors particular to their life history and requirements. These circumstances must be dealt with in greater depth in any recovery plan for a listed species.

7.5

Protection status of listed species

Protection status is a rough but useful guide to determine priorities. Species that are protected (within Nature Preserves or in some portions of national parks) or semi-protected (on publicly owned conservation lands that may have multiple purposes) have a better chance of being adequately managed or monitored. If 50% or fewer of the sites on which a species occurs are protected, the species is at much greater risk of being lost. Animals, unlike plants, are mobile and in many instances can

move from site to site and are protected while they are on a protected site. On the other hand, as property of the state, animals receive more protection than do plants wherever they are.

Plants

Illinois

- 28.7% of element occurrences (EOs) (209 of 728) have no protection or semi-protection. Most of the unprotected EOs occur on privately owned property.
- 26.8% of the listed species (40 the 149) have 50% or fewer of their EOs protected or semi-protected.

Indiana

(based on records documented since 1979; an additional 39 listed species have not been documented since 1979 or are considered extirpated)

- 44.8% of EOs (189 of 422) have no protection.
- 47.9% of listed species (47 of 102) have only 50% or fewer of their EOs on public lands.

Animals

Illinois

- 58.7% of EOs (285 of 485) of listed animal species are unprotected: 81.1% of fish, 85.7% of mammals, 23.1% of amphibians and reptiles, 57.5% of birds, and 4.3% of invertebrates.
- 60% of listed animal species (33 of 55) have only 50% or fewer of their occurrences protected.

Indiana

(from records documented since 1979)

- 60% of EOs (138 of 238) of listed animal species are unprotected: 100% of fish, 80% of mammals, 43% of amphibians and reptiles, 64% of birds, and 42% of invertebrates (Lepidoptera reported).
- 58% of listed animal species (18 of 31) have only 50% or fewer of their occurrences protected.

7.6

Management and recovery recommendations

Natural-area scientists and restorationists have long since learned that mere protection is not enough to preserve systems and their species adequately. For these rare

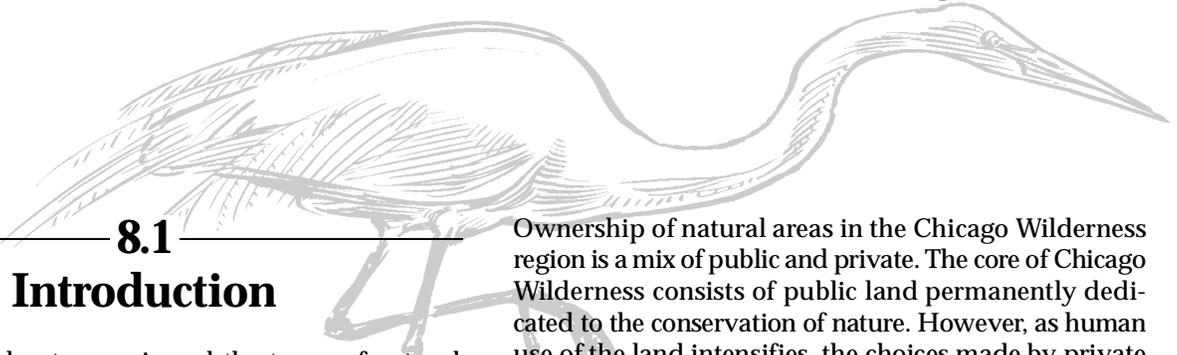
species to continue at present levels or to increase, sound management and restoration programs are essential, involving knowledge of the make-up of communities that include rare species and of the means of maintaining their structure and function. While sound community management plans will go a long way towards the conservation and recovery of many endangered and threatened species, some species will always require special management attention, accompanied by a well-designed monitoring program.

Recommendations

- ✓ Acquire more public land to increase the size and number of available habitats. Among the criteria to consider in purchasing land should be the presence of endangered and threatened species; greater emphasis should be placed on land acquisition as a means of protecting rare species. Priority should be given to creating complexes of communities, since many animal species depend on a variety of habitats.
- ✓ Legal protection of plants, in contrast to that of animals, is weak. Enact stronger legislation for the protection of rare native plants.
- ✓ Enlarge and consolidate existing natural communities by creating buffers, or by restoration, to counteract the effects of fragmentation, particularly the isolation of populations of rare species. For some species, such as insects, it is more important to enlarge sites than to create new ones.
- ✓ Increase the levels of protection for unprotected or semi-protected sites with known occurrences of endangered and threatened species. For example, incorporate such sites into the Nature Preserves system.
- ✓ Work with private landowners, either individual or corporate, to protect the endangered and threatened occurrences on their property. Use conservation easements and other incentives to protect endangered and rare resources on private land.
- ✓ In management plans for all sites with endangered and threatened species, include specific provisions to eliminate stresses and threats and to enhance recovery of these species.
- ✓ To measure effects of management activities on rare species, design monitoring programs (for representative populations) to provide feedback to adapt management activities and approaches.
- ✓ Institute a region-wide monitoring program for rare species, implemented by trained volunteers as well as agency staff, to enhance and coordinate current efforts to measure population trends. Protocols should be species-based.
- ✓ Rotate and diversify management treatments in order to maintain a variety of habitats needed by many species.
- ✓ Create a common Chicago Wilderness database. To avoid duplication of research and effort, managers should have access to centralized information about the needs of rare species and management practices related to them for adaptation to their own sites. Linking with Natural Heritage Databases in Illinois, Indiana, and Wisconsin is critical to this process.
- ✓ Expand *ex situ* programs for endangered and threatened plant species so that adequate seed or plant material is available for appropriate reintroduction as more sites are restored.
- ✓ Develop recovery plans for both federal-listed species and state-listed species that have been identified as priorities. The Chicago Wilderness Endangered and Threatened Species Task Force has identified approximately 150 species as priorities for recovery in the region, assigned to six categories (see Appendix 6). The plans should be realistic, suited to the CW region, and workable within county and other regional structures and agencies. Reference should be made to recovery plans already developed or in process for federally listed species as models to be adapted and simplified for state-listed species. Essential elements of these recovery plans include:
 - Historical and present extent of populations (using GIS-based mapping)
 - Occurrences on private and public lands
 - Life history characteristics
 - Identification of stressors, threats, and trends
 - Ecological requirements and availability of appropriate habitats for reintroduction
 - Identification of seed sources and germination and nursery facilities for reintroduction of plant stock; identification of source populations and rearing facilities for reintroduction of animal stock
 - Outline of appropriate management practices
 - Monitoring the effects of management practices as part of a species-based monitoring program
 - Identification of research needs

Chapter 8

Preserving Land and Water Resources for Biodiversity



8.1

Introduction

The previous chapters reviewed the types of natural communities found in the Chicago Wilderness area and the goals and actions needed to sustain them. As noted in Chapter 3, the natural areas of the region can be seen as shrinking islands in an increasingly non-natural landscape. To overcome this, two categories of action stand out: 1) enlarging natural areas by protecting the land and 2) managing the land to sustain native ecological communities. This chapter discusses the first of these two actions; Chapter 9 discusses the second.

Before the remaining unprotected natural areas disappear from the Chicago Wilderness region, it is essential that we identify and protect the land that is important to sustaining our natural ecological communities. Acquisition and other protection must be accomplished as soon as possible and must be focused on high-priority sites. Also, natural areas within publicly owned land must be protected from conversion to intensive uses such as golf courses and playing fields.

The landscape is being shaped by market forces, and conservation needs to take account of and function within the economic and regulatory processes. Consumption of land has accelerated faster than population growth, but consumers are showing increasing preference for environmentally sensitive developments with well designed open space and natural areas. And as development covers the remaining open areas of Chicago Wilderness, the public is supporting referenda for acquisition of additional natural areas. Acquisition by entities devoted to conservation is the most direct and certain form of protection and should be strongly supported. But many other methods can help provide protection. The following sections describe these methods.

Ownership of natural areas in the Chicago Wilderness region is a mix of public and private. The core of Chicago Wilderness consists of public land permanently dedicated to the conservation of nature. However, as human use of the land intensifies, the choices made by private landowners become increasingly important. Land management by private owners can strongly affect the course of events in nearby public natural areas. Fortunately, every year more citizens and public officials inquire about techniques for, and become more adept at, preserving open space and restoring habitat.

8.2

Private landowners: initiatives for conservation

8.2.1 Introduction

Private property owners can play a critical role in Chicago Wilderness. Especially important are those who own:

- lands that harbor significant habitat
- critically situated lands with important restoration potential
- lands that adjoin high-quality habitat

Property owners with lands meeting any of these descriptions can make a long-term commitment of all or part of their property to the overall fabric of large-scale ecosystem restoration. The privately owned properties that can play an especially important role in Chicago Wilderness are those that include remnant habitats of good to high quality, those with lesser-quality habitats that could be improved by restoration of missing species, and those on which degraded habitats can be replaced or soil hydrology can be restored.

Typically, the larger the property the better, but also important are clustered, separately owned, smaller sites with cooperative neighbors and also all sites that adjoin or directly affect properties with threatened or endangered species or rich natural communities. In addition, all properties in critical watersheds have a role to play. The critical watersheds are those of very high-priority and high-priority streams, and those of exceptional and important lakes, as defined in Chapter 6. Types of privately owned property most likely to play an important role in Chicago Wilderness are include residential lots three acres and larger, golf courses, corporate campuses, commonly owned open space in planned unit developments, hunt clubs, undeveloped investment properties, and recreational lands owned by individuals and corporations.

Recommendations for private property owners

- ✓ Property owners who believe they own important habitats should have inventories of their land made by the staff of local, state, or federal agencies or by experienced citizens associated with local conservation organizations.
- ✓ Property owners who wish to commit to long-range protection and enhancement of their habitats should first assess the various methods of legal protection (listed in detail below).
- ✓ Property owners who do not wish to encumber or sell their land, but recognize its habitat value, should pursue habitat-enhancement techniques, participate in larger landscape restoration efforts, inspire neighboring property owners, and share information on uncommon species observed on their property.
- ✓ Property owners who have already established a strategy to protect and restore their property should assess potential impacts on their habitat from changes to land use on neighboring properties and, based on that assessment, pursue strategies with neighboring property owners to insure protection and expansion of the habitat resources.
- ✓ Corporate property owners should restore native plant and animal communities on their lands or expand existing restorations wherever possible to expand, link, or enhance nearby habitats. This can provide employee and community benefits and, in some cases, can achieve significant savings on land management.
- ✓ Chicago Wilderness should map and catalog the extent of private properties in the region that could play an important role in broader ecosystem restoration efforts.

- ✓ Chicago Wilderness should establish a process whereby private property owners can become effective participants in broader efforts to restore ecosystems.

Conservation strategies available to private property owners are described in the remainder of section 8.2.

8.2.2 Conservation easements

Illinois statutes allow private property owners to donate conservation easements to governmental bodies or not-for-profit conservation organizations certified as 501c3 by the IRS. The property owner retains title to the property, but the easement is granted in perpetuity, to protect the natural resources from major changes in land use, such as the building of structures, removal of native flora or fauna, grading or disruption of soils, or similar restrictions specific to each property. The management of the property to enhance natural resource values, or the role it would play in a larger ecosystem restoration, is normally spelled out in a separate management agreement, which can be amended periodically to respond to changing conditions.

Approximately 2000 acres of land have had conservation easements applied by private property owners. The key not-for-profit organizations who hold conservation easements include: Corlands (1400 acres), the Conservation Foundation of Du Page County (200 acres), the Land Foundation of McHenry County (150 acres), Lake Forest Open Lands 300 acres, plus 220 acres in easements 170 acres managed for others under lease agreements.), and the Fox Valley Land Foundation (50 acres). Examples include the Weers easement in McHenry County, the Merit Club in Lake County, the Shaw easement in Kane County, and the Barbara and Allan Wilson easement in Lake in the Hills.

8.2.3 Illinois Nature Preserves

Illinois Nature Preserves can be established on properties that hold threatened or endangered species or especially high-quality habitats. Sixteen privately owned Illinois Nature Preserves have been established in the Chicago Wilderness area. They constitute some of the richest concentrations of biodiversity that have survived since presettlement times. Examples include the Parker Fen in McHenry County and the Bystricky Prairie in McHenry County.

However, the integrity of Nature Preserves can still be compromised by impacts from surrounding land uses. Thus, continuing efforts are needed to expand and buffer these preserves, as well as to link them to a broader restored landscape. Buffer zones can be established with any of the other mechanisms described in section 8.2.

8.2.4 Illinois Land and Water Reserve

Illinois Land and Water Reserves are approved by the land owner and registered with the Illinois Nature Preserves Commission and the Illinois Department of Natural Resources. Eligible sites include high quality habitats, large blocks of habitat that support area sensitive species, natural community restorations and endangered species relocation sites. Land and Water Reserves may also be used to buffer nearby or adjoining Illinois Nature Preserves. Examples include the Brooklands Wood Reserve in Antioch Township, Lake County, Illinois; and the Webber Reserve in Antioch Township, Lake County, Illinois.

8.2.5 Transfer to restricted trust

A property owner may establish a limited trust that owns the property and has trustees who operate the trust with specific instructions to preserve and manage the trust. The trust can take ownership during the owner's lifetime, allowing the owner to continue residence on the property, or it can come into existence upon the death of the owner. Such a trust needs to be funded in perpetuity in order to pay taxes, insurance, normal maintenance, and natural-area management. This is not a common method of land preservation because of the commitment needed from the trustees, but it is a possible strategy in certain situations.

8.2.6 Commitments, less than perpetuity

The vast majority of property owners in the Chicago Wilderness area who maintain their lands in a natural condition have not made long-term, legally binding commitments to restrict changes or development of their property, nor have they participated in coordinated efforts to restore habitat within their local watershed or their neighborhood. Yet thousands of private property owners actively enhance or restore their lands for habitat purposes because of a personal commitment.

Because of the positive news reports of native landscape restoration, as well as the educational initiatives of environmental advocacy groups and individuals, more property owners every year are attempting to restore communities of associated native flora and fauna (prairie, woodland, wetlands) or to enhance habitat for individual species (butterfly gardens, bluebird boxes, bat boxes). Their level of success in establishing optimum biological integrity depends wholly on the quality of information and advice they receive.

Many of these properties can perform very important roles within the Chicago Wilderness because of their location within large potential bioreserves. These properties also are the primary source from which future conservation easements, Illinois Nature Preserves, and Land and Water Reserves will be drawn. Because of their growing and dispersed nature, an important task for Chicago Wilderness members will be to catalog their extent, to determine their roles in larger preservation and restoration efforts, and to establish a process through which property owners can participate in the overall effort. Examples include the Abbott Laboratories prairie restoration and native orchid habitat protection in North Chicago, the Perle Olsson prairie and woodland restoration in Ringwood, and the Joan and John Knoll prairie restoration in Bull Valley.

8.2.7 Landscape restoration to serve a corporate purpose

An increasing number of corporations are using native landscape restoration to minimize groundskeeping costs, to provide areas of interest for employees, and to achieve good public relations with a conservation-minded local community. In most cases, these restorations have no underlying long-term commitment, but nonetheless they open up such a possibility. These restorations can play a strategic role in protecting on-site habitat, buffering or linking nearby habitats, or increasing stormwater absorption. As one example, Commonwealth Edison has seeded prairie plants into its rights of way in Cary, Orland Park, Zion, Mokena, and the south side of Chicago. As another example, Modine Corporation has seeded prairie plants on its property in Ringwood. For discussion of natural landscaping, see section 11.3.2 and Appendix 9.

8.2.8 Transfer of private property to public ownership or to conservation organizations

Property owners who wish to preserve their lands for habitat protection and public use have various options for transferring their property to a public land-holding body or to a not-for-profit conservation organization in the region. Each of these agencies operates under financial limitations as well as a strategic acquisition plan or set of criteria for purchases or acquisitions. In certain cases, property owners may find no agency willing to purchase property or to accept a donation. This is a region-wide issue that needs to be resolved. One source of information on local public agencies and land trusts is the OpenLands Project.

Donation by property owner

Outright donation: Full title and ownership of property is donated to a conservation agency. Income tax deductions are usually available for this charitable donation.

Donation by devise: A gift of land to a conservation agency is accomplished through a will, expressly stating that, if accepted, the land will be used for conservation purposes and not sold or developed. An income tax deduction is not received, but estate taxes may be substantially reduced.

Donation with reserved life estate: Land is donated to a conservation agency, but with a provision that the donor retains a right to live on it or otherwise use it. The charitable contribution is computed based on the fair market value of the donation minus the value of the life interest in the property as determined using IRS actuarial tables.

Sale by property owner

Sale at fair market value: A conservation agency pays the fair and reasonable appraised value for property if it falls within its strategic acquisition area, and if the agency has the funds to make such a purchase. The seller is liable for income tax on the capital gain.

Bargain sale: The seller sells the land for less than the appraised market value and gains a charitable IRS deduction, thus avoiding some or all of the capital-gains tax.

Installment sale: A portion of the land is sold yearly rather than all of it at one time, lessening the capital-gains tax.

Sale with reserved life estate: Property is sold to a conservation agency while the seller retains the right to live on the property for all or a portion of his or her lifetime. This mechanism can provide the means to meet both the needs of the seller and the long-term objectives of the buyer.

Lease-back: Property is sold with a pre-established right of the seller to retain its use through a lease for an agreed-upon period of time. It is similar to a life estate in meeting the needs of the seller while satisfying the objectives of the buyer.

Right of first refusal: A conservation agency is usually negotiating with several property owners at any given time, and its yearly budget may not allow it to purchase all potential properties on the market. Or the agency may not offer a seller as much as the seller wishes to receive. In these situations, a conservation-minded property owner can assign a right of refusal to the conservation agency. This guarantees the agency the right to match a price offered by another potential purchaser.

Recommended actions for Chicago Wilderness member organizations to facilitate transfer of private property

- ✓ Educate the land-owning public about the options and incentives available for transferring open space to public and not-for-profit conservation agencies.
- ✓ Assure that all areas within the Chicago Wilderness region are served by one or more organizations that will take title to important habitats in order to manage them.
- ✓ Look for funding mechanisms so that lack of resources for ongoing ecological management is no longer an impediment to the donation of important habitat.

8.3**Local governments: plans, ordinances, contracts, and strategies**

Local governments already have the framework for preserving and restoring habitat in their codes. In most cases, standards for protecting and restoring habitat may need to be added, but rarely do new approaches need to be created. However, a well-implemented policy for preservation and restoration of habitat by a local government will include evaluating and amending all plans, ordinances, contracts, codes, and strategies and making amendments where needed. *Protecting Nature in Your Community: A Guidebook for Protecting and Enhancing Biodiversity* was prepared by NIPC to educate local governments on the importance of biodiversity, and to provide tools for restoration and protection. Additional roles for local municipalities are discussed in Section 11.2.2.

Recommendations for local governments

- ✓ Encourage local citizens to offer ideas for habitat preservation and restoration in community visioning exercises.
- ✓ Identify lands with high habitat value and lands with good restoration potential and designate them as natural resource preserves in comprehensive, strategic, and special-area plans. Consider municipal ownership and management of these lands for open space and biodiversity values.
- ✓ Designate stream corridors, swales, and hydric-soil networks as open-space links in comprehensive plans and in strategic and special-area plans.

- ✓ Develop five-year capital improvement programs for stormwater management that minimize infrastructure investment, replacement, and maintenance by using best management practices that:
 - Use natural swales
 - “Daylight” storm sewers by converting them to open swales
 - Encourage infiltration with perforated pipe
 - Adopt zero-discharge standards when appropriate
 - Plant deep-rooted native vegetation on the banks of streams and detention ponds to control erosion
 - Develop programs to minimize use of pesticides and fertilizers on municipal lands through Integrated Pest Management policies or other means.
 - Use other best management practices such as those identified by NIPC (1992, 1994, 1997)
- ✓ Develop five-year capital improvement programs for sewage treatment that minimize infrastructure investment, replacement and maintenance costs by using best management practices that:
 - Use land-treatment systems
 - Use restored wetlands as absorption fields
 - Use created wetlands for “polishing”
 - Use other best management practices such as those identified by NIPC (1992, 1994, 1997)
- ✓ Develop general-purpose capital improvement programs that minimize infrastructure investment, replacement, and maintenance using best management practices that:
 - Use native plants to landscape rights of way
 - Encourage stormwater infiltration via swales, vegetated filter strips, and perforated pipe
 - Make roadway widths no wider than necessary to ensure public safety and to accommodate other modes of travel such as bicycling
 - Avoid seeps, springs, and organic soils when locating new roads and facilities
- ✓ Adopt zoning ordinances that incorporate natural-resource overlay zoning districts and hydric-soil overlay districts, which supplement other zoning requirements that apply to specific areas. Adopt zoning ordinances that require developers to protect and restore natural resources, to provide buffers for wetlands and streams, to minimize impervious surfaces, and to cluster home sites.
- ✓ Adopt subdivision regulations that require:
 - Inventory of natural habitats, designation of hydric soils, and location of underground tiles at the sketch-plan stage
 - Design of detention areas to achieve or approach zero discharge for two-year storms
 - Preservation of habitats and hydric soil systems
 - Buffers for wetlands, streams, and drainage corridors
 - Designation of lands with conservation easements or dedication to local government at the preliminary planning stage.
- ✓ Use engineering standards and practices that incorporate measures to protect and restore natural resources, that emphasize infiltration over discharge of storm water, and that are flexible enough to respond to varying environmental situations.
- ✓ Insure the municipal code allows and encourages the restoration of natural plant communities and habitats for native wildlife in residential and commercial landscaping.
- ✓ Use native landscaping on municipal lands and restore existing natural areas to create wildlife habitat, protect water quality, and demonstrate these landscaping practices for residents and businesses.
- ✓ Creatively design annexation and development agreements to protect and restore natural resources to the highest possible degree, including immediate identification and protection of major resources and a process for identification and protection of other resources in later stages
- ✓ Use TIF districts to acquire or restore natural habitats and community open space as part of redevelopment, to provide habitat and implement hydrological best management practices such as those recommended by municipal consultants and by NIPC (1992).
- ✓ Adopt intergovernmental agreements between or among neighboring communities to coordinate protection and restoration of natural resources and of hydrology.
- ✓ Undertake municipal conference initiatives that focus on the protection and restoration of natural resources, the identification of local ecosystems, and the modification of stormwater systems as described above in this section.
- ✓ Chicago Wilderness organizations should develop a training and technical assistance program for municipal and county officials by which they would receive information on how to incorporate biodiversity in their plans, programs, ordinances and regulations.

8.3.1 Examples of public and private initiatives for open space and habitat

Parkland dedication: Nunda Township accepted title to 30 acres of drained hydric soils from the developer of adjoining land. The township converted a portion to a prairie restoration, created several soccer fields, and left the remainder as passive open space.

Watercourse dedication: The Kane County Forest Preserve District obtained title to Otter Creek and adjoining wetlands from the developer of the Thornwood development in South Elgin.

Greenway dedication: The Kane County Forest Preserve District obtained a broad greenway through the Mill Creek development, which includes Mill Creek and adjoining wetlands and uplands.

Road corridor dedication: Most roads in the Village of Long Grove include habitat easements that are dedicated as part of the process of reviewing development plans.

Wetland dedication: The Valley Hill Estates developer in the Village of Bull Valley established a conservation easement on the Boone Creek Fen, an Illinois Natural Area Inventory site, and an adjoining oak ridge that acts as a buffer.

Habitat dedication: Due to planned-development agreement, annexation agreement, or other development agreement, 120 acres of a 191-acre, 74-lot development were preserved as open space and for habitat restoration through an agreement among seven different parties, including the Lake Forest Open Lands Association, Lake County Forest Preserve, and City of Lake Forest.

Cooperation between government units to protect habitat: The Village of Inverness postponed consideration of an annexation proposal for 90 days to allow the Cook County Forest Preserve District to purchase a five-acre buffer to the Baker's Lake Nature Preserve.

Open space associated with sewage treatment for buffering effluent: The Northgate development in Huntley will use a land-treatment system that pipes treated effluent to dedicated open space. This avoids discharge from a sewage-treatment plant into the Class-A-rated Kishwaukee River system, while also providing expanded habitat for the upland sandpiper in a portion of the treatment area.

Habitat as part of common private ownership of open space: The 667-acre Prairie Crossing development in Grayslake retains 463 acres of open space, including 160 acres of restored wetlands, restored prairie, fields, mead-

ows, and parks. The development is designed to have zero discharge for two-year storms.

Habitat associated with golf courses: The Ruffled Feathers Golf Course in Lemont incorporates 29 acres of restored wetlands and uses the design principles advocated by Audubon International for habitat protection. The Village of Lakewood purchased a bankrupt 18-hole golf course in 1992; learned that it included a 36-acre, high-quality fen, and dedicated it in 1995 as the Kishwaukee Fen Illinois Nature Preserve.

Restoration projects funded with fines from regulatory enforcement actions or mitigation agreements: The Oak Lawn Park District recreated meanders for three quarters of a mile of Stoney Creek into a broader floodway, restored riparian native vegetation, and established a public greenway and trail in place of a deeply incised, overgrown stream channel with little public access. Fifty species of birds, fish, and other fauna have rediscovered the area. See box for case study from Northwest Indiana.

8.3.2 Regulation

Short of purchasing or leasing a piece of land or acquiring some of the rights that constitute land ownership, governments at all levels have various rights to regulate the development or use of land. This authority is most commonly delegated by state governments to counties and municipalities, whose zoning regulations are the principal local tool for regulating the use of land. Zoning ordinances often require specified amounts of permanent open space, typically in the form of lot-size requirements, setback requirements, or maximums for a building's site coverage. These ordinances can be applied to preserve small natural areas.

Counties and municipalities may also regulate development to prevent specific environmental impacts. For example, many of the local governments throughout the Illinois portion of Chicago Wilderness have adopted model local ordinances for stream and wetland protection, erosion and sedimentation control, floodplain management and stormwater drainage and detention, or they have developed and adopted their own codes. NIPC has prepared model ordinances for use by local governments, including the *Model Floodplain Ordinance*, *Model Stormwater Drainage and Detention Ordinance: A Guide for Local Officials*, *Model Stream and Wetland Protection Ordinance*, and the *Model Soil Erosion and Sediment Control Ordinance: A Guide for Local Officials*.

Regulations affecting the development of flood plains may aid in the preservation of natural communities. However, these regulations usually do not preclude development unless it diminishes flood storage capacity

Conservation and restoration of Karner blue butterfly habitat

A case study at National Steel Corporation's Midwest Division in Portage, Indiana

In July of 1992, National Steel Corporation, Midwest Division (Midwest Division) applied to the United States Environmental Protection Agency (U.S. EPA) and Indiana Department of Energy Management (IDEM) for a Class 3 Resource Conservation and Recovery Act (RCRA) permit modification to expand the existing Greenbelt Hazardous Waste Landfill currently in operation on its property in Portage, Indiana. As part of permitting requirements, U.S. EPA and the United States Fish and Wildlife Service (U.S. F&WS) conducted several site visits to determine whether the landfill expansion would negatively impact any state or federal, proposed/listed threatened or endangered species.

During a U.S. EPA site visit to the project area (known as "Greenbelt II") in 1992, lupine plants were discovered growing in the area to be impacted. This plant serves as the sole larval host for the Karner blue butterfly, which was known to occur nearby in the Indiana Dunes National Lakeshore. On a subsequent visit with personnel from the Indiana Department of Natural Resources, one adult male Karner blue butterfly was observed at the impact site. Due to rapid population declines over the past 15 years, this butterfly species is listed as federally endangered under the Endangered Species Act.

All permits issued under RCRA must be in compliance with other federal laws, including the Endangered Species Act. As part of this requirement, U.S. EPA must consult with U.S. F&WS if any actions under its jurisdiction have potential to impact any proposed/listed threatened or endangered species. Because a Karner blue butterfly population occurred in the impact area, U.S. F&WS required that U.S. EPA provide a Biological Assessment to determine if the proposed landfill expansion would adversely affect the Karner blue butterfly or its habitat. Midwest Division prepared the Biological Assessment and provided it to U.S. EPA and U.S. F&WS for review

From data gathered during the Biological Assessment, it was determined that approximately 17 acres of moderately suitable habitat for the Karner blue butterfly would be impacted by the 30 acre expansion of the existing Greenbelt landfill and clean-up of the Eastside Solid Waste Management Unit (Eastside SWMU). Pursuant to the Endangered Species Act, the U.S. F&WS prepared a Biological Opinion and Incidental Take Statement, outlining the expected damages to the Karner blue butterfly and measures for mitigating these disturbances. An unused portion of Midwest Division's property (known as the Conservation Area) was selected as the mitigation site because of the presence of relatively undisturbed oak savanna habitat, lupine, and a variety of Karner blue butterfly nectar sources. The Conservation Area totaled 45 acres in size, of which approximately 25 acres was relatively undisturbed oak savanna with a dense understory of young black oak, sassafras and cherry trees. The remaining 20 acres consisted of old agricultural fields, black locust thickets, and areas recovering from previous sand mining operations.

Part of mitigation for the loss of habitat required by the Greenbelt expansion permit included translocating lupine plants from the Greenbelt II site to the Conservation Area. It was thought that any over-wintering Karner blue butterfly eggs would also be translocated with the lupine plants. In March and April of 1993, 759 plugs of soil containing 1,610 lupine plants were moved from the Greenbelt II landfill expansion site to the Conservation Area. Each of the soil plugs containing lupine was placed in one of 13 "Lupine Translocation Areas" located on the edges of the wooded portions of the Conservation Area. Each lupine plant was marked with a metal tag and a colored pin flag. In May and June of 1993, 7,987 additional lupine seeds and 2,063 lupine seedlings were planted on the translocated plugs. This was done to ensure that Karner blue butterfly larvae occurring there would have sufficient food sources. In addition to the translocated lupine, seeds and seedlings, dense native populations of lupine (over 30,000 plants) already occurred throughout the Conservation Area.

(Continued on next page.)

Following lupine translocation, Midwest Division was required to conduct habitat restoration activities at the Conservation Area. The Karner blue butterfly requires a mosaic of open to partially closed canopy oak savanna with a ground cover dominated by lupine (the only known foodplant for the larvae of this species), grasses and adult nectar sources. Lupine and many of the adult nectar sources are dependent on fire for their continued survival. Fire suppression over the past 20-30 years had resulted in the growth of a dense understory of young trees at the Conservation Area. These trees shaded out the herbaceous layer, making much of the area unsuitable as Karner blue butterfly habitat. Over 35,000 young trees and shrubs were removed manually in the winters of 1993 and 1994. In addition, more than 9,000 black locust trees and saplings were cut and treated with herbicide.

Midwest Division was also required to implement biological monitoring programs to track shifts in various habitat characteristics following restoration. They were also required to monitor the survivorship of translocated lupine and any Karner blue butterflies that may have been moved to the Conservation Area. Over 65 percent of the translocated lupine plants had survived as of 1997 and 75 percent of the plugs had at least one lupine plant present. Initial butterfly surveys in the spring of 1993 found that no Karner blue butterflies were translocated to the Conservation Area. However, these surveys did identify a previously unknown population of the butterfly already occurring at the Conservation Area. Between 1993 and 1997, this population steadily increased in size from approximately 160 individuals to more than 1,000. In 1998, the Conservation Area was deeded to the Indiana Dunes National Lakeshore (IDNLS) for inclusion in their West Beach Subunit.

In addition to the Conservation Area, Midwest Division also purchased a privately-owned, 50 acre parcel of land along Stagecoach Road and adjacent to the Inland Marsh Subunit of IDNLS. This parcel of land is known to contain a viable Karner blue butterfly population and numerous plant species considered very rare in the greater Chicago region.

or exposes structures to flood damage. Thus without added specific habitat protection regulations, flood plain ordinances alone are insufficient.

State and federal rules also apply to development affecting wetlands. Permits to dredge or fill wetlands are subject to the approval of the U.S. Army Corps of Engineers and state agencies. However, other damaging impacts, such as excavation or vegetation removal, may not be covered by federal or state regulations. The permit can be obtained only if appropriate mitigation measures are taken. For high-quality wetlands, mitigation may not be permitted. Often, developers search for an entity to which they might donate wetlands as permanent open space. This search is often frustrated by a lack of local conservation management organizations or their inability to take on the management of small or fragmented wetlands unless adequate long-term funding is provided.

Development projects using federal dollars may be subject to an environmental impact statement (EIS). An EIS has, in some instances, provided the impetus for compromises or adjustments to the design of a project for the benefit of natural-area preservation. Projects that pose a

hazard to threatened or endangered species can be challenged under both federal and state law.

In the area of wastewater management in Illinois, the Environmental Protection Agency has authority to set boundaries for systems that collect and treat wastewater. A natural area lying outside any designated service area thus enjoys a limited form of protection from development that would normally require sewers. The Illinois Environmental Protection Agency has been reluctant to limit the expansion of wastewater service areas upon request, even if the expansion would expose high-quality streams to discharges of treated wastewater. It is recommended that the Illinois EPA 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.

One of the best tools available to local governments for protecting natural areas is their power to prepare and adopt comprehensive plans. While such plans carry only advisory authority, they can set the stage for action to protect important areas long before development could cause harm or destruction.

A more specialized type of plan that has proven beneficial for preserving natural areas is one specifically addressing future needs and opportunities for parks, open spaces, and greenways. The forest preserve and conservation districts in Illinois, the Illinois Department of Natural Resources, and a growing number of park districts and townships have adopted plans that identify key areas to be protected.

An increasing number of local governments and organizations have been actively planning and implementing greenways (generally defined as open space corridors with multi-functional values). Many greenways are based on river and stream corridors and on abandoned rail lines, which often encompass one or more natural communities. The Northeastern Illinois Planning Commission and the OpenLands Project have jointly sponsored a Regional Greenways Plan for the six Illinois counties in the Chicago Wilderness region.

8.3.3 Watershed planning and management

Recent attention has been focused on the unfulfilled potential of comprehensive watershed planning, involving multiple government units and addressing all aspects of managing water resources. This concept brings together the various aspects of water management, which have heretofore been planned separately, if at all. Watershed management includes regional management of storm water, of flood plains, of water supply, and of water quality, covering both non point source and point source water pollution.

This more comprehensive approach to planning has arisen, in part, because many of the costly flood control projects of past years not only have failed to eliminate

flooding but also have often resulted in severe environmental degradation. By the same token, water-quality management planning has tended to focus solely on wastewater collection and treatment and has typically failed to achieve the original national purpose of attaining streams, lakes, and rivers fit for swimming and fishing.

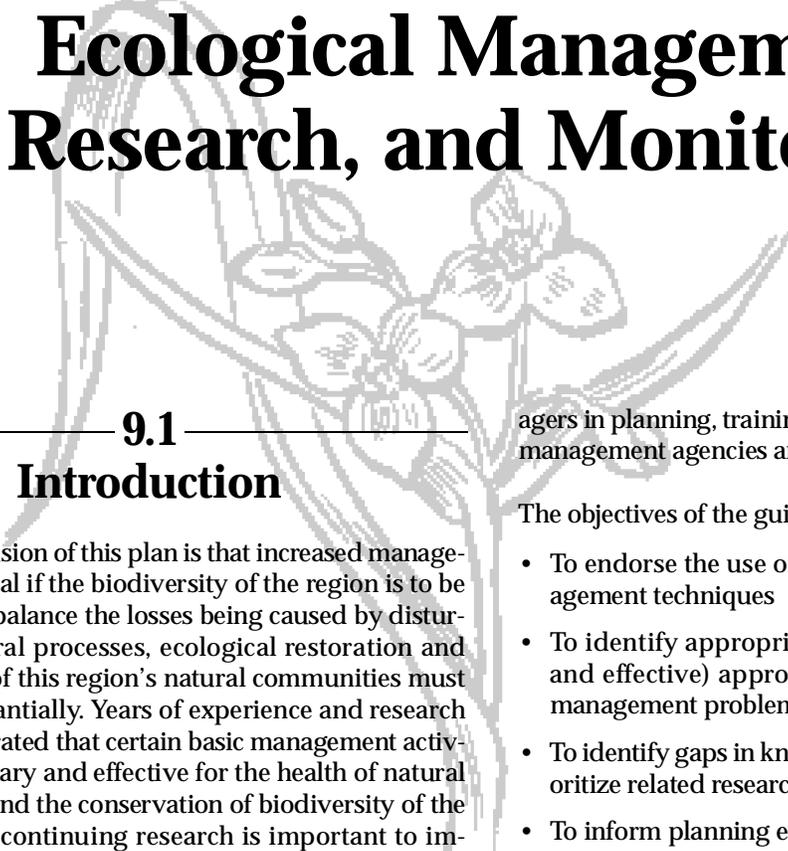
Examples of integrating various aspects of water management are evolving in several parts of the region, most notably where local governmental and citizen-based groups have taken an active interest in addressing their local problems in a comprehensive fashion. A Vision for Butterfield Creek (Prepared by Johnson, Johnson, and Roy for the Butterfield Creek Steering Committee, 1994) is an excellent model for local action. Countywide agencies also have played a lead role in organizing stormwater planning. Local councils of governments have also provided leadership such as with the South Suburban Mayors and Managers Association's South Suburban Stormwater Strategy: A Plan for Watershed Management (1998).

8.3.4 Best management practices for new urban and suburban development

NIPC (1992) gives a survey of best management practices for the process of urban and suburban development is contained in the NIPC publication. Among the topics covered are site planning and design, soil erosion and sediment control, stormwater drainage and detention, and the protection of water bodies and wetlands. Each of these topics is directly related to the preservation of the region's biodiversity. Further information can be obtained from the Center for Watershed Management, located in Silver Spring, Maryland.

Chapter 9

Ecological Management, Research, and Monitoring



9.1

Introduction

A major conclusion of this plan is that increased management is essential if the biodiversity of the region is to be preserved. To balance the losses being caused by disturbance of natural processes, ecological restoration and management of this region's natural communities must increase substantially. Years of experience and research have demonstrated that certain basic management activities are necessary and effective for the health of natural communities and the conservation of biodiversity of the region. While continuing research is important to improve management techniques, ongoing management is essential for all of our natural communities. Applying adaptive management in a context of monitoring and research is the best way to improve on existing techniques while reducing and reversing the ongoing rate of loss.

9.2

Techniques and guidelines for ecological restoration and management

9.2.1 Purpose of the guidelines

To facilitate increased management in the region, the Chicago Wilderness Land Management Team has begun the task of developing Ecological Restoration and Management Guidelines. These guidelines will function at two levels. First, they will provide general information about why, how, when, and where certain techniques are used. Second, the guidelines will provide more detailed information that will summarize the state of knowledge about various techniques to aid land man-

agers in planning, training, and working with other land-management agencies and volunteers.

The objectives of the guidelines are:

- To endorse the use of effective restoration and management techniques
- To identify appropriate (safe, efficient, economical, and effective) approaches and solutions for typical management problems
- To identify gaps in knowledge and to develop and prioritize related research questions
- To inform planning efforts with practical information on techniques, costs and benefits, and expected results
- To identify situations that require discussion and information-sharing among land managers
- To foster communication among agencies on issues that require collaborative decisions
- To provide regional support for good land-management decisions
- To provide information to decision-makers with jurisdiction over natural resources

Guidelines cannot identify the specific practices or techniques to be applied at any given site. No single best method or combination of methods can be applied across the region for all situations. Instead, management plans need to be developed for each site using management practices adapted to site conditions and appropriate to the goals for the site. However, guidelines can point out factors and concerns that are helpful in thinking through site plans and use of various practices throughout our region.

Guidelines can help in selecting management techniques to eliminate an ecological stress from a natural community. Some sites with invasive brush can be managed with prescribed fire alone, while others may require hand

clearing, and still others will warrant mechanical clearing. The goal of all of these treatments is to maintain the site using only prescribed fire. But due to different densities of brush and other site conditions, different restoration techniques are needed to get to this stage. In this example, the effectiveness of the restoration technique can be measured in more than one way. First, one can check the reduction of the invasive brush. Second, one can see the intensity and coverage of the prescribed burn. A third, longer-term measure would be the recovery of the natural community.

In most cases, land managers are trying to correct damage done from as many as 200 years of neglect. Restoration is a process that requires time, and some sites may take several years before beginning to show significant signs of progress. It is advisable to fully inform the public of what can be expected and, where possible, to include practices that yield short-term as well as long-term results.

In developing guidelines, the Land Management Team has assigned high priority to specific practices. The following sections explain why these techniques are important, give basic prerequisites for their use, and offer recommendations for enhancing their use across the region.

9.2.2 Prescribed burning

Chapters 3 and 5 have identified fire as a fundamental tool in the restoration and management of natural communities in our region. This tool allows land managers to effectively and economically manage sizable natural areas using a natural process. It is by far the single most important management technique at their disposal.

Planning is the key to successful use of fire as a management tool. Although prescribed burns are essential to long-term health of natural areas, they can have short-term impacts upon some plant and animal (primarily insect) life. For this reason, sites are either burned in portions or on a landscape level that allows natural patchiness to provide refuge. More research needs to be conducted to see how several key species and groups respond to prescribed burns of various intensities, coverages, and frequencies.

Prescribed burns as applied today have several beneficial effects upon degraded natural communities. One of the most important effects is controlling brush by setting small saplings and seedlings back. A second important effect is stressing plants that are not adapted to fire. This allows native species to compete better with the invasive species. A third effect is the recycling of nutrients, which are released from dead vegetation by the fire. Studies have shown that immediately after a fire, plants

grow taller, they flower more and longer, and they produce more seed. Fourth, fire exposes the soil and sprouting plants to sunlight and warmth earlier in the year than in unburned areas, allowing earlier growth and more robust plants (Pauly 1997).

A good burn plan includes a clear statement of goals and objectives, a map of burn units, and a prescription that defines the safety parameters: required limits for wind direction and speed, relative humidity, and temperature. The plan also should include optimum timing and conditions, and it should describe the tools and personnel required. Typically, it includes a smoke-management strategy, a notification list, and evidence of all required permits.

Some important references for developing prescribed-burn plans are Collins and Wallace (1990), Henderson and Statz (1995), Hulbert (1988), Wright and Bailey (1982), Packard and Mutel (1997), Ladd (1991), and McClain (1994).

While all land managers for major natural areas in Chicago Wilderness currently use burning in their programs, some actions that would increase the capacity of all managers to use prescribed burning as a management tool. These include the following.

Recommendations

- ✓ Land-management agencies should develop a comprehensive training program for crew members and burn leaders that emphasizes prescribed burning in Midwest ecosystems and burning in metropolitan settings.
- ✓ Land-management agencies should procure sufficient equipment and workforce so that enough natural areas can be burned within the appropriate time periods to achieve the goals of this plan.
- ✓ Chicago Wilderness members should work with the Illinois Nature Preserves Commission to monitor and participate in the development of new legislation that affects prescribed burning in Illinois. Similarly, members should work with state Environmental Protection Agencies as they develop air-quality regulations to facilitate prescribed burns.
- ✓ Land-management agencies, in conjunction with other Chicago Wilderness members, should develop outreach programs to educate local officials, fire chiefs, preserve neighbors, etc., about the use of fire in managing natural ecosystems.
- ✓ Chicago Wilderness members should cooperate to improve knowledge about research questions such as:

- What are the positive and negative effects of prescribed burning on endangered, threatened, and watch species?
- What is the optimum timing and frequency of fire to conserve designated ecological targets?
- What are the effects of various prescribed-burning regimes on native shrubs?
- What are the best uses of fire to control invasive species?

9.2.3 Restoration and management of hydrology

Hydrology includes surface water (ponds and wetlands), groundwater (springs, seeps, and subsurface flow), and riparian systems (streams and rivers). A comprehensive approach to restoring and managing the natural communities of any site should include a thorough review of that site's hydrology, both historic and present. Chapters 3, 5, and 6 describe ways in which the hydrology throughout the region has been altered, typically by the installation of subsurface drain tiles, the channelizing of streams, the construction of dams, dikes, and ditches, the filling of wetlands, and the construction of impervious surfaces.

Modifications to hydrology in the past century and a half were usually attempts to make land more suitable for farming and development, or to convey water off site as quickly and efficiently as possible. Changes in drainage by ditches, tiles, storm sewers, and other means have greatly altered the habitats and ecology of the region. Instead of infiltrating into the soil and then moving as groundwater through the natural communities, most storm water and melt water now run off the surface, changing the quantity and timing of water availability. Hydrologic alteration eliminates some communities and degrades the quality of others.

A review of historical information and a field inspection should determine whether a site has undergone hydrological modification by human actions. A number of information sources can be useful. These include soil analysis, physical evidence of drainage alterations such as field tile or straightened stream channels, aerial photos, topographic maps, and personal contacts with previous owners and local officials. The analysis should also consider the effects of off-site alterations to hydrology.

Before recommending the restoration of hydrology, a land manager must determine if proposed alterations comply with state drainage laws. For example, will they affect surrounding or downstream property owners? This information is essential for obtaining necessary federal, state, and local permits.

Examples of management techniques include removing drain tiles, either in part or in their entirety; filling ditches; removing berms and spoil piles; removing water-level control structures; re-meandering streams; controlling invasive species; and reintroducing native species. Monitoring of groundwater levels before and after restoration is an essential component of a successful project.

Some important references in planning hydrological restorations are Brooks et al. (1997), Payne (1992), Mitsch and Gosselink (1993), Galatowitsch and van der Valk (1994), and Hammer (1992).

Recommendations

- ✓ Chicago Wilderness members and local agencies should create a database of current hydrological data from restoration and mitigation projects and make it available on the Internet.
- ✓ Chicago Wilderness members and local agencies should standardize the methods for collection of hydrological data, including the use of remote data-sensing equipment.
- ✓ Chicago Wilderness members and local agencies should provide training to land owners and land managers in techniques for identifying hydrological disturbances, locating and removing agricultural field tiles, and installing groundwater monitoring wells.
- ✓ Local agencies should identify large, artificially drained wetlands and prioritize them for restoration.
- ✓ Chicago Wilderness members and local agencies should further develop education and outreach programs on wetland ecosystems, making use of demonstration and restoration projects.
- ✓ Chicago Wilderness members and local agencies should address key research questions, such as:
 - How do offsite factors affect hydrology at a site, and what are the implications for restoring the site's hydrology?
 - What are the best methods for restoring hydrology, and when should they be implemented?

9.2.4 Reestablishment of native species

Most restoration management is not focused on individual species. Instead, management seeks to improve diversity and health in general through removal of invasive species, reintroduction of fire, etc. The goal is to improve and enlarge habitat for native plants and animals and to ensure long-term regional viability of native species. In some circumstances, however, the appropriate management technique is the reintroduction of native

species previously lost from a site. Five possible objectives for the reintroduction of native species are:

- To restore natural biodiversity
- To provide expanded habitat for listed or critical species
- To promote conservation awareness
- To develop expanded sources of native plants and seeds and native genetic diversity
- To provide better infiltration of storm water

Species reintroduction can reverse the twin trends of habitat and ecosystem loss and can help sustain rare species. Reintroduction artificially disperses and increases native biota where natural dispersal patterns have been disrupted or fatally compromised. For example, nest predators that prosper in today's fragmented habitat have severely curtailed reproduction of the Blanding's turtle; captive rearing and reintroduction programs are mechanisms to sustain the species. Reintroduction also serves as a tool for recreating the large blocks of native plant communities and community complexes now missing from the Chicago Wilderness region. Seeds and/or plants are reintroduced to degraded natural communities or to former agricultural lands to fill gaps. Large blocks of the native landscape are crucial for the viability of area-sensitive species, to avoid edge effects, and they reduce the chance that a chance event will wipe out an entire population.

Native-species reintroduction in the Chicago region began early in this century with the extirpated white-tailed deer. In the 1960s the region saw its first prairie restorations, most notably the 100-acre project at the Morton Arboretum. Larger-scale projects have now been undertaken, such as the 1000-acre Fermilab prairie restoration, where a phased series of projects on old farmland is creating valuable habitat. In another example of reintroduction, the formerly abundant prairie white fringed orchid is being returned to appropriate sites.

When planning to reintroduce a native species or a mix of species, the site manager must consider several issues about the species' biology and the site, to insure that the reintroduction has a chance of succeeding and will not harm other conservation or restoration efforts. The following items should be considered, especially for sites that contain established high-quality communities or rare species or when working with rare or threatened species:

- taxonomic status of individuals to be reintroduced
- historical information about the loss and fate of species populations from the region and from the reintroduction site, including losses from any previous reintroduction

- the status and ecology of the species or groups of species to be reintroduced
- the effect the reintroduced species will have on the ecosystem and on species currently occupying the required habitat
- the rate of reintroduction, the optimal number of individuals to be reintroduced, and the composition of the reintroduction

The site must be within the historic range of the species being introduced and should offer long-term protection. Previous causes of decline for the species should be eliminated or significantly reduced. Habitat restoration should be at a stage to sustain the reintroduced population.

To retain functioning native communities within Chicago Wilderness, we need seeds and plants of local origin. In some cases, the supply has run short, and some species are not available in the commercial market. Some actions to pursue to develop a larger supply of seed and plants of local ecotypes include the following.

Recommendations

- ✓ Land management agencies that have not already done so should develop in-house nurseries to produce seeds and plants. A nursery can produce large quantities of seed at low cost and can also produce propagules irrespective of natural environmental conditions.
- ✓ Expand seed and plant exchanges. Member organizations can trade for seed or plants of the local or regional ecotype that are not available within their own land. This creates a market for the seed and plants that are surplus for one organization but useful to another that year.
- ✓ Donate or exchange the use of facilities. Local conservation organizations and landowners can make use of each other's facilities or landholdings to build up the number of available propagules. The collaborative efforts create a regional economy of scale and assist individual organizations whose resources are stretched thin.
- ✓ Conduct propagation research. The task of recovering over 1500 native plant species is a daunting one. Only about 350 of these species have been propagated commercially or for restoration. The personnel and facilities of significant botanical research organizations within Chicago Wilderness provide great potential for research into propagating native plants for restoration and could act as a clearinghouse for such work. Such botanical facilities include the Chicago Botanical Garden and the Morton Arboretum. Staff from these facilities can and also do help in preparing recovery plans for rare species.

- ✓ Work with home gardeners. Volunteers have provided their backyards as nurseries for several plant species identified for inclusion in restoration seeding. Gardeners receive seed or plants to grow in their backyards. The seed from these plants is collected and used in restoration projects.

Research topics of importance to enhance the success of species reintroduction projects include how underground biota influence reintroduction of flora; autecology and synecology of little-known species; and propagation and dispersal requirements for selected species. Specific research and recovery needs for priority plant species are included in Chapter 7.

References useful for planning plant species re-introductions include Bowles (1990), Falk et al. (1996), Packard and Mutel (1997), and Swink and Wilhelm (1994).

9.2.5 Control of invasive plant species

The invasion by aggressive species is an international conservation issue of the most serious concern, because it threatens native biodiversity in regions and preserves across the globe. Invasive species are those that become established in natural or semi-natural ecosystems or habitat, are an agent of change, and threaten native biological diversity. The international Convention on Biological Diversity recognizes invasive species as one of the major threats to biodiversity and calls upon the governments of the world to take steps to prevent the introduction and manage the impact of invasive species. The Field Museum hosted an international symposium addressing this subject in 1997. Locally the goal is to reverse the trend of degradation caused by invasion and to minimize the negative alteration of natural communities.

Approximately two dozen invasive plant species are currently causing serious and sometimes devastating damage to natural areas in our region, reducing native plant diversity (and thereby associated animal diversity) by successfully competing for space, water, sunlight, and nutrients. Once established, these plants are difficult to eliminate or control. Most of our invasive species are introduced from the Old World, but others are native species that have become similarly aggressive with the disruption of normal ecological processes, such as alteration to natural hydrology or suppression of natural fire. The spread of these species is recognized as a direct threat to natural communities and to some endangered species, and it is arguably the greatest single threat to the integrity of the flora and fauna of the Great Lakes region.

A plan to control invasive species is an important element in any management plan. In dealing with invasive species, two important maxims are that prevention is at

least as important as eradication and that identifying and resolving the cause of the invasion is a critical step in control. Some invasive species are of region-wide concern, not only causing impacts where they occur, but also posing a threat to parts of the region not yet invaded. In such cases it is important for Chicago Wilderness to develop a regional component to planning, research, and control. Decisions about specific methods for controlling invasive species depend on several variables including the species involved, the nature of the invasion, surrounding environmental conditions, resources available, and the management objectives for the area. In most cases a combination of control methods works best. Three categories of control are available:

Physical control

Physical controls include prescribed fire, mowing, restoration of hydrological function, cutting, pulling, girdling, and other methods that physically remove or weaken the invasive species, promoting successful competition by natives. Mowing can be effective for the control of some annual and biennial pioneering invaders if native plants are available to provide long-term competition. The timing of mowing is important, both to achieve control and to avoid injury to nesting grassland birds. Hand pulling or removal of seeds can be effective for small areas, but is labor intensive. Girdling is an important tool when working in high-quality areas or for creating habitat for cavity-nesting birds or bats. Sections 9.2.2 and 9.2.3 discuss management with fire and hydrological restoration. Flooding by manipulating water levels can be effective in some wetland situations where some species such as cattails can be drowned.

Biological control

Biological control uses the natural enemies and competitors of a species to control its population. Predators or diseases not currently known in the area are used. These should be host-specific to avoid negative impacts on non-target species. The USDA closely regulates such introductions. Currently biological controls are being implemented for purple loosestrife and Eurasian water milfoil. Early indications look positive. The use of bacterial sprays to combat gypsy moths is of some concern, since the bacteria also destroy some native moths and butterflies. Another form of biological control is the seeding of native plant species that may in time out-compete invasive species under restored natural conditions.

Chemical control

Herbicides are by far the most commonly used pesticide in management of natural areas. They are often used in combination with physical or biological controls. In most cases, they are used on a temporary basis with the objective of establishing a balanced condition where the nat-

ural processes of fire and competition by native plants will be sufficient to exclude the invasive species. Herbicide is commonly used to control brush when it has grown beyond the size controlled by fire and when its shade has limited the availability of fuel.

Before any pesticide can be sold in the United States, it must be registered and approved by the U.S. Environmental Protection Agency. How the pesticide may be used is governed by terms specified in the product label, which has regulatory authority and limits the amounts to be used and the conditions under which application occurs. State governments test and license individuals seeking to apply pesticides commercially or on public land, usually through their departments of agriculture. Land-owning entities may have additional rules about use of pesticides and qualifications of those applying them.

Used according to label requirements, herbicides provide a cost-effective and safe means of controlling invasive vegetation, especially in short-term situations where the problem has arisen because natural processes have been disrupted by human activity. In most such cases, the best long-term solution is to restore the natural processes to the maximum extent possible. For example, buckthorn can be controlled by prescribed burns, but only after the large buckthorns and their roots have been controlled with herbicide.

It is important for each landowner to establish priorities for invasive-species control. Of highest importance are:

- preventing new infestations
- targeting the existing problems that are the fastest growing and fastest spreading
- targeting species that are the most disruptive to natural ecosystems
- monitoring for new threats and stopping them before the new species becomes established

The following species are particularly problematic invasive plants in the Chicago Wilderness region. These species are currently causing biodiversity loss and, if left unchecked, will cause irreparable damage to our native species and communities.

<i>Garlic mustard</i>	<i>Teasel</i>
<i>Canada thistle</i>	<i>Tartarian honeysuckle</i>
<i>Purple loosestrife</i>	<i>Reed canary grass</i>
<i>Black locust</i>	<i>Crown vetch</i>
<i>Moneywort</i>	<i>White and yellow sweet clover</i>
<i>Giant reed grass</i>	<i>Glossy buckthorn</i>
<i>Common buckthorn</i>	<i>Multiflora rose</i>
<i>Leafy spurge</i>	<i>Oriental bittersweet</i>
<i>Autumn olive</i>	<i>Narrow-leaved cattail</i>

Native species can become invasive under some conditions. One example is the invasion of prairies and woodlands by gray dogwood, box elder, elm, ash, etc. in the absence of regular fire. The control of these species should be addressed in management plans.

In addition to these problem plants, several invasive animal species are causing harm to or threatening biodiversity in the region.

Many of the actions to protect terrestrial and aquatic communities from the threat of invasive species are discussed in earlier chapters.

Recommendations

- ✓ Continue to develop and share cost-effective protocols for controlling targeted invasive species.
- ✓ Monitor species locally and regionally to identify and anticipate problems before they reach epidemic proportions.
- ✓ Develop region-wide collaborative efforts to control invasive species on all public land not already managed for biodiversity, including utility and transportation rights-of-way
- ✓ Develop and promote native landscaping recommendations for residential and commercial properties that strongly discourage the use of potentially invasive species in landscaping, working through nurseries and other outlets.

9.2.6 Management of problem wildlife

The fragmentation of ecosystems in the Chicago Wilderness region and the growing populations of some wildlife species (especially deer) present real challenges to the conservation of biodiversity. Each native plant and animal species is valued as a component of ecosystems. Some wildlife species, however, are having quantifiable negative impacts upon plant and animal communities and ecosystems. As discussed in sections 3.3.7 and 5.7.9, many species and natural communities are threatened by overabundant animals. Over abundance can destroy ecological balances, destabilizing relationships within the community and making it vulnerable to invasive species. Such species (native or introduced) are problems that require careful attention. Some animal species cause damage or inconvenience to people, and some are a threat to rare species and healthy natural communities.

In aquatic communities, the zebra mussel, round goby, rusty crawfish, and common carp can drive other species to local extinction. Research on the national or larger regional level is badly needed to find ways to protect high-quality ecosystems from these species. The Canada

goose, though native, has become so abundant (in the absence of natural predators and through creation of artificial habitat) that it pollutes some waterways and conflicts with human uses of its favorite local habitat, mowed lawns. It is also very destructive of efforts to restore wetlands.

In terrestrial communities, some native species have become overabundant due to the loss of large predators (wolves, mountain lions, and human hunters). Thus in many areas, breeding birds are heavily impacted from high numbers of smaller predators such as raccoons, skunks, and opossums.

A severe threat to many songbird species is nest parasitism by the brown-headed cowbird. The cowbird once had only temporary impact, as it followed wandering herds of bison. Today it thrives in mowed areas and is able to invade all parts of most of the region's fragmented forested habitats, permanently thwarting most reproduction by some species.

Thousands of stray and feral cats roam the Chicago area, the suburbs, farmlands, and natural areas. These animals have significant impacts on wildlife populations and can be health risks to other cats, wildlife, and humans. Recent research suggests, for example, that rural cats in Wisconsin are killing an estimated 39 million birds per year (American Bird Conservancy 1998).

One of the most serious threats to woodland and other communities in the region comes from white-tailed deer. The continuing development of open lands removes available deer habitat, concentrating deer in limited remaining open space. These deer consume a great number of plants and, if unchecked, their consumption leads to the loss of native plants and animals, including endangered species. The effects of excessive browsing are many. (See Crawley (1983) for a summary.)

Deer populations can grow rapidly in the absence of natural predators and regular management. A study of radio-collared deer from DuPage and Cook counties from 1994 through 1998 found that adult deer have high annual survival rates (>80%) and few natural predators. Automobiles and trains accounted for more than 60 % of urban deer mortality (Etter 1998). Populations can more than double annually in the absence of predators if left unchecked.

Deer management in the Chicago region currently occurs under approved management plans. A plan for managing deer (or other wildlife) involves:

1. Identifying the problem and measuring the extent of damage caused by the wildlife
2. Evaluating possible solutions and techniques for abating the damage and selecting techniques
3. Educating the public, agency personnel, and decision makers about the problem and the need for the recommended solution
4. Obtaining all necessary local, state, and federal permits
5. Developing a monitoring program to evaluate success and making changes as needed

Important tools in deer-management programs are models that predict the response of a population to management or lack thereof. With the high degree of scrutiny that wildlife-management programs receive, models are essential to the careful choice of a management solution. A project funded by Chicago Wilderness has developed a simple deer management model, based on data from local studies, that helps managers predict trends in a deer population (Etter 1999).

In forest preserves and other public lands in Chicago Wilderness, deer are removed by state-qualified sharpshooters. Work occurs when preserves are closed. Venison is donated to local charities, including the Greater Chicago Food Depository. This is the best available method and is used by agencies nationwide. Contraceptives may one day offer an effective form of population control, but no practical programs have been demonstrated.

Increasing the efforts to limit the damage from deer and invasive animals is of great importance to biodiversity conservation in the region. The following actions would enhance the effectiveness of such programs.

Recommendations

- **Deer**
 - ✓ Until effective alternative methods become available, deer should be harvested regularly to limit numbers to levels that support a balance that sustains a full range of native plants and provides diverse habitat for birds and other animals.
 - ✓ Disseminate any new information on alternative control methods to land managers.
 - ✓ Disseminate models that predict responses of deer populations to management to managers and encourage their widespread use. Continue to improve existing models based on additional field research and the incorporation of stochastic functions and spatial components.
 - ✓ As deer populations are managed and reduced in size, there will be an increased need for more accurate census techniques. Additional research should

be carried out to develop more effective census techniques in general.

- ✓ State and federal agencies should provide support for collecting information from deer harvests that can provide a basis for future decisions about deer management. This information would include collection locations; gender; the number, gender, and age of fetuses; and reproductive information.
- ✓ Public agencies (and private landowners where relevant) should cooperate more closely to manage deer across borders of managed lands.

• Zebra mussels and the round goby

- ✓ Support continued research on limiting the spread of zebra mussels. Promising research pursued by Chicago Wilderness members shows that control of zebra mussels in river systems would be most efficiently focused on particular upriver source sites rather than on the entire river. Illinois Natural History Survey (INHS) found that removing zebra mussels or constructing barriers to prevent down-river dispersal of larvae would have a strong negative effect on down-river populations. Plans are underway to construct a dispersal barrier to the round goby, another invasive species, in the Chicago Ship and Sanitary Canal.
- ✓ Provide more public outreach and education calling for boat owners to take responsibility for cleaning boats and boating equipment prior to transporting them from one water body to another.
- ✓ Promote research on methods to control zebra mussels and round goby.

• Feral cats

- ✓ Chicago Wilderness members should lead a public education effort explaining the problems caused by feral cats and advocating that people not feed stray cats, support cat licensing laws, support humane removal of stray cats from neighborhoods and wildlife areas, and keep domestic cats indoors.

9.2.7 Management plans

To guide and coordinate conservation of biodiversity in the Chicago Wilderness region, management plans are needed at several levels. At the broadest, regional scale, this Biodiversity Recovery Plan seeks to describe and gain consensus on existing conditions, goals for recovery, and the major steps needed to reach the goals. At the other end of the geographic scale, each managed site should also have a site plan that describes its current condition, desired conditions, and the steps needed to attain them.

Depending on the preference of the landholder, a site plan can cover a few acres or thousands. For a large site with multiple habitats and ecological communities, a set of plans for smaller areas may be appropriate. Especially for publicly owned lands, plans need to provide a logical basis for conservation and restoration that informs and enrolls support of all stakeholders. Such plans should also reflect other plans, such as those for recovery of endangered species, greenways, stream restoration, and water trails.

Between the regional recovery plan and the site plans there may be multiple levels of plans by landowners such as the counties or states, based on their needs and policies. Plans at all levels must support each other, providing a clear path to recovery.

The content of management plans varies greatly depending on the needs of the organizations involved. In addition to addressing the questions of where we are now, where we are trying to go, and what actions are needed, other important questions are: what natural processes have been disrupted, what human activities are causing problems, and how will progress be monitored?

The Science and Land Management Teams of Chicago Wilderness are continuing to define management techniques, suggested content of site plans, and recommendations for site monitoring. One recommendation can be made now.

Recommendation

- ✓ Chicago Wilderness members should support regional ecological performance standards, monitoring techniques to measure attainment of the performance standards, and evaluation techniques (such as a regional report card) to evaluate land restoration and management.

9.3

Monitoring and adaptive management

9.3.1 Introduction

While land managers use the best available knowledge about communities and species, there is always opportunity and need to improve management techniques and to learn more about ecosystems. Management and monitoring need to be organized so that they help evaluate the effectiveness of current techniques, and management needs research projects that answer questions relevant

to management. Research, monitoring, and inventory are distinct activities, yet they must be linked to make their results immediately useful to conservation practitioners. 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.

Central to the adaptive approach proposed here is multi-scale ecological monitoring, a process for measuring progress toward goals for conservation and ecologically sensitive development. Chicago Wilderness members are designing a region-wide monitoring program that will detect change in pattern and process at three levels: (1) the landscape, (2) natural and human communities, and (3) species. At every stage of design and implementation, this monitoring program will involve a broad spectrum of stakeholders in the region's ecological health: professional scientists, citizen scientists, volunteers, schools, land managers, local businesses, community-based organizations, and urban planners, among others.

Much ecological monitoring is already underway in the region. Chapter 11 describes many of these on-going efforts under the roles of county and state agencies and volunteers. Now is the time to unify and strategically add to these efforts, so that their results can keep pace with rapid region-wide change. Critical for this effort will be a monitoring framework that allows integration across space and time, as well as across organizations, and that strengthens and streamlines the participation of diverse contributors. Here we propose a flexible thought process for designing such a framework, to be tested among the complexities of this metropolitan ecosystem.

9.3.2 Adaptive management and conservation design

Conservation design is a process for deriving conservation goals and strategies directly from assessment of biological values and the threats to those values. Although conservation design is site-based, the "site" can scale from a single natural area to an entire region. A region-wide ecological monitoring program is just one outcome of the conservation design process. Others are a program of scientific research and an agenda for ecological inventory. We consider monitoring, research, and inventory distinct but closely related:

- Ecological monitoring is an iterative process for measuring progress toward conservation goals.
- Ecological research is a systematic approach of posing and answering questions to reveal cause-and-effect relationships.

- Ecological inventory is a snapshot of conditions at one time (e.g., species richness, population distribution, pattern of vegetation on the landscape) that establishes a baseline against which to measure change over time.

Conservation design focuses our efforts in monitoring, research, and inventory so that they contribute directly to conservation action. Each of these three activities incorporates human elements into the larger context of regional biodiversity, with the ultimate goal of improving quality of life.

We approach conservation design through a series of questions that allow us to identify biological (including human) values, threats to these values, and adaptive action to protect these values from these threats. The questions include:

- What is the geographic scope of our conservation efforts?
- How does this site work (at scales ranging from individual preserves to the whole region)?
- What do we want to protect or enhance within this site?
- What do we want these targets to look like in x years?
- What could prevent us from achieving this vision for our targets?
- What should we accomplish to offset these threats to specific targets?
- What will we do to reach these goals and objectives?

The work to produce this recovery plan has provided initial answers for several of these questions. Chapters 4 and 6 identify our initial conservation targets to answer the third question. Chapters 4 and 5 offer vision statements to answer the fourth question. Immediate next steps are to complete the conservation design and to begin implementing an integrated program of inventory, monitoring, and research.

One result of this process will be the identification of conservation and development strategies. These become the experimental treatments of adaptive management. Addressing the most severe threats may require a mixture of innovative strategies drawn from science, policy, stewardship, and institution building. Once a strategy is in place, conservation and development actions define the schedule, people, and funds necessary to implement it. Ongoing work will link strategies to goals; ultimately, our aim is to address human and natural communities simultaneously. Like the rest of the plan, these strategies are evolutionary: we will learn both from our mistakes and from our successes.

9.3.3 The link between management and monitoring

Ecological monitoring is the mechanism regulating the loop between our management goals (including goals for restoration) and our strategies for conservation and development. How can we make that mechanism both concrete and adaptive? In Chicago Wilderness, we are testing an approach to monitoring design that builds on the process of conservation design. As in conservation design, our emphasis is on action.

Ecological surveillance is the measurement of long-term trends in the ecological condition of species and communities. Though not goal- or action-oriented, surveillance can complement ecological monitoring by providing additional spatial and temporal context.

Our approach to monitoring design is as follows:

Choose indicators

An *indicator* is a variable that measures change toward a goal/objective or in completing a strategy/action. *Outcome indicators* show whether we are reaching our threat-related management goals and objectives; *performance indicators* show whether we actually have implemented the strategies and actions that we devised to accomplish these goals. Although in a few cases we may find a single variable that is sufficient to answer our questions about progress for a particular goal or strategy, usually we will use multiple indicators that draw from several levels of organization and that address some combination of composition, structure, and function. The key is to find the smallest set of indicators that will give us confidence in our conclusions. Chicago Wilderness members are interviewing land managers, planners, and scientists to reveal potential monitoring indicators for the landscape, human and natural communities, and species. Later we will determine the optimal subset of these possible indicators related to our goals and strategies. We will rank these indicators by analyzing threats and will aggregate them across geographic scales. Even if we find some indicators that we can use successfully at all sites in the region, we still will use many site-specific indicators.

We emphasize that indicators are variables, not organisms. We may use the population size of threatened prairie species A, for example, as an indicator of progress toward a goal of reestablishing viability for species A. If we have good evidence that threatened species B or prairie species C shares species A's conservation needs, we may feel confident in using A's population size as a proxy in measuring progress toward our goals and strategies for B and C. Very rarely, if ever, will we find an indicator related to a single taxon that will "speak for"

the health of an entire ecosystem. More useful will be suites of indicators, perhaps including composite variables that are indices of quality or integrity.

Set thresholds

A *threshold* is a value of an indicator that, when crossed, sends up a "red flag" calling for a management response. The response might be a policy change in a human community as well as a change in the practice of ecological stewardship of a natural community.) This threshold may be tied to status (e.g., "respond if the population of species A declines to 500 individuals") or to trend (e.g., "respond if the population of species A is declining by 10 individuals per month"). Like establishing a vision for conservation or development targets, deciding on appropriate thresholds involves many uncertainties, and hence discomforts, for the decision-makers. In Chicago Wilderness, we will rely on a combination of targeted research and the extensive experience of land managers to set and refine these thresholds.

Plan options for management responses

Knowing *when* to intervene does not imply that we know *how* to intervene. Red flags may go up quickly, and we must be prepared to act. Given the uncertainties inherent in systems as complex as ecosystems, we are unlikely to be successful in specifying a fixed management response when a particular threshold is crossed. Instead, we must plan a range of options. For the most part, we will direct our responses toward sources of threats, rather than the stresses associated with them. Once again, the wealth of knowledge in Chicago Wilderness institutions and individuals will supply options for management intervention. Research and cycles of monitoring will modify these options as time goes on.

Design sampling protocols

Once we have laid out monitoring indicators, thresholds, and responses, we will focus on sampling design, including intensity of monitoring and methods of data collection. Our methods must be not only scientifically sound but also as simple and cost-effective as possible. In our interviews of land managers, planners, and scientists, we will use current and past monitoring methods as guides for the future. In addition, a workshop will provide intensive training in sampling design, as well as program design, specifically tailored to the needs of the region.

Implement the monitoring program

The monitoring program for Chicago Wilderness is already in progress. Projects range from landscape-level measures of change in vegetation cover to measures of change in the populations of individual species in particular preserves. Through the process of monitoring

design described above, we will consolidate, adapt, and unify this program so that stewards can benefit from the landscape-level results and the region can benefit from the data of individual conservation areas. Participation by the broad range of actors in Chicago Wilderness will be central to success.

9.3.4 The link between research and monitoring

To have confidence in monitoring results, we must have confidence in at least two kinds of linkages: between source of threat and the stress that it creates on a target, and between a conservation or development strategy and the goal that we hope to achieve thereby. Through concentrating research effort on the linkages between threats and the highest-priority targets, and between strategies and the highest-priority goals, we can ensure that investment maximizes conservation impact.

As with monitoring, research at many levels of organization is flourishing throughout Chicago Wilderness. The Recovery Plan outlines overall research needs: the gaps between what we now know and what we need to know to promote the quality of human and natural communities. Our next step will be to link these needs for research more specifically to the questions given in section 9.3.2.

9.3.5 The link between inventory and monitoring

Even in Chicago Wilderness, a landscape with a long history of scientific study, we still lack inventories of some taxa and natural communities, both for particular conservation areas and for the region as a whole. As we design monitoring programs, biological and socioeconomic inventory becomes critical for measuring change. How can we make these assessments cost-effective, as well as connect them tightly to our goals and strategies for conservation and development?

We are experimenting with several nontraditional approaches to ecological inventory. Using satellite imagery, aerial photography, and Geographic Information Systems (GIS), we are conducting *inventories at the landscape level*, such as vegetation maps and quantitative analyses of cover type. As we couple this remote sensing with ground truthing and representative assessment of species and communities within cover types, we increase our confidence in the use of these landscape units as surrogates for units of biodiversity at smaller scales. We also are evaluating the effectiveness of *rapid assessment methods* for taxa that give clues to the current condition of natural lands and waters. We recognize the need for a

baseline of *human ecological data*, as well; we are drawing on existing databases of real-estate trends in Chicago-area neighborhoods and are exploring the possibility of incorporating other social and economic information.

9.3.6 Information management for monitoring

Through the design process outlined here, we will work toward a regional framework for conservation science in which monitoring, research, and inventory interlock and support one another. Holding this framework together will be a system of information management that allows us to scale across geography and across levels of organization. Chicago Wilderness has begun to develop an electronic catalogue of geo-referenced data sets held by member institutions. One of our greatest challenges will be to integrate data for human and natural elements across the entire region. One of our greatest strengths is a commitment to participation by a complete cross section of stakeholders in information management. Participatory data management not only strengthens our scientific framework but also fosters the dedication of the region's human communities to conservation and ecologically sensitive development.

9.3.7 Promoting management-related research

The complexity of ecosystems and ecosystem function is greater than we are capable of imagining. This becomes more apparent when we attempt the tasks of rebuilding and restoring natural communities. Having a complete understanding of these systems is not necessary to begin preserving them, but improved knowledge is needed to support long-term preservation and restoration of all species and communities and to improve efficiency. If we begin to work while there are sufficient species and fragments of habitat left, under intelligent management and with restoration of natural processes, the fabric of these natural communities may mend itself. Nonetheless continued research is necessary to better guide restoration.

Traditional science has enumerated and described species and communities. Today, as management of our natural resources becomes more important, scientific research is critical in guiding and in determining the success and direction of these management efforts. To reach our conservation goals, a better understanding is needed of the presettlement landscape conditions and processes, of current landscape condition and processes, of the best techniques to improve ecological health, and of requirements for sustaining biodiversity over the long term. Scientists and land managers in the Chicago Wilderness

region should work together to compile a prioritized list of research needs and to support research projects that will lead to this improved knowledge.

The Chicago Wilderness consortium has already brought together scientists, restorationists, and policy makers to focus attention on important research questions and gaps in information. Now, an atmosphere needs to be fostered that will promote the investigation of these questions. A first step is to build better links between land managers and academia and to promote more research projects within the region.

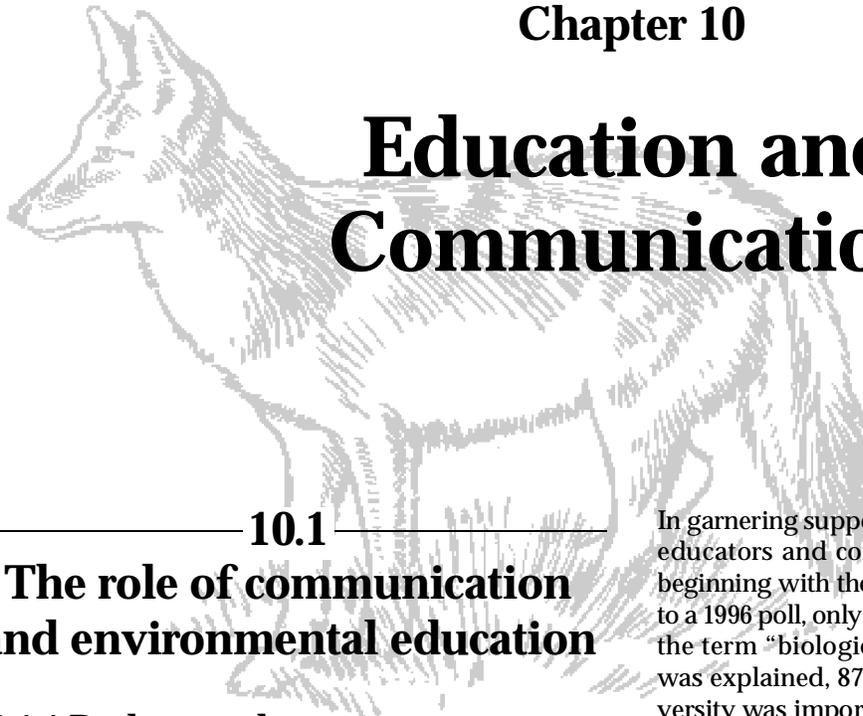
Existing scientific knowledge about regional natural areas needs to be published and integrated. Integration of this knowledge with programs to develop monitoring protocols, to conduct further inventories, and to address additional research needs will help to ensure preservation of much of the biodiversity of the region.

Recommendations

- ✓ Compile a prioritized list of research needs and support targeted research projects with internal and external grants.
- ✓ Set up a central source of information for students and professors about priority research needs.
- ✓ 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.
- ✓ Compile a thorough literature review of previous studies regarding management of natural communities and conservation of biodiversity relevant to efforts in the Chicago Wilderness region.

Chapter 10

Education and Communication



10.1

The role of communication and environmental education

10.1.1 Background

Public awareness and support are inherent elements in the recovery of this region's biodiversity. As we head into the next century, we are faced with a variety of threats to the unparalleled natural wealth of the Chicago region. The decisions to address those threats will be made by a variety of groups, including elected officials and public landowners, as well as by individuals. Individuals not only drive the larger decisions with their votes but also make daily decisions affecting the health of our natural ecosystems, ranging from home building to checking their boats for zebra mussels before transportation. Individuals are also the past, present, and future of the region's renowned volunteer stewardship efforts. Indeed, the future of our native landscapes depends upon the support and involvement of our citizenry.

Fortunately, most Americans consider environmental protection a priority, and there is widespread concern about air and water pollution, destruction of tropical rain forests, and toxic waste contamination (Gallup News Service 1999). While not ranked as highly, habitat lost to development also elicits broad concern (Belden and Russonello 1996). On a local level, people have a strong affinity for our parks and forest preserves, and they have demonstrated solid support for increased land acquisition. Conservationists, then, have a base upon which to build public support, a base that includes appreciation for the beauty of nature, a sense of responsibility to future generations, and the desire for a healthy environment.

In garnering support for biodiversity recovery, however, educators and communicators face many challenges, beginning with the term "biodiversity" itself. According to a 1996 poll, only two out of ten Americans had heard of the term "biological diversity." Yet, when the concept was explained, 87% indicated that "maintaining biodiversity was important to them" (Belden and Russonello 1996). In order to strengthen and broaden public awareness, conservation communicators need to not only define but also to make biodiversity real and to convey its connection to our own quality of life.

While it will take time for the word and the concepts of biodiversity to enter the public vocabulary and consciousness, concerned organizations must act with a sense of urgency. As earlier chapters indicate, the region's remaining natural communities and habitats urgently need to be protected and restored in landscapes of sufficient size and quality to protect biodiversity. In order to inform the public, organizations must, therefore, employ short-term communication strategies while building longer-term educational approaches.

By definition, environmental education is long term in scope and takes significant investment in resources and time, but it produces powerful results. Environmental education is characterized as a process addressing the knowledge, awareness, attitudes, skills, and participation of a target audience. The following specific objectives, as outlined by UNESCO in 1978, have been adopted by the Chicago Wilderness Education and Communication Team:

- Fostering clear *awareness* of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas
- Helping social groups and individuals gain a variety of *experiences* in and acquire a basic *understanding* of the environment and its associated problems

- Helping social groups and individuals acquire a set of values and feelings of *concern* for the environment and the motivation for actively participating in environmental improvement and protection
- Helping social groups and individuals acquire the *skills* for identifying and solving environmental problems
- Providing social groups and individuals with the opportunity to be actively *involved* at all levels in working toward resolution of environmental problems

These objectives help guide the development of an environmentally literate citizenry, capable of making well-informed decisions about protecting local biodiversity. While short-term communications strategies can raise awareness and get the public involved at an entry level, both formal and nonformal programs in biodiversity education are needed to sustain that interest and develop the deeper understanding that will lead to the active public support required to ensure biodiversity recovery.

10.1.2 Communication opportunities

Through the work of professionals and forums in market research, much has been learned about the communications challenges for Chicago Wilderness. The Consultative Group on Biodiversity initiated the Biodiversity Project in 1995 to assess public opinion on biodiversity, develop collaborative strategies to increase public awareness and engagement, and lay the groundwork to implement those strategies. The Biodiversity Project (1998) identifies six objectives to guide conservationists toward fostering public support:

1. Help the public recognize biodiversity in its everyday experience.
2. Help the public understand its dependence on nature.
3. Raise fundamental ecological literacy.
4. Help the public understand the specific human impacts on biodiversity.

A new environmental education initiative in northwest Indiana

The Indiana Dunes Environmental Learning Center provides a new resource for biodiversity education for the entire Chicago Wilderness region. Launched in October 1998, the Learning Center is a not-for-profit residential facility developed in partnership with the USDI National Park Service. Located in Indiana Dunes National Lakeshore, the project is receiving widespread support from area businesses and industry.

The new facility, located on the site of an old summer camp, has overnight capacity for eighty people in ten cabins, with plans to triple the capacity through expansion. One-fourth of the capacity of the Learning Center is reserved for classes that need financial assistance to attend, supported by funding from diverse sources. The primary service area is considered to be a 90-mile radius, or a 1½ hour drive, from its location near Chesterton in Porter County.

The initial program for 4th-6th grade classes aims to provide understanding of ecological principles and the importance of biodiversity through hands-on experience in the outdoors. Teachers and administrators are enthusiastic about how the curriculum helps them meet new state science curriculum requirements. There are also art, language arts and social science elements. A high school program that involves students in ecological monitoring and stewardship will be expanded in the 1999-2000 school year.

The Learning Center has been successful in attracting classes from diverse ethnic and racial communities. This result also reflects the diverse membership and the high level of cooperation with local environmental organizations such as the Grand Calumet Task Force and the Minority Health Coalition of Michigan City. The Learning Center has also organized an Environmental Education Network of agencies and private groups that is providing the means for outreach to educators and the general public. In May 1999, for example, twenty agencies participated in a resource fair for teachers, with a second such event scheduled for early in the 1999-2000 school year. Weekend and summer programs are also provided for adults and special groups including teachers and children. The Learning Center is also made available to other groups, provided at least 25% of their program schedule is devoted to environmental issues.

5. Help the public understand its capability to act to conserve biodiversity.
6. Motivate the public to act to conserve biodiversity.

The conservation agencies and organizations of the Chicago region, in concert with our highly visible botanic gardens, zoos, and museums, have the opportunity to realize these objectives and, working together, to effect positive change. They must integrate current efforts in communication, marketing, and education and direct them toward these objectives. Local organizations and agencies involved with conserving biodiversity need to prioritize their efforts and devote more resources to communicating about local restoration efforts. They can then create comprehensive campaigns and programs that connect biodiversity conservation to core values that people already hold, applying the knowledge gained through public-opinion research and thorough evaluation of the effectiveness of various efforts.

People get the information that forms their attitudes and behaviors from a wide range of sources beyond the communication and education programs of conservation organizations. Schools, the media, and community leaders contributing in important ways to the values held by the public. They also interpret conservation issues for the public. Outreach and education to these audiences is crucial to developing “third-party” endorsements and affirmation of actions such as ecological restoration.

The most successful marketing strategies are those that catapult issues into popular culture. Smokey the Bear is a prime example in the conservation arena. Another is the attention drawn to the devastation of tropical rain forests, which has resulted in a remarkably high level of awareness for an issue occurring thousands of miles from our shores. If conservation communicators can employ these strategies to the local situation, they have the advantage of using issues that have a much more direct impact on our citizens’ quality of life. By working together, utilizing market research, devoting more resources, and adopting innovative approaches, we can engage the public and realize the goals of this plan.

10.1.3 The current state of environmental education in schools in the Chicago Wilderness region

Since 1995, the Chicago Wilderness Education and Communication Team has been working to identify and resolve issues of biodiversity education specific to the region. They have assessed and addressed the state of current biodiversity education efforts in a number of areas. Information from this work is summarized below. To date, the majority of research about the collective

reach and implementation of biodiversity education has centered on in-school programs. There exists a need for the same type of documentation with out-of-school programs and life long learning efforts.

Biodiversity education does not appear to play a major role in the region’s public schools. Surveys from two states in the Chicago Wilderness region (Sebasto-Smith and Small 1997, Lane et al. 1994) show that, although teachers want to integrate environmental education into the curriculum, a number of barriers exist. According to the surveys, 90% of Illinois teachers and 94% of Wisconsin teachers “agreed” or “strongly agreed” that it is important to integrate environmental concepts into their subject or grade level. In addition, 87% of Illinois teachers and 90% of Wisconsin teachers “agreed” or “strongly agreed” with the statement “a goal of my teaching is to increase students’ level of environmental responsibility.” However, 65% of Illinois teachers reported they were not infusing environmental education into their curriculum and 76% of Wisconsin teachers spend less than 15% of their overall teaching time infusing environmental concepts.

Why do teachers overwhelmingly say that environmental education is important but dedicate less than an hour per week to the topic? The top five reasons given by teachers in the two states are listed below:

Illinois:

1. Not enough resources/funding
2. Not enough preparation time
3. Not enough knowledge or background
4. Not enough class time
5. Other concepts more important

Wisconsin:

1. Concepts not related to subject matter
2. Not enough knowledge or background
3. Not enough class time
4. Other
5. Not enough preparation time

It is ironic that there are such similarities between the findings in both states, since there are major differences in how the two states mandate the integration of environmental education. Wisconsin has mandated 1) periodic assessment of the environmental literacy of its teachers and students, 2) pre-service training in environmental education for teachers, and 3) consideration of environmental education concepts in the development, implementation, and evaluation of school-district curriculum plans. In contrast, Illinois has a relatively ambiguous and unenforced mandate for environmental education in its schools. While these surveys did not cover the status of biodiversity education in Indiana, the third state in the Chicago Wilderness region, it is noteworthy that a posi-

tion dedicated to integrating environmental education at the state level was recently left unfunded. In addition, the Indiana Department of Education currently has no mandated environmental education component for the K–12 curriculum.

10.1.4 Cultural diversity and biodiversity

Research shows that, in addition to children, other important audiences including minorities, low-income populations, and senior citizens are generally being left out of environmental education (U.S. Environmental Protection Agency 1996). An illustration of this void is the finding by Belden and Russonello (1996) that two in ten Americans said they had heard of “biodiversity.” These respondents were most likely to be men, upper-income, college-educated, and professionals. However, the same survey reveals the potential for building support among broader audiences. In describing who is most likely believe “maintaining biodiversity is very important,” Belden and Russonello state, “Demographically, they have lower incomes, live in cities, and are found in higher proportions among African Americans and Hispanics.”

A summary of 1990 census data for the portion of Chicago Wilderness in northeastern Illinois contains the following. As of that year, 12% of residents were born outside the United States. In that same year, 20% of all households spoke a language at home other than, or in addition to, English. Perhaps a better measure of the human diversity in the region are the proportions of Hispanics (12%), non-Hispanic blacks (19%), and non-Hispanic whites (69%) living in northeastern Illinois in that year. Forecasts prepared by the Northeastern Illinois Planning Commission indicate the population of this same area will be 22% Hispanic, 23% non-Hispanic black, and 55% non-Hispanic white in the year 2020. As our population grows more racially and ethnically diverse over the coming decades, the long-term success of Chicago Wilderness will be determined in part by its ability to attract the support of all segments of the population.

These numbers are particularly noteworthy because today the large majority of members of most environmental organizations are non-Hispanic whites. A combination of factors may account for this disparity, a circumstance that local environmental organizations need to fully understand if their messages are to reach all segments of the population. A recent report to Congress by the U.S. Environmental Protection Agency Advisory Council (1996) offers several reasons for the failure to reach diverse audiences, including:

- lack of materials, commitment and, organizational support

- uncertainties in knowing how to engage Hispanic and non-white audiences
- difficulties in adapting traditional strategies to non-formal environments within these communities

Further information on the importance of culture in shaping attitudes toward the natural environment can be gleaned from a 1998 survey of leaders and a cross-section of citizens in two sample areas in the region, the Uptown neighborhood of Chicago and the Butterfield Creek watershed in southern Cook County. The survey showed that one’s age, economic status, and place of residence are associated with attitudes about the environment. For example, suburban environmental concerns included over-development and flooding, while inner-city concerns included air pollution, poor water quality, litter, asthma and lead poisoning (Babcock 1998).

The survey also showed that open space evoked powerful images of home and cultural history for immigrants as well as native residents. City parks are often used as gathering places for ethnic communities, not to celebrate nature per se, but to enable these groups to share in their common language and culture. Other findings indicated that fishing and gardening were viewed differently by different groups. Motivations for these activities ranged from a desire to follow cultural traditions to simple economic necessity. A key finding for conservationists to consider was the respondents’ low level of familiarity with the natural resources found in the Chicago region, especially among immigrant communities.

In a study of nonformal outreach programs, Sayre et al. (1997) interviewed Chicago residents to determine what types of programming they might find interesting and desirable, and why they may not be participating in existing programs. This study found that many of the institutions that are charged with educating the public about the environment are not viewed as an educational resource by certain population segments. Further, though a myriad of good programs is available, people interviewed were not aware of them. Most important, however, was the finding that under-served communities are receptive to environmental outreach efforts, if awareness of diverse communities is enhanced and input collected from them.

10.1.5 Tools for communicating and teaching about biodiversity

While evaluating the current state of biodiversity education in the Chicago region, Chicago Wilderness has also begun to create the tools needed to improve both the scope and methods of communication and education efforts. Some of these tools, which are described in

“12 natural wonders of the Chicago Wilderness”

A collaborative campaign to foster a connection to Chicago region natural areas

From April 1998-May 1999, Chicago Wilderness conducted a communications campaign called “12 Natural Wonders of the Chicago Wilderness.” Its aim was to increase awareness of natural areas throughout the region, through an integrated effort centered around the designation of 12 spectacular yet accessible preserves. The elements of the campaign included both broad-based and targeted communications. At the core was the nature walks program, a year-long series of 29 guided walks. Led by skilled interpreters from the collaborating partners, the walks involved more than 500 people over the course of the campaign.

Materials produced for the campaign included the Natural Wonders preserve guide, (6,000 distributed), poster (4,000) and 1999 calendar (5,000). Designed to introduce biodiversity issues beyond the traditional conservation audiences, the materials featured spectacular vistas, colorful plants and animals, and clear messages about biodiversity and habitat restoration. Media coverage provided not only continued awareness, but also encouraged a sense of community pride for those designated locations (more than forty print and electronic features were garnered). Another element of the campaign was the Media Workshop in December 1998, where journalists were introduced to a multitude of biodiversity issues. Direct outreach to 15 community groups surrounding the preserves included slide presentations and participation in events that reached more than 450 people. In addition, the Chicagoland Environmental Network launched a database of people responding to the campaign for notice of future events and volunteer opportunities. Combined with additional sources, this provides Chicago Wilderness with nearly 4,000 individuals as a base for building greater awareness and involvement.

The formal evaluation of the campaign (Forester, 1999) included mail and phone surveys with the various groups reached through the campaign. This data revealed:

From nature walk participants:

- Nearly 40% of survey respondents have returned to the Natural Wonder preserve they visited since their walk.
- As a result of reading the Natural Wonders brochure, 32% of respondents have visited other Natural Wonders described there. Another 66% plan to visit another site, while only 2% were unsure they would.
- The majority of nature walk respondents heard about the walks through media coverage.
- The most noted positive aspect of their walk was the walk leader’s knowledge (each walk had a theme relating to restoration and management).

From outreach audiences:

- While a majority of the participants were non-Hispanic white (88%) the percentage of other racial and ethnic groups was higher here than that of the nature walks respondents.
- Most participants heard about the presentations and other outreach activities through friends or other people.
- The overwhelming majority felt that the programs increased their knowledge about “biodiversity in the Chicago region” (98%) and “habitat restoration in the Chicago region” (96%).
- 20% of respondents reported they would be interested in volunteering to conserve natural areas.

From media workshop participants and non-attending media who requested workshop packets:

- 90% of survey respondents have since used information learned in the workshop.
- 100% of respondents are interested in attending future media workshops.
- 80% felt that media coverage of conservation issues was inadequate, although half thought such coverage has been increasing.

greater detail in Appendix 7, are:

For Educators:

- Biodiversity Kit
- *Chicago Tribune* Educational Services supplement, “Chicagoland Ecosystem”
- Chicago Wilderness Atlas Education Package

For Individuals, Agencies, Organizations:

- *Chicago Wilderness: An Atlas of Biodiversity*
- *Chicago WILDERNESS Magazine*
- Chicago Wilderness “Portable Resources” (video, slide show, display)
- Chicagoland Environmental Network (CEN)
- Chicago Wilderness Web Site at www.chiwild.org

A preliminary assessment of the effectiveness of these tools reveals varied awareness of the materials and a wide-range of implementation strategies. Specific needs and solutions are addressed in sections 10.1.6 and 10.2.

10.1.6 Biodiversity education needs in the Chicago Wilderness region

Since its inception, the Chicago Wilderness Education and Communication Team has used a matrix to determine specific needs for education about biodiversity in the Chicago Wilderness region. The matrix plots audiences versus the five essential components of education (knowledge, skills, awareness, attitude and participation). Existing environmental education programs appear in the matrix cells according to the objectives they meet. Several conclusions about programming, which parallel research findings in environmental education, have been drawn from the matrix:

- Although there are many programs aimed at school-age children, the approach is by no means comprehensive and many students are not being reached.
- Most programs or resources available for biodiversity education for school-age children lack at least one of the components of attitude, skill and participation essential to quality education.
- Biodiversity topics pertaining to the Chicago region do not appear to be emphasized at local colleges and universities.
- Although tools exist for biodiversity education, they are not being used effectively for community-based education and are not reaching diverse audiences.

10.2

Goals and actions for biodiversity education and communication

10.2.1 Introduction

The overall goals for biodiversity education for Chicago Wilderness are to improve the knowledge, awareness, attitudes, skills, and participation of diverse stakeholders in the recovery process. This effort requires actions that carry audiences through each level, culminating in active participation. The target audiences are diverse, so actions tailored to each are required.

Some recommendations for biodiversity recovery, however, cannot wait until educational goals are met. Significant current challenges require immediate strategies to increase public awareness and understanding. The perception of ecological restoration, in particular, requires urgent attention. While most local citizens agree with the idea of restoration, there is a lack of understanding of the techniques required (Barro and Bright 1998). Communication strategies need to address these perceptions—and misperceptions—about restoration techniques.

Agencies and organizations must, therefore, complement their long-term approaches to environmental education with actions aimed at achieving more focused, short-term biodiversity communication goals. The following sections outline both long-term education goals and short-term communication goals.

10.2.2 Long-term education goals

- **Goal 1: Ensure that every student graduating from a school system in the Chicago Wilderness region is “biodiversity-literate.”**

The most efficient way to educate the next generation about biodiversity issues is to fully integrate the subject into the existing public and private school systems.

Recommendations

- ✓ Develop a commonly held definition of “biodiversity literacy”—what knowledge, skills, attitudes, and experience are essential to help people make informed decisions and participate in biodiversity protection.
- ✓ Increase the visibility of biodiversity concepts and issues in state education standards to encourage teachers to integrate biodiversity content into other programs.

- ✓ Give school staff the incentive to devote precious instructional time to biodiversity topics by demonstrating to teachers how using biodiversity as a unifying theme could improve test scores.
- ✓ Support state plans that integrate environmental education into schools. In particular, work to support the passage of the Environmental Education Literacy of Illinois Master Plan.
- ✓ Develop “best practices” for teacher training, such as the package being produced for the Mighty Acorns youth stewardship education program.

- **Goal 2: Expand the scope of existing and future programs in biodiversity education to include components for attitudes, skills, and participation in curricular design.**

One of the greatest challenges in biodiversity education is getting students involved in the process of conservation. To achieve this, programs need to include components for attitude, skills, and participation.

Recommendations

- ✓ Determine the effectiveness of existing biodiversity education programs for achieving “biodiversity literacy,” and use successful programs as models.
- ✓ Foster professional development for organizations inaugurating biodiversity education, and increase the number of pre-service and in-service opportunities for teachers to strengthen their qualifications to teach biodiversity.

- **Goal 3: Make biodiversity in Chicago Wilderness a component of the degree programs of local colleges and universities.**

Although students at many local institutions of higher education are peripherally exposed to the biodiversity of the region through courses that visit natural sites, there are few efforts to make the region’s unique resources a focus of study. Because of this, we are losing an excellent opportunity to inform our most educated citizens.

Recommendations

- ✓ Survey existing course selections at local universities. Identify courses that effectively and thoroughly communicate key information about local biodiversity and work to increase their visibility.
- ✓ Develop a degree program in restoration ecology at a local university with an accompanying field station.

- ✓ Promote practicum opportunities by linking universities with professional land managers in the region.

- **Goal 4: Expand and improve the use of existing tools for biodiversity education, and create new tools as needed.**

A number of recent formal studies and informal surveys have highlighted the need for better ways of developing and disseminating tools for biodiversity education. Steps to address this challenge are listed below.

Recommendations

- ✓ Work toward the better distribution of existing tools by forming a distribution center and investing in publicity about the center.
- ✓ Assess the effectiveness of tools for reaching their target audiences.
- ✓ Create new tools for groups starting community-based, non-school projects in biodiversity education. For example, create a biodiversity program primer with a list of potential partners.
- ✓ Produce tools and materials in multiple languages.

- **Goal 5: Increase the number of communities being reached with non-school-based programs in biodiversity education.**

As described in Section 10.1.4, it is imperative that we provide services for biodiversity education to cultures and communities throughout the Chicago Wilderness region. Reaching this wide range of people requires the variety of actions listed below.

Recommendations

- ✓ Foster neighborhood- and community-based programs aimed at improving the environment and biodiversity locally to unify different cultural groups for concerted community action.
- ✓ Identify specific leaders in cultural and ethnic communities who can inform educators and communicators and serve as partners for collaborative programs.
- ✓ Create a diverse base of spokespeople, including professionals and volunteers, who can serve as “ambassadors” for biodiversity to a wider variety of communities.
- ✓ Develop collaborations between Chicago Wilderness member organizations and cultural, ethnic, and arts and humanities organizations to foster the exploration of nature through cultural avenues.

- ✓ Improve the infrastructure within conservation agencies and organizations to better support community-based biodiversity projects.
- ✓ Develop links between school-based biodiversity programs and community projects.
- ✓ Find new ways of providing urban populations with opportunities to become aware of and explore the region's natural communities (for example, a "biodiversity bus" to bring urban residents to outlying natural areas).
- ✓ Devote more effort to recruiting citizen scientists from more diverse communities. Build effective tools to track the success of recruiting techniques, and use the effective techniques to expand the reach of volunteer-recruitment programs.
- ✓ Encourage the providers of non-formal education programs to recruit and employ professional educators who reflect the diversity of the communities they serve.

- **Goal 6: Measure local citizens' understanding of biodiversity by developing appropriate gauges for long-term effectiveness of education programs.**

The only way to assess success in reaching Goals 1–5 is to measure the target audiences' understanding of biodiversity issues. To accomplish this, resources should be dedicated to creating appropriate measures and systematically collecting data.

Recommendations

- ✓ Create appropriate gauges and gather baseline data on targeted communities.
- ✓ Gather data at set intervals to measure long-term change.
- ✓ Disseminate findings to agencies and organizations involved in biodiversity education.

10.2.3 Short-term communications goals

- **Goal 1: Gain a better understanding of the views of a broader segment of the Chicago-area population on biodiversity issues such as ecological restoration.**

The current concerns and viewpoints of different population segments must be understood before communication can be effective. While national market research is valuable to decision-makers and conservation communicators, unique circumstances (such as county forest preserve systems) exist in the Chicago region, and they may affect our citizens' values and views. More local research on issues related to biodi-

versity protection is needed, including ecological restoration and knowledge of or access to avenues of public involvement.

Recommendations

- ✓ Compile existing local market research, including that gathered through land-acquisition bond campaigns, to determine gaps in the understanding of public values and perceptions.
- ✓ Commission professional market research locally to better inform communications strategies and messages.
- ✓ Disseminate research findings to decision-makers and conservation agencies and organizations.

- **Goal 2: Increase the public's understanding of the role of management in natural areas.**

Many people believe nature should be left alone. In the Chicago Wilderness region, however, only aggressive land management can restore the natural processes that allow an ecosystem to "take care of itself." Communication strategies must emphasize the human role in nature as healer and must show that management is necessary to alleviate the pressures placed on ecosystems in a large metropolitan area. Understanding these messages can lead to endorsement of ecological restoration, even though its methods (such as prescribed fire) may appear damaging in their early stages.

Recommendations

- ✓ Craft a common lexicon that describes restoration efforts, and create methods to evaluate and adapt the messages to grow in effectiveness.
- ✓ Foster the delivery of essential message points not only through conservation agencies and organizations, but also through a broader range of institutions and channels.
- ✓ Engage and educate those who interpret conservation issues for the public, including community leaders, media, and elected officials.

- **Goal 3: Improve communication with those immediately affected by management decisions.**

Neighbors and users of forest preserves and other natural areas should be aware of management decisions and understand their necessity. In the early stages, habitat restoration is typically not aesthetically pleasing. Whether conducting demonstration burns or distributing brochures house-to-house, staff of land-management agencies and stewards need to let people know what's going to happen and why. They should

also work with user groups (such as birders, hikers, and canoeists) on issues of common concern.

Recommendations

- ✓ Ensure that restoration efforts, particularly in new areas, include plans for communications to local residents, and that resources are available for efficient and appropriate communication efforts.
 - ✓ Create a communication guide that restoration agencies can use to help develop these plans, including resources that already exist and successful examples from other agencies.
 - ✓ Conduct direct outreach to organizations in the local communities, such as block clubs and religious groups, that are interested in environmental work.
 - ✓ Engage advocacy organizations that work on environmental issues (such as air and water quality or sprawl) and educate them about biodiversity loss.
 - ✓ Seek opportunities to inform journalists and increase media coverage of restoration and land management.
 - ✓ Review current mechanisms for public involvement in land-management decisions and make improvements, using models that are successful in other arenas.
 - ✓ Create a structure for collaborating partners not only to react quickly but also to anticipate issues that arise in public forums.
- **Goal 4: Communicate documented benefits of local restoration efforts, especially those of most value to humans.**

To accept restoration techniques as necessary, people need to know that these efforts are producing the desired results, that habitats are being restored. Restoration efforts also need to be connected with tangible benefits—showing that biodiversity is a necessity, not a luxury.

Recommendations

- ✓ Gather data on the results of restoration efforts, translating the data into easily understood benefits.
- ✓ Create communications tools that connect restoration results to core values: the beauty and wonder of nature, our responsibility to future generations, and the desire for a healthy environment.
- ✓ Include illustrations of restoration results in programs, nature walks, signs, and other communication vehicles.

- ✓ Develop innovative campaigns and programs that position habitat restoration in mainstream culture (such as museum exhibits, ad campaigns, and retail promotions).

- **Goal 5: Improve the credibility and public perception of the people involved in restoration efforts.**

The perception exists in some communities that restoration is the folly of misguided volunteers or outsiders. Better explanations are needed of the role of the professionals and volunteers in restoration projects, as well as of the volunteers' experience and training of and their value to land management agencies.

Recommendations

- ✓ Seek trusted local spokespeople who represent the sound, scientific thinking behind restoration and/or exemplify the role of the local volunteer.
 - ✓ Provide support for volunteers who interact with the public, and offer training in public speaking, ecological concepts, interpretation, etc.
 - ✓ Emphasize the public service provided by volunteers and the leverage of public funds through donated time.
 - ✓ Ensure that decision-makers are aware of the value of conservation volunteers.
- **Goal 6: Improve communication about biodiversity with key decision-makers such as elected officials and their staff, land managers, and planners.**
- These key decision-makers need information about local biodiversity before issues arise in order to make informed decisions. They also need quick access to new information as issues are being considered. Communication programs and tools need to address their needs.

Recommendations

- ✓ Assess current tools and programs to inform key decision-makers for content, availability, and effectiveness in increasing understanding of the importance of local biodiversity.
- ✓ Survey, as necessary, to assess key decision-makers' knowledge, attitudes, and information needs.
- ✓ Develop vehicles to keep decision-makers regularly informed, such as tours, literature, up-to-date scientific information, and contacts for further information.

10.3

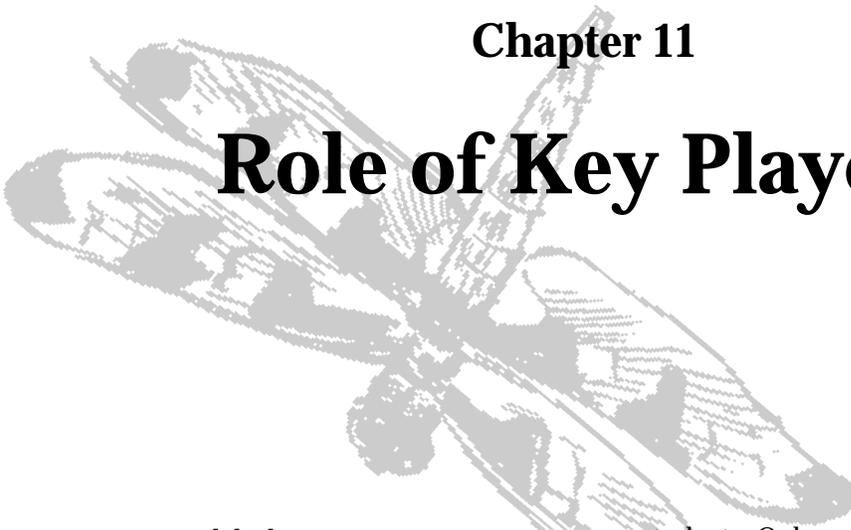
Conclusion

While the challenges to conservation educators and communicators are many, they *can* engage the public on biodiversity by working together, understanding their audiences, devoting more resources, and adopting innovative approaches. While the American public is relatively unaware of the loss of biodiversity, we in the Chicago region have the tangible demonstration to motivate positive change right before our eyes—no citizen in

the metropolitan area is more than twenty minutes from a natural area. Communicators can build on the public's affinity for our parks and forest preserves and the unique opportunities they provide. While Chicago and urban centers worldwide struggle with issues such as quality of life, over-development, pollution, and traffic congestion, Chicago Wilderness also has the potential to create a new model of a metropolitan citizenry that is aware, appreciates its natural ecosystems, and takes action on their behalf.

Chapter 11

Role of Key Players



11.1

Introduction

Achieving the objectives of this plan requires the teamwork of many agencies, institutions, corporations, and individuals. This chapter identifies key players and describes their current roles in preserving biodiversity. Except where stated to the contrary, this plan calls upon all of these key players to continue performing their current roles and, in a few instances, to take additional actions. In addition to the roles and actions outlined here, Chapter 8 includes many recommendations for actions that government agencies can pursue to contribute to land and water protection. Also, each of the recommendations in the preceding chapters needs to be addressed by one or more of the key players identified here. The order of presentation that follows is not intended to suggest relative importance. Those who own and manage sites containing natural communities are obviously central actors, but so too are those who provide the funding, the expertise, and the volunteer hours required to make this plan succeed.

Both governmental and non-governmental organizations are now moving to protect and restore the rich biodiversity of the region. One aspect of this is their cooperation in the development of this plan.

11.2

Role of government agencies

11.2.1 Overview

As the greater Chicago region developed, governments were created and modified to provide desired services: police, fire, transportation, zoning, recreation, pollution

control, etc. Only very recently have we realized that some conservation needs are not adequately addressed by existing governmental agencies. No one governmental body has responsibility for conserving biodiversity. In addition, the science of conservation biology has emerged fairly recently, and conservation issues exist on scales that do not neatly coincide with governmental boundaries.

11.2.2 Local governments

Forest preserve and conservation districts

These special districts are among the most important of the many actors involved in biodiversity recovery in the Chicago region, simply because they hold extensive lands containing natural communities. (See Table 11.1.) If this plan is to succeed, these county agencies must continue their selective acquisition efforts and must increase appropriate land management to assure that natural communities are being preserved.

While subject to property-tax caps, most Chicago-area counties have gained or plan to seek voter approval for funding substantially more land acquisition in the coming years. Public support for increased spending on the active management of natural lands is also critically important and may require more extensive public education. An alternative may be legislative relief from caps for this type of expenditure.

The Forest Preserve District of Cook County has not yet announced any referendum. A land-acquisition plan was developed in 1994 and was pending approval by the County Board as of September 1999.

The Forest Preserve District of DuPage County, in the fall of 1997, gained voter approval by referendum to spend \$75 million for open-space preservation.

Table 11.1
Major public land owning agencies information

	FPD of Cook County	FPD of DuPage County	FPD of Kane County	FPD of Will County	Lake County, IL FPD	McHenry County CD	Illinois DNR	Wisconsin DNR	Indiana DNR	US Forest Service	National Park Service
Total acres owned	67,700	23,000	8,000	12,000	20,794	10,800	21,364	6,484	17,285	15,080	10,092
Total acres serving conservation objectives	54,170	19,550	7,200	6,296	17,832	10,200	—	—	—	—	9,120
Acres actively managed	8,041	9,000	<6,000	2,500	8,000	7,191	—	2,836	—	2,940	4,780
Formally protected natural areas	4,359	65	850	2,903	1,579	1,451	4,206	445	2,492	0	9,120
Referendum/bond issue (within past 4 years)	.no	yes (1997)	yes (1999)	yes (1999)	yes (1999)	no	n/a	n/a	n/a	n/a	n/a
Monetary amount	n/a	\$75M	\$70M	\$70M	\$35M	n/a	n/a	n/a	n/a	n/a	n/a
Desired additional acres through referendum	n/a	2,400	5,000	6,500	4,000	n/a	n/a	n/a	n/a	n/a	n/a
Formally established goal or cap on total land holdings (in acres)	75,000	25,000	13,000	18,500	45,000	—	—	—	—	19,000	n/a

Total acres owned = All of the land holding acres of the agency within Chicago Wilderness region.

Total acres actively managed = This is the land that is being actively managed for conservation purposes. This may include removing of invasive species, burning, and other restoration practices.

Total acres of land serving conservation purposes = This is land that is not developed with buildings, parking lots, golf courses, ball fields, etc. It is also not agricultural land, unless it is slated for restoration. However, this land is not necessarily being actively managed. Therefore it is serving conservation purposes and could be actively managed if desired.

Formally protected natural area = For Illinois county lands, this is based on land designated as Nature Preserves or Land and Water Reserves through the INPC.

The Forest Preserve District of Kane County has spent \$23 million over the last five years and plans to preserve another 5,000 acres over the next 20 years. On April 13, 1999, a referendum for \$70 million for land acquisition passed by 66%.

The Lake County Forest Preserves' referendum on April 13, 1999, passed by 66%, providing \$35 million to buy land and \$20 million for habitat restoration, trails, and other improvements. A voter-approved 1993 referendum had previously provided \$20 million for land acquisition and \$10 million for restoration, trails, and improvements.

The McHenry County Conservation District hopes to double its current inventory of 10,500 acres over the next 10 years.

The Forest Preserve District of Will County, on April 13, 1999, won 57% voter approval for \$70 million to buy 6,500 acres.

Additional roles of forest preserve and conservation districts are public education and outdoor recreation. These roles derive from the statutory responsibilities outlined in their enabling legislation. The districts also serve as primary coordinator of volunteer stewardship and monitoring work on the land they own and manage. Providing such opportunities for public enjoyment, learning, and involvement helps build understanding of the mission of the districts and support for public funding to preserve and restore the districts' lands.

Recommendations

- ✓ In keeping with their central role as land managers, the forest preserve and conservation districts should continue to play lead roles in identifying, evaluating, and acquiring unprotected natural communities within their jurisdictions.
- ✓ Federal and state agencies should support these efforts with funding and technical resources. The most recent example of such a partnership was the Chicago Wilderness collaboration that produced the natural-areas inventory for McHenry County.
- ✓ Forest preserves should use all tools available to add land to their holdings. It is also recommended that existing natural areas be protected from purchase requests by commercial and other interests or conversion to intensive recreational uses.

Park districts

The mission of park districts more heavily emphasizes recreation than does the mission of conservation and forest preserve districts. However, this does not preclude them from making a valuable contribution to the conser-

vation of biodiversity. Many of the 148 park districts in the Illinois portion of Chicago Wilderness have the opportunity to acquire or manage natural communities falling within their jurisdiction. Such sites are sometimes too small to meet the acquisition criteria of the local forest preserve or conservation district. The St. Charles Park District, for example, has adopted policies for preserving and maintaining natural areas and is a leader in restoring natural areas in their ownership. Pilcher Park, an Illinois Natural Areas Inventory site, sets a good example of working with volunteer stewards and with the state Nature Preserves Commission to manage its fine resource. Many park districts, including the Chicago Park District, have become involved in restoring wetlands and in reestablishing native prairies and woodlands. Lake County Parks and Recreation in Crown Point, Indiana, has been actively acquiring and restoring natural areas. Park districts can and should play the important role of educating the public on the importance of maintaining biodiversity.

Like forest preserve districts, park districts are subject to property-tax caps and may have to hold public referenda in order to finance acquisitions or major projects. Public education by all parties regarding the importance of biodiversity can be vitally important to the success of such referenda.

Sanitary districts

The role of sanitary districts in recovering biodiversity is limited principally to the collection, treatment, and discharge of wastewater that meets federal and state standards. Some are also responsible for treating storm water that reaches their plants through combined sewer systems. Hence they have an interest in storm water management. Treated effluent can have major impacts on aquatic biodiversity depending on both its quality and the location of the point of discharge. Unfortunately, the regulatory practices determining discharge locations usually consider only engineering standards such as the availability of stream flow for dilution rather than the impact on the ecology of the receiving stream. The state governments have regulatory authority for discharge locations and limits.

Sanitary districts may also own land that supports significant biodiversity. Such land affords opportunities for partnering with organizations more directly charged with conservation of biodiversity. The largest landowner of this type is the Metropolitan Water Reclamation District, which encompasses most of Cook County. The District has effectively used intergovernmental agreements and other cooperative agreements to enhance the use and maintenance of District lands to support biodiversity. This good practice should be continued and expanded.

Sanitary districts also have indirect impact on biodiversity when extension of their service areas facilitates more intense development. While the primary function of sanitary districts is to provide service, they can work actively with other governmental units that have a more direct role in directing development and protecting natural areas. Such cooperative effort can be important to protecting biodiversity.

Recommendations

- ✓ Since the concern for maintaining biodiversity is not one of the purposes for which sanitary districts were created, enabling legislation should be amended to specify the authority and obligation of districts to protect biodiversity.
- ✓ In the case of private utility companies that provide wastewater collection and treatment services, and whose franchises are regulated by the Illinois Commerce Commission, a similar broadening of authorizing legislation would be appropriate.

Illinois counties and municipalities

County governments regulate land in unincorporated areas and, in some instances, play important roles in stormwater and/or wastewater management. Municipal governments regulate the use of land and also have the authority to annex new land, typically for the purpose of facilitating new development. A number of municipalities also own and operate their own wastewater treatment systems and therefore can extend sewer service as part of an annexation agreement.

Illinois, with its heavy emphasis on the property and sales taxes to fund municipal governments, has created a strong incentive for municipalities to expand into new areas. Several recent tax-reform initiatives have looked at the problem of over-reliance on the local property tax and have made recommendations that would lessen the incentives for territorial expansion.

Some municipalities operate their own park systems and therefore may be the most appropriate bodies to preserve natural areas within their boundaries. Also, both county and municipal governments have the authority to prepare and adopt comprehensive plans. These plans should identify open spaces meriting preservation and specify who should be responsible for their preservation.

Municipalities can also take direct action in managing lands that they own to support biodiversity and they can acquire and manage additional land. Even in municipalities that have separate park districts, they can play an important role in funding the acquisition and management of open space, wetlands and other natural areas. In situations where park districts do not have sufficient

financial capacity, municipalities can provide assistance through cooperative agreements. This is especially the case with Illinois home rule communities that are not limited by tax caps. Chapter 8, section 8.3 discusses other possible actions by municipalities related to plans, ordinances, etc.

Recommendations

- ✓ Counties and municipalities should amend their comprehensive plans, zoning ordinances, and other regulations to incorporate relevant recommendations contained in this plan.
- ✓ When a state infrastructure investment such as a toll road or major airport is likely to trigger substantial residential, commercial, or industrial development, affected governments (including state, county, municipal and other local jurisdictions) should enter into intergovernmental agreements designed to prevent adverse environmental impacts, including the loss of biodiversity. Such agreements were developed as part of the process for considering a proposed expressway in central Lake County, Illinois.
- ✓ Municipalities should play an active role in protection and management of biodiversity by managing their lands to support native ecological communities and consider acquisition of additional land for these purposes.

Northwest Indiana municipalities

The municipalities in Indiana, such as the City of Gary and the City of Hammond, have unique roles in preserving and protecting biodiversity. This stems from the large impact of business and industry in northwestern Indiana. These businesses and industries are key elements of local economies and, in many instances, owners of environmentally sensitive land.

To effectively protect biodiversity in northwestern Indiana, partnerships need to be nurtured among the various agencies of the federal, state, and county governments, city departments, and private organizations that own and oversee land requiring preservation and long-term management. For example, this is important for the City of Gary since it contains portions of the Indiana Dunes National Lakeshore as well as several pieces of dune-and-swale ecosystems that are protected and managed by the Indiana Department of Natural Resources and private conservation groups.

These cooperative partnerships may evolve into comprehensive and cooperative planning and management initiatives among the various agencies, departments, and organizations. At present there is no comprehensive, coordinated, or cooperative relationship between the var-

ious habitat managers and landowners in the City of Gary, such as the City Park Department and the Redevelopment Commission.

The cities of northwest Indiana may develop guidelines for the staffs of economic-development departments and planning departments urging them to include, where possible, habitat preservation in development projects that impact sensitive areas and habitat restoration in previously disturbed areas. While these cities are developing the capacity to manage natural resources, state, federal, or private agencies and organizations may assist in providing technical assistance for city-owned natural resources.

Recommendations

- ✓ In northwest Indiana, city departments should enter into partnerships aimed at protecting biodiversity with federal, state, and county agencies and with private organizations that own and oversee land requiring preservation and long-term maintenance.
- ✓ Indiana cities and their regional planning and development agencies should develop a process for taking inventory of natural areas and prioritizing areas for preservation and restoration in conjunction with economic-development initiatives.
- ✓ Indiana cities and their partner agencies should develop plans and allocate funds to preserve land and to manage preserved land consistently.

Special units of government

The Chicago Wilderness region is home to a number of specialized units of government that can play an especially important role in providing for expanded habitat. The argument is often raised that enabling legislation does not specifically identify habitat protection and restoration as an activity of such districts. Yet various governmental bodies nonetheless can play a major role simply by administratively choosing to do so. Thus, the Illinois Department of Transportation plants prairies along its rights of way because it saves maintenance dollars over the long run and the program is well received by the public. Grade schools and high schools plant prairie gardens; community colleges restore large natural areas on their grounds. The Metropolitan Water Reclamation District of Greater Chicago grants long-term, low-cost leases on its important natural areas for habitat management. None of these public agencies are legislatively enabled to accomplish these activities, nor are they legislatively precluded from doing so. They choose to do so for the community good and, often, because it means lower maintenance and operation costs.

Mosquito abatement districts: Alternative approaches to mosquito control that do not harm other fauna need to be identified through round-table discussions among the mosquito abatement districts and Chicago Wilderness representatives.

Drainage districts: Drainage techniques that serve agriculture while also improving habitat, controlling erosion, and controlling storm water should be identified and used along channelized streams managed by drainage districts.

The Fox River Waterway Management Agency: Waterway-management agencies should implement strategies to protect and enhance habitat throughout their jurisdictions, especially for fish migration and spawning, water bird migration and nesting, restoration, control of exotic species, shoreline erosion control, and protection and enhancement of mussel beds.

Illinois Prairie Trail Authority: This authority, representing the five Illinois collar counties, could play an important role in coordinating region-wide public access, education, and activities related to natural areas adjoining the collar-county trail network.

Local highway departments: These departments can play a leading role in habitat restoration and protection by detaining storm water on site, managing salt use, pursuing environmentally benign alternatives to salt, and using native landscaping within rights of way more extensively.

Illinois International Port District: The Port District includes Lake Calumet, one of the largest and most important habitats for birds and fish in southeast Chicago. There is a need for a long-range management plan, developed with community involvement, to provide a balance between habitat preservation and economic development. Such a plan should deal with restoring water quality and providing access to Lake Calumet for appropriate recreational activities.

11.2.3 State agencies

Illinois Department of Natural Resources

The Illinois Department of Natural Resources (IDNR) has played a lead role in conserving biodiversity in northeastern Illinois by establishing and maintaining the Illinois Natural Areas Inventory (INAI), by acquiring and managing land, and by providing technical assistance to public and private agencies and groups interested in resource conservation. IDNR also administers several grant programs to fund biodiversity-related initiatives. This section describes various IDNR programs.

The **Illinois Natural History Survey** (INHS), founded in 1858, is recognized as the nation's premier natural history survey. INHS scientists study plants and animals and how they interact among the variety of ecosystems. Scientists from the **Illinois Water Survey and Geological Survey** also study critical factors involved in ecosystem function such as hydrological patterns and soil structure.

As for land protection, IDNR is the third largest non-federal public landowner in the six-county region (see Table 11.1) with over 21,300 acres of state parks, natural areas, conservation areas, and registered Land and Water Reserves. The Office of Resource Conservation (ORC) and the Office of Land Management and Education (OLME) are responsible for identifying and managing these ecosystems. The Surveys, ORC, and OLME are involved with watershed management, restoration ecology, long-term monitoring of natural communities, controlling invasive species, and fish and wildlife ecology. They foster improved management of the state's biological resources and public appreciation of Illinois's natural heritage.

The **Office of Water Resources** has regulatory responsibilities in stream channels, floodways, and floodplains.

The **Illinois Nature Preserves Commission** works with landowners who wish to voluntarily protect high-quality natural areas as either Illinois Nature Preserves or Registered Illinois Land and Water Reserves. These high-quality natural areas have frequently already been identified on the Illinois Natural Areas Inventory, either as relatively undisturbed natural plant communities or as habitat for state-listed endangered or threatened species.

Dedication of these natural areas is a legal process whereby the owner voluntarily restricts future uses of the land in perpetuity for the purpose of preserving the land in its natural state. The owner retains custody but relinquishes the right to develop the land or make any changes that negatively affect the natural qualities of the property. Sites dedicated as Illinois Nature Preserves or registered as Illinois Land and Water Reserves are protected under the auspices of the Illinois Natural Areas Preservation Act. That act states that "areas dedicated as nature preserves are hereby declared to be put to their highest, best, and most important use for the public benefit."

After the land is dedicated, it becomes part of a statewide system of nature preserves or land-and-water reserves that is overseen by the Illinois Nature Preserves Commission, a nine-person citizen body appointed by the Governor. To date, 285 sites totaling 37,778 acres have been dedicated as Illinois Nature Preserves, and 33 sites totaling 14,675 acres have been registered as Illinois Land and Water Reserves. Of that total, 106 nature preserves and five land-and-water reserves are located in the six-

county region of northeastern Illinois. Nearly half of these protected areas are owned by the county forest preserve and conservation districts. The Illinois Department of Natural Resources, park districts, municipalities, and private parties own the remainder.

Many high-quality natural areas in northeastern Illinois, however, remain unprotected. A number of the high-quality Chicago lake-plain prairies and wetlands, for example, have not been formally protected.

The Nature Preserves Commission staff also provides recommendations and assistance regarding restoration and management of protected sites. The staff also works cooperatively with landowners, municipalities, and regulatory agencies to prevent or minimize impacts associated with changing land uses on Illinois Natural Areas Inventory sites and protected sites.

The Nature Preserves Commission is an important partner in the Volunteer Stewardship Network, providing the legal basis for volunteers to apply herbicides by indemnifying those who become licensed through the state.

The **Illinois Endangered Species Protection Board** is an independent board of nine members appointed by the governor. The board was created by the Illinois Endangered Species Protection Act of 1972 and is dedicated to protecting Illinois's endangered and threatened species. Following from this mandate is the evaluation and listing of animal and plant species as state-endangered or -threatened. The list is updated and published every five years following a two-year review process.

Duties of the board include the following:

- Listing, delisting, or changing the listing status of species of plants and animals
- Advising the Department of Natural Resources on the assistance, protection, conservation, and management of native endangered and threatened plants and animals and their habitats
- Encouraging and promoting research and investigations that determine status of native plants and animals that may be eligible for listing, and promoting research and management that may enhance the possibility of success of a listed species and ultimately lead to recovery and delisting
- Informing the public about matters pertaining to threatened and endangered species
- Working with other agencies and organizations to conserve threatened and endangered plants and animals and their habitats

IDNR has a long record of providing financial support for land acquisition in northeastern Illinois. The department administers the state's **Open Space Lands Acquisition and Development Program (OSLAD)**, the **Natural Areas Acquisition and Development Program (NAAF)**, **C-2000 Ecosystem Program**, and the **Open Land Trust (OLT)**.

OSLAD has helped local park and forest preserve districts acquire and develop substantial open spaces. Funded by the Illinois real-estate transfer tax, OSLAD is budgeted statewide at \$17,715,000 for FY 99. In FY 98, applications from local governments in Cook County were approved at a level of \$3,925,000, while applicants in the collar counties were awarded \$5,466,000. Since its beginning in FY 86 through FY 98, OSLAD has provided \$27,735,000 to Cook County applicants and \$31,656,000 to the collar counties. OSLAD requires a 100% local match.

NAAF was established in 1989 with a portion of the real-estate transfer tax. The fund is dedicated for acquisition and stewardship of natural areas, including habitat for endangered and threatened species, high-quality natural communities, wetlands, and other areas with unique or unusual qualities of natural heritage. Lands acquired remain in state ownership. Approximately \$2 million each year is used for acquisition and stewardship.

C-2000 Ecosystem Program funds watershed- and ecosystem-based local partnerships that seek to maintain and enhance natural areas and coordinate conservation efforts with other local interest such as business. Among the projects eligible for grants are those for land acquisition or the purchase of conservation easements for the purpose of habitat protection or restoration. Total grants for the statewide program are expected to average \$3 million per year. Partnerships within northeastern Illinois include Chicago Wilderness, the Fox River Ecosystem Partnership, Lake Calumet Ecosystem Partnership, Prairie Parklands Partnership, Thorn Creek Ecosystem Partnership, Wisconsin-Upper Des Plaines Partnership, and the Upper DuPage River Coalition.

The C-2000 Ecosystems Program has established pilot projects in four downstate watersheds designed to "fix" local streams by a variety of methods including better land management. These will serve as important case studies for application within the Chicago Wilderness region.

OLT is Governor Ryan's landmark initiative to dedicate \$160 million over four years to acquire natural areas and open space and to provide recreational opportunities for the citizens of Illinois. The program will allow the IDNR to acquire land; create a grant program for units of local government to acquire land; and enter into management

agreements with not-for-profit organizations on land acquisition.

Recommendation

- ✓ The State of Illinois should continue its grants programs for open space with more funds for acquisition directed to northeastern Illinois. Open Lands Trust Act funds should primarily protect lands with current or potential biodiversity values.
- ✓ The state should continue to acquire high-quality natural areas through the NAAF.

Indiana Department of Natural Resources

The mission of the Indiana Department of Natural Resources (DNR) is to protect, enhance, preserve, and wisely use natural, cultural, and recreational resources for the benefit of Indiana's citizens. It does so through public information programs to promote awareness and conservation of Indiana's natural resources, by acquiring public lands with programs such as the Indiana Heritage Trust, and by using a watershed-based multi-disciplinary management approach in its programs.

The **Division of Nature Preserves** is responsible for inventory, protection, dedication, and management of Indiana's remaining natural areas. In addition, the Indiana Natural Heritage Data Center, within the Division of Nature Preserves, collects, manages, and provides data on Indiana biodiversity, including endangered species, natural communities, and conservation lands in the state.

In the Chicago Wilderness area of northwest Indiana, the Division conducts field inventories for endangered species and natural communities, manages several nature preserves, and works with various conservation partners protecting some of the most diverse natural areas in the state. Two funding sources allow the Division to acquire (or assist in acquiring) natural lands: the Indiana Natural Heritage Protection Campaign and the Indiana Heritage Trust program. The former is a public/private program to fund conservation that has successfully protected the best remaining natural areas across the state. The latter program, which is funded by sale of the environmental license plates, has proven to be one of the most successful conservation-funding programs ever in Indiana.

Wisconsin Department of Natural Resources

The Wisconsin Department of Natural Resources (DNR) has broad responsibility and involvement in managing biodiversity in Wisconsin. It manages the state owned wildlife areas (such as the New Munster Wildlife Area), recreational areas (like the Bong State Recreational Area), and state parks (such as Big Foot Beach State Park). In

addition, the Department often works in partnership with other public and private agencies and groups to acquire, preserve, and manage unique sites and natural areas (such as the Chiwaukee Prairie). The Department regulates modifications to waterways and wetlands, establishes and enforces effluent standards for industrial and municipal wastewater facilities, and approves modifications to sewer service areas. Wisconsin DNR oversees local implementation of zoning regulations for floodplains and shores. Wisconsin DNR maintains the Natural Heritage Inventory in Wisconsin and implements the state law on endangered and threatened species.

In May 1995, the Wisconsin DNR issued a report entitled *Wisconsin's Biodiversity as a Management Issue*. This report presented the department's strategy for the conservation of biological diversity. It provided DNR employees with an overview of the issues associated with biodiversity and provided a common point of reference for incorporating the conservation of biodiversity into DNR's management framework. In June 1995, the Wisconsin DNR published a land-use report entitled *Common Ground*. *Common Ground* focuses specifically on improving DNR programs and policies that relate to making decisions about land use. This report reflects the DNR's desire to have strong public policies that not only protect Wisconsin's environment but also enhance the state's economy and maintain a high quality of life. In 1996, the Wisconsin DNR reorganized so that program implementation and land management are carried out in Geographic Management Units (GMUs). GMUs reflect the natural boundaries provided by watersheds and river basins. The Wisconsin DNR has formed "partnership teams" with the public and private sectors to guide planning and implementation within the GMUs. Wisconsin DNR is currently working on a map of terrestrial ecological regions based on the National Hierarchical Framework of Ecological Units.

Illinois Environmental Protection Agency

The Illinois Environmental Protection Agency (IEPA) regulates waste discharges to water, air, and land. A major role for maintaining biodiversity is oversight of water-quality management planning as mandated by the federal Clean Water Act. In that capacity, IEPA approves the sizing, location, and limits on effluents for sewage-treatment plants. IEPA also determines the boundaries of areas to be served by treatment plants, and it thereby can influence patterns of growth and development.

The Agency also administers the national permit program for stormwater discharges. This program has the potential to significantly reduce the adverse effects of stormwater runoff on the biodiversity of streams. Phase

One of the program covers municipal storm-sewer systems that do not receive sanitary sewage and that serve populations of 100,000 or more, construction activities that disturb five acres or more, and numerous industrial activities. In the fall of 1999, Phase Two will extend the program to small municipalities and construction activities disturbing one or more acres of land.

In addition to regulating discharges to streams and lakes, IEPA administers state water-quality standards that are set by the Illinois Pollution Control Board to establish conditions that must be maintained in streams and lakes. The standards include limits for various chemicals, to protect both human health and aquatic life.

IEPA regulation of air pollution and contaminated land also benefits both aquatic and terrestrial biodiversity. A specific aspect of air-pollution control that is important for protection and restoration of biodiversity is the issuance of permits to landowners for conducting prescribed burns.

IEPA's Office of Pollution Prevention encourages businesses to prevent pollution before it becomes a problem. The agency also promotes holistic approaches that eliminate the sources of waste in products, processes, and raw materials.

Illinois Department of Transportation

As a major landowner, the Illinois Department of Transportation (IDOT) sets an example when it employs best management practices in its highway design and maintenance. To its credit, IDOT has demonstrated a willingness to establish and maintain native landscaping along many state roads including some in northeastern Illinois.

IDOT also participates in the regional transportation planning process in northeastern Illinois, including identification and mitigation of environmental impacts of transportation facility decisions.

Recommendation

- ✓ IDOT should incorporate biodiversity principles into all transportation infrastructure planning and all implementation decisions.

Illinois State Toll Highway Authority

Planning the widening or extension of major toll roads in the Illinois portion of the Chicago Wilderness region is a part of the official regional transportation-planning process. The authorization to build is made solely by the Illinois General Assembly, with actual construction directed by the Illinois State Toll Highway Authority.

One of the most recent major additions to the Chicago-area system of expressways and toll roads is the north-south toll road in DuPage County. The environmental impact statement (EIS) prepared for that project identified a number of potential adverse impacts and proposed remedies. It specifically discussed erosion controls to protect adjacent streams during construction.

Recommendation

- ✓ Future toll-road construction projects must assure full compliance with EIS recommendations.

Illinois Department of Agriculture

This agency supports farmers who participate in conservation programs under federal farm bills and in general habitat restoration. The Illinois Department of Agriculture has sought to curb excessive conversion of farmland to other uses by commenting on proposed actions involving federal or state monies that could cause the loss of farmland. This advisory review is conducted under the authority of the Illinois Farmland Protection Act, PA 82-945. There is some possibility that this act could be used to block land acquisition by forest preserve districts or other conservation agencies.

Other Illinois legislation pertaining to farmland preservation include: 1) the Agricultural Areas Conservation and Protection Act, PA 81-1173; 2) Protection of Farming Operations from Nuisance Suits, PA 82-509; and 3) Illinois Soil and Water Conservation District Act.

11.2.4 Intergovernmental organizations

In the Chicago Wilderness region, three intergovernmental planning agencies cover multiple counties: 1) the Northeastern Illinois Planning Commission, 2) the Northwestern Indiana Regional Planning Commission, and 3) the Southeastern Wisconsin Regional Planning Commission. Given the cross-section of local governments serving on their boards, they are well positioned to facilitate coordinated, intergovernmental planning and to provide technical assistance on local environmental matters. A fourth agency, the Chicago Area Transportation Study (CATS), is the designated MPO specifically for transportation planning for northeastern Illinois.

Northeastern Illinois Planning Commission

The Northeastern Illinois Planning Commission (NIPC) has a threefold role in preserving biodiversity. First, it develops and adopts regional plans, such as the Regional Greenways Plan, which has been widely accepted and used by local as well as state government. Like the Greenways Plan, the Biodiversity Recovery Plan can set a direction for the region and, once adopted by NIPC, can serve as a guide for municipalities, counties, and other

government units. Second, NIPC studies growth and development patterns, and it prepares forecasts for population, households, and employment. Also, NIPC monitors water quality in streams, lakes, and wetlands, and it promotes good planning and the use of best management practices for these resources. Third, NIPC works with local governments to promote intergovernmental activities through means such as intergovernmental agreements and planning processes for joint areas.

Northwestern Indiana Regional Planning Commission

The Northwestern Indiana Regional Planning Commission (NIRPC) promotes biodiversity through various activities of planning, implementation, and policymaking. As the federally recognized planning organization for Northwest Indiana, NIRPC recently adopted the Vision 2020 Transportation Plan for Northwest Indiana, which incorporates environmental sensitivity, promotes wise use of land, and encourages the use of alternative fuels. NIRPC's Environmental Management Policy Committee serves as a regional advisor and facilitator for discussion and public education on air quality. It also acts as a point of contact for discussion, coordination, and action on a wide range of programs and projects for air, land, and water quality. NIRPC is assisting in the preparation of an inventory and functional assessment of wetlands in the three-county region. It also prepared a management plan for the Trail Creek watershed. NIRPC serves as staff to the Quality of Life Council, a regional roundtable of public and private leaders that promotes sustainable development in Northwest Indiana. NIRPC is currently reactivating its role in community and economic development to promote Smart Growth for the region. NIRPC also provides staff support to two river-basin commissions whose missions include wetland and habitat restoration.

Southeastern Wisconsin Regional Planning Commission

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) is the official area-wide, comprehensive planning agency for southeastern Wisconsin, which comprises Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha Counties. SEWRPC provides the basic information and planning services necessary to solve problems that transcend the boundaries and fiscal capabilities of the region's local units of government.

Since its inception, SEWRPC has placed a high priority on the identification, protection, and wise use of the natural resources of the region. In 1997, the commission completed a *Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin*. This plan is the product of almost ten years of

intensive work conducted under the guidance of a Technical Advisory Committee consisting of individuals particularly knowledgeable about the natural areas and the habitats of critical species of the region. Through an extensive inventory, this plan identified all of the high-quality natural areas and habitats of critical species remaining in the seven-county region. It formulated recommendations for the protection, wise use, and proper management of those areas and habitats. This report also provides information to promote sound rural and urban development, avoiding conflicts between development proposals and resource protection.

Chicago Area Transportation Study

The Chicago Area Transportation Study (CATS) is federally recognized Metropolitan Planning Organization (MPO) for transportation planning for the six-county Chicago region. CATS leads the region in producing the long range transportation plan, the 2020 Regional Transportation Plan (1997) which identified levels of investment for existing transportation facilities and for transportation system expansion. The Transportation Plan calls for priority investments in our existing system and at the same time includes new expressways, toll roads and transit lines. Each of these projects, if built, could affect a number of wetlands and other natural communities.

- ✓ The regional transportation planning process should incorporate biodiversity principles into the transportation planning and programming process.

Municipal associations

Like regional planning commissions, municipal associations facilitate joint action by their member governments. They are usually organized within a single county but can collaborate across county borders when necessary. To date, their chief activities related to the environment have been in the areas of water supply and solid-waste management. Their support of biodiversity recovery as a municipal concern would be very helpful to the objectives of Chicago Wilderness.

11.2.5 Federal administrative agencies

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) carries out a wide array of federal statutes having to do with the physical, chemical, and biological environment. It has major authority to regulate discharges of pollutants to water, air, and land. It regulates these discharges either directly or by delegating authority to those states that demonstrate capacity and willingness. It also has responsibility for research and technology transfer in related

areas. Many EPA functions affect biodiversity. Examples include review of environmental impact statements prepared by other federal agencies, incentive programs to address land runoff to surface waters, identification of high-quality wetlands, wetland permit reviews, and wetland enforcement. The agency also has a small pilot program encouraging the use of native plants in private land holdings such as corporate campuses.

U.S. Army Corps of Engineers

The Corps of Engineers, under Section 10 of the Rivers and Harbors Act, regulates construction in navigable waters, including major waterways and Lake Michigan. The Corps also has authority under Section 404 of the Clean Water Act to issue permits for the deposition of dredged and fill materials and for excavation in waters of the United States, which include most wetlands and streams. Wetlands are still vulnerable to deterioration since such activities as vegetation removal, erosion, destruction of buffers, conversion to impoundments, and the discharge of storm water into wetlands are not regulated.

The Corps has various authorities allowing them to evaluate, design, and implement solutions to aquatic resource problems. Projects require a local partner or sponsor. The authorities include those specifically authorized by Congress, plus the Continuing Authorities Program, particularly Section 206 (Aquatic Ecosystem Restoration), Section 204 (using dredged material to restore wetlands or other aquatic systems) as well as others. Studies may be accomplished through the "Planning Assistance to States" program, which supplies technical expertise to evaluate, design, and implement solutions to the ongoing loss of biological integrity in and around streams.

The Corps has the authority to grant permits for projects that affect wetlands, provided the impacts are no more than minimal. Mitigation of project impacts is considered as part of the overall evaluation of a project. The Chicago District has developed some innovative practices that have greatly aided the region's ability to improve and restore degraded habitat. Mitigation banks, in-lieu fee programs, and the use of enforcement and noncompliance resolutions to improve impacted habitat are noteworthy. While resources have been somewhat constrained in the last few years, the Corps continues to look for ways to maximize its effectiveness and to develop partnerships with many of the diverse groups involved in wetlands.

U.S. Department of Agriculture:

USDA Forest Service

"Caring for the land and serving the people" is the mission of the USDA Forest Service. The Forest Service,

through partnerships with state and local natural-resource agencies, works in Northeastern Illinois to manage forests, prairies, and related natural resources for long-term sustainability and for improved quality of life for all citizens. The Chicago area is home to three USDA Forest Service offices: the Midewin National Tallgrass Prairie in Wilmington, the North Central Research Station in Evanston, and the Northeastern Area State and Private Forestry office in Evanston.

The Midewin National Tallgrass Prairie is part of the National Forest System. Administered by the Forest Service in close cooperation with the Illinois Department of Natural Resources, Midewin is the largest piece of protected open space in northeastern Illinois. Although public access to Midewin is currently restricted because of the Army's ongoing cleanup of the former Joliet Arsenal, Midewin's mission is to conserve and enhance native populations of plants and animals, provide opportunities for research and environmental education, support continuing agricultural uses in some areas, and provide a variety of recreation opportunities. Prairie restoration and new research have already begun at Midewin, and opportunities for the public to visit and work on the site will grow over the coming years.

North Central Research Station in Evanston conducts social-science research aimed at managing forest environments for urban populations. Northeastern Area State and Private Forestry provides financial and technical assistance for managing forest ecosystems in populated areas. This assistance includes conservation education, woodland restoration, and management of trees in parklands and streets, as well as management of exotic pests such as the Asian longhorned beetle and gypsy moth.

Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) is the federal agency that works with private landowners and communities to achieve their conservation goals through a voluntary approach to land stewardship. NRCS emphasizes voluntary, science-based assistance, partnerships, and cooperative problem solving at the community level. NRCS employees are skilled in many scientific and technical specialties, including soil science, soil conservation, watershed planning, hydrology, and wetland science. Assistance is provided through a network of local field offices.

NRCS can support aspects of the Biodiversity Recovery Plan through its efforts in community assistance and watershed planning. Using the watershed-planning process, community members can determine local priorities for resources and can develop a plan of action that addresses the needs of both the community residents and their environment. In addition to general technical assis-

tance, NRCS provides technical leadership for the many provisions of the 1996 Farm Bill, including the Wetland Reserve Program, Wildlife Habitat Incentives Program, and Conservation Reserve Program. These programs can be used in the protection and restoration of biodiversity in the Chicago Wilderness area.

U.S. Department of Interior: U.S. Fish and Wildlife Service, National Park Service

The U.S. Fish and Wildlife Service operates an Ecological Services field office in northeastern Illinois that implements the Endangered Species Act, including listing, recovery, and consultation. The Service offers consultation to other federal agencies on their permits, licenses, and funded projects. It provides technical and monetary support to private and public landowners for habitat restoration. It also investigates effects of environmental contaminants on fish and wildlife, participates in regional conservation planning, and provides education and outreach to schools and the general public on biodiversity conservation.

The Service also operates the 93 million-acre National Wildlife Refuge system, which provides habitat for migratory birds, endangered species, and other fish and wildlife. The Service could play a major role in the Chicago Wilderness region as a federal landowner, assisting in the acquisition of large parcels necessary to create habitat complexes identified in this plan and restoring habitat for area-sensitive species.

Also within the Department of Interior, the National Park Service maintains the Indiana Dunes National Lakeshore and conducts scientific studies.

U.S. Department of Transportation

The U.S. Department of Transportation provides over \$1 billion annually to the Chicago Wilderness region for a variety of programs relating to transportation. The current federal transportation-funding act is called TEA-21, the Transportation Equity Act for the 21st Century. While the bulk of TEA-21 funding locally goes toward maintaining our existing systems of highways and mass transit, funding is also used for acquisition of bicycle- and foot-trail rights of way, historic preservation, beautification programs, landscaping (e.g. natural landscaping) of transportation rights of way, and environmental mitigation. Each of these can help meet some of the biodiversity objectives of Chicago Wilderness.

TEA-21 requires a planning process and a funding process for improving and expanding transportation systems. These processes can provide a mechanism to promote biodiversity recovery, both through the design of new and improved transportation systems and through

their consideration of actions to avoid or mitigate environmental damage.

Recommendation

- ✓ Transportation designers and planners should carefully follow the TEA-21 process, taking advantage of its programs related to biodiversity in the Chicago Wilderness region.

U.S. Department of Energy

Two Department of Energy (DOE) National Laboratories have extensive land holdings in northeastern Illinois: Argonne National Laboratory and Fermi National Accelerator Laboratory (Fermilab). DOE has devoted resources to establishing and maintaining native species on both properties.

Argonne is a 1500-acre research facility in DuPage County that is surrounded by the Waterfall Glen Forest Preserve. The approximately 700 acres of undeveloped land at Argonne include woodland, wetland, and prairie habitats. Argonne has ecological research capabilities in the areas of mycorrhizal fungi and soil ecology, carbon sequestration, phytoremediation (using plants to concentrate and break down pollutants), and ecological assessment.

Fermilab has one of DOE's seven National Environmental Research Parks (NERPs), representing the tallgrass prairie region for the country. The NERP is an outdoor laboratory, containing over 1000 acres of reconstructed prairie, natural and constructed wetlands, agricultural land, and open water. Since its dedication in 1989, researchers from universities and from other DOE sites (including Argonne) have used the park to conduct more than 40 projects, including investigations of succession, soil structure, and microbial communities, evolution of plant defenses, and predator-prey dynamics, as well as surveys of vertebrates and invertebrates.

they fill in the cracks, clear bottlenecks, and otherwise creatively and adeptly make a difference. The large number of organizations contributing to biodiversity conservation in the region precludes including full discussion of their roles in this plan. This in no way implies that these organizations are any less vital to the achievement of this plan than the other actors described in this chapter. Appendix 8 provides an overview of the variety of non-governmental organizations in the region, their missions and significant accomplishments.

The region's museums, zoos, arboreta, and botanic gardens contribute profoundly to the evolving "conservation culture" of the region. Hundreds of thousands of people annually attend their exhibits and educational events. Their large research staffs, on the cutting edge of conservation around the globe, bring a focus of solid science to the many challenging questions facing conservationists here.

Many conservation organizations are run largely or entirely by volunteers active in their communities on a broad range of issues of conservation, environmental education, and open space. Some of these organizations own and manage local lands for habitat. Many are active in land-use planning and community development.

Some larger organizations with staff play major roles in acquisition of natural lands, conservation science, policy and planning, and volunteer recruitment. They often collaborate with public agencies in highly cost-effective partnerships.

Public participation is often key to the effective functioning of government agencies in a democratic society. Preserve users, neighbors, and other taxpayers have a healthy and growing interest in wise management of conservation lands. Not-for-profit conservation groups have a long and valuable history of advocacy and other forms of public participation that can improve the responsiveness and focus of all types of institutions. Just as volunteer programs have contributed mightily in health, education, and youth sports, volunteer programs in conservation and environmental education have a growing importance. These programs owe their effectiveness to partnerships between governmental and non-governmental organizations.

Non-governmental organizations have also been important in building coalitions and have played important roles in development of Chicago Wilderness itself, Midewin National Tallgrass Prairie, the Volunteer Stewardship Network, and a wide variety of other conservation successes in the region.

11.3

Role of private sector

11.3.1 Non-governmental organizations

The non-governmental organizations of the Chicago region that focus on conservation have demonstrated the flexibility and creativity to contribute to conservation at a high level. With a wide range of missions, they engage in various programs to preserve biodiversity, including direct work on protected natural areas, community-based organizing and education, and advocacy. In addition,

11.3.2 Business and industry

Commercial Club of Chicago: Historically, the private, for-profit sector has played an important role in open-space preservation in the Chicago region. The most widely known examples include Aaron Montgomery Ward's defense in the 1890s of Grant Park as "forever open clear and free" and architect Daniel Burnham's *Plan of Chicago*, produced in 1909. It is noteworthy that the sponsorship of this "Burnham Plan" came from the Commercial Club of Chicago, an organization representing the leaders of most major corporations and professions in the Chicago region. The introduction to the 1970 reprint (Commercial Club of Chicago 1970) includes the following passage by architectural historian Wilbert Hasbrouck, AIA:

Two vitally important results of the plan are the development of the lakefront and the extension of the Forest Preserve System of Cook County. Burnham often is given credit for initiating the forest preserves which ring metropolitan Chicago with a green belt...but this basic system had been established before the plan came into being. The concept of the Forest Preserve System was formulated by architect Dwight Heald Perkins, who served his apprenticeship in Burnham's office during the Columbian Exposition. What Burnham did do was to encourage the extension and continuation of the forest districts. There is no question that without the plan, the forest preserves as we know them today would not exist.

In 1999, the same Commercial Club of Chicago published a sequel to the Burnham Plan, which includes a strong endorsement of Chicago Wilderness (Johnson 1999).

Northwest Indiana Forum: This group, the leading organization of businesses in northwestern Indiana, has played an important role in promoting open-space preservation. It did so by helping to negotiate the settlement of pollution claims by the US EPA against certain local industries. This settlement directed corporate contributions toward the preservation of environmentally important sites rather than the payment of fines.

Homebuilders: Chicago-area homebuilders are in a unique position to promote the conservation of biodiversity by means of good site design and the preservation of open spaces such as wetlands contained on a building site. Some have done so, but many have found it difficult to find qualified organizations willing to receive and properly manage small open spaces. This issue requires further analysis by Chicago Wilderness members before recommending solutions.

Natural landscaping: Many businesses are also landowners. In the U.S., approximately 20 million acres of lawn are cultivated, covering more land than any single crop. Natural landscaping—using native plants and

plant communities in landscaping—is an opportunity to reestablish diverse native plants, thereby inviting the birds and butterflies back home. Using native plants promotes biodiversity and stewardship of our natural heritage. One approach to promoting biodiversity on private lands is "naturalizing" the land using restoration techniques such as planting and prescribed fire. Another approach is using native plants in more formal landscapes in place of turf grasses.

Several corporations in the Chicago region have chosen to use natural landscaping on their own properties. Examples include Sears corporate headquarters in Hoffman Estates, the AT&T corporate campus in Lisle, the Lucent Technologies campus in Naperville, and several right-of-way sites belonging to Commonwealth Edison.

Among the major reasons for natural landscaping is cost saving. Appendix 9 compares costs of the two basic options for landscape design and management. The first option is to plant and maintain hybrid turf grasses and other non-native ornamental plants and trees. These plants are now established throughout the non-agricultural portions of the region, especially in most parks and residential areas and in most commercial and institutional sites. NIPC (1997c) estimates that over a ten-year period, installation and maintenance of Kentucky blue grass cost \$59,400 per acre. The second option is to use native plants, and in some cases to restore hydrology, which in turn will support more animals, birds and other native species. The NIPC study estimates that over a ten year period, installation and maintenance of either buffalo grass or prairie grasses and forbs cost under \$10,000 per acre.

It is important to note that natural landscaping complements the ecological restoration taking place across the Chicago Wilderness. In natural landscaping, the property owner is concerned primarily with selecting from the palate of native plants and is generally not interested in restoring the hydrology or soils on the site. Nonetheless, replacing the monoculture of lawns with native plants enhances habitat for birds and insects and also provides important public education for broader restoration projects.

11.3.3 Farmland owners

All of the highest quality streams in the Chicago Wilderness region are in primarily agricultural areas, which suggests that most farming in the Chicago region is more compatible with preservation of stream quality than is most suburban development. Croplands intermixed with pasture and woodlands can result in a habitat suitable for certain native bird species, such as meadowlarks, as well as a variety of mammals.

Agricultural areas offer the most feasible opportunity for large-scale expansion of natural areas, although prime farmland should be kept in production where at all possible. In evaluating land for its preservation potential, soil maps can be especially helpful, especially to find hydric soils whose drainage has been altered by drain tiles.

Various techniques to preserve farmland have been developed and applied nationally. In the Chicago area, tax assessments can reflect agricultural land values if the owner agrees not to develop the land for ten years. Kane, McHenry, and Will Counties in northeastern Illinois have defined prime agricultural areas and sought, with mixed success, to keep them from being developed. One tool available to counties is agricultural zoning, but their authority to zone is preempted once a nearby municipality annexes the land. Few municipalities have identified farmlands to be preserved in their comprehensive plans.

One farming practice that can affect biodiversity is the setting aside of certain lands for conservation purposes, using subsidies available under the U.S. Department of Agriculture Conservation Reserve Program (CRP). Currently, 7,348 acres of farmland have been set aside under ten-year contracts in the collar counties of Illinois. CRP has already been shown to help stabilize or even increase previously declining bird populations, including those of Henslow's sparrow, Grasshopper sparrow, and meadowlark. The more recently established Conservation Reserve Enhancement Program (CREP) includes state matching funds for contracts ranging from 15-year to permanent easements. However, in the Illinois portion of Chicago Wilderness, CREP is only available for floodplains and wetlands in the Lower Fox River Valley.

Farmers can also help preserve natural communities by maintaining vegetative filter strips of at least 25 feet adjacent to streams and by keeping livestock waste out of streams. Also, farmers owning wetlands and wood lots containing important native communities can help preserve them by establishing adjacent buffer areas. The federal and state Departments of Agriculture should use educational programs to encourage the application of best management practices to such areas.

11.3.4 Private owners of large, low-density, non-agricultural properties

Many privately owned, non-farm properties scattered throughout the region contain extensive open spaces that support or could support natural communities or at least a variety of native species. Prime examples are the Morton Arboretum, the Marshall Field estate in Lake County, Illinois, and the Max McGraw Wildlife Center in East Dundee. Some newer private housing subdivi-

sions are incorporating open space and natural areas into their design, such as the Prairie Crossing development in Grayslake and the Coffee Creek development in Chesterton. Other examples include golf courses, corporate headquarters such as the Sears property in Hoffman Estates, Tel Labs in Bolingbrook, and private residences on lots of five or more acres. Some, like those mentioned above, are already using native landscaping or managing natural communities within their properties. Their accomplishments should be made more widely known so that other property managers can learn to develop similar strategies. Section 11.3.2 discusses natural landscaping; Appendix 9 details the cost savings it offers.

Any private landowner whose property contains or buffers remnant natural communities can grant protective easements or take other measures to help assure the preservation of biodiversity. Chapter 8 discusses the actions available to private owners.

11.3.5 Residential property owners

Residential properties can play a role in Chicago Wilderness by providing habitat. Small yards in urban settings have limitations but they can play an effective role in enhancing bird habitat especially during the migratory season, diversifying the native species composition of urban trees and shrubs, and providing local environmental education opportunities. For those with larger lots, homeowners can provide a broader base of restoration activities with natural landscaping which creates micro-habitats for birds and insects. Natural landscaping slows runoff and increases water absorption, a hydrological impact with benefits to stream and river biodiversity and groundwater-fed wetlands.

Lots which adjoin forest preserves or nature preserves may contain native soil organisms, seed and plant stock and may be migration corridors for amphibians, reptiles, insects and other fauna. Simple restoration techniques in these situations may allow a yard to blossom into usable habitat in a very short period of time.

Lots which adjoin, share or include detention ponds can play a role in enhancing the water quality and biodiversity of our region's streams and rivers by creating wetland edges, planting deep-rooted plants on the berms and higher ground, and if designed as "dry ponds," supporting their retrofitting into wet pond/wetland habitats.

Larger lots can play an important role in regional habitat enhancement. Aside from the suggestions described above, larger residential acreages can create more diverse restorations. An increasing number of private restorations have sustained 100-200 native plant species. Larger lots can restore natural hydrological functions (e.g., total

absorption of rainwater in most storm events). They can also participate in cooperative long term natural resource management efforts with nearby forest preserves and natural area management agencies. For a list of techniques for committing private property to local environmental management initiatives, see Section 8.2.

Benefits to biodiversity are both direct and indirect. Direct benefits include providing habitat for organisms that rely on native plants for food and shelter such as butterflies and migrating birds. Indirect benefits include educating people about native ecosystems and gaining their interest and support for protecting and restoring their natural heritage. Further benefit can be provided by owners of land close to natural areas by providing native habitat that has the effect of expanding the size of the protected area.

11.4

Role of volunteers

11.4.1 Importance of volunteers

Volunteerism has a rich history in American tradition. Volunteer firefighters and paramedics continue to play essential roles in many areas even today. Legions of volunteers provide vital assistance in hospitals, museums, botanical gardens, and other institutions across the country.

In the Chicago region, volunteers have played vital roles in preserving biodiversity. Many of the member organizations of Chicago Wilderness involve volunteers in a wide variety of activities, ranging from hands-on restoration through teaching to advocacy. Volunteers often do important work that otherwise would not get done. Crucial management can sometimes be omitted or delayed because there are simply not enough staff resources available. Volunteers are motivated by knowing that species populations will die out without their help. Over the years, restoration volunteers have developed techniques and a culture that makes this work both effective and fun for thousands of people. Many volunteers have developed considerable expertise. These skilled volunteers are an important part of the conservation team of many agencies. There is room for participation by many thousands more volunteers through the various programs of Chicago Wilderness member organizations.

Volunteers provide a major resource as docents, guides, monitors, and workers. Volunteers physically clean up streams, monitor lakes and streams, maintain bird counts, support scientific studies by gathering data, and restore

native ecosystems on public land. Restoring ecosystems includes controlling exotic species, removing brush, conducting prescribed burns, and gathering, processing, and planting seeds. Considering the magnitude of the need to manage publicly owned land for biodiversity, a substantial increase in volunteer activity appears to be the only practical option. In fact, one measure of the success of this plan will be the extent to which volunteers are involved in implementing its recommendations.

Chicago-area forest preserve and conservation districts have long recognized how volunteers can help them to carry out their mission. The Illinois Association of Conservation and Forest Preserve Districts has encouraged member districts to emphasize public participation in natural-resource management by providing opportunities for volunteering. The recommendations emphasize that the districts should provide volunteer and service groups with staff support. Volunteers can be an important means of achieving the fundamental goals and purposes of conservation organizations. They are a valuable extension of paid staff and can have a powerful presence because of their numbers, distribution, and willingness to be active after business hours and on weekends.

Volunteer programs are strongest and most effective when they encourage volunteers to be deeply involved and to have a sense of real connection to the places they work. The full potential of volunteers is not simply as laborers, but as self-motivated, creative owners involved in planning, organizing, implementing, and evaluating projects. Empowering volunteers to apply their energy and creativity under the guidance of land-owning organizations offers immense potential. They are stewards of public land, acting on behalf of the public in the public interest.

11.4.2 Strengthening volunteer programs for protection and restoration of biodiversity

Volunteers should be invited to be partners in planning and implementing land management. This strengthens the ties between volunteers and the host organization and ensures consistency and continuity. Time donated by volunteers should result in accomplishing important additional tasks, not performing work otherwise expected of staff. Thus, the host organization should use volunteer help in defining and building the volunteer program itself.

Recommendations

- ✓ Land-managing agencies should invite volunteers to be partners both in planning and in implementing land management.

- **Specific actions for host organizations**

- ✓ Develop a strategy for involving volunteers. Identify functions and tasks to be accomplished by volunteers.
- ✓ Provide opportunity for personal satisfaction in accomplishing tasks that are needed for restoration. People serve as volunteers because they find satisfaction in the work. Successful volunteer programs build on this fact to accomplish the purposes of the organization.
- ✓ Remove barriers. Make it easy and inviting for volunteers to contribute time and energy. If requirements and/or qualifications are necessary, provide ways for volunteers to earn them through training or certification based on tests of ability or knowledge.
- ✓ Provide an organized context for volunteer activities. At a minimum, provide a stable set of ground rules to accommodate volunteer efforts and involve volunteer leaders in developing them.
- ✓ Encourage volunteers to adopt or take “ownership” for specific functions or places.
- ✓ Identify a specific person within the host organization as the central contact for volunteers.
- ✓ Provide recognition for volunteers regularly.
- ✓ Provide support for a volunteer newsletter and related communications that offer education and information on volunteer opportunities.
- ✓ Provide tools or other necessary resources where possible.
- ✓ Provide opportunities for face-to-face contact between volunteer leaders and organization staff.
- ✓ Provide support with heavy equipment operated by staff if needed and possible.
- ✓ Develop long-term site plans for restoration and protection and annual work plans for activities to complete them. Include volunteers in the planning process and identify their role clearly.
- ✓ Have experienced volunteer leaders, trained and certified by the landowning agency, provide on-site supervision of most volunteer activities.

- **Training and certification**

- ✓ Develop criteria for various functions and tasks and facilitate training to ensure expertise in them.
- ✓ Certification is appropriate for some activities, including applying herbicide on public land and

participating in prescribed burns. In such cases it is important to establish clear requirements and the means of meeting them such as training or testing at convenient times and places.

- **Volunteer leaders**

- ✓ Leadership among volunteers develops as people gain experience and knowledge. Those willing to accept and provide leadership should be encouraged to do so and should be given added responsibility and recognition.
- ✓ The Volunteer Stewardship Network (see below) should be supported and recognized as a valuable asset in developing leadership, expertise, and overall membership in conservation programs.

11.4.3 Citizen scientists and the Volunteer Stewardship Network

An important type of volunteer is the citizen scientist, who enjoys learning scientific aspects of the local ecology. Such individuals may become involved in education, monitoring, research, or various stewardship activities. They represent a major resource and are often core members of volunteer programs.

The Volunteer Stewardship Network is an unincorporated organization of self-motivated site stewards and citizen scientist/ecologists who have worked with many land managers to lead ecosystem protection and restoration. These volunteers, who serve as leaders for thousands of other volunteers in our region, work to maintain communication among their groups and to build collective expertise. As volunteers become more invested in the success of natural-areas management and assume leadership roles within the network, they both strengthen the network and increase the number and quality of volunteers.

The Illinois EcoWatch Network is a volunteer ecosystem monitoring program coordinated through the Illinois Department of Natural Resources, Division of Energy and Environmental Assessment. EcoWatch volunteers are trained as Citizen Scientists to monitor streams, forests/woodlands, prairies, wetlands, and urban green spaces using biological indicators. EcoWatch arose from research indicating a need for monitoring data collected at a large number of sites using systematic and consistent methods. EcoWatch monitoring programs were designed by state scientists who are responsible for analyzing the data collected, with input from the broader scientific community.

11.4.4 Examples of successful volunteer programs

One example of a successful volunteer-driven program is the Mighty Acorns. This educational program involves many adult volunteers, working through twelve partner agencies, who work with schools to introduce grade-school children to natural areas and to adopt a field site that they visit three times each year during different seasons. Working in groups of five to seven per adult volunteer, the children participate in restoration work such as removing weeds and brush or gathering and planting seeds. This hands-on approach with ample instruction brings children into contact with nature in a way that most have not experienced.

Other very successful local volunteer programs include the Butterfly Monitoring Network, the Orchid Recovery Project, the Bird Conservation Network, EcoWatch, the Interreligious Sustainability Project, and many groups engaged in on-the-ground ecological restoration in every county in northeastern Illinois as well as several counties in Indiana.

11.5

Conflict resolution and intergovernmental cooperation: recommending a comprehensive process for managing growth

One of the thorniest issues in the management of public lands is how to satisfy competing user groups. Those who enjoy active outdoor recreation such as horseback riding, biking, and field sports often find themselves competing with those who wish to see fragile natural areas left undisturbed. Transportation planning often pits the need for transportation facilities against land-use plans and the need to protect natural resources. Since governmental agencies have an obligation to serve all reasonable interests, the resolution of disputes over use can become an arduous process. Various conflict-resolu-

tion processes have been developed, but, at all geographic scales from region-wide transportation planning to site design, the best outcomes usually involve creative planning and compromise among all interested parties. A purpose of this plan is to heighten local officials' understanding of biodiversity and its dependence on place. Officials must know how to value local habitats and ecological functions so that they can be fully considered in dealing with controversies and competing pressures.

Governments, too, frequently compete for land. Annexation disputes and disagreements over proposed uses of land are common. One frequent course of action has been to develop intergovernmental boundary agreements well in advance of actual land development. The municipalities in the corridors for the proposed extensions of the north-south toll road in Lake and Will Counties have recently negotiated non-binding intergovernmental agreements on the future uses of land, including the designation of permanent open spaces. The municipalities in the vicinity of the proposed third airport in Will County have done the same. The effectiveness of these agreements has yet to be tested, as none of these projects has yet received final approval for construction.

To further the goals of this plan and to establish a smart and equitable approach to resolving conflicts, we recommend a coordinated, intergovernmental, region-wide, comprehensive process for managing growth. Appendix 10 contains a recommended set of procedures for establishing and carrying out such a process. To make this recommendation tangible, the Appendix uses an example of planning a transportation corridor (the example presented is for a major arterial corridor, such as Strategic Regional Arterial, where complex, intergovernmental issues call for such a process). This example illustrates the actions, procedures, and considerations that should be included to ensure careful weighing of a full set of values and outcomes before making decisions. The recommendations in the example apply to residential-area planning, planning for economic development, and open-space planning.

Appendix 1

Chicago Wilderness Terrestrial Community Classification System

This community classification system for The Chicago Wilderness region has several purposes: 1) to facilitate the understanding of biodiversity (genes, species, communities); 2) to serve as a tool for the assessment of the status of communities (how much is left, how fragmented, how degraded are they, threats, etc.); and 3) to aid land managers in their work of restoring and maintaining diverse native ecosystems.

Introduction

The most influential early systems for classifying the Chicago region's natural communities for conservation purposes were those of Curtis (1959) and White (1978). Both cases, depended on finding and describing "undisturbed" sites. These systems were of tremendous value to conservation. But they worked best for prairie and closed forest communities—not as well for the open oak communities that were so characteristic of this region and which are of special conservation concern today. The fire-dependent ancient timbered lands of the tallgrass region have been more carefully considered during the decades since the work of Curtis and White. The Nature Conservancy, the USDA Forest Service, the Midwest Oak Ecosystems Recovery Plan, the Illinois DNR (Bowles, 1996) and others have developed a variety of approaches to handle the region's oak communities. These differ from Curtis and the Illinois Inventory in two ways. First, they add additional categories (for example woodlands) and they clarify the definitions of some of their original components (for example savannas and shrublands). Second they seek to be more applicable to degraded lands (including restorable lands).

The community descriptions as presented here are based upon relatively high quality sites (i.e. sites which are less disturbed (closer to presettlement condition), and have a relatively high proportion of their species intact). Sites which are disturbed or degraded tend to carry a lower portion of their original character and biota, and thus are less likely to smoothly fit the community description. However, it is still important to identify these degraded sites as a degraded variant of their original community type (rather than describing such areas as "new community types" or as "non-communities"). The more degraded a site becomes, the less it will tend to have in common with the high quality community description, and the more one may be forced to rely on peripheral information to correctly identify a given area. For example, a very degraded mesic savanna may have 85% tree canopy cover, and no presence of grasses or sedges. This will make site identification difficult if one simply relies on the literal description of high quality "mesic savanna". However, if one notices that the site in question has large, scattered bur oaks with large lower branch scars, and the site is on a very gently sloping moraine, one may determine that the site is a degraded mesic savanna.

The community descriptions are a summary of average conditions. In reality, ecologists have found that no two sites are exactly alike. Therefore, classification is an exercise in aggregating unique sites which have some features in common. By presenting average, or typical, or modal information, the community

descriptions presented here only indicate what one is going to find in many cases, but not all cases. It is impractical or unrealistic to define communities based on exact criteria, such as "high quality mesic savannas all have at least 5% coverage by bur oak". Such rules always seem to have exceptions, and therefore, it is best to simply describe the average or most typical community characteristics.

It is important to be aware of the affects of past land uses on the structure and species composition of modern communities. For example; presents of large lower branches, nearly sweeping the ground, on oak trees are very likely the result of historic pasturing on the site and not indicative of presettlement community structure. Frequent fires would have fire pruned such lower branches. Abundance of some understory or canopy trees may be the result of grazing selection by various species of domestic livestock. Ironwood (*Ostrya virginiana*) and Hawthorne (*Crataegus* spp.), understory species, are grazing increasers as is white ash (*Fraxinus americana*). Such grazing impacts can also be seen in the herbaceous layer as well. Pennsylvania sedge (*Carex pennsylvanica*) and spring beauty (*Claytonia virginica*) increase under light grazing while May apple (*Podophyllum peltatum*) is an increase under heavy grazing pressure.

Deer browsing is also an important factor to be aware of, especially as it relates to natural communities within large urban areas. In these areas deer herds are usually uncontrolled and communities are highly fragmented resulting in intense browsing pressure. Deer browsing has been shown to be a strong influence on the structure and species composition of natural communities. Deer selectively browse certain species such as oaks while having less impact on ash, maple, and a number of shrub species. Deer have a tremendous influence on the herbaceous layer as well. Many palatable species such as orchids and trilliums are greatly reduced in number or eliminated while others, such as *Dentaria laciniata*, are greatly increased.

It is important to realize that no communities possess discrete or definite boundaries, especially on larger less fragmented sites. Therefore, any of these communities is transitional between other communities, especially on similar substrates or with similar physiognomic or moisture conditions. For example; a dry-mesic sand prairie is transitional between dry and mesic sand prairie. This transitional characteristic is especially true when either; physiognomy, moisture, substrate, or combinations of these characters are the same. Because of this transitional nature of communities, any one community description needs to include those sites which would almost meet the requirements for the next wetter community and those sites which would almost meet the requirements for the next drier community as well as those which fall exactly in the middle of the community type. It is important to be aware of the transitional properties of classification. The system presented here is of a coarser scale than some classification systems which will serve to make some delineation of community less difficult. It should be easier to separate a wet community from a mesic community than it is to separate one which is wet from one which is wet-mesic.

Community descriptions include lists of dominant and characteristic species of both plants and animals. Dominant species are those which express the most influence on the rest of the community. In the case of wooded communities, this would refer to the largest most frequently occurring trees. In herbaceous communities, this would refer to species exhibiting the greatest cover and frequency. Characteristic means those species, which although not necessarily abundant, have a relatively high probability of being found when in the community and a relatively low probability of being found when not in the community. These lists best describe the community when being found as a group of species rather than as individual species.

The classification system below was synthesized from the systems currently most used in the Chicago region including all those listed above.

Major vegetation types: forest, shrubland, grassland

Our forested communities include all communities that are dominated by trees (that is the various forest, woodland and flatwoods types), with an average canopy cover of 50% or greater. There are three characteristics: (1) wetness (that is whether an area is wet, mesic (as it is used here, mesic refers to average moisture, the soil being moist for most of the growing season) or dry), (2) upland/floodplain, distinguished by the absence or presence of regular flooding, and (3) forest/woodland, originally 100-80% canopy for forests and 80-50% canopy for healthy woodlands (but the canopy coverage of modern examples does not define these communities; the communities are defined by the remnant biota). The woodland and forest communities occur mostly on loamy soils although some may occur on gravel. Another forested community, flatwoods, is the result of specialized soil conditions and the influence of ground water at or near the surface. Flatwoods occur on level or nearly level topography. Floodplain forests are classified separately from upland forests because periodic flooding greatly affects the soil, fauna, and flora in floodplains.

The grassland communities include the prairies, shrublands, and savannas (those communities which developed with less than 50% tree cover). Compared to forest types, there are more, relatively good, examples of grassland subtypes (with the exception of savannas) that have been carefully studied by conservation biologists. As a result these grassland community descriptions have been developed from a larger base of knowledge. Grasslands, also unlike wooded lands, do not have the structural complexity and post settlement disturbance factors to complicate their classification. Shrublands were a substantial component of the Chicago region's original landscape. However no high quality examples of most types have survived, and they have been relatively little studied. This community type may express itself more clearly after more land is restored.

Levels of the community classification are defined as follows: Forested communities, prairies, etc. are community classes. Within community classes, using prairie as an example, the natural communities are fine-textured-soil, sand, gravel, dolomite. Within natural community types, dry-mesic, mesic, etc. are subtypes.

Forested communities

Upland forest

(Developed under 80-100% canopy cover.) This natural community has a multi-layered structure with canopy, sub-canopy, shrub, and herbaceous layers. Microtopographic-microclimatic variation, fire return frequency and intensity, soil moisture, wind throw and its frequency, and disease outbreaks allowed for the development of structural and compositional features characteristic of upland forests. 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 than for other woodland or savanna types. 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 based on soil moisture fit into the upland forest category.

- Dry-mesic. This is an oak dominated, multi-layered community with a higher incidence of disturbance from fire than the next two subtypes. The under story is dominated by shade and partial shade tolerant herbaceous species. Topographic features such as moraine slopes and/or soil types contribute to better drainage. Due to the exposure to droughty conditions and higher fire frequency, there is less or no significant presence of sugar maple.

Dominant plants: *Quercus alba*; Sub-dominant plants: *Quercus rubra*, *Quercus velutina*

Characteristic plants: *Amelanchier arborea*, *Carya ovata*, *Fraxinus americana*, *Ostrya virginiana*, *Poa sylvestris*, *Ribes missouriense*, *Trillium flexipes*, *Viburnum prunifolium*

Characteristic animals:

- Mesic. Soil that have moisture available for most of the growing season results in a dense overstory and a high importance of sugar maple and, in undisturbed stands, an under story of shade-tolerant species. These forests occur on north-facing slopes, in ravines, and on level soil with moderately high available moisture and in situations where topographic features, such as large rivers and lakes, afforded these sites protection from frequent or intense fires. The *Acer* spp. component of this type typically occupied small fire refugia but have spread widely since settlement. Although fire frequency was less than in dry-mesic forests, the fire frequency was thought to have allowed for the reproduction of oak and other light demanding species which are gradually lost in the absence of fire.

Dominant plants: *Acer saccharum*, *Quercus rubra*; Sub-dominant plants: *Acer nigrum*, *Ostrya virginiana*, *Tilia americana*

Characteristic plants: *Actaea rubra*, *Adiantum pedatum*, *Aralia racemosa*, *Carex laxiculmis*, *Carex woodii*, *Caulophyllum thalictroides*, *Circaea lutetiana*, *Dicentra cucullaria*, *Dryopteris goldiana*, *Hepatica acutiloba*, *Jeffersonia diphylla*, *Orchis spectabilis*, *Staphylea trifolia*, *Trillium grandiflorum*, *Uvularia grandiflora*, *Viburnum acerifolium*

Characteristic animals: Wood thrush, ovenbird

- Mesic forest (variant). A variant of the mesic forest occurs in the eastern portion of the Chicago Wilderness region, especially in Indiana, where *Fagus grandifolia* becomes a co-dominant with sugar maple.

Dominant plants: *Acer saccharum*, *Fagus grandifolia*

Characteristic plants: *Carex careyana*, *Carex leptoneura*, *Carex plantaginea*, *Cornus rugosa*, *Dryopteris noveboracensis*, *Galium lanceolatum*, *Lindera benzoin*, *Lonicera canadensis*, *Panax trifolius*, *Panicum commutatum ashei*, *Pyrola asarifolia purpurea*

Characteristic animals: ovenbird, red-eyed vireo

- Wet-mesic. This community experiences high moisture levels and poor drainage due to level topography. The moist silty loamy soil conditions are associated with shallow drainage-ways and seepage areas. These forests are functionally, compositionally, and structurally different from floodplain forests.

Dominant plants: *Quercus rubra*, *Acer saccharum*; Sub-dominant plants: *Juglans nigra*, *Ulmus americana*

Characteristic plants: *Carex davisii*, *Carpinus caroliniana*, *Celtis occidentalis*, *Cornus alternifolia*, *Impatiens capensis*, *Quercus macrocarpa*, *Ulmus rubra*

Characteristic animals:

Floodplain forest

(>80% canopy cover.) Floodplain forests are on the floodplain of rivers and streams. The communities are [determined] shaped by the frequency and duration of flooding, nutrient and sediment deposition, and by the permeability of the soil. The canopy cover is similar to upland forest but with more open understories due to the frequent flooding. The soil moisture classes range from wet-mesic to wet

- Wet-mesic. This is the most common floodplain forest community. This subtype receives less frequent and intense flooding than wet floodplains. As a result the understory is more well developed with a richer herbaceous layer.

Dominant plants: This forest is usually a mixture of trees, with no clear dominants.

Characteristic plants: *Acer negundo*, *Acer saccharinum*, *Actinomeris alternifolia*, *Asarum canadense*, *Celtis occidentalis*, *Chaerophyllum procumbens*, *Ulmus nigra*, *Laportea canadensis*, *Lindera benzoin*, *Lysimachia ciliata*, *Mertensia virginica*, *Sambucus canadensis*, *Smilax tamnoides*, *Ulmus americana*, *Ulmus rubra*

Characteristic animals: massasauga rattlesnake, barred owl, red-shouldered hawk, acadian flycatcher, yellow-throated vireo, prothonotary warbler

- Wet. Flooding in this community is so frequent or prolonged that the diversity of trees is lowered. The under story and often the overstory are open. Nettles and vines are often prominent.

Dominant plants: Any of the following species may be locally dominant; *Acer saccharinum*, *Populus deltoides*, *Salix nigra*

Characteristic plants: *Acer negundo*, *Ambrosia trifida*, *Boehmeria cylindrica*, *Carex grayi*, *Cinna arundinacea*, *Echinocystis lobata*, *Elymus virginicus*, *Fraxinus pennsylvanica*, *Laportea canadensis*, *Pilea pumila*, *Rudbeckia laciniata*, *Urtica procera*, *Vitis riparia*

Characteristic animals: massasauga rattlesnake, barred owl, red-shouldered hawk, acadian flycatcher, yellow-throated vireo, prothonotary warbler

Flatwood

(50-80% canopy cover or less.) Flatwoods occur on level or nearly level soil that has an impermeable or slowly permeable layer (Aquiclude) which causes a shallow, perched water table. The plants and animals must adapt to seasonally wet conditions from the perched water table; and then they must withstand summer dry conditions because the slowly permeable soil layers stop replenishment of soil moisture from capillary action and restrict rooting and burrowing depth. Because soil moisture fluctuates so widely by the season, the moisture class is not in the natural community name. Plants typical of dry and dry-mesic soil grow on slight rises, and depressions contain ephemeral and seasonal ponds. The temporary, fishless, ponds provide breeding habitat for amphibians and support diverse aquatic invertebrates. Many flatwoods had a higher component of savanna vegetation in presettlement times.

- Northern. This community is found associating with the Valparaiso, Tinley, and Lake Border Morainic Systems on poorly drained, nearly level ground. Vernal ponds are characteristic.

Dominant plants: *Quercus bicolor*, *Ulmus americana*, *Fraxinus nigra*

Characteristic plants: *Aster ontarionis*, *Cardamine bulbosa*, *Carex bromoides*, *Carex crus-corvi*, *Carex lupulina*, *Carex muskingumensis*, *Carpinus caroliniana var. virginiana*, *Cephalanthus occidentalis*, *Cinna arundinacea*, *Corylus americana*, *Fraxinus pennsylvanica subintegerrima*, *Glyceria striata*, *Habenaria psycodes*, *Illex verticillata*, *Impatiens capensis*, *Iris virginica var. shrevei*, *Onoclea sensibilis*, *Ranunculus flabellaris*, *Rubus pubescens*, *Saxifraga pennsylvanica*, *Scutellaria lateriflora*, *Ulmus rubra*, *Viburnum rafinesquianum*

Characteristic animals: Appalachian eyed-brown butterfly, blue spotted salamander, tiger salamander, wood frog, tree frog, spring peeper, chorus frog, wood duck, solitary sandpiper, red-headed woodpecker

- Sand. This is a flatwoods community which develops on soils with two distinct layers: a meter or more of acidic sand over silty clay. This community is not well pronounced in northeastern Illinois and is more typically found in the southern portion of the Chicago Wilderness Region. In the region these communities are found associated with the Chicago Lake Plain and old glacial lake beds in the southwestern portion of the region. Where natural firebreaks occur, sand flatwoods occur rather than shrub prairie or wet-mesic prairie. In the absence of fire, these prairie communities can succeed to sand flatwoods.

Dominant plants: *Quercus palustris*, *Acer rubrum*; Sub-dominant plants: *Quercus alba*, *Quercus rubra*, *Fraxinus americana*

Characteristic plants: *Eleocharis tenuis* var. *verrucosa*, *Maianthemum canadense*, *Mitchella repens*, *Nyssa sylvatica*, *Osmunda cinnamomea*, *Vaccinium angustifolium*

Characteristic animals:

Woodland

(Originally 50-80% canopy cover.) Woodlands developed under a canopy cover intermediate between savanna and forest. Many original woodlands today have canopy cover greater than 80% (and thus appear to fit the forest structure category) due to fire suppression. Such sites can be most easily recognized by failure of the canopy tree species to reproduce with few if any canopy tree species represented in the seedling or sapling layer. These communities may have had a well developed shrub layer which has become shade suppressed in modern times. A conservative woodland shrub and herbaceous layer may be present in the best quality remnants. Woodlands may differ from savannas in having significantly higher populations of spring ephemerals.

- Dry-mesic. These are woodlands situated on well drained soils and on the tops or south-facing slopes of moraines. These soils and topographic conditions permit for better drainage and drier soil conditions, and greater fire frequency.

Dominant plants: *Quercus alba*; Sub-dominant plants: *Fraxinus americana*, *Quercus rubra*, *Quercus macrocarpa*

Characteristic plants: *Agrimonia pubescens*, *Anemone thalictroides*, *Aster shortii*, *Carex rosea*, *Carex cephalophora*, *Carex pensylvanica*, *Corylus americanus*, *Gallium triflorum*, *Geranium maculatum*, *Heiraceum scabrum*, *Helianthus decapetalus*, *Krigia biflora*, *Luzula multiflora*, *Silene stellata*, *Solidago ulmifolia*, *Trillium recurvatum*, *Viburnum prunifolium*

Characteristic animals: white-footed mouse (*Peromyscus leucopus*), eastern chipmunk, great crested flycatcher, eastern wood pewee, downy woodpecker, fox squirrel

- Mesic. These woodlands occur on more level terrain with loamy soils of a higher moisture content than dry-mesic sites.

Dominant plants: *Quercus rubra*; Sub-dominant plants: *Acer nigrum*, *Quercus alba*

Characteristic plants: *Asclepias exaltata*, *Carex hirtifolia*, *Carex jamesii*, *Caulophyllum thalictroides*, *Cirsium altissimum*, *Geranium maculatum*, *Lithospermum latifolium*, *Panicum latifolium*, *Podophyllum peltatum*, *Prenanthes alba*, *Prunus virginiana*, *Taenidia integerrima*, *Trillium flexipes*, *Viburnum lentago*

Characteristic animals: red-headed woodpecker, yellow-billed cuckoo, indigo bunting, Baltimore oriole, blue-gray gnatcatcher, eastern wood pewee, great crested flycatcher, Cooper's hawk, rose-breasted grosbeak blue-winged warbler

- Wet-mesic. These woodlands often interdigitate with northern flatwoods.

Dominant plants: *Quercus bicolor*, *Salix nigra*; Sub-dominant plants: *Fraxinus pennsylvanica*, *Quercus macrocarpa*, *Quercus coccinea*

Characteristic plants: *Arisaema dracontium*, *Cardamine douglassii*, *Carex grisea*, *Cinna arundinacea*, *Floerkea proserpinacoides*, *Isopyrum biternatum*, *Juglans nigra*, *Menispermum canadensis*, *Phlox divaricata*, *Polemonium reptans*, *Ranunculus septentrionalis*, *Ribes americanum*, *Sanicula gregaria*

Savanna communities

(10-50% canopy cover.) Savannas are wooded communities with graminoid groundcover. They developed under an average tree canopy cover 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 in presettlement times. They were among the most widespread and characteristic communities in Illinois, but few high quality stands remain. Most remnants have obviously been changed. 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. Two savanna natural communities can be named: fine-textured-soil savanna and sand savanna. Individual savanna subtypes are distinguished by soil moisture.

Fine-textured-soil savanna

This typical savanna natural community occupies fine-textured-soil on till plains and lowlands. Savannas occurred as an ecotonal belt along streamside forests, as "islands" in prairie or forest, and on extensive areas of hilly land. Three subtypes based on soil moisture are described.

- Dry-mesic. In this community, soil moisture levels are analogous to dry-mesic upland forest. Grass height and the composition of the herbaceous vegetation are analogous to that of dry-mesic prairie.

Dominant plants: *Quercus macrocarpa*, *Quercus velutina*; Sub-dominant plants: *Juglans nigra*, *Quercus alba*, *Quercus coccinea*

Characteristic plants: *Andropogon scoparius*, *Corylus americana*, *Helianthus divaricatus*, *Silene stellata*, *Smilax lasion-
eura*, *Sorghastrum nutans*

Characteristic animals: eastern bluebird, red-headed woodpecker, field sparrow, fox squirrel, prairie deer mouse (*Peromyscus maniculatus bairdii*)

- Mesic. This community is found at the base of moraine ridges and (rarely) as islands in welland vegetation.

Dominant plants: *Quercus macrocarpa*; Sub-dominant plants: *Quercus alba*, *Quercus coccinea*

Characteristic plants: *Andropogon gerardi*, *Andropogon scoparius*, *Heliopsis helianthoides*, *Lathyrus venosus*, *Sorghastrum nutans*, *Thaspium trifoliatum*

Characteristic animals: silvery blue butterfly, red-headed woodpecker, eastern bluebird, northern flicker, eastern kingbird, black-billed cuckoo, blue-winged warbler

- Wet-mesic. These communities often interdigitate with northern flatwoods.

Dominant plants: *Quercus macrocarpa*, *Quercus bicolor* (often lacking in western sections); Sub-dominant plants: *Quercus coccinea*

Characteristic plants: *Veronicastrum virginicum*

Characteristic animals: hobomok skipper, silvery checker spot

Sand savanna

The soils are very sandy, with little humus. Sand savannas are associated with dune and swale topography and beach ridges. The undulating topography presumably limited the severity of fires and allowed a savanna to develop instead of a sand prairie. The herbaceous vegetation of a sand savanna is quite similar to that of sand prairies. Three sand savanna subtypes are distinguished by soil moisture.

- Dry. This community occurs on excessively drained soils of dunes.

Dominant plants: *Quercus velutina*

Characteristic plants: *Carex pensylvanica*, *Andropogon scoparius*, *Koeleria cristata*, *Lupinus perennis*, *Opuntia* sp., *Stipa spartea*

Characteristic animals:

- Dry-mesic. There is some development of an A horizon in this community, because of its low topographic position or because it occurs on north-facing or east-facing slopes. These topographic positions and slope aspect provide higher soil moisture, cooler temperatures, and higher relative humidity which reduce fire intensity and frequency.

Dominant plants: *Quercus velutina*, *Quercus alba*

Characteristic plants: *Aster linariifolius*, *Carex pensylvanica*, *Comandra richardsonii*, *Helianthus divaricatus*, *Phlox pilosa*, *Stipa spartea*

Characteristic animals: olympia marble-wing, karner blue butterfly, Indian skipper.

- Mesic. This subtype is found only in Indiana and in close proximity to the shore of Lake Michigan. This type tends to occur in between ridges where microclimatic conditions tend to be more humid and soils wetter.

Dominant plants: *Quercus alba*, *Quercus velutina*, *Betula papyrifera*

Characteristic plants: *Andropogon gerardi*, *Aralia nudicaulis*, *Maianthemum canadense*, *Cypripedium reginae*, *Salix humilis*

Characteristic animals:

Shrubland communities

Shrublands, known also as barrens, were derived by drought-induced landscape-level fires in woodlands or savannas. Windstorms and canopy-clearing fires combined to reduce these communities to grub sprouts and shrubs interspersed with grasses and sedges. Animal- and wind-borne seed dispersal accounted for additional shrub invasion. Shrubland formation was favored in landscape positions with fire intensities reduced from that in prairies, as on the leeward sides of wetland, at woodland/savanna edges, on coarse droughty substrates, and on more rolling topography. Canopy coverage in shrublands is <10%, as in prairies. Structure is characterized by a temporally and spatially dynamic mosaic of shrubs, grubs (multiple-stemmed resprouted trees), grasses, forbs, and small tree saplings. Shrub and grub coverage ranges from 30% to 80%.

Fine-textured-soil shrubland

These shrublands occurred on rugged glacial moraines and kame complexes, and intervening undulating ground moraine and outwash plains, respectively. They were most often associated with the western edges of brushy woodlands, from which they were derived as hot fires followed prolonged droughts. Small impenetrable copses of fire-tolerant shrubs alternated with larger less densely woody areas and grassy openings. Two subtypes based on soil moisture are recognized.

- Dry-mesic. Located on well-drained uplands, these shrublands were especially characterized by copses of hazelnut and plum, and numerous oak grubs. A matrix of upland prairie, savanna, and woodland graminoids provided the major fuel for the maintenance fires which prevented succession to woodland. Diversity was very high in thinly wooded openings, and augmented by the intrusion of tongues of prairie during the hottest fires.

Dominant plants: *Andropogon scoparius*, *Corylus americana*, *Danthonia spicata*, *Prunus americana*, *Pyrus ioensis*, *Quercus coccinea*, *Quercus macrocarpa*, *Salix humilis*

Characteristic plants: *Apocynum androsaemifolium*, *Ceanothus americanus*, *Lathyrus venosus*, *Polygala senega*, *Pteridium aquilinum*, *Helianthus divaricatus*

Characteristic animals: silvery blue, coral hairstreak, Edward's hairstreak, blue racer, bobwhite, field sparrow, lark sparrow, yellow-breasted chat, Bell's vireo

- Wet-mesic. Wet mesic shrublands occupied poorly drained undulating lowlands, often lying between wetlands, which acted to reduce fire frequency, and woodland or savannas. Wetland shrubs, such as willows and dogwoods, were the principal woody component of these shrublands. Tall thick grassy openings acted as fuels for occasional high intensity fires. Diversity was highest on slightly better drained inclusions.

Dominant plants: *Calamagrostis canadensis*, *Cornus stolonifera*, *Elymus virginicus*, *Quercus macrocarpa*, *Salix glaucophylloides*, *Salix petiolaris*, *Spiraea alba*

Characteristic plants: *Asclepias purpurascens*, *Aster lateriflorus*, *Coreopsis tripteris*, *Gentiana quinquefolia*, *Heliopsis helianthoides*, *Onoclea sensibilis*

Characteristic animals: acadian hairstreak, silvery checkerspot, common yellowthroat, willow flycatcher, woodcock, yellow warbler

Sand shrubland

Dune slopes and swale margins of glacial lake plains were the principal location of sandy shrublands. Droughty soils allowed development of a larger graminoid component, facilitating hotter and more frequent fires than on fine-textured-soils. The shrub and grub component was consequently thinner and shorter in stature. Two subtypes based on soil moisture are again recognized.

- Dry-mesic. The extremely well-drained slopes and crests of sand dunes are optimal dry-mesic sand shrubland locations. Black oak grubs, and in the Kankakee Sand Areas region, sassafras copses, are the common woody components, interspersed with prairie grasses, sedges, and forbs characteristic of drier sand savannas and sand prairies. Thinly vegetated patches of sand structurally resembling central Illinois and Wisconsin inland sand barrens communities and lake Michigan foredunes are present in areas of windblown sand or heavy grazing/browsing. Annuals, mosses, earth stars and lichens characterize these microenvironments, which burn infrequently compared to the dominant fire-maintained grass/shrub matrix. Several species of sand savanna and sand prairie reptiles occur in dry-mesic sandy shrublands.

Dominant plants: *Andropogon scoparius*, *Corylus americana*, *Quercus velutina*, *Salix humilis*, *Sassafras albidum*, *Sorghastrum nutans*

Characteristic plants: *Asclepias amplexicaulis*, *Lupinus perennis*, *Opuntia humifosa*, *Phlox bifida*, *Staphylea trifoliata*

Characteristic animals: Edward's hairstreak, karner blue, bull snake, eastern hognose snake, six-lined racerunner, lark sparrow

- Wet-mesic. This community subtype is equivalent to the shrub prairie recognized by the Illinois Natural Areas Inventory, described as dominated by shrubs, prairie grasses, and a continuous ground layer of mosses. This shrubland is virtually restricted to the older better leached acid sands of the Chicago lake plain and Kankakee River sand area. Diversity is high and noted for acid, nutrient-poor soil indicators, including heaths, eastern orchids, and even bog species.

Dominant plants: *Andropogon gerardi*, *Gaylussaccia baccata*, *Panicum virgatum*, *Polytrichum* spp., *Rubus hispidus*, *Salix humilis*, *Spiraea tomentosa*, *Vaccinium angustifolium*,

Characteristic plants: *Aronia prunifolia*, *Bartonia virginica*, *Osmunda regalis*, *Parthenium integrifolium*, *Pedicularis canadensis*, *Vaccinium angustifolium*, *Viola lanceolata*

Characteristic animals: acadian hairstreak, willow flycatcher, woodcock, yellow-breasted chat, yellow warbler

Prairie communities

This community class includes communities dominated by grasses on mineral soil. Trees may be present, but less than 10% of the area has a tree canopy. Four natural communities are recognized: fine-textured-soil prairie, sand prairie, gravel prairie, dolomite prairie.

Fine-textured-soil prairie

This natural community is termed simply fine-textured-soil prairie because it includes the typical, "black-soil" prairies. Soils are deep and fine-textured, usually silt loam or clay loam derived from loess or glacial till, although the prairies may occur on alluvium. Prairie communities in some other natural communities (for example mesic sand prairie) may also have soils with deep, dark A horizons, so the term black soil is not applicable solely to this natural community. Soil moisture for these prairies ranges from dry to wet.

- Dry. Rare for the Chicago region, elevated topographic position provides better drainage than the other two subtypes of this community. Grass heights are usually under three feet.

Dominant plants: *Andropogon scoparius*, *Carex bicknellii*, *Stipa spartea*

Characteristic plants: *Amorpha canescens*, *Euphorbia corollata*, *Helianthus occidentalis*, *Parthenium integrifolium*, *Petalostemum candidum*, *Prenanthes aspera*, *Zizia aptera*

Characteristic animals:

- Mesic. Available moisture being present throughout the growing season allows for maximum plant species diversity and maximum grass and forb height. The grass layer may be only 1 meter tall if *Sporobolus heterolepis* dominates, but it is sometimes 2 meters tall.

Dominant plants: *Andropogon gerardi*, *Sorghastrum nutans*, *Sporobolus heterolepis*

Characteristic plants: *Asclepias sullivantii*, *Baptisia leucophaea*, *Eryngium yuccifolium*, *Heuchera richardsonii*, *Liatris pycnostachya*, *Lithospermum canescens*, *Petalostemum candidum*, *Silphium laciniatum*, *Silphium terebinthinaceum*

Characteristic animals: Franklin's ground squirrel, bobolink, meadowlark

- Wet. Surface water is present during the winter and spring, and the soil is nearly always saturated. Plant species diversity is lower than in other prairie natural communities.

Dominant plants: *Calamagrostis canadensis*, *Carex pellita*, *Carex sartwellii*, *Spartina pectinata*

Characteristic plants: *Cacalia tuberosa*, *Eupatorium maculatum*, *Eupatorium perfoliatum*, *Hypoxis hirsuta*, *Iris virginica* var. *shrevei*, *Lysimachia quadriflora*, *Lythrum alatum*, *Oxypolis rigidior*, *Phlox glaberrima*, *Prenanthes racemosa*, *Senecio pauperulus*

Characteristic animals:

Sand prairie

Soils in this natural community are coarse-textured: sand, loamy sand, and sandy loam can support sand prairie. However, prairies on sandy loam are considered sand prairie only if they are acidic enough to have characteristic plants. Sand prairies are found on sandy outwash plains, lake plains, and valley trains, and the soil moisture varies from dry to wet.

- Dry. The soil lacks a dark A horizon, and grass is less than 1 meter tall. Dry sand prairies are rather rare because the proper topographic position for dry sand usually also reduces fire severity enough to allow a savanna to develop.

Dominant plants: *Andropogon scoparius*, *Calamovilfa longifolia*, *Koeleria cristata*

Characteristic plants: *Arenaria stricta*, *Artemisia caudata*, *Callirhoe triangulata*, *Lithospermum croceum*, *Monarda punctata*, *Opuntia compressa*

Characteristic animals:

- Mesic. This subtype has a deep A horizon in acid sand. Mosses and low shrubs are common, although the shrubs are not dominant. Characteristic mesic prairie forbs such as *Echinacea pallida*, *Ratibida pinnata*, and *Silphium laciniatum* are rare or absent.

Dominant plants: *Andropogon gerardi*, *Andropogon scoparius*, *Sorghastrum nutans*, *Stipa spartea*

Characteristic plants: *Aletris farinosa*, *Aronia melanocarpa*, *Aronia prunifolia*, *Aster umbellatus*, *Calopogon tuberosa*, *Helianthus mollis*, *Liatris aspera*, *Parthenium integrifolium*, *Rubus hispidus*, *Scleria triangulata*, *Solidago speciosa*, *Viola pedata*

Characteristic animals: Fowler's toad, regal fritillary

- Wet. Surface water is present in this subtype for as much as one-third of the year. Wet sand prairie is floristically very similar to wet fine-textured-soil prairie.

Dominant plants: *Andropogon gerardi*, *Calamagrostis canadensis*, *Juncus* spp., *Spartina pectinata*, *Thelypteris palustris*.

Characteristic plants: *Osmunda cinnamomea*, *Osmunda regalis*, *Rhexia virginica*, *Viola lanceolata*, *Xyris torta*

Characteristic animals:

Gravel prairie

This natural community includes prairies on gravel or very gravelly soil. The soils are usually calcareous. Because the gravel provides rapid permeability, the soil moisture classes range from dry to mesic.

- Dry. These prairies are on steep gravel slopes, and the grasses average less than 1 meter in height.

Dominant plants: *Andropogon scoparius*, *Bouteloua curtipendula*

Characteristic plants: *Arenaria stricta*, *Asclepias lanuginosa*, *Aster ptarmicoides*, *Aster sericeus*, *Linum sulcatum*, *Lithospermum incisum*, *Ranunculus rhomboides*

Characteristic animals: ottoe skipper, gorgon checkerspot, grasshoppers in the genus *Arphia*, *Pseudopomala brachyptera* (grasshopper), plains froghopper

- Mesic. Soil moisture is relatively high because of the low topographic position. The height of the grass and the diversity of plant species approach that of fine textured mesic prairie. Calciphilic plants are common because the gravel is usually calcareous.

Dominant plants: *Andropogon gerardi*, *Sorghastrum nutans*, *Sporobolus heterolepis*

Characteristic plants: *Gentiana puberulenta*, *Psoralea tenuiflora*, *Scutellaria parvula*, *Satureja arkansana*, *Valeriana ciliata*

Characteristic animals: Aphrodite, scurfy pea flower moth, leadplant flower moth, *Ammoea lacticlava* (beetle)

Dolomite prairie

Dolomite prairies occur where dolomite is less than 1.5 meters below the surface. Certain common prairie plants are absent because of the shallow soils and high pH. Many other species are restricted to dolomite prairies, but some of these (such as *Desmanthus illinoensis*, *Eleocharis compressa*, and *Satureja arkansana*) are not restricted to specific natural communities. The subtypes range from dry to wet.

- Dry. The soil is extremely shallow to negligible in this subtype, and patches of dolomite pavement are common.

Dominant plants: *Andropogon scoparius*, *Bouteloua curtipendula*

Characteristic plants: *Blephilia ciliata*, *Kuhnia eupatorioides*, *Muhlenbergia cuspidata*, *Penstemon hirsutus*

Characteristic animals:

- Mesic. The soil depth is 15 or more centimeters over dolomite. As bedrock depth decreases, the natural community intergrades with mesic fine-textured-soil prairie, but deeply rooted forbs such as *Baptisia leucantha*, *Baptisia leucophaea*, *Silphium laciniatum*, and *Silphium terebinthinaceum* are absent from mesic dolomite prairie.

Dominant plants: *Andropogon gerardi*, *Sorghastrum nutans*, *Sporobolus heterolepis*

Characteristic plants: *Galium boreale*, *Petalostemum foliosum*

Characteristic animals:

- Wet. The soil is usually quite shallow over bedrock and is frequently saturated, or surface water is present. This is a very rare subtype even in extensive dolomite areas because depressions usually have a deep enough soil layer to support a sedge meadow at this moisture level.

Dominant plants: *Andropogon scoparius*, *Calamagrostis canadensis*, *Carex pellita*, *Deschampsia caespitosa*, *Spartina pectinata*

Characteristic plants: *Cacalia plantaginea*, *Solidago ohioensis*, *Solidago ridellii*

Wetland communities

Wetland communities have saturated or flooded soils for all or most of the year. This condition excludes or greatly reduces oxygen availability to plant roots and soil dwelling animals and decomposers. This oxygen deficiency is the most important factor determining the function and composition of wetlands. Important factors differentiating the six wetland natural communities recognized are fire frequency, water source, water chemistry, and topographic location.

Marsh

Marshes are hydrologically cyclical wetlands dominated by emergent reed, graminoids, and cyperoids, and aquatic plants. Structure and water levels are determined by the interaction of short-term precipitation patterns, muskrat activity, and fire frequency. Spatial variation in vegetation and wildlife composition varies with water depth. The stages of the marsh cycle form a continuum from closed 100% cover by emergent vegetation to a ponded state in which open water covers all but the marsh's shallow edges. Maximum structural and compositional diversity is reached at the 50% open water: 50% emergent vegetation hemi-marsh stage, in which these two structural features are completely interspersed to maximize the internal water: vegetation interface.

- Basin. Basin marshes occur in glacial kettles, potholes, and swales on morainal deposits and outwash and lacustrine plains. They are most often found in community complexes with savannas or prairies. Hydrological input is from run-off and some groundwater sources. The closed emergent-hemi-marsh-pond cycle of stages is most typical of this marsh type.

Dominant plants: *Carex aquatilis*, *Carex lacustris*, *Carex utriculata*, *Leersia oryzoides*, *Scirpus acutus*, *Sparganium eurycarpum*, *Typha latifolia*, *Zizania aquatica*

Characteristic plants: *Acorus calamus*, *Bidens cernua*, *Equisetum fluviatile*, *Lysimachia thysiflora*, *Polygonum cocineum*, *Sagittaria latifolia*, *Scutellaria lateriflora*, *Sium suave*

Characteristic animals: broad-winged skipper, purplish copper, Blanding's turtle, muskrat, yellow-headed blackbird, least bittern, sora, Virginia rail

- Streamside. Streamside marshes are restricted to the floodplains of creeks and rivers. They border the streams themselves or occupy connected backwaters and abandoned oxbows. The standard marsh hydrological cycle is supplemented and modified by multiple, or at least annual, stream flooding. This flow through action by flooding removes and deposits sediment, nutrients, plant propagules, and small animals. This short term instability is counter-balanced by greater long term water level stability for marshes closest to the stream-course.

Dominant plants: *Carex lacustris*, *Carex trichocarpa*, *Echinochloa walteri*, *Leersia oryzoides*, *Scirpus acutus*, *Scirpus fluviatilis*, *Typha latifolia*

Characteristic plants: *Hibiscus palustris*, *Lobelia cardinalis*, *Rudbeckia laciniata*, *Scutellaria lateriflora*, *Sicyos angulatus*

Characteristic animals: Blanding's turtle, map turtle, green heron, sora, Virginia rail

Bog

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 groundcover, Sphagnum moss, combines to create a highly anaerobic, cold nutrient-deficient acidic substrate of Sphagnum peat with little biochemical decay. Prehistoric fires at bog edges and slow but gradual neutralization by calcareous seepages from mineral rich bordering glacial outwash have converted the rims and even interior portions of many bogs to marshes and sedge meadows. Three developmental stages in bog succession are recognized as distinct subtypes, but all are characterized by relict boreal wetland vegetation.

- **Graminoid.** Graminoid bogs are the first stage in bog development. They form a floating mat of Sphagnum peat either on the edges of kettle lakes or as remnant inclusions in other floating graminoid communities. Small shrubs and sedges add vertical structural complexity to this community.

Dominant plants: *Betula pumila*, *Carex aquatilis*, *Carex lasiocarpa*, *Chamaedaphne calyculata*, *Dryopteris thelypteris*, *Polytrichum commune*, *Sphagnum* spp.

Characteristic plants: *Dulichium arundinaceum*, *Drosera rotundifolia*, *Menyanthes trifoliata*, *Pogonia ophioglossoides*, *Salix pedicellaris*, *Sarracenia purpurea*, *Viola pallens*

Characteristic animals: willow flycatcher, yellow warbler

- **Low shrub.** This community exists as the second stage of bog succession on thick floating Sphagnum peat or, in only two Chicago Region sites, as grounded peat mats with thin floating edges along an encircling moat. A dense mat of low statured leatherleaf heath on Sphagnum dominates the low diversity core of the moat bordered low shrub bogs. Diversity increases considerably toward the moat edge where the community closely resembles the graminoid bog subtype.

Dominant plants: *Chamaedaphne calyculata*, *Polytrichum commune*, *Sphagnum* spp.

Characteristic plants: *Aronia prunifolia*, *Eriophorum virginicum*, *Osmunda cinnamomea*, *Rhus vernix*, *Rubus hispidus*, *Vaccinium macrocarpon*, *Viola pallens*

Characteristic animals: willow flycatcher, yellow warbler

- **Forested.** This community exists on fairly well consolidated peat. Hummocks (which tend to be more acid) and small, wet depressions are characteristic. Two distinct layers are added to the forb-sedge herbaceous stratum: a tree layer of deciduous tamarack (greater than 20% coverage) and a stratum of tall shrubs. This subtype includes both forested bogs with a markedly acid upper peat horizon and those with only scattered areas of acidity. The latter have been termed "half bogs" or "forested fens" by some authorities.

Dominant plants: *Carex disperma*, *Carex oligosperma*, *Carex trisperma*, *Ilex verticillata*, *Larix laricina*, *Rhus vernix*, *Sphagnum* spp.

Characteristic plants: *Carex canescens*, *Carex chordorrhiza*, *Cyripedium acaule*, *Lycopodium lucidulum*, *Osmunda cinnamomea*, *Osmunda regalis*, *Vaccinium corymbosum*

Characteristic animals: Nashville warbler, veery

Fen

Fens are created and maintained by the continuous internal flow of mineralized groundwater emanating from bordering upland calcareous sand and gravel glacial outwash formations. An impervious layer of till below the outwash gravel lenses forces cold, oxygen-deficient, mineralized groundwater to seep laterally at the bases of upland slopes. Peat enriched with magnesium and calcium carbonates forms the fen substrate, which supports many calciphile, plants adapted to high concentrations of dissolved alkaline minerals.

- **Calcareous floating mat.** This community exists as a thin floating, bed of peat in glacial lake basins. Diffused calcareous seepage from bordering upland and fire created this community from graminoid bogs, which they resemble in composition. The mat supports a tall matrix of sedge and grasses, low-statured boreal relict shrubs and boreal herbs, and in some cases, calciphiles typical of graminoid fens.

Dominant plants: *Calamagrostis canadensis*, *Carex aquatilis* var. *elatior*, *Carex lasiocarpa*, *Carex prairea*

Characteristic plants: *Aster borealis*, *Hypericum virginicum* fraseri, *Menyanthes trifoliata*, *Potentilla palustris*, *Salix candida*, *Salix pedicellaris*, *Utricularia intermedia*

Characteristic animals: swamp sparrow

- **Graminoid.** Sloping peat is either at the edge of a moraine/outwash formation or, more rarely, is a raised island in a marsh or sedge meadow. In the latter case, this has been attributed to an upwelling of groundwater. Dominant plants are a mixture of mesic to wet prairie grasses and sedges. Although the peat is quite elevated, it resists decay due to the high level of calcium and magnesium carbonate. Diversity is quite high since both mesic and wet prairie species can occur side by side in addition to numerous calciphilic and hydrophilic species. Frequently fire helps maintain the grassland structure of graminoid fens, which overlap physically and compositionally with calcareous sedge meadow.

Dominant plants: *Andropogon gerardi*, *Carex haydenii*, *Carex prairea*, *Carex sterilis*, *Potentilla fruticosa*, *Sorghastrum nutans*, *Sporobolus heterolepis*

Characteristic plants: *Cirsium muticum*, *Gentiana procera*, *Lobelia kalmii*, *Lysimachia quadriflora*, *Muhlenbergia glomerata*, *Parnassia glauca*, *Selaginella apoda*, *Solidago ohioensis*, *Solidago uliginosa*, *Valeriana ciliata*

Characteristic animals: Baltimore checkerspot, mulberrywing skipper, swamp metalmark, elfin skimmer, *Nanothemis bella* (dragonfly).

- Forested. This community is a relict northern evergreen cedar swamp restricted to deep, spring-fed forested ravines. White cedar and other wetland trees (>20% coverage), wetland shrubs, and sedges form a complex multi-layered community harboring typical fen calcophiles, sedge meadow species, and many boreal wetland cedar swamp species. Fallen cedar trunks resprout new trees and in decay create a hummocky terrain and substrate for other species, as in many old growth mesic forests. Only one example of this community, divided by a tollway, remains in the Chicago Region.

Dominant plants: *Carex leptalea*, *Carex sterilis*, *Cornus alternifolia*, *Fraxinus nigra*, *Symplocarpus foetidus*, *Thuja occidentalis*

Characteristic plants: *Caltha palustris*, *Conioselinum chinense*, *Cornus rugosa*, *Geum rivale*, *Habenaria hyperborea*, *Polymnia canadensis*, *Rubus pubescens*, *Solidago patula*, *Angelica atropurpurea*

Characteristic animals: mottled sculpin (in associated spring runs)

Sedge meadow

Sedge meadows are sedge dominated grasslands with wet prairie grass co-dominants on organic or sand substrates. Groundwater seepage and/or shallow flooding are the principal hydrological factors, and frequent fire is needed to retain their open structure. They are structurally homogeneous dense matrices of either tussock-forming sedges, which are often on calcareous organic substrates and grade into fens, or shallowly flooded rhizomatous sedge stands which grade into marshes.

Dominant plants: *Calamagrostis canadensis*, *Carex lacustris*, *Carex prairea*, *Carex sartwellii*, *Carex stricta*

Characteristic plants: *Angelica atropurpurea*, *Aster puniceus*, *Bromus ciliatus*, *Campanula aparinoides*, *Chelone glabra*, *Epilobium leptophyllum*, *Eupatorium maculatum*, *Lathyrus palustris*, *Lycopus uniflorus*, *Viola nephrophylla*

Characteristic animals: Baltimore checkerspot, eyed brown, black dash skipper, dion skipper, American bittern, sandhill crane, sedge wren, swamp sparrow, pigmy shrew

Panne

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

- Panne. This community has considerable floristic overlap with the graminoid fen and the calcareous seep. Competition is not as intense as in fens, because the panne's sod is not dense.

Dominant plants: *Calamagrostis canadensis*, *Carex buxbaumii*, *Carex sartwellii*, *Cladium mariscoides*, *Juncus balticus* var. *littoralis*, *Potentilla fruticosa*, *Rhynchospora capillacea*, *Scirpus americanus*

Characteristic plants: *Agalinis purpurea*, *Carex viridula*, *Eleocharis olivacea*, *Gentiana crinita*, *Linum medium* var. *texanum*, *Triglochin maritima*, *Utricularia cornuta*

Characteristic animals: Fowler's toad

Seep and spring

This community subclass occurs where groundwater flows to the surface. A seep is an area with saturated soil caused by water flowing to the surface in a diffuse rather than concentrated 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. A spring, as opposed to a seep, has a concentrated flow of groundwater from a definite orifice. The various communities in this subclass are separated on the basis of water chemistry.

- Neutral. This common seep type most often occurs on small muck deposits in ravine woodlands and forests. It is saturated by circumneutral water and structurally a mix of trees, shrubs, and sedge/forb components.

Dominant plants: *Carex hystricina*, *Carex interior*, *Cornus alternifolia*, *Symplocarpus foetidus*, *Impatiens capensis*, *Pilea pumila*

Characteristic plants: *Angelica atropurpurea*, *Caltha palustris*, *Cystopteris bulbifera*, *Fraxinus nigra*, *Solidago patula*, *Viola cucullata*

Characteristic animals: brook stickleback, mottled sculpin

- Calcareous. Groundwater is so highly calcareous that tufa (recrystallized calcium and magnesium carbonate deposits) forms. Many "neutral" seeps are slightly calcareous, but the distinction is drawn when tufa is present, forest cover is absent, and peat deposits (usually) adjoin the seep. Calcareous seeps occur in close association with various fen communities. They are cyperoid dominated communities with high floristic overlap with graminoid fens and pannes. Some calcareous seeps are known to have formed in tile blowout areas of partially drained fens.

Dominant Plants: *Carex sterilis*, *Deschampsia caespitosa*, *Eleocharis rostellata*, *Rhynchospora capillacea*, *Silphium terebinthinaceum*

Characteristic plants: *Berula erecta*, *Cladium mariscoides*, *Juncus brachycephalus*, *Scleria verticillata*, *Tofieldia glutinosa*, *Triglochin palustris*

Characteristic animals: Hine's emerald, pickerel frog, mottled sculpin

- Acid. The acid seepage water flows through sand, usually at the edge of dune or beach ridges. Some muck deposits can accumulate. Ferns, grasses, and shrubs form a structurally multilayered community.

Dominant plants: *Glyceria striata*, *Osmunda cinnamomea*, *Symplocarpus foetidus*

Characteristic plants: *Athyrium filix-femina*, *Dryopteris spinulosa*, *Osmunda regalis*, *Physocarpus opulifolius*

Characteristic animals: brook stickleback

Cliff communities

Vertical exposure of resistant bedrock as well as unconsolidated materials are included in this community. Soils are generally non-existent, and natural communities have been delimited on the basis of substrate. Aspect and degree of shading are also significant, but have not been used to separate communities due to practical considerations.

- Eroding bluff. This natural community is associated with eroded high bluffs consisting of glacial till along the shore of Lake Michigan. Because this community is maintained by continual lake erosion the plant community is not well developed.

Dominant plants:

Characteristic plants: *Aster pilosus*, *Danthonia spicata*, *Fragaria virginiana*, *Potentilla simplex*, *Rudbeckia hirta*, *Solidago nemoralis*

Characteristic animals:

- Dolomite cliff. Aspect and substrate characteristics are important determinants of species composition and abundance. In general, the north and east-facing slopes support the most vegetation. Another important factor is the degree of shading from the adjacent forest.

Characteristic species: *Cystopteris bulbifera*, *Physocarpus opulifolius*, *Aralia racemosa*, *Campanula rotundifolia*, *Pellaea glabella*

Characteristic animals: cliff swallow

Lakeshore communities

Lake-deposited sands form the substrate for this community. Depending on the age of the deposit and the successional development, three natural communities are formed. These natural communities are limited to the shoreline and near shore areas of Lake Michigan.

- Beach. Soil development is minimal because the sand is recently deposited. Two basic subdivisions can be distinguished: the nearly bare zone of sand nearest the lake and the better-vegetated grassland farther away.

Dominant plants: *Ammophila breviligulata*, *Calamovilfa longifolia*, *Elymus canadensis*

Characteristic plants: *Cakile edentula*, *Corispermum hyssopifolium*, *Euphorbia polygonifolia*

Characteristic animals: Piping plover, sanderling

- Foredune. This natural community is characterized by the beginnings of soil development. Fairly dense cover of low shrubs and grasses is present. There is some overlap with dry sand prairie.

Dominant plants:

Characteristic plants: *Andropogon scoparius*, *Arctostaphylos uva-ursi*, *Juniperus horizontalis*

- High dune. This is a more well developed natural community than the previous two located on tall steep slopes behind the foredune.

Dominant plants:

Characteristic plants: *Amelanchier arborea*, *Artemisia caudata*, *Hamamelis virginiana*, *Quercus velutina*, *Sassafras albidum*, *Smilacina stellata*, *Solidago caesia*

Cultural communities

This division includes communities that were created by human disturbance. In terms of natural quality, they are Grade D or E. All Grade E communities are cultural communities, but not all Grade D communities are cultural. If land is Grade D because the original natural community has been destroyed by human activities and the land has recovered somewhat, then it is a cultural community. However, if the original natural community was not removed, or if secondary succession has progressed to the stage where, for example, a recently clearcut forest is now a Grade D forest, it is not a cultural community, because the original community was not completely altered. The cultural communities are described briefly below.

- **Cropland.** This includes row crops and forage crops.
- **Unassociated woody growth.** Mixes of shrubs and trees which owe their existence to recent human (i.e. post settlement) land use practices. Unassociated woody growth is so named because its constituent species do not naturally occur together, either historically, or as associates in long term self-perpetuating communities. However, all of the native constituent species do occur in other natural community types. Most unassociated woody growth communities develop as woody plants colonize Eurasian meadows, abandoned farm fields, prairies, sedge meadows, or cut-over forest, woodland, and savanna. Other than a comparison with the original natural community which the unassociated woody growth ultimately replaced, there is no standard by which to assess unassociated woody growth. The diversity of herbaceous flora tends to be exceedingly low in the unassociated woody growth, as there are no processes occurring which promote survival of such flora. Without a stabilizing herbaceous layer, the presence of the unassociated woody growth can promote soil erosion and degraded water quality.
- **Grass.** Old fields dominated by Eurasian cool season grasses are an example of this type.
- **Shrub.** Thickets of buckthorn, gray dogwood, and introduced honeysuckle are examples of this type.
- **Tree.** Dense stands of Norway maple, black locust, green ash, and American elm are examples of this type.
- **Tree plantations.** Orchards, arboreta, and other tree plantations are in this artificial community.
- **Developed land.** Any sort of land that has been highly modified or has structures is placed in this class. It includes strip-mined land, roadways, buildings, and cemeteries.

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Appendix 2
 Crosswalk between Chicago Wilderness Communities
 and the National Standard for Community Types

Chicago Wilderness name	The Nature Conservancy name	G-rank
Dry-mesic upland forest	White oak-red oak dry-mesic forest	G4?
Mesic upland forest	North-central maple-basswood forest*	G4?
	Beech-maple glaciated forest	G3G4
Wet-mesic upland forest	North-central maple-basswood forest*	G4?
Wet-mesic floodplain forest	Central green ash-em-hackberry forest	G?
Wet floodplain forest	Silver maple-elm-(cottonwood) forest	G4?
Northern flatwood	Northern (Great Lakes) flatwood	G2
Sand flatwood	Pin oak-swamp white oak sand flatwood	G2?
Dry-mesic woodland	Northern dry-mesic oak woodland	G3G4
Mesic woodland	Red oak-sugar maple-elm forest	G?
Wet-mesic woodland	Swamp white oak woodland	G1
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 sand savanna	Black oak/lupine barrens*	G3
Dry-mesic sand savanna	Black oak/lupine barrens*	G3
	Lakeplain mesic oak woodland	G2
Mesic sand savanna		
Dry-mesic fine-textured-soil shrubland	Hazelnut barrens	G1?
Wet-mesic fine-textured-soil shrubland	Dogwood-mixed willow shrub meadow	G3G4
Dry-mesic sand shrubland	Midwest dry-mesic sand prairie*	G3
Wet-mesic sand shrubland	Hardhack shrub prairie	G1Q
Dry fine-textured-soil prairie	Midwest dry-mesic prairie	G2G3
Mesic fine-textured-soil prairie	Central mesic tallgrass prairie	G2
Wet fine-textured-soil prairie	Central wet-mesic tallgrass prairie	G2G3
	Central cordgrass wet prairie	G3?
Dry sand prairie	Midwest dry sand prairie	G2G3
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
Mesic dolomite prairie	Midwest dry-mesic Limestone-dolomite prairie	G2?
Wet dolomite prairie	Midwest wet-mesic dolomite prairie	G2?
Basin marsh	Bulrush-cattail-burreed shallow marsh	G?
Streamside marsh	Midwest mixed emergent deep marsh	G5
	River bulrush marsh	G?
Graminoid bog	Northern poor fen	G3G4

Appendix 2. Crosswalk between Chicago Wilderness Communities and the National Standard for Community Types

Low shrub bog	Leatherleaf bog	G5
Forested bog	Central tamarack poor swamp	G4?
Calcareous floating mat	Midwest calcareous floating mat	G?
Graminoid fen	Cinquefoil-sedge prairie fen*	G3G4
Forested fen	White cedar seepage swamp	G3G4
Sedge meadow	Lake sedge meadow	G4G5
	Tussock sedge wet meadow	G4?
Panne	Interdunal wetland	G2?
Neutral seep	Skunk cabbage seepage meadow	G4?
Calcareous seep	Cinquefoil-sedge prairie fen*	G3G4
Sand seep	Midwest sand seep	G2?
Eroding bluff	Small eroding cliffs	G?
Dolomite cliff	Alkaline moist bluff-cliff	G5
Beach	Great Lakes sea-rocket strand beach	G2G4
Foredune	Great Lakes beachgrass dune*	G3G5
High dune	Great Lakes beachgrass dune*	G3G5
	Central water lily aquatic wetland	G4G5
	Dogwood-willow-blueberry swamp	G4?
	Northern buttonbush swamp	G4

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.

Appendix 3
Glossary of Scientific and Common Names Used in Text

Acadian hairstreak	<i>Satyrium acadia</i>	Common reed	<i>Phragmites communis</i>
Alewife	<i>Alosa pseudoharengus</i>	Cottonwood	<i>Populus deltoides</i>
American bittern	<i>Botaurus lentiginosus</i>	Creek chub	<i>Semotilus atromaculatus</i>
American burnet	<i>Sanguisorba canadensis</i>	Crown vetch	<i>Coronilla varia</i>
American bur-reed	<i>Sparganium americanum</i>	Darter	Family Percidae
American burying beetle	<i>Nicrophorus americanus</i>	Deer	<i>Odocoileus virginianus</i>
American pondweed	<i>Potamogeton americana</i>	Dion skipper	<i>Euphyes dion</i>
American redstart	<i>Setophaga ruticilla</i>	Dog violet	<i>Viola conspersa</i>
Amur maple	<i>Acer ginnala</i>	Dogwood	<i>Cornus florida</i>
Aphrodite fritillary	<i>Speyeria aphrodite</i>	Dune thistle	<i>Cirsium pitcheri</i>
Appalachian eyed- brown	<i>Lethe appalachia</i> or <i>Satyrodes appalachia</i>	Dusted skipper	<i>Atryonopsis hianna</i>
Ash	<i>Fraxinus</i> sp.	Dwarf scouring rush	<i>Equisetum scirpoides</i>
Asiatic honeysuckle	A complex of <i>Lonicera</i> sp.	Eastern box turtle	<i>Terrapene carolina</i>
Baltimore checkerspot	<i>Euphydryas phaeton</i>	Eastern chipmunk	<i>Tamias striatus</i>
Basswood	<i>Tilia americana</i>	Eastern hognose snake	<i>Heterodon platirhinos</i>
Beach pea	<i>Lathyrus japonicus</i> var. <i>glaber</i>	Eastern kingbird	<i>Tyrannus tyrannus</i>
Belfrag's stinkbug	<i>Chlorochroa belfragei</i>	Eastern newt	<i>Notophthalmus viridescens</i>
Bell's vireo	<i>Vireo bellii</i>	Eastern pipistrelle	<i>Pipistrellus subflavus</i>
Bellwort	<i>Uvularia grandiflora</i>	Eastern racer	<i>Coluber constrictor</i>
Black oak	<i>Quercus velutina</i>	Eastern rat snake	<i>Elaphe obsoleta</i>
Black oat grass	<i>Stipa avenacea</i>	Elm	<i>Ulmus</i> sp.
Black tern	<i>Chlidonias niger</i>	Eurasian water milfoil	<i>Myriophyllum spicatum</i>
Black walnut	<i>Juglans nigra</i>	European buckthorn	<i>Rhamnus cathartica</i>
Blanding's turtle	<i>Emydoidea blandingii</i>	Eyed brown	<i>Lethe eurydice</i>
Bluebell dragonfly	<i>Nannothemis bella</i>	False bugbane	<i>Trautvetteria caroliniensis</i>
Blue-spotted salamander	<i>Ambystoma laterale</i>	Fern moths	<i>Callopostria cordata</i> and <i>C. mollissima</i>
Bluntnose minnow	<i>Pimephales notatus</i>	Fernleaf pondweed	<i>Potamogeton robbinsii</i> (???= fern pondweed)
Bobolink	<i>Dolichonyx oryzivorus</i>	Few-seed sedge	<i>Carex oligosperma</i>
Bog birch	<i>Berula pusilla</i>	Forked aster	<i>Aster furcatus</i>
Broad winged skipper	<i>Poanes viator</i>	Four-toed salamander	<i>Hemidactylium scutatum</i>
Brown creeper	<i>Certhia americana</i>	Fowler's toad	<i>Bufo fowleri</i>
Buffalo berry	<i>Sherperdia canadensis</i>	Frosted elfin butterfly	<i>Incisalia irus</i>
Buffalo clover	<i>Trifolium reflexum</i>	Garlic mustard	<i>Alliaria petiolata</i>
Buff-breasted sandpipers	<i>Tryngites subruficollis</i>	Giant reed	<i>Phragmites communis</i>
Bugseed	<i>Coriospermum hysopifolium</i>	Globe mallow	<i>Sphaeralcea angusta</i>
Bulblet bladder fern	<i>Cystopteris bulbifera</i>	Glossy buckthorn	<i>Rhamnus frangula</i>
Bullsnake	<i>Pituophis catenifer</i>	Goby	<i>Neogobius melanostomus</i>
Bulrush	<i>Scirpus hattorianus</i>	Graham's crayfish snake	<i>Regina grahamii</i>
Bush honeysuckle	<i>Lonicera</i>	Grasshoppers	Order Orthoptera
Byssus skipper	<i>Problema byssus</i>	Grass-leaved arrowhead	<i>Sagitaria graminea</i>
Caddisflies	Order Trichoptera	Gray fox	<i>Urocyon cinereoargenteus</i>
Carp	<i>Cyprinus carpio</i>	Gray squirrel	<i>Sciurus carolinensis</i>
Cattail	<i>Typha latifolia</i>	Great copper	<i>Lycaena xanthoides</i>
Cerulean warbler	<i>Dendroica cerulea</i>	Great grey copper	<i>Lycaena xanthoides dion</i>
Channel catfish	<i>Ictalurus punctatus</i>	Green frog	<i>Rana clamitans</i>
Chara	<i>Chara</i> sp.	Greenfruit bur-reed	<i>S. chlorocarpum</i>
Cobweb skipper	<i>Hesperia metea</i>		
Common juniper	<i>Juniperus communis</i>		

Appendix 3. Glossary of Scientific and Common Names

Grote's dart moth	<i>Loxagrotis grotei</i>	Oak	<i>Quercus</i> sp.
Gypsy moths	<i>Lymantria dispar</i>	Ottoo skipper	<i>Hesperia ottoe</i>
Hairy puccoon	<i>Lithospermum caroliniense</i>	Pacific salmon	
Hairy rock cress	<i>Arabis hirsuta</i>	Painted turtle	<i>Chrysemys picta</i>
Hall's bulrush	<i>Scirpus</i> sp.	Pale false foxglove	<i>Agalinis skinneriana</i>
Hazel	<i>Corylus americana</i>	Pale vetchling	<i>Lathyrus ochroleucus</i>
Henslow' sparrow	<i>Ammodramus henslowii</i>	Paw paw	<i>Asimina triloba</i>
Hepatica	<i>Hepatica americana</i>	Paw paw sphinx moth	<i>Dolba hylaeus</i>
Hill's thistle	<i>Cirsium hilli</i>	Persius duskywing skipper	<i>Erynnis persius persius</i>
Hobomok skipper	<i>Poanes hobomok</i>	Phlox flower moth	<i>Schinia indiana</i>
Horizontal juniper	<i>Juniperus horizontalis</i>	Pickerel frog	<i>Rana palustris</i>
Hornyhead chub	<i>Nocomis biguttatus</i>	Pike	<i>Esox lucius</i> (?northern pike)
Impatiens	<i>Impatiens</i> sp.	Pileated woodpecker	<i>Dryocopus pileatus</i>
Indian skipper	<i>Hesperia sassacus</i>	Pipevine swallowtail	<i>Battus philenor</i>
Indiana bat	<i>Myotis sodalis</i>	Pitcher's thistle	<i>Cirsium pitcheri</i>
Ironweed	<i>Vernonia fasciculata</i>	Plains leopard frog	<i>Rana blairi</i>
Ivory sedge	<i>Carex eburnea</i>	Prairie bush clover	<i>Lespedeza leptostachya</i>
Jack pine	<i>Pinus banksiana</i>	Prairie white fringed orchid	<i>Platanthera leucophaea</i>
Japanese hedge parsley	<i>Torillus japonicus</i>	Prothonotary warbler	<i>Protonotaria citrea</i>
Kalm St. John's wort	<i>Hypericum kalmianum</i>	Pugnose shiner	<i>Notropis anogenus</i>
Karner blue butterfly	<i>Lycaeides melissa samuelis</i>	Purple loosestrife	<i>Lythrum salicaria</i>
King rail	<i>Rallus elegans</i>	Purple cliff brake	<i>Pellaea glabella</i>
Kirtland's snake	<i>Clonophis kirtlandii</i>	Purple-fringed orchid	<i>Platanthera psycodes</i>
Knapweed	<i>Centaurea maculata</i>	Purplish copper	<i>Lycaena helloides</i>
Lake perch		Queen of the prairie	<i>Filipendula rubra</i>
Lamprey	<i>Petromyzon marinus</i>	Queen snake	<i>Regina septemvittata</i>
Largemouth bass	<i>Micropterus salmoides</i>	Raccoon	<i>Procyon lotor</i>
Lark sparrow	<i>Chondestes grammacus</i>	Rattlesnake master borer moth	<i>Papaipema eryngii</i>
Leafhoppers	Family Cicadellidae	Red oak	<i>Quercus rubra</i>
Leafy prairie clover	<i>Dalea foliosa</i>	Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Leafy spurge	<i>Euphorbia eschula</i>	Redhorse	<i>Moxostoma</i> sp.
Little bluestem	<i>Andropogon scoparius</i>	Redroot	<i>Ceanothus herbaceous</i>
Loggerhead shrike	<i>Lanius ludovicianus</i>	Red-shouldered hawk	<i>Buteo lineatus</i>
Maple	<i>Acer</i> sp.	Red-veined prairie leafhopper	<i>Aflexia rubraneura</i>
Marram grass	<i>Ammophila breviligulata</i>	Reed canary grass	<i>Phalaris arundinacea</i>
Marsh valerian	<i>Valeriana uliginosa</i>	Regal fritillary	<i>Speyeria idalia</i>
Marsh wren	<i>Citothorus palustris</i>	Rice grass	<i>Oryzopsis asperifolia</i>
Massasauga	<i>Sistrurus catenatus</i>	River otter	<i>Lutra canadensis</i>
Mouse colored lichen moth	<i>Pagara simplex</i>	Round-leaved sundew	<i>Drosera rotundiflora</i>
Narrow-leaf cattail	<i>Typha augustifolia</i>	Royal fern borer	<i>Papaipema speciosissima</i>
Nodding trillium	<i>Trillium cernuum</i>	Ruddy turnstones	<i>Arenaria interpres</i>
Northern cranesbill	<i>Geranium??</i>	Sago pondweed	<i>Potamogeton pectinatus</i>
Northern cricket frog	<i>Acris crepitans</i>	Sand cherry	<i>Prunus pumila</i>
Northern fern geometer	<i>Petrophora subaquaeria</i>	Sand cress	<i>Arabis lyrata</i>
Northern harrier	<i>Circus cyaneus</i>	Sand reed grass	<i>Calamovilfa longifolia</i>
Northern hog sucker	<i>Hypentelium nigricans</i>	Sandhill crane	<i>Grus canadensis</i>
Northern leopard frog	<i>Rana pipiens</i>	Savanna blazing star	<i>Liatriis scariosa</i> var. <i>nieuwlandii</i>
Northern water snake	<i>Nerodia sipedon</i>	Scrub oak	apparently <i>Quercus velutina??</i>
Norway maple	<i>Acer platanoides</i>	Sculpin	Family Cottidae
		Sea rocket	<i>Cakile edentula</i>
		Semipalmated plovers	<i>Charadrius semipalmatus</i>

Appendix 3. Glossary of Scientific and Common Names

Sensitive fern borer	<i>Papaipema inquaesita</i>	Walking fern	<i>Camptosorus rhizophyllus</i>
Shadbush	<i>Amelanchier arborea</i>	Water arum	<i>Calla palustris</i>
Shore St. John's wort	<i>Hypericum adpressum</i>	Water celery	<i>Vallisneria americana</i>
Short-eared owl	<i>Asio flammeus</i>	Water parsnip	<i>Sium suave</i>
Silver bordered fritillary	<i>Boloria selene</i>	Water star weed	<i>Elodea ??</i>
Silvery blue	<i>Glaucopsyche lygdamus</i>	Water stargrass	<i>Heteranthera dubia</i>
Silvery checkerspot	<i>Chlosyne nycteis</i>	Watercress	<i>Nasturtium officinale</i>
Slender rock brake	<i>Cryptogramma stelleri</i>	Western chorus frog	<i>Pseudacris triseriata</i>
Smallmouth bass	<i>Micropterus dolomieu</i>	Western meadowlark	<i>Sturnella neglecta</i>
Smooth green snake	<i>Liochlorophis vernalis</i>	Western ribbon snake	<i>Thamnophis proximus</i>
Spotted salamander	<i>Ambystoma maculatum</i>	Whip-poor-will	<i>Caprimulgus vociferus</i>
Spotted turtle	<i>Clemmys guttata</i>	White ash	<i>Fraxinus americana</i>
Spring peeper	<i>Pseudacris crucifer</i>	White footed mice	<i>Peromyscus leucopus</i>
Stonefly	Family Perlidae	White oak	<i>Quercus alba</i>
Stoneroller	<i>Campostoma</i> sp.	White pine	<i>Pinus strobus</i>
Striped shiner	<i>Luxilus chrocephalus</i>	White stem pondweed	<i>Potamogeton praelongus</i>
Suckers	Family Castostomidae	Wild plum	<i>Prunus americana</i>
Sugar maple	<i>Acer saccharum</i>	Willow flycatcher	<i>Empidonax traillii</i>
Summer tanager	<i>Pirangarubra</i>	Winged polygala	<i>Polygala paucifolia</i>
Swamp metalmark	<i>Calephelis muticum</i>	Wood frog	<i>Rana sylvatica</i>
Sweet clover	<i>Melilotus</i>	Woodland vole	<i>Microtus pinetorum</i>
Sycamore	<i>Platanus occidentalis</i>	Yellow birch	<i>Betula lutea</i>
Sycamore sawfly	<i>Lithophane signosa</i>	Yellow breasted chat	<i>Icteria virens</i>
Tartarian honeysuckle	<i>Lonicera</i> sp.	Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Teasel	Family Dipsaceae	Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>
Trailing arbutus	<i>Epigaea repens</i>	Zebra mussels	<i>Dreissena polymorpha</i>
Tuliptree	<i>Liriodendron tulipifera</i>	Zebra swallow-tail butterfly	<i>Eurytides marcellus</i>
Two-spotted skipper	<i>Euphyes bimacula</i>		
Upland sandpiper	<i>Bartramia longicauda</i>		
Veiny pea	<i>Lathyrus venosus</i>		

Appendix 4
Preliminary Results of Community Workshop Assessments

Quantity ranking

Very high risk
(of cessation of contributing ecosystem values due to number of acres remaining, percent remaining vs. pre-European settlement extent, number of occurrences, number of sufficiently large occurrences, amount under protection)

fine-textured-soil prairie
sand prairie
gravel prairie
dolomite prairie
streamside marsh
forested fen
graminoid fen
calcareous seep
sand seep
wet-mesic fine-textured-soil savanna
mesic sand savanna

High risk
wet-mesic upland forest
mesic fine-textured-soil savanna
dry sand savanna
calcareous floating mat
sedge meadow
panne
neutral seep
northern flatwood
sand flatwood

Moderate risk
dry-mesic upland forest
mesic upland forest
dry-mesic woodland
mesic woodland
wet-mesic woodland
wet-mesic floodplain forest
wet floodplain forest
basin marsh
bog
dry-mesic fine-textured-soil savanna
dry-mesic sand savanna

Condition ranking

Poor
(rapidly losing biodiversity or little of good quality remaining)

fine-textured-soil prairie
sand prairie
gravel prairie
dolomite prairie
dry-mesic woodland
mesic woodland
wet-mesic woodland
dry-mesic fine-textured-soil savanna
mesic fine-textured-soil savanna
wet-mesic fine-textured-soil savanna
streamside marsh
forested fen
graminoid fen
calcareous seep
sand seep
mesic upland forest
wet-mesic upland forest

Fair
(quite a bit of biodiversity remaining but declining or moderate amount remaining)

wet-mesic floodplain forest
wet floodplain forest
northern flatwood
sand flatwood
dry sand savanna
basin marsh
bog
calcareous floating mat
sedge meadow
neutral seep
dry-mesic upland forest

Good
(much biodiversity survives and fairly stable, but not all of high quality)

dry-mesic sand savanna
mesic sand savanna
panne

Biological importance

(based on species richness, numbers of E/T species, habitat significance, levels of species conservatism, special habitat features, and ecological functions)

High importance

fine-textured-soil prairie
 sand prairie
 gravel prairie
 dolomite prairie
 flatwood
 woodland
 fine-textured-soil savanna
 sand savanna
 marsh
 fen
 sedge meadow
 panne
 calcareous seep

Medium importance

upland forest
 floodplain forest
 bog

Low importance

sand seep
 neutral seep

Distribution assessment

Good/best examples in Chicago Wilderness Region
(significantly contributing to global conservation)

fine-textured-soil prairie
 sand prairie (dune and swale)
 dolomite prairie
 gravel prairie ??
 woodland
 fine-textured-soil savanna
 sand savanna (lake plain)
 basin marsh
 calcareous floating mat
 graminoid fen
 panne

Wide spread

(good examples in the region but also good examples elsewhere)

upland forest
 floodplain forest
 flatwood???
 streamside marsh
 sedge meadow
 calcareous seep

Edge of range

(better opportunity to conserve elsewhere)

bog
 forested fen
 sand seep
 neutral seep

Appendix 5
Chicago Wilderness Aquatic Classification: Streams

Stream category	Physical description	Ecological description	Indicator fish species	Macroinvertebrate species	Plant species	Example stream
<u>Headwater streams</u>	1st order/small drainage area Little or no pool development	Low habitat heterogeneity Low trophic complexity High P/R	sculpins, dace caddis fly, stone fly	<i>Oreonectes propinquus</i>	water cress, chara water patsnip, betula	Black Partridge Creek Silver Creek
Continuous flow	cool temp./stable temp, DO					
• Course substrate						
• Fine substrate						Rob Roy
Intermittent flow	highly variable flow, temp	colonizers, asivation flood avoidance, abiotic high reproductive rates	bluntnose minnow striped shiner			Mill Creek headwaters
• Course substrate						
• Fine substrate						
Low order	2nd-4th order Small to medium-sized creeks More stable temp, DO Riffle and pool development	More complex habitat Increased trophic complexity More allochthonous input Biotic factors seasonally imp.				
High gradient	>5 ft/mile course substrate cobble, gravel		darters/stonerollers horneyhead chub suckers/sm bass			Tyler Creek Buck Creek Long Run Creek
Low gradient	<5 ft/mile fine substrate silt, sand		creek chub bluntnose minnow redfin shiner/sunfish		sago pond weed water star weed American pond weed	Lily Cache Skokie River Plum Creek Mill Creek
Mid order	5th-8th order Large creeks to medium rivers Stable flow, temp High habitat diversity	Most complex habitat Predators abundant Diverse energy sources Highest biological diversity				
High gradient	>3 ft/mile gradient course substrate		smallmouth bass northern hogsucker redhorse	<i>Oreonectes propinquus</i>		Lower Fox River Kankakee River Kishwaukee River
Low gradient	<3 ft/mile gradient fine substrate		largemouth bass bluegill/sunfish pike, carpsuckers channel catfish	<i>Oreonectes virilis</i>		Upper Fox River Upper Des Plaines

Chicago Wilderness Aquatic Classification: Lakes

Lake category	Physical description	Ecological description	Dominant fish species	Macroinvertebrate species	Plant species	Herps	Example lake
Natural							
Lake Michigan	cool water temp large, stable	oligotrophic	sculpin, barbot yellow perch salmonids (i, native) ale wives (i), smelt (i)	zebra mussels (i)			
Glacial							
• Kettle	isolated basin, mostly shallow warmwater, high in watershed, stratification common	stable, biotic factors important; low trophic complexity; low species diversity	brown bullhead lake chubsucker warmouth	<i>Procambarus</i>	water shield, eel grass	common map turtle, mudpuppy	Lake Elizabeth Cedar Lake Defiance Lake
• Flow through	connected to stream system, high watershed/ surface area, turnover; minimal stratification	high habitat and species diversity, high trophic complexity	northern pike, largemouth bass, yellow bass, bluegill, pugnose minnow	mussels (floater)	lotus, grass- leaved pondweed	blanding's turtle	Fox Chain o Lakes Loon Lake
Bottomland							
	adjacent to large stream seasonally flooded, shallow	seasonal recruitment abiotic factors dominant	topminnows, pike bullheads, bowfin	snails abundant	emergent plants, lotus, duckweed, algal blooms		Lyons Marsh Saganashkee Slough
Vernal pond/pool							
	seasonally inundated depression, generally small	fishless, abiotic dominant, low trophic diversity	n/a	<i>Phallicambarus photians</i> <i>Cambarus</i> , <i>Procambarus</i>	sedges, stranded aquatics, mermaid weed	high diversity salamanders newts	Ryerson Woods Deer Grove, Busse
Manmade							
Naturalized							
	old, mature shoreline no intensive management	long-term stability, successionally advanced				high diversity	Sag Quarry Bluff Spring Fen Quarry
Other							
	dug, dammed etc., recent intensively managed	unstable communities, no advanced succession					Busse Lake Beck Lake

Appendix 6
 Priority Groups of Endangered and Threatened Plant Species in Chicago Wilderness

List based on Illinois and Indiana Natural Heritage Database. Wisconsin to be incorporated. Where species are listed as endangered or threatened in both states but only one state is noted in this list, it means the species does not occur in the CW region of the other state or was not judged to be a priority in the CW region by the state representatives who compiled the list. Ongoing revision is essential to this process and this document.

Priority group 1

Globally rare species (based on TNC ranking); includes federal listed and former candidate species (C1/C2).

Agalinis auriculata (IN)
Agalinis skinneriana (IL, IN)
Aster furcatus (IL, IN)
Cirsium hillii (IL, IN)
Cirsium pitcheri (IL, IN)
Dalea foliosa (IL)
Hymenoxys acaulis glabra (IL)
Hypericum adpressum (IL, IN)
Lespedeza leptosachya (IL)
Lycopodiella subappressa (IN)
Platanthera leucophaea (IL, IN)
Rhus aromatica arenaria (IN)
Scirpus hallii (IN)
Scirpus purshianus (IN)
Solidago simplex gillmanii (IN)
Talinum rugospermum (IN)
Tomanthera auriculata (IL)

Priority group 2

Great Lakes endemic species or those whose critical range is within Chicago Wilderness Region.

Arenaria patula (IL) (dolomite prairie; quasi-endemic, disjunct from glades further south)
Cirsium pitcheri (IL; IN–recovery plan in progress)
Dalea foliosa (IL) (dolomite prairie; quasi-endemic, disjunct from glades further south)
Hypericum kalmianum (IL; not listed in IN but occurs there)
Isoetes butleri (IL) (dolomite prairie; quasi-endemic, disjunct from glades further south)
Lathyrus maritimus glaber (IN) (*L. japonicus glaber* IL) quasi-endemic in Great Lakes region–recovery plan in progress in IL
Salix syrticola (IL) (*Salix cordata* IN)
Sphaeralcea angusta (*Malvastrum hispidum*) (IL) ???

Priority group 3

Species that are disturbance dependent (early successional) or that do not fall within a well-defined community type.

Corydalis sempervirens (IN)
Fuirena pumila (IN)
Geranium bicknellii (IL, IN)
Juncus pelocarpus (IN)
Lathyrus maritimus glaber (IN) (*Lathyrus japonicus glaber*–recovery plan in IL)
Lechea intermedia (also taxonomic questions) (IL)
Myosotis laxa (IN)
Oenothera perennis (IL, IN)
Plantago cordata (IL–may be extirpated in region)
Polygala incarnata (IL)
Polygonum careyi (IN)
Ranunculus cymbalaria (IN)

Scirpus hallii (IN)
Sisyrinchium montanum (IL, IN)
Strophostyles leiosperma (IN)
Tomanthera auriculata (IL) *Agalinis auriculata* (IN)
Trifolium reflexum (IL)

Priority group 4

Species that have fewer than 50% of their EOs in protected sites in state indicated: either Level 1 (Nature Preserves) or Level 2 (other public lands).

Agalinis skinneriana (IN)
Amelanchier sanguinea (IL)
Ammophila breviligulata (IL)
Androsache occidentalis (IN)
Arabis glabra (IN)
Bidens beckii (IL)
Buchnera americana (IN)
Carex crawei (IN)
Carex richardsonii (IN)
Cimicifuga racemosa (IL)
Eleocharis geniculata (IN)
Eleocharis microcarpa (IN)
Fimbristylis puberula (IN)
Hudsonia tomentosa (IN)
Hypericum pyramidatum (IN)
Juncus articulatus (protected, but only known from 1 site) IN
Linum striatum (IN)
Ludwigia sphaerocarpa (IN)
Lycopodiella verticillatum (IN)
Orobanche fasciculata (IN)
Panicum verrucosum (IN)
Potamogeton richardsonii (IN)
Psilocarya scirpoidees (IN)
Ranunculus cymbalaria (IL)
Rynchospora globularis recognita (IN)
Sanguisorba canadensis (IL)
Selaginella rupestris (IN)
Shepherdia canadensis (IL)
Sisyrinchium atlanticum (IL)
Sparganium americanum (IL)
Sparganium chlorocarpum (IL)
Sphaerlacea angusta (IL)
Spiranthes lucida (IL)
Spiranthes magnicamporum (IN)
Symphoricarpos albus albus (IL)
Talinum rugospermum (IN)
Valerianella chenopodifolia (IL)

Priority group 5

Species with particular taxonomic or reproductive problems and/or needing life history research; species whose survival or reproductive success is seriously compromised by external factors such as herbivory, hydrology, canopy closure, poaching, etc. Most species in Priority Group 1 can also be added to this Group.

Ammophila breviligulata (stiff competition with *Elymus arenarius*–IL)
Asclepias lanuginosa (reproductive problem–IL)
A. ovalifolia (reproductive problem–IL)

Aster furcatus (reproductive problem–IL)
Botrychium matricariaefolium (hydromesophytic woods–disturbed hydrology–IN)
B. simplex fern taxonomic research–IL, IN)
Carex debilis rudgei (lakeplain swamps/hydromesophytic forest–disturbed hydrology–IN)
C. folliculata (mesophytic swamps–disturbed hydrology–IN)
C. leptonevia (hydromesophytic forest–disturbed hydrology–IN)
Chrysosplenium americanum (hydromesophytic forest–disturbed hydrology–IN) *Cirsium hillii* (reproductive questions–IL, IN)
Cypripedium parviflorum (purple loosestrife invasion/browse/poaching–IL)
C. reginae (deer browse threat to reproductive success–IL)
Filipendula rubra (reproductive problem; non-seed producing–IL)
Hymenoxys acaulis glabra (reproductive problems–IL)
Lathyrus ochroleucus (reproductive problems: nonflowering/seeding populations–IL, IN)
Lathyrus venosus (fire suppression/closed canopy–IN)
Lycopodium tristachyum (closed canopy–N)
Malaxis unifolia (IN)
Orobanche fasciculata (parasitic–IL, IN)
Phlox bifida stellaria (fire suppression/closed canopy–IN)
Platanthera ciliaris (IL, IN)
P. psycodes (deer browse threat to reproductive success–IL)
Rubus setosus (taxonomic questions–IL, IN)
Scirpus hattorianus (habitat compromise–IL)
Shepherdia canadensis (IL, IN)
Trillium cernuum macranthus (deer browse/canopy closure–IL, IN)

Priority group 6

Species that may be adequately protected or stable but are restricted to rare communities within CW in state indicated.

Note: Communities used here are still to be cross-walked with the CW community classification system.

Arenaria patula (dolomite prairies–IL)
Bidens beckii (aquatic; glacial lakes–IL)
Cakile edentula (lakeshores, beaches–IL)
Calla palustris (bogs–IL, IN)
Cardamine pratensis var. *palustris* (fens, calcareous floating mats–IL)
Carex atherodes (wet meadows/shallow marshes–IN)
C. bebbii (calcareous fens and prairies–IN)
C. brunescens (bogs–IL, IN)
C. canescens disjuncta (bogs–IL)
C. chordorrhiza (bogs–IL)
C. conoidea (calceous prairies/dolomite prairies–IN)
C. cryptolepis (fens–IN)
C. disperma (bogs–IL)
C. garberi (pannes- IL, IN)
C. intumescens (flatwoods–IL)
C. limosa (sphagnum bogs–IN)
C. oligosperma (bogs–IL)
C. trisperma (bogs–IL)
C. tuckermanii (flatwoods–IL)
Castilleja sessiliflora (lakeshore sand prairie–IL)
Ceanothus herbaceus (sand savannas–IN, IL)
Chaerophyllum procumbens shortii (mesophytic wooded bluffs–IN)
Chamaedaphne calyculata (bogs–IL)
Cornus canadensis (bogs–IL, IN) edge of range
Cypripedium acaule (bogs–IL)
Drosera rotundifolia (bogs–IL)
Eleocharis melanocarpa (moist sandy prairies–IN)
E. olivacea (pannes–IL)

E. pauciflora (pannes/seeps–IL)
E. rostellata (calcareous seeps and springs–IL)
Epilobium angustifolium (bogs–IN)
Eriocaulon septangulare (lake border with calcareous soils–IN)
Eriophorum virginicum (bogs–IL)
Gentiana puberulenta (black soil prairies–IN)
Isoetes butleri (dolomite prairies–disjunct from glades further south–IL)
Juncus scirpoides (wet sandy soils/wet prairies–IN)
Juniperus horizontalis (lakeshore, foredunes–IL)
Lathyrus ochroleucus (dry oak woods/savannas–IN)
L. venosus (dry prairies/savannas–IN)
Larix laricina (bogs–IL)
Liatris scariosa var. *nieuwlandii* (savannas–IL)
Platanthera ciliaris (bogs–IL)
P. hyperborea (pannes, fens–IN)
P. psycodes (flatwoods–IL)
Potamogeton gramineus (aquatic/glacial lakes–IL)
P. praelongus (aquatic/glacial lakes–IL)
P. pulcher (aquatic/shallow acid waters–IL, IN)
P. robbinsii (aquatic/glacial lakes–IL, IN)
P. strictifolius (aquatic/calcareous lakes and ponds)
Potentilla anserina (pannes/calcareous flat marshes–IN)
Rhynchospora alba (pannes/calcareous seeps and springs/bogs–IL)
Ribes hirtellum (bogs–IL)
Salix serissima (bogs–IL)
Scirpus cespitosus (calcareous springs and seeps–IL)
Scirpus smithii (bog or sandy pond shores–IL, IN)
Scirpus hallii (sand ponds–IN)
Scleria reticularis (sandy soil/marshes–IN)
Sphaerlacea angusta (*Malvastrum hispidum*) (dolomite prairies–IL)
Sparganium androcladum (clean water lakes–IN)
Thuja occidentalis (bogs/forested springy fens/eroded bluffs–IL)
Tofieldia glutinosa (pannes/seeps–IL)
Triglochin palustris (seeps/springs/marl flats–IL, IN)
Utricularia cornuta (calcareous seeps/pannes–IL, IN)
U. geminiscapa (bogs–IN)
U. intermedia (calcareous seeps/pannes–IL)
U. minor (calcareous seeps/pannes–IL, IN)
U. subulata (pannes–IN)
Vaccinium macrocarpon (bogs–IL)
V. oxycoccos (bogs–IL)
Valerianella chenopodifolia (limestone bluffs and riparian areas–IL, IN)

Appendix 7
Tools for Communication and Education Efforts

Tools for educators	Description	Purpose/audience
Biodiversity Kit	Problem-based program with sample scenarios for exploring local biodiversity. Includes 148-page Educator's Guide.	To engage K-8th graders in searches for viable solutions to biodiversity threats.
<i>Chicago Tribune</i> Educational Services supplement, "Chicagoland Ecosystem"	Sixteen-page newspaper supplement for educational use with activities for grades 4-9.	To help students understand biodiversity and its local implications.
Chicago Wilderness Atlas Education Package	Integrated educational tool that includes <i>Chicago Wilderness: An Atlas of Biodiversity</i> , "Natural Wonders" poster with educational activities and <i>Tribune</i> Educational Services supplement.	For educators and students to learn about the natural communities of the Chicago region.
Tools for individuals, agencies and organizations	Description	Purpose/audience
<i>Chicago Wilderness: An Atlas of Biodiversity</i>	Full-color, 64-page book describing the natural communities of the region.	For the general public, educators, media, elected officials, corporate and community leaders.
Chicago WILDERNESS Magazine	Quarterly magazine celebrating the rich natural heritage of the region.	To convey the messages of local biodiversity protection in a popular format; for all general audiences.
Chicago Wilderness "Portable Resources"	Fifteen-minute video called "This is Chicago Wilderness"; colorful and informative tabletop display; slide show presentation.	To give organizations the means for both internal and external communication about Chicago Wilderness.
Chicagoland Environmental Network (CEN)	Public point-of-contact for volunteer opportunities and events, managed by Brookfield Zoo.	To provide means for public to become informed about and involved in local conservation activities.
Chicago Wilderness Web Site at www.chiwild.org	Comprehensive resource for news and issues related to biodiversity protection, managed by Chicago Academy of Sciences.	To increase public awareness and provide forum for scientists, educators and land managers to share information.

Appendix 8

Chicago Wilderness Member Organizations: Their Mission and Significant Regional Achievements

(As of June 1999. For an up-to-date listing of members, visit www.chicagowilderness.org.)

Federal agencies	Mission	Significant regional achievements
U.S. Army Corps of Engineers, Chicago District	Maintains seven harbors, operates the Chicago Lock, designs and constructs flood control and shoreline protection projects, regulates discharge into waters of the U.S., including wetlands, does work for other agencies, and assists in emergencies. Key local projects include the Chicago Shoreline Protection Project, Chicagoland Underflow Project reservoirs, Upper Des Plaines Flood Damage Reduction Project and Waukegan Harbor Feasibility Study.	
U.S. Department of Energy, Argonne National Laboratory	Research and development in the basic sciences, energy, and environmental management.	1500-acre site surrounded by forest preserve. Vegetation communities of the site have been mapped using field surveys, remote sensing, and a Geographic Information System. Initiated the restoration of its oak woodland and prairie communities removing invasive non-native species and enhancing reproduction of native species. In addition, establishment of a 6-acre native tallgrass prairie has begun on a former building site. Argonne staff has been involved in prairie restoration and research programs in the Chicago area and a number of colleges and universities have participated in ecological research on the Argonne site.
U.S. Dept. of Energy, Fermi National Accelerator Laboratory	Research exploring the fundamental nature of matter and energy	Fermilab's National Environmental Research Park program makes land available for externally funded environmental research projects. To date, over 40 projects have been proposed, and several are currently underway.
Environmental Protection Agency, Region 5	Protecting human health and preserving our natural resources; preventing and abating pollution; education; setting and enforcing environmental standards, assisting states and local govts.	
U.S. EPA Great Lakes National Program Office	Oversees implementation of the U.S./Canada Great Lakes Water Quality Agreement to "restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin ecosystem."	Efforts include monitoring and reporting on conditions in the basin ecosystem, and also funding demonstration projects (e.g., habitat protection, restoration)
Urban Resources Partnership	Partnership of seven federal agencies to provide technical assistance or funding for projects in urban areas.	Works with communities and non-profit community focused projects with "on the ground" natural resources and educational opportunities for under served communities. Has sponsored projects such as community gardens and ecosystem restoration.
USDA Forest Service	Caring for the land and serving the people.	Through unique partnerships with state and local natural resource agencies, works in Northeastern Illinois to manage forests, prairies, and related natural resources for long term community and ecological sustainability and improved quality of life of all citizens. The Chicagoland area is home to three USDA Forest Service offices—the Midewin National Tallgrass Prairie in Wilmington and the joint North Central Research Station/Northeastern Area State and Private Forestry offices in Evanston.
USDA Natural Resources Conservation Service	To provide assistance for conservation on private lands.	A natural resources agency that provides science-based information, products, and services, and works with other groups and agencies on watershed planning, flood protection and wildlife habitat, etc.
USDI Fish and Wildlife Service	Protect and enhance fish and wildlife resources for the American people.	Works with partners to restore wetlands and trust resources; manages land in the national wildlife refuge system. In the Chicago area has been involved about 100 wetland restoration or enhancement, or research projects.

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USDI National Park Service, Rivers Trails and Conservation Assistance Program	Conserves natural and cultural resources of the Park System for enjoyment, education and inspiration of this and future generations.	The Chicago Rivers Demonstration Project, an NPS collaborative effort led by Friends of the Chicago River, was initiated in 1992 to enhance the natural and recreational resources of the Chicago and Calumet Rivers.
USDI National Park Service, Indiana Dunes National Lakeshore	Preserves more than 10,000 acres of shoreline, wetlands, oak woodlands, savanna and bog.	More than 15 miles of Lake Michigan shoreline are managed. Includes more than 1440 species of vascular plants as well as critical habitat for 2 federally listed species.

State agencies	Mission	Significant regional achievements
Illinois Department of Natural Resources	Conserves, preserves and enhances Illinois' natural resources; provides outdoor recreation for public.	Develops recreational facilities; protects natural areas; manages game and fish populations; protects endangered plant and animal species. Partnered with US Forest Service to restore Midewin National Tallgrass Prairie. Developed C-2000 Ecosystem Program to fund watershed restoration projects. IDNR was instrumental in Redwing Slough, a wetland protection and stewardship project in Lake County, and the Urban Fishing Program, which gives youngsters an alternative to gangs and drugs.
Illinois Natural History Survey	Conducts research on natural resources to assure maintenance of State's biodiversity. Through its research and education programs, the Survey fosters responsible management and appreciation of the state's biological resources. The Survey's collections of plant and animal specimens are among the largest and oldest in North America and are used by researchers from all over the world.	
Illinois Nature Preserves Commission	Works to protect high-quality natural areas and habitats of endangered and threatened species.	Works with private and public landowners through voluntary efforts. Statewide, 278 sites totaling approximately 35,000 acres have been dedicated as Illinois Nature Preserves, including 102 sites totaling 15,140.28 acres in northeastern Illinois' six counties.
Indiana Department of Natural Resources	Protect, enhance, preserve, and wisely use natural, cultural, and recreational resources	Manages numerous properties, including museums and wildlife areas. In May 1995, the Indiana Natural Resources Commission adopted a Resolution to formally recognize the importance of the Lake Michigan coastal region to the state and to rededicate the professional staff of the Commission and the DNR in service to the region.

Local agencies	Mission	Significant regional achievements
Chicago Park District	To enhance the quality of life throughout Chicago by becoming the leading provider of recreational and leisure opportunities; providing safe, inviting and beautifully maintained parks and facilities; and creating a customer-focused and responsive park system.	Thousands of children and families participate in a wide range of natural resource-focused programs and ongoing restoration and management of lagoons, wetlands, prairies, and other ecosystems located throughout Chicago parks.
City of Chicago, Department of Environment	Conserve natural resources; education; prevent pollution	Operates the North Park Village Nature Center, a 61-acre preserve and environmental education facility on Chicago's northwest side that offers natural resources based community service and outreach programs in Chicago schools and hundreds of other programs annually.
Crystal Lake Park District	Provide safe programs, parks, facilities and services and to preserve and protect open land and water areas. District's Nature Center reconnects people with nature via educational programming and exhibits.	

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Downers Grove Park District	Year-round recreation programs; parks, open space, and natural areas.	Restores and maintains 160 total acres at the Belmont Prairie State Nature Preserve and Lyman Woods, participates in the DuPage County River Sweep, and offers interpretive programs.
Forest Preserve District of Cook County	Protect, and restore areas with scientific, ecological, recreational, and historic values; creates an interconnected system of forest preserves that will be a national model of urban/open-space preservation.	
Forest Preserve District of DuPage County	To acquire open land and manage it to protect and enhance its natural values for public recreation, education and pleasure.	Has acquired nearly 23,000 acres (10% of land in the County). Completed extensive natural cover and habitat inventory for all properties. Maintains records on GIS database. Pursues an aggressive Natural Areas Management Program on 9,000 acres of quality natural areas.
Forest Preserve District of Kane County	Protect, and restore areas with scientific, ecological, recreational, and historic values.	Maintains about 7,500 acres of open space at the western fringe of the Chicago Wilderness. Maintains 12 Preserves protected under the Nature Preserve Ordinance of 1983, and many other areas of preservation and restoration.
Forest Preserve District of Will County	Protect, and restore areas with scientific, ecological, recreational, and historic values.	The Old Plank Road Trail, a 10-foot wide asphalt trail designed for non-motorized recreational use, currently runs from Park Forest to New Lenox. The trail is being extended to Park Road, in Joliet Township, which should be completed by November 1999; the total trail length will then be 19 miles. The trail is scheduled to be completed to downtown Joliet in 2001 and will measure 22 miles.
Geneva Park District	Provide recreational programs, and open space.	Offers programs and classes for adults and youth at Peck Farm Park, a nature interpretive site; holds environmental education field trips for schools, and community groups.
Kane-DuPage Soil and Water Conservation District	Provide natural resource information and assist with natural resource concerns.	SWCD programs include an annual conservation plant sale, fish sales for pond stocking, a well-water testing program and various education programs for youth and adult audiences.
Lake County Forest Preserves	To preserve a dynamic and unique system of natural and cultural resources, and to develop innovative educational, recreational and cultural opportunities of regional value, while exercising environmental and fiscal responsibility.	Own 21,000 acres of land with a goal of 26,000 acres, or 40 acres per 1,000 residents, by the year 2005. Earned voter approval of \$85 million for land acquisition, habitat restoration, trails and other improvements this decade. Used by 75 percent of Lake County's population, with over 2.5 million visitors per year. Protecting 85 to 90 percent of lands for nature preservation and restoration. Increased natural resource management by 300 percent since 1993, with 12,000 acres now managed. Created 7,000-acre Des Plaines River Greenway protecting 88 percent of riverbank in Lake County and connecting many large Forest Preserves including dedicated Illinois Nature Preserves.
Lake County Stormwater Management Commission	The combination of explosive growth and wet topography has heightened the need for stormwater management. The Commission, composed of six municipal members and six County Board members, is responsible for implementing the Comprehensive Stormwater Management Plan, which was adopted in 1990 and a county wide watershed development ordinance adopted in 1992.	
Long Grove Park District	Preserve natural areas, and open space.	Holds over 400 acres of open space, including an Illinois Nature Preserve; Owns Woodland Nature Center devoted to nature education for both adults and children, and is working to enhance the habitat of one population of the prairie white fringed orchid. Acts as a depository agency for easement grants.
McHenry County Conservation District	Preserve and restore natural areas and open spaces for education, recreation, and environmental benefits	Biodiversity activities are centered around: 1) the permanent protection of existing natural areas through purchases or easements, 2) restoration of ecosystems, to pre-European settlement conditions, and 3) the provision of environmental education through workshops, school field trips, interpretive walks and a variety of other programs.

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Metropolitan Water Reclamation District of Greater Chicago	Protecting Lake Michigan and area waterways.	Provides sewage treatment with seven water reclamation plants, and prevents pollution of rivers and the lake with the "Deep Tunnel." Operates five urban waterfalls and the Centennial Fountain.
North Cook County Soil and Water Conservation District	The mission of the North Cook County Soil and Water Conservation District is to provide for the Conservation of the natural resources of the District.	Agreement with the Army Corp to review Soil Erosion and Sediment Control plans on construction sites requiring Army Corp permits; host an environmental competition for high school students called the Envirothon; watershed planning facilitation; and soil erosion and sediment control workshops for municipalities.
Northeastern Illinois Planning Commission	Comprehensive, long range planning agency for the six-county region.	Facilitates intergovernmental cooperation. Provides regional guidance for stormwater management, water quality, stream, lake, and wetland protection, and conservation development. Develops forecasts for population, households and employment. Develops regional plans or water resources, open space and greenways, e.g., co-authored the Northeastern Illinois Regional Greenways Plan. Develops the Regional Growth Strategy and co-develops regional plans for transportation.
Oakbrook Terrace Park District	Meeting recreation needs.	Acquire, develop and maintain resources to facilitate recreational experiences and open space.
Schaumburg Park District	Education about natural history and the relationships of people to the land.	Manages over 225 acres of passive-use areas that encompass a wide range of habitat types and hundreds of native plant and animal species. A living history farm presents a glimpse of local land use during the late 1800s.
St. Charles Park District	Provides diverse programs, parks; preserves and protects open spaces, natural areas.	The Park District is actively managing and restoring six natural areas encompassing approximately 500 acres. Two of the natural areas are dedicated Illinois State Nature Preserves. Nature education is offered in a variety of venues to all ages.
Private not-for -profit org. Advocates for conservation /sustainable development	<u>Mission</u>	<u>Significant regional achievements</u>
Center for Neighborhood Technology	Promoting public policies, which support sustainable, just and vital urban communities.	Campaign for a Sustainable Chicago, vision of a city in which environmental restoration fueled equitable economic revitalization. Defines its work in terms of interrelated strategies: information and communications, assets and opportunities, and collaborative learning and action.
Chicago Audubon Society	The Chicago Audubon Society is an environmental organization with a particular interest in birds and their habitats. As a chapter of the National Audubon Society, its objective is protection of the environment through education, stewardship, conservation and community interaction. The ideological and hands-on support of its members is the Society's major resource.	
Citizens for Conservation	Saving Living Space for Living Things through protection, restoration and stewardship of land, conservation of natural resources and education.	Helped preserve more than 2,000 acres in the Barrington area and owns more than 270 acres; some as open space others being restored to fen, bog, sedge meadow, prairie, marsh and savanna. Flint Creek Savanna and Grigsby Prairie are current restoration projects.
The Conservation Fund	Emphasizes the integration of economic and environmental goals.	Through real estate transactions, demonstration projects, education, and community based activities, designs long-term measures to conserve land and water resources. Current projects include working with the Liberty Prairie Reserve to expand open space and provide habitat in Lake County; works with communities and the private sector to implement development techniques that minimize impacts on environment.
DuPage Audubon Society	_____	_____

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Environmental Law and Policy Center of the Midwest	Develop and advocate policies that preserve the environment and foster economic growth.	Won landmark federal court ruling requiring fuller accounting of relationship between proposed new toll roads and continued suburban sprawl; successfully protected Savannah Depot, Illinois largest unfragmented sand prairie, from development; induced state regulators to tighten pollution limits for Illinois waterways.
Fort Dearborn Chapter, Illinois Audubon Society	Protect native flora and fauna of Illinois and the habitats that support them through pollution control, the conservation of energy and all natural resources, a sound ecological relationship between human populations and their environments, and education. Studies all aspects of bird life, including identification and conservation, and hosts workshops that explore other aspects of biodiversity.	
Illinois Audubon Society	Preserves habitat, especially for threatened and endangered species, and conducts educational programs; prevent pollution, curb urban sprawl and safeguard environmental regulations.	
National Audubon Society	Protect habitat critical to our health and health of planet. Works with Chicago-area Audubon chapters and Chicago Wilderness members to conserve and restore nature. Focuses on wildlife, habitat and public education.	
Northwest Indiana Forum Foundation, Inc.	Stimulate private-sector economic growth.	Works for a sustainable northwest Indiana, using partnered environmental, natural resource and restoration efforts such as the Quality of Life Council, the Indiana Harbor and Ship Canal-Grand Calumet River Area of Concern activities and the Indiana Dunes Environmental Learning Center.
Prairie Woods Audubon Society	To conserve the environment, wildlife and natural habitats, education, and fellowship.	Supports two instructors who currently reach more than 5,000 grade school children through environmental education program, including studies on the ecology of prairies, ponds, wetlands, winter survival of animals and a study on owls. Holds monthly meetings and field trips.
Sierra Club, Illinois Chapter	Explore, enjoy and protect wild places of the Earth.	Works on pollution and conservation issues such as preserving large tracts of open space, strengthening water quality standards, reducing/proper disposal of solid waste, and promoting alternative transportation; land use planning
Thorn Creek Audubon Society	Promote the enjoyment and appreciation of birds, to educate adults and children concerning our natural environment, to preserve, protect and restore wildlife habitat, and to create awareness of local environmental issues.	
Private not-for -profit org. Educational/communication /professional/research	<u>Mission</u>	<u>Significant regional achievements</u>
Brookfield Zoo	Creating sustainable and harmonious relationships with nature	Award-winning exhibitory of animals and ecosystems that encourage conservation action and caring. Local and international research and education programs that support conservation efforts. Founder and home of Chicagoland Environmental Network, coalition of local environmental organizations that promotes conservation projects and volunteer opportunities.
Calumet Environmental Resource Center	Environmental and economic "information clearing house"	Houses over 2,500 documents, air photos, and maps on the region for organizations, agencies, and individuals. Helped form Lake Calumet Ecosystem Partnership.
Chicago Academy of Sciences	Scientific literacy for all citizens. Conservation and quality of life exhibits and environmental education programs.	Education outreach programs (e.g., CAos Club; Ecological Citizenship (EcoCit)); science workshops for teachers; lectures; field trips, weekend workshops and other programs for children and adults. Opening Peggy Notebaert Nature Museum in October 1999 focusing on ecology and natural history of the midwest from Great Lakes to prairies.

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Chicago Botanic Garden	To stimulate and develop an appreciation and understanding of gardening, botany, and conservation by developing gardens, plant collections, and education and research programs of excellence while providing a continuing aesthetic experience at the Chicago Botanic Garden.	Living museum with 23 gardens, 385 acres total, 75 acres of lakes, 15 acres of prairie, and 100 acres of woods. Over 8,000 taxa of plants and over 900,000 visitors each year. The Skokie River restoration project is a permanent study site for streambank stabilization techniques. Mary Mix McDonald Woods, a flat woods and open oak woodland, is a restoration management project. The Suzanne S. Dixon Prairie is a 15-acre display of 6 regional prairie communities. Our research program on endangered and rare plants for the purposes of conservation and reintroduction includes genetic analysis, propagation, reproductive systems research, monitoring, and seed banking.
Chicago Ornithological Society	Promotes the recreational, educational and scientific aspects of ornithology in the area.	Publishes <i>The Birder</i> , a newsletter containing articles on area birds and birding and information on field trips for studying birds in their natural habitats. Holds regular meetings with speakers (both professional and amateur Ornithologists from around the country) who make presentations to COS members on diverse topics related to birding and ornithology. Schedules classes on bird identification. Maintains an e-mail forum (IBET) for Illinois birders to share information.
College of DuPage	Offers more than 100 nature and ecological classes each year including Prairie Ecology; 40 acres of the campus' 279 acres has been designated as nature preserves; 30 scientific papers have been published using data gathered from its preserves; offers biweekly prairie tours to the public during summer.	
Conservation Research Institute	Research and education in the restoration and management of natural ecosystems.	Works to identify factors that are significant in contributing to the biodiversity and stability of woodlands, wetlands, and prairies—to help planners, government agencies, and land owners manage remnant and restored land effectively.
The Field Museum	A research and educational institution devoted to understanding and preserving natural and cultural diversity.	Regional inventory, monitoring, and research programs that focus on species, communities, and landscape processes of conservation concern. Education programs, public exhibits, and other outreach on the region's biological diversity.
Hammond Environmental Education Center	Education about the effect every day choices on the environment.	Provides hands-on environmental learning activities for children and adults. Holds lecture series, teacher training workshops, and a summer day camp. Displays showing recycling efforts from industry; federal and state agencies, and environmental organizations are available.
Illinois-Indiana Sea Grant College Program	Fosters the creation and stewardship of an enhanced and sustainable environment and economy along southern Lake Michigan and in the Great Lakes region through research, education and outreach. Currently has active research and outreach programs in the areas of biological resources, coastal business and environment, and water quality.	
Indiana Dunes Environmental Learning Center	Promote appreciation for and understanding of natural resources at south end of Lake Michigan.	Establishment of residential environmental education facility in partnership with Indiana Dunes National Lakeshore, with school programs for 4th-6th grades and high school, plus teacher training and nonschool programs for all ages including adults, plus Environmental Education Consortium and other outreach activities.
Indiana University Northwest	Teaches courses on ecological science and environmental problems; performs research on metapopulation ecology, population ecology of amphibians and reptiles, prairie restoration and enhancement of species diversity in small prairie remnants; establishes native prairie habitats along the Little Calumet River; offers public slide presentations on Chicago Wilderness natural areas.	
Irons Oaks Environmental Learning Center	Environmental education for local school districts.	37-acre nature preserve in the south suburbs of Chicago. The Land Management Plan provides for prairie restoration and removal of non-native vegetation from the oak forest.

Appendix 8. Chicago Wilderness Member Organizations: Their Mission and Significant Regional Achievements

<p>Jurica Nature Museum</p>	<p>Small natural history museum located on the campus of Benedictine University. Includes specimens displayed in natural habitats. Offers field trips, a free discovery box loan program and winter workshops for elementary school teachers.</p>	
<p>Lincoln Park Zoo</p>	<p>Education, wildlife preservation, and recreation.</p>	<p>The nation's oldest zoo, receives more than three million visitors annually. Houses 1,000 mammals, reptiles and birds; conducts local and international conservation efforts, programs for students and teachers, and special events. Participates in nearly 40 Species Survival Plans (guidelines for captive breeding, monitoring) endangered species (e.g., lowland gorillas, Siberian tigers, black rhinos).</p>
<p>Max McGraw Wildlife Foundation</p>	<p>Scientific, educational, and charitable corporation for conservation of natural resources.</p>	<p>Conducts research and conservation education work to improve wildlife and fisheries management and conservation techniques. Provides funds in support of research, education, and related conservation.</p>
<p>Morton Arboretum</p>	<p>Encourage planting and conservation of trees and other plants through plant collections, research, and education.</p>	<p>A 1,700-acre arboretum displays more than 3,600 kinds of plants from the north temperate zone. Collections are combined with 700 acres of oak woodland, reconstructed prairie, rare species habitat, and wetlands. Actively involved in research on rare plants and on the nature of presettlement vegetation.</p>
<p>John G. Shedd Aquarium</p>	<p>Enjoyment and conservation of aquatic life through education, research and public display.</p>	<p>Funded and provided staff for an investigation into the decline of the Illinois cricket frog population, worked with the Illinois EPA to create an exhibit about non-point source pollution, and is also involved in several Species Survival Plans and breeding programs.</p>
<p>Sustain, The Environmental Information Group</p>	<p>Works for sustainable environment through innovative communication strategies such as media support, graphic design work, internet support, and consulting.</p>	
<p>The Wetlands Initiative</p>	<p>Restoring our nation's wetland resources to reduce flooding, improve water quality, and expand wildlife habitat and conduct research and education.</p>	<p>Educating landowners about the importance of wetlands and proper stewardship of what they own; restoration of wetlands in Lake, Cook and Will Counties, and research into the structure of wet dolomite prairie. Current projects include working with the Cook County Forest Preserve to create the plan for wetland restoration at Poplar Creek, Skokie Lagoon, and Tinley Creek, and working with the US Forest Service to identify and restore the wetlands of Midewin National Tallgrass Prairie.</p>
<p>Wild Ones Natural Landscapers, Ltd.</p>	<p>Promotes biodiversity and environmentally sound landscaping practices.</p>	<p>Rescues plants from natural areas being destroyed and helps preserve gene pools by keeping these plants in gardens, or donating them to restoration organizations. Provides lectures, field trips, workshops, seeds, plants and personal help to its members and the general public.</p>

Private not-for-profit org.
Local stewardship and land protection

Mission

Significant regional achievements

<p>Butterfield Creek Steering Committee</p>	<p>An intergovernmental watershed management organization comprising the south suburban municipalities of Homewood, Flossmoor, Olympia Fields, Richton Park, University Park, Glenwood and Chicago Heights.</p>	<p>Developed a plan for the watershed—"A Vision for Butterfield Creek"; developed and adopted a comprehensive watershed management ordinance. Currently pursuing a variety of open space preservation, stream management, education, and habitat enhancement projects.</p>
<p>Calumet Ecological Park Association</p>	<p>Preserve natural lands; highlight cultural resources; revitalize economy in the area.</p>	<p>Establish an urban ecological park in Chicago's Lake Calumet area and northwest Indiana.</p>

Appendix 8. Chicago Wilderness Member Organizations: Their Mission and Significant Regional Achievements

Campton Historic Agricultural Lands, Inc.	Land trust, acquires and protects land for open space preservation and education.	Founded in 1977 with the 163-acre donation of the Garfield Farm Museum, CHAL has protected an additional 118 acres, restoring 45 as wetlands, prairie, and woodlands. CHAL considers the historic, natural, agricultural and open-space aspects of properties for protection.
Canal Corridor Association	Economic revitalization conservation of cultural and natural resources.	Works with public/private partnerships, offers technical assistance in historic preservation, land conservation and economic development. In 1984, the Association secured the Congressional designation of National Heritage Corridor, recognizing the significance of the 450 sq.mile area from Chicago to LaSalle/Peru, Illinois.
The Conservation Foundation	Preserve open natural lands, improve rivers and watersheds, conservation education.	The Foundation works in DuPage, Kane, Kendall and Will counties, boasts more than 1,400 members, and coordinates several programs: Land Trust, DuPage River Coalition, Trails Project, Environmental Education Project, West Chicago Prairie Stewardship Group, and the Big Rock Creek Project.
Friends of the Chicago River	Foster the vitality of the Chicago River for the human, animal, and plant communities within its watershed.	Educational projects; recreational projects; and restoration projects. Collaborated with private, government, and non-profit partners in the restoration of wetlands and stream corridors. Developing a watershed management plan for the north branch of the Chicago River and guidelines for re-naturalizing the channelized portions of the Chicago River.
Friends of the Parks	Improve and protect Chicago's parks.	Saved over 70 acres of lakefront parkland from private development; initiated an Adopt-A-Park/Adopt-A-Beach program, in which 65 businesses, schools, community groups and neighbors care for local parks; developed 149 local park advisory councils; mobilized thousands of volunteers to clean and green Chicago's parks on Earth Day, and the Great Lakes Beach Sweep.
Friends of Ryerson Woods	Protect this rare ecosystem for present and future generations.	Sponsors environmental education programs and projects Help manage the needs and uses of the Edward L. Ryerson Conservation Area.
Garfield Park	Enhance and maintain collections and facilities (greenhouses?) through community programs.	A task force formed from representatives from various community, education, and environmental organizations to revitalize the Conservatory after losses of aroid plants following a cold snap in 1994. Offers educational tours of the Conservatory, a Summer Nature Camp, an After School Program, and a Community Gardening and Greening Program.
Lake Forest Open Lands Association	Conservation and restoration of open space within Lake Forest and vicinity.	Has preserved and manages over 700 acres of prairie, savanna, woodlands and wetlands in the Lake Forest area. Recently expanded its scope of environmental education by opening the Lockhart Family Nature Center,educating over 3,000 students and general public annually.
Lake Michigan Federation	Lake Michigan Federation To restore urban aquatic habitat, promote better land and water use practices, and cut toxics that threaten children's health around Lake Michigan.	Advocates for improving citizen access to aquatic habitat in cities, such as wetlands, nearshore bird stopovers, and fish spawning grounds; works for improved water quality; and coordinates thousands of volunteers for cleaning Lake Michigan beaches as part of Coastal Cleanup day every September.
Liberty Prairie Conservancy	Preserve open space, integrate public land acquisition, private conservation, low density development.	Private owners have protected more than 650 acres of land through conservation easements. Protected wildlife corridors; enhanced water quality; preserved farmland; trails for hiking, biking, and horse-back riding; tranquil views to people driving through the Reserve.

Appendix 8. Chicago Wilderness Member Organizations: Their Mission and Significant Regional Achievements

Openlands Project	Protect and enhance public open space in northeastern Illinois.	Helped preserve more than 41,000 acres of native habitat and other public spaces, including the Midewin National Tallgrass Prairie. Helped establish the Illinois Prairie Path and the I&M Canal National Heritage Corridor. Its 21st Century Open Space Plan is a comprehensive approach to “green infrastructure” for the region.
Save the Dunes Conservation Fund	To protect and restore the Indiana Dunes region.	Uses education, research, conservation, and legal safeguards to achieve goals. Produced the Grand Calumet River Lagoons Watershed Plan, established a bird-banding station, and conducts regular water quality monitoring.
Save the Prairie Society	Acquire, preserve and restore natural areas and wildlife habitat; conservation education	Incorporated in 1975 to save the 80 acre Wolf Road Prairie from development. Restoring 5 acres of savanna, prairie and stream corridor buffer to the preserve. Provides field trips, nature programs and educational materials. In 1993, launched the Natural Areas Rescue Fund (NARF), a land acquisition project to save imperiled “orphan” natural areas and endangered species in Illinois.
Shirley Heinze Environmental Fund	Preserve, protect, and restore natural lands in the Indiana Dunes region; educate the public on environmental issues; promote clean air and water.	Acquired nearly 600 acres of wetland, prairie, dune, woodland, and dune-and-swale habitat in Northwest Indiana for preservation, restoration, and management as nature preserves. Sponsored more than 100 educational hikes and other programs for the general public, schools, and community groups. Published three books of local environmental interest.
Glenview Prairie Preservation Project	Educate the community about the uniqueness of the native prairie located on the site of the former Glenview Naval Air Station; advocate for the official designation of the prairie as a permanent preserve a public space of sufficient size to maintain the viability, quality, and diversity of the current prairie ecosystem.	
The Grove National Historic Landmark	Historical education and recreation.	A 124-acre facility offers historical, cultural and ecological programs; restore and preserve the grounds, the Interpretive Center, and the historic structures.
The Nature Conservancy	Preserving plants, animals and natural communities by protecting land.	Illinois Chapter has helped protect 82,000 acres of prairie, savanna, woodlands and wetlands. Over 22,000 members in the Chicago region, and supports nearly 6,000 “citizen scientists” through the Volunteer Stewardship Network.
The Trust for Public Land	Acquire open lands for the preservation of native plants, animals, biotic communities, and geological or geographical formations of scientific interest.	

Appendix 9
Examples of Natural Landscaping Installation and Maintenance Cost

Economic benefits to using native landscape treatments

The following table represents 1995 costs per acre for the three identified landscape treatments.

Installation and seed costs	Kentucky blue grass	Buffalo grass	Prairie grasses and forbs
Seed	\$500	\$1,000	\$1,200
Ground prep. and installation	\$2,000	\$500	\$500
Watering, mowing, weeding related to installation	\$2,000	\$500	no weeding first year
	<u>\$4,500</u>	<u>\$2,000</u>	<u>\$1,700</u>
Overseeding (seed and install)***	\$900	\$550	\$500
Annual maintenance costs			
Mowing (\$75/week)	\$2,400	\$750	
Watering	\$2,000		
Fertilizing (\$90/application)	\$270	\$90 ***	
Weed control (\$50/application)	\$100	\$100 ***	
Core Aeration	\$450		
Prescribed burn and/or mowing			\$400 *
Weeding and hand-wicking			\$1,200 **
	<u>\$5,220</u>	<u>\$940</u>	<u>\$1,600</u>

* Includes permit application submittal; in most cases, the larger the site the lower the incremental cost of controlled burning, depending on the complexity of the fire plan.

** May or may not be necessary during the first 5 years of establishment.

*** May or may not be necessary during the first 3 years of establishment.

The above figures represent a "typical" seed installation. Installation and maintenance charges may vary based on ground preparation, seeding rate and desired appearance.

Annual maintenance figures are based on a 32 week growing season.

Per acre costs compared over a 10 year period

Year	Treatment	Kentucky blue grass	Buffalo grass	Prairie grasses and forbs
1	install. & maint.	\$9,720	\$2,940	\$1,700 *
2	maint. & overseed	\$6,120	\$1,490	\$1,900
3	maint. & overseed	\$6,120	\$1,490	\$1,900
4	maint. & overseed	\$6,120	\$1,490	\$1,900
5	maintenance	\$5,220	\$490 **	\$1,400
6	maintenance	\$5,220	\$300	\$200 ***
7	maintenance	\$5,220	\$300	\$200
8	maintenance	\$5,220	\$300	\$200
9	maintenance	\$5,220	\$300	\$200
10	maintenance	\$5,220	\$300	\$200
		<u>\$59,400</u>	<u>\$9,400</u>	<u>\$9,800</u>

* No maintenance is required for the first year of prairie grass establishment.

** After fourth year establishment of Buffalo grass, mowing frequency will decrease to 4 times per year or less depending on desired appearance.

*** Following full establishment of the prairie, generally after year 5, annual maintenance will be reduced to an annual burn.

Appendix 10

Conflict Resolution and Inter governmental Cooperation. A Model for Growth Management.

In this example, suppose a suburban setting contains an arterial roadway. The suburban area is now experiencing development pressures and increased traffic on the arterial roadway. The arterial corridor passes through several towns and through unincorporated areas between the towns. The corridor also includes streams, wetlands, and woodlands, each with valuable plant and animal species. The roadway, which has served the communities well for the past 20 years, now has regular instead of infrequent congestion. Regional growth forecasts indicate a possible doubling of population, households, and employment in the area.

The process

1. Establish an agreed-upon statement of purpose

The initial step is to get the counties and towns in the corridor to agree that the process is desired, to agree generally on a statement of purpose, and to find the resources necessary to accomplish their purposes. Elected officials should be involved as decision-makers throughout the process to ensure accountability. General-purpose governments (counties and municipalities) initiate the planning process to establish a public purpose and because many or most of the recommendations will fall on the local governments to implement. The statement of purpose usually includes general statements about the goals of the process (for example, traffic mitigation, environmental protection, and adherence to community visions) and an agreement to cooperate to achieve a mutually beneficial future. If the corridor includes rich biodiversity or has potential for biodiversity recovery, then the goal of preserving or recovering biodiversity is included in the purpose statement. Depending on the specific issues in the area, the , counties and towns may also ask park districts and forest preserve districts, and even schools, townships, and library districts, to join the process. The governments, by formal intergovernmental agreement, can form an entity such as a corridor-planning council. At least six of these have already been established in the Chicago Wilderness area. The Illinois Local Land Resource Management Planning Act enables the creation of these entities.
2. Organize the structure of the planning process

Once there is agreement to pursue the process, a structure should be established designating:

 - A steering committee (most likely elected officials)
 - A technical committee (primarily the staffs of the government members)
 - An advisory committee (neighborhood groups, business interests, environmental interest groups, and several unaffiliated but concerned citizens)
3. Establish and carry out the steps of the planning process

Generally, the process includes the following steps. Each step involves review by each of the three committees, thus involving the decision-makers, the technical staff, and the various interest groups. The meetings of these committees should offer opportunities for input from the citizenry. This ensures that all

values, views, and constituencies have had a chance to meaningfully influence the decisions.

1. Visioning through techniques such as visual preference surveys, charrettes, and brainstorming
2. Establishment of initial goals and objectives
3. Inventories of existing conditions (natural resources as well as land use, traffic and economic conditions, and other community-development factors such as historic areas) and projections or forecasts of future conditions
4. Generation of a full range of alternatives
5. Screening of alternatives to narrow the number to a manageable size. This step also involves using the preliminary evaluation.
6. Detailed evaluation of the selected alternatives. The goals and objectives established in step 2 are used here so that the alternative plans are evaluated in accordance with the desired end state of the corridor.
7. Assessment of the impact of each alternative, including cost-effectiveness and implementation considerations
8. Selection of one alternative
9. Adoption of the plan and initiation of its implementation

Decision-making

The keys to the planning process are establishing a good vision and establishing clear goals and objectives for the process. These not only help define a good set of alternatives but also provide the framework for a comprehensive evaluation. In our example of a road corridor for a rapidly growing suburban area, planners might traditionally settle on expanded arterial capacity, adding to that care and consideration for avoiding negative impacts on wetlands or woodlands or other natural areas. The traditional solution probably would also include minimizing impacts on already developed neighborhoods or business districts. However, this comprehensive approach requires the consideration of a wider set of alternatives and a greater attention to their impacts.

- A full range of transportation alternatives should be looked at, including introducing or increasing public transportation and providing for and promoting the use of bicycling and walking. If the corridor includes a train station, transit-oriented development can make it convenient for residents to use the rail system instead of driving.
- The planners should consider how to manage access to the road (both now and in the future) to allow the road to function according to its design, instead of letting multiple access points unnecessarily clog the roadway.
- Considerations of urban and suburban design and land-use design should be included to make sure that new developments overload neither the transportation facilities nor other public facilities such as water and sewer systems.

- Providing housing affordable to local workers helps shorten work trips and travel times.
- Mixing land uses in new or current developments allows people to walk or bicycle where they might otherwise drive.
- Aesthetic considerations (historic preservation, landscaping, signage, and lighting standards) are also important so that new development fulfills the vision.

Because our example corridor runs through areas with high-quality natural resources, the impact assessment should not only consider mitigating potential negative impacts but should also consider possibilities that avoid the negative impacts altogether. The vision for the corridor should include enhancement the natural resources (and biodiversity), not simply the mitigation of harm. Avoidance is usually the best initial policy, but it may not always be possible. If the roadway crosses streams or rivers or other natural areas, the crossing structures can be designed or

redesigned to minimize impacts or in some cases to improve the situation. If the roadway is to be altered and it happens to be adjacent to a channelized stream, the new roadway design might accomplish a dual purpose by acquiring enough land to allow restoration of that stream through re-meandering and the planting of native vegetation. Opportunities for expanding wetlands should also be considered. The acquisition of additional rights of way for the roadway might also help accomplish this objective. The right of way could also be considered for a greenway corridor, with planting of native vegetation, especially if that corridor is designated in the Regional Greenways Plan. In short, there are ways to accomplish multiple purposes within a corridor-planning process. Rather than simply thinking of the process as a way to choose among cookbook solutions, we can see it as an inclusive process that can ultimately produce plans and programs that meet multiple objectives.

Appendix 11
Recommendations and Action Statements

This appendix provides a chapter by chapter summary of the many recommendations contained in this plan. For their full meaning, they should be read in the context within the text of the chapters.

Chapter 1. Executive Summary
Chicago Wilderness and its Biodiversity Recovery Plan

1. Manage more land to protect and restore biodiversity
2. Preserve more land with existing or potential benefits for biodiversity
3. Protect high-quality streams and lakes through watershed planning and mitigation of harmful activities to conserve aquatic biodiversity
4. Continue and expand research and monitoring
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
6. Adopt local and regional development policies that reflect the need to restore and maintain biodiversity

Chapter 3.
The Biodiversity Challenge in an Expanding Region

- ✓ 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.
- ✓ 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 5.
Terrestrial Communities: Status, Needs and Goals

- ✓ Increase number of acres under management on public lands
 - 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
 - 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
 - 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
 - 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
 - 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
 - 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
 - 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
 - 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
 - Manage associated uplands with wetlands
 - Manage communities as part of a large system
 - Manage whole watersheds to conserve ecosystem processes
 - Restore communities as part of mosaics

- ✓ Protect priority areas
 - 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
 - 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
 - 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
 - Communicate across the region about planned fluctuations in wetlands
 - Vary management from site to site

- ✓ Increase seed supply of local genotypes
 - 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
 - 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

Chapter 6.
Aquatic Communities; Status, Needs and Goals

- ✓ Reduce hydrological alteration
 - Continue to identify watersheds with streams that have exceptional aquatic biological integrity to inform planning efforts and set priorities.
 - Limit development in some high-priority subwatersheds.
 - Direct development into areas that limit hydrological alteration.
 - Promote cluster development.
 - Require storm-water detention that effectively controls the full range of flood events.
 - Promote natural drainage as an alternative to storm sewers.
 - Create buffer strips and greenways along streams.
 - Acquire additional land for conservation.
 - Develop storm-water management plans.
 - Enforce erosion-control measures on new construction.
 - Create or restore streamside wetlands.
 - Educate decision-makers about development patterns and the effects of land uses on streams.

- ✓ Reduce deterioration of habitat quality
 - Remove unnecessary dams.
 - Retain or restore emergent and near-shore vegetation.
 - Re-meander channelized streams.
 - Restore riffles, pools, sandbars, and other elements of in-stream habitat.
 - Study the effects of riparian management.
 - Survey how people use aquatic resources and study the economic impacts of uses such as fishing and recreational boating.
 - Use bioengineering solutions to control streambank erosion.

- ✓ Reduce deterioration of water quality
 - Rigorously enforce non-degradation standards.
 - Develop and implement best management practices to control soil erosion, sedimentation, and storm water runoff.
 - Find alternatives to new and expanded effluent discharges to high-quality streams. For example, route sewage flows to regional facilities and use land treatment.
 - Re-examine standards and practices for sewage treatment.
 - Promote effluent polishing through constructed wetlands for all discharges to moderate- and high-quality streams.
 - Encourage pollution-control regulators to use biocriteria for water quality standards.
 - Gain community support for watershed management.
 - Evaluate aquatic insects as indicators of water quality.
 - Evaluate the need for improved water quality standards.
 - Encourage volunteer monitoring.

- ✓ Lake Recovery and Protection Actions
 - Develop specific recovery plans for species and lakes of concern
 - Develop better mechanisms to control the invasion of exotic species
 - Plan, protect, and manage lakes at the watershed level
 - Develop a region-wide process to track and study threats to lakes
 - Conduct research to better understand habitat requirements of aquatic species
 - Investigate and mitigate the threat of salinization
 - Investigate and prepare for the possibility of reintroduction of native species
 - Strengthen laws protecting species and their habitats
 - Integrate biodiversity concerns into laws, policies, and guidelines
 - Clarify ambiguous laws relating to lakes and their management
 - Increase public understanding of lake biodiversity issues
 - Increase public involvement in lake management and protection

- ✓ Lake Michigan Recovery and Protection Actions
 - Identify information gaps concerning the Lake Michigan shoreline in the region with respect to surviving habitat, and opportunities for habitat restoration, so that practical goals can be developed.

- Identify key site-specific aquatic habitat restoration opportunities to support local and lake-wide biodiversity.
- Identify site-specific opportunities to provide shoreline protection that also provides improved habitat.

Chapter 7

Status of Endangered and Threatened Species: Assessment and Recommendations

- ✓ Acquire more public land to increase the size and number of available habitats. Among the criteria to consider in purchasing land should be the presence of endangered and threatened species; greater emphasis should be placed on land acquisition as a means of protecting rare species. Priority should be given to creating complexes of communities, since many animal species depend on a variety of habitats.
- ✓ Legal protection of plants, in contrast to that of animals, is weak. Enact stronger legislation for the protection of rare native plants.
- ✓ Enlarge and consolidate existing natural communities by creating buffers, or by restoration, to counteract the effects of fragmentation, particularly the isolation of populations of rare species. For some species, such as insects, it is more important to enlarge sites than to create new ones.
- ✓ Increase the levels of protection for unprotected or semi-protected sites with known occurrences of endangered and threatened species. For example, incorporate such sites into the Nature Preserves system.
- ✓ Work with private landowners, either individual or corporate, to protect the endangered and threatened occurrences on their property. Use conservation easements and other incentives to protect endangered and rare resources on private land.
- ✓ In management plans for all sites with endangered and threatened species, include specific provisions to eliminate stresses and threats and to enhance recovery of these species.
- ✓ To measure effects of management activities on rare species, design monitoring programs (for representative populations) to provide feedback to adapt management activities and approaches.
- ✓ Institute a region-wide monitoring program for rare species, implemented by trained volunteers as well as agency staff, to enhance and coordinate current efforts to measure population trends. Protocols should be species-based.
- ✓ Rotate and diversify management treatments in order to maintain a variety of habitats needed by many species.
- ✓ Create a common Chicago Wilderness database. To avoid duplication of research and effort, managers should have access to centralized information about the needs of rare species and management practices related to them for adaptation to their own sites. Linking with Natural Heritage Databases in Illinois, Indiana, and Wisconsin is critical to this process.
- ✓ Expand *ex situ* programs for endangered and threatened plant species so that adequate seed or plant material is available for appropriate reintroduction as more sites are restored.
- ✓ Develop recovery plans for both federal-listed species and state-listed species that have been identified as priorities. The Chicago Wilderness Endangered and Threatened Species Task Force has identified approximately 150 species as priorities for recovery in the region, assigned to six categories (see Appendix 6). The plans should be realistic, suited to the CW region, and workable within county and other regional structures and agencies. Reference should be made to recovery plans already developed or in process for federally listed species as models to be adapted and simplified for state-listed species.

Chapter 8

Preserving Land and Water Resources for Biodiversity

Recommendations for private property owners

- ✓ Property owners who believe they own important habitats should have inventories of their land made by the staff of local, state, or federal agencies or by experienced citizens associated with local conservation organizations.
- ✓ Property owners who wish to commit to long-range protection and enhancement of their habitats should first assess the various methods of legal protection (listed in detail below).
- ✓ Property owners who do not wish to encumber or sell their land, but recognize its habitat value, should pursue habitat-enhancement techniques, participate in larger landscape restoration efforts, inspire neighboring property owners, and share information on uncommon species observed on their property.
- ✓ Property owners who have already established a strategy to protect and restore their property should assess potential impacts on their habitat from changes to land use on neighboring properties and, based on that assessment, pursue strategies with neighboring property owners to insure protection and expansion of the habitat resources.
- ✓ Corporate property owners should restore native plant and animal communities on their lands or expand existing restorations wherever possible to expand, link, or enhance nearby habitats. This can provide employee and community benefits and, in some cases, can achieve significant savings on land management.

- ✓ Chicago Wilderness should map and catalog the extent of private properties in the region that could play an important role in broader ecosystem restoration efforts.
- ✓ Chicago Wilderness should establish a process whereby private property owners can become effective participants in broader efforts to restore ecosystems.

Recommended actions for Chicago Wilderness member organizations to facilitate transfer of private property

- ✓ Educate the land-owning public about the options and incentives available for transferring open space to public and not-for-profit conservation agencies.
- ✓ Assure that all areas within the Chicago Wilderness region are served by one or more organizations that will take title to important habitats in order to manage them.
- ✓ Look for funding mechanisms so that lack of resources for ongoing ecological management is no longer an impediment to the donation of important habitat.

Recommendations for local governments

- ✓ Encourage local citizens to offer ideas for habitat preservation and restoration in community visioning exercises.
- ✓ Identify lands with high habitat value and lands with good restoration potential and designate them as natural resource preserves in comprehensive, strategic, and special-area plans. Consider municipal ownership and management of these lands for open space and biodiversity values.
- ✓ Designate stream corridors, swales, and hydric-soil networks as open-space links in comprehensive plans and in strategic and special-area plans.
- ✓ Develop five-year capital improvement programs for storm-water management and sewage treatment that minimize infrastructure investment, replacement, and maintenance by using best management practices.
- ✓ Develop general-purpose capital improvement programs that minimize infrastructure investment, replacement, and maintenance using best management practices.
- ✓ Adopt zoning ordinances that incorporate natural-resource overlay zoning districts and hydric-soil overlay districts, which supplement other zoning requirements that apply to specific areas. Adopt zoning ordinances that require developers to protect and restore natural resources, to provide buffers for wetlands and streams, to minimize impervious surfaces, and to cluster home sites.
- ✓ Adopt subdivision regulations that require:
 - Inventory of natural habitats, designation of hydric soils, and location of underground tiles at the sketch-plan stage
 - Design of detention areas to achieve or approach zero discharge for two-year storms

- Preservation of habitats and hydric soil systems
- Buffers for wetlands, streams, and drainage corridors
- Designation of lands with conservation easements or dedication to local government at the preliminary planning stage.

- ✓ Use engineering standards and practices that incorporate measures to protect and restore natural resources, that emphasize infiltration over discharge of storm water, and that are flexible enough to respond to varying environmental situations.
- ✓ Insure the municipal code allows and encourages the restoration of natural plant communities and habitats for native wildlife in residential and commercial landscaping.
- ✓ Use native landscaping on municipal lands and restore existing natural areas to create wildlife habitat, protect water quality, and demonstrate these landscaping practices for residents and businesses.
- ✓ Creatively design annexation and development agreements to protect and restore natural resources to the highest possible degree, including immediate identification and protection of major resources and a process for identification and protection of other resources in later stages
- ✓ Use TIF districts to acquire or restore natural habitats and community open space as part of redevelopment, to provide habitat and implement hydrological best management practices such as those recommended by municipal consultants and by NIPC (1992).
- ✓ Adopt intergovernmental agreements between or among neighboring communities to coordinate protection and restoration of natural resources and of hydrology.
- ✓ Undertake municipal conference initiatives that focus on the protection and restoration of natural resources, the identification of local ecosystems, and the modification of storm-water systems as described above in this section.
- ✓ Chicago Wilderness organizations should develop a training and technical assistance program for municipal and county officials by which they would receive information on how to incorporate biodiversity in their plans, programs, ordinances and regulations.

Chapter 9. Ecological Management, Restoration and Monitoring

Prescribed Burning

- ✓ Land-management agencies should develop a comprehensive training program for crew members and burn leaders that emphasizes prescribed burning in Midwest ecosystems and burning in metropolitan settings.
- ✓ Land-management agencies should procure sufficient equipment and workforce so that enough natural areas can be burned within the appropriate time periods to achieve the goals of this plan.

- ✓ Chicago Wilderness members should work with the Illinois Nature Preserves Commission to monitor and participate in the development of new legislation that affects prescribed burning in Illinois. Similarly, members should work with state Environmental Protection Agencies as they develop air-quality regulations to facilitate prescribed burns.
- ✓ Land-management agencies, in conjunction with other Chicago Wilderness members, should develop outreach programs to educate local officials, fire chiefs, preserve neighbors, etc., about the use of fire in managing natural ecosystems.
- ✓ Chicago Wilderness members should cooperate to improve knowledge about research questions such as:
 - What are the positive and negative effects of prescribed burning on endangered, threatened, and watch species?
 - What is the optimum timing and frequency of fire to conserve designated ecological targets?
 - What are the effects of various prescribed-burning regimes on native shrubs?
 - What are the best uses of fire to control invasive species?

Restoration and management of hydrology

- ✓ Chicago Wilderness members and local agencies should create a database of current hydrological data from restoration and mitigation projects and make it available on the Internet.
- ✓ Chicago Wilderness members and local agencies should standardize the methods for collection of hydrological data, including the use of remote data-sensing equipment.
- ✓ Chicago Wilderness members and local agencies should provide training to land owners and land managers in techniques for identifying hydrological disturbances, locating and removing agricultural field tiles, and installing groundwater monitoring wells.
- ✓ Local agencies should identify large, artificially drained wetlands and prioritize them for restoration.
- ✓ Chicago Wilderness members and local agencies should further develop education and outreach programs on wetland ecosystems, making use of demonstration and restoration projects.
- ✓ Chicago Wilderness members and local agencies should address key research questions, such as:
 - How do offsite factors affect hydrology at a site, and what are the implications for restoring the site's hydrology?
 - What are the best methods for restoring hydrology, and when should they be implemented?

Reestablishment of native species

- ✓ Land management agencies that have not already done so should develop in-house nurseries to produce seeds and plants. A nursery can produce large quantities of seed at low cost and can also produce propagules irrespective of natural environmental conditions.
- ✓ Expand seed and plant exchanges. Member organizations can trade for seed or plants of the local or regional eco-type that are not available within their own land. This creates a market for the seed and plants that are surplus for one organization but useful to another that year.
- ✓ Donate or exchange the use of facilities. Local conservation organizations and landowners can make use of each other's facilities or landholdings to build up the number of available propagules. The collaborative efforts create a regional economy of scale and assist individual organizations whose resources are stretched thin.
- ✓ Conduct propagation research. The task of recovering over 1500 native plant species is a daunting one. Only about 350 of these species have been propagated commercially or for restoration. The personnel and facilities of significant botanical research organizations within Chicago Wilderness provide great potential for research into propagating native plants for restoration and could act as a clearing-house for such work. Such botanical facilities include the Chicago Botanical Garden and the Morton Arboretum. Staff from these facilities can and also do help in preparing recovery plans for rare species.
- ✓ Work with home gardeners. Volunteers have provided their backyards as nurseries for several plant species identified for inclusion in restoration seeding. Gardeners receive seed or plants to grow in their backyards. The seed from these plants is collected and used in restoration projects.

Control of invasive plant species

- ✓ Continue to develop and share cost-effective protocols for controlling targeted invasive species.
- ✓ Monitor species locally and regionally to identify and anticipate problems before they reach epidemic proportions.
- ✓ Develop region-wide collaborative efforts to control invasive species on all public land not already managed for biodiversity, including utility and transportation rights-of-way
- ✓ Develop and promote native landscaping recommendations for residential and commercial properties that strongly discourage the use of potentially invasive species in landscaping, working through nurseries and other outlets.

Management of problem wildlife

- ✓ Until effective alternative methods become available, deer should be harvested regularly to limit numbers to levels that support a balance that sustains a full range of native plants and provides diverse habitat for birds and other animals.

- ✓ Disseminate any new information on alternative control methods to land managers.
- ✓ Disseminate models that predict responses of deer populations to management to managers and encourage their widespread use. Continue to improve existing models based on additional field research and the incorporation of stochastic functions and spatial components.
- ✓ As deer populations are managed and reduced in size, there will be an increased need for more accurate census techniques. Additional research should be carried out to develop more effective census techniques in general.
- ✓ State and federal agencies should provide support for collecting information from deer harvests that can provide a basis for future decisions about deer management. This information would include collection locations; gender; the number, gender, and age of fetuses; and reproductive information.
- ✓ Public agencies (and private landowners where relevant) should cooperate more closely to manage deer across borders of managed lands.
- ✓ Support continued research on limiting the spread of zebra mussels. Promising research pursued by Chicago Wilderness members shows that control of zebra mussels in river systems would be most efficiently focused on particular upriver source sites rather than on the entire river. Illinois Natural History Survey (INHS) found that removing zebra mussels or constructing barriers to prevent down-river dispersal of larvae would have a strong negative effect on down-river populations. Plans are underway to construct a dispersal barrier to the round goby, another invasive species, in the Chicago Ship and Sanitary Canal.
- ✓ Provide more public outreach and education calling for boat owners to take responsibility for cleaning boats and boating equipment prior to transporting them from one water body to another.
- ✓ Promote research on methods to control zebra mussels and round goby.
- ✓ Chicago Wilderness members should lead a public education effort explaining the problems caused by feral cats and advocating that people not feed stray cats, support cat licensing laws, support humane removal of stray cats from neighborhoods and wildlife areas, and keep domestic cats indoors.

Management plans

- ✓ Chicago Wilderness members should support regional ecological performance standards, monitoring techniques to measure attainment of the performance standards, and evaluation techniques (such as a regional report card) to evaluate land restoration and management.

Promoting management-related research

- ✓ Compile a prioritized list of research needs and support targeted research projects with internal and external grants.
- ✓ Set up a central source of information for students and professors about priority research needs.
- ✓ 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.
- ✓ Compile a thorough literature review of previous studies regarding management of natural communities and conservation of biodiversity relevant to efforts in the Chicago Wilderness region.

Chapter 10

Education and Communication

- ✓ Ensure that every student graduating from a school system in the Chicago Wilderness region is “biodiversity-literate.”
 - Develop a commonly held definition of “biodiversity literacy”—what knowledge, skills, attitudes, and experience are essential to help people make informed decisions and participate in biodiversity protection.
 - Increase the visibility of biodiversity concepts and issues in state education standards to encourage teachers to integrate biodiversity content into other programs.
 - Give school staff the incentive to devote precious instructional time to biodiversity topics by demonstrating to teachers how using biodiversity as a unifying theme could improve test scores.
 - Support state plans that integrate environmental education into schools. In particular, work to support the passage of the Environmental Education Literacy of Illinois Master Plan.
 - Develop “best practices” for teacher training, such as the package being produced for the Mighty Acorns youth stewardship education program.
- ✓ Expand the scope of existing and future programs in biodiversity education to include components for attitudes, skills, and participation in curricular design
 - Determine the effectiveness of existing biodiversity education programs for achieving “biodiversity literacy,” and use successful programs as models.
 - Foster professional development for organizations inaugurating biodiversity education, and increase the number of pre-service and in-service opportunities for teachers to strengthen their qualifications to teach biodiversity.

Appendix 11. Recommendations and Action Statements

- ✓ Make biodiversity in Chicago Wilderness a component of the degree programs of local colleges and universities
 - Survey existing course selections at local universities. Identify courses that effectively and thoroughly communicate key information about local biodiversity and work to increase their visibility.
 - Develop a degree program in restoration ecology at a local university with an accompanying field station.

- ✓ Expand and improve the use of existing tools for biodiversity education, and create new tools as needed.
 - Promote practicum opportunities by linking universities with professional land managers in the region.
 - Work toward the better distribution of existing tools by forming a distribution center and investing in publicity about the center.
 - Assess the effectiveness of tools for reaching their target audiences.
 - Create new tools for groups starting community-based, non-school projects in biodiversity education. For example, create a biodiversity program primer with a list of potential partners.
 - Produce tools and materials in multiple languages.

- ✓ Increase the number of communities being reached with non-school-based programs in biodiversity education
 - Foster neighborhood- and community-based programs aimed at improving the environment and biodiversity locally to unify different cultural groups for concerted community action.
 - Identify specific leaders in cultural and ethnic communities who can inform educators and communicators and serve as partners for collaborative programs.
 - Create a diverse base of spokespeople, including professionals and volunteers, who can serve as “ambassadors” for biodiversity to a wider variety of communities.
 - Develop collaborations between Chicago Wilderness member organizations and cultural, ethnic, and arts and humanities organizations to foster the exploration of nature through cultural avenues.
 - Improve the infrastructure within conservation agencies and organizations to better support community-based biodiversity projects.
 - Develop links between school-based biodiversity programs and community projects.
 - Find new ways of providing urban populations with opportunities to become aware of and explore the region’s natural communities (for example, a “biodiversity bus” to bring urban residents to outlying natural areas).

- Devote more effort to recruiting citizen scientists from more diverse communities. Build effective tools to track the success of recruiting techniques, and use the effective techniques to expand the reach of volunteer-recruitment programs.

- Encourage the providers of non-formal education programs to recruit and employ professional educators who reflect the diversity of the communities they serve.

- ✓ Measure local citizens’ understanding of biodiversity by developing appropriate gauges for long-term effectiveness of education programs
 - Create appropriate gauges and gather baseline data on targeted communities.
 - Gather data at set intervals to measure long-term change.
 - Disseminate findings to agencies and organizations involved in biodiversity education.

- ✓ Gain a better understanding of the views of a broader segment of the Chicago-area population on biodiversity issues such as ecological restoration
 - Compile existing local market research, including that gathered through land-acquisition bond campaigns, to determine gaps in the understanding of public values and perceptions.
 - Commission professional market research locally to better inform communications strategies and messages.
 - Disseminate research findings to decision-makers and conservation agencies and organizations.

- ✓ Increase the public’s understanding of the role of management in natural areas.
 - Craft a common lexicon that describes restoration efforts, and create methods to evaluate and adapt the messages to grow in effectiveness.
 - Foster the delivery of essential message points not only through conservation agencies and organizations, but also through a broader range of institutions and channels.
 - Engage and educate those who interpret conservation issues for the public, including community leaders, media, and elected officials.

- ✓ Improve communication with those immediately affected by management decisions.
 - Ensure that restoration efforts, particularly in new areas, include plans for communications to local residents, and that resources are available for efficient and appropriate communication efforts.

- Create a communication guide that restoration agencies can use to help develop these plans, including resources that already exist and successful examples from other agencies.
 - Conduct direct outreach to organizations in the local communities, such as block clubs and religious groups, that are interested in environmental work.
 - Engage advocacy organizations that work on environmental issues (such as air and water quality or sprawl) and educate them about biodiversity loss.
 - Seek opportunities to inform journalists and increase media coverage of restoration and land management.
 - Review current mechanisms for public involvement in land-management decisions and make improvements, using models that are successful in other arenas.
 - Create a structure for collaborating partners not only to react quickly but also to anticipate issues that arise in public forums.
- ✓ Communicate documented benefits of local restoration efforts, especially those of most value to humans.
- Gather data on the results of restoration efforts, translating the data into easily understood benefits.
 - Create communications tools that connect restoration results to core values: the beauty and wonder of nature, our responsibility to future generations, and the desire for a healthy environment.
 - Include illustrations of restoration results in programs, nature walks, signs, and other communication vehicles.
 - Develop innovative campaigns and programs that position habitat restoration in mainstream culture (such as museum exhibits, ad campaigns, and retail promotions).
- ✓ Improve the credibility and public perception of the people involved in restoration efforts.
- Seek trusted local spokespeople who represent the sound, scientific thinking behind restoration and/or exemplify the role of the local volunteer.
 - Provide support for volunteers who interact with the public, and offer training in public speaking, ecological concepts, interpretation, etc.
 - Emphasize the public service provided by volunteers and the leverage of public funds through donated time.
 - Ensure that decision-makers are aware of the value of conservation volunteers.

- ✓ Improve communication about biodiversity with key decision-makers such as elected officials and their staff, land managers, and planners
- Assess current tools and programs to inform key decision-makers for content, availability, and effectiveness in increasing understanding of the importance of local biodiversity.
 - Survey, as necessary, to assess key decision-makers' knowledge, attitudes, and information needs.
 - Develop vehicles to keep decision-makers regularly informed, such as tours, literature, up-to-date scientific information, and contacts for further information.

Chapter 11 Role of Key Players

Forest preserve and conservation districts

- ✓ In keeping with their central role as land managers, the forest preserve and conservation districts should continue to play lead roles in identifying, evaluating, and acquiring unprotected natural communities within their jurisdictions.
- ✓ Federal and state agencies should support these efforts with funding and technical resources. The most recent example of such a partnership was the Chicago Wilderness collaboration that produced the natural-areas inventory for McHenry County.
- ✓ Forest preserves should use all tools available to add land to their holdings. It is also recommended that existing natural areas be protected from purchase requests by commercial and other interests or conversion to intensive recreational uses.

Sanitary districts

- ✓ Since the concern for maintaining biodiversity is not one of the purposes for which sanitary districts were created, enabling legislation should be amended to specify the authority and obligation of districts to protect biodiversity.
- ✓ In the case of private utility companies that provide wastewater collection and treatment services, and whose franchises are regulated by the Illinois Commerce Commission, a similar broadening of authorizing legislation would be appropriate.

Illinois counties and municipalities

- ✓ Counties and municipalities should amend their comprehensive plans, zoning ordinances, and other regulations to incorporate relevant recommendations contained in this plan.
- ✓ When a state infrastructure investment such as a toll road or major airport is likely to trigger substantial residential, commercial, or industrial development, affected governments (including state, county, municipal and other local jurisdictions) should enter into intergovernmental agreements designed to prevent adverse environmental impacts

including the loss of biodiversity. Such agreements were developed as part of the process for considering a proposed expressway in central Lake County, Illinois.

- ✓ Municipalities should play an active role in protection and management of biodiversity by managing their lands to support native ecological communities and consider acquisition of additional land for these purposes.

Northwest Indiana municipalities

- ✓ In northwest Indiana, city departments should enter into partnerships aimed at protecting biodiversity with federal, state, and county agencies and with private organizations that own and oversee land requiring preservation and long-term maintenance.
- ✓ Indiana cities and their regional planning and development agencies should develop a process for taking inventory of natural areas and prioritizing areas for preservation and restoration in conjunction with economic-development initiatives.
- ✓ Indiana cities and their partner agencies should develop plans and allocate funds to preserve land and to manage preserved land consistently.

State agencies

- ✓ The State of Illinois should continue its grants programs for open space with more funds for acquisition directed to northeastern Illinois. Open Lands Trust Act funds should primarily protect lands with current or potential biodiversity values.
- ✓ The state should continue to acquire high-quality natural areas through the NAAF.
- ✓ IDOT should incorporate biodiversity principles into all transportation infrastructure planning and all implementation decisions.
- ✓ Future toll-road construction projects must assure full compliance with EIS recommendations.

Intergovernmental organizations

- ✓ The regional transportation planning process should incorporate biodiversity principles into the transportation planning and programming process.

Federal administrative agencies

- ✓ Transportation designers and planners should carefully follow the TEA-21 process, taking advantage of its programs related to biodiversity in the Chicago Wilderness region.

Strengthening volunteer programs for protection and restoration of biodiversity

- ✓ Land-managing agencies should invite volunteers to be partners both in planning and in implementing land management.

- ✓ Develop a strategy for involving volunteers. Identify functions and tasks to be accomplished by volunteers.
- ✓ Provide opportunity for personal satisfaction in accomplishing tasks that are needed for restoration. People serve as volunteers because they find satisfaction in the work. Successful volunteer programs build on this fact to accomplish the purposes of the organization.
- ✓ Remove barriers. Make it easy and inviting for volunteers to contribute time and energy. If requirements and/or qualifications are necessary, provide ways for volunteers to earn them through training or certification based on tests of ability or knowledge.
- ✓ Provide an organized context for volunteer activities. At a minimum, provide a stable set of ground rules to accommodate volunteer efforts and involve volunteer leaders in developing them.
- ✓ Encourage volunteers to adopt or take "ownership" for specific functions or places.
- ✓ Identify a specific person within the host organization as the central contact for volunteers.
- ✓ Provide recognition for volunteers regularly.
- ✓ Provide support for a volunteer newsletter and related communications that offer education and information on volunteer opportunities.
- ✓ Provide tools or other necessary resources where possible.
- ✓ Provide opportunities for face-to-face contact between volunteer leaders and organization staff.
- ✓ Provide support with heavy equipment operated by staff if needed and possible.
- ✓ Develop long-term site plans for restoration and protection and annual work plans for activities to complete them. Include volunteers in the planning process and identify their role clearly.
- ✓ Have experienced volunteer leaders, trained and certified by the landowning agency, provide on-site supervision of most volunteer activities.
- ✓ Develop criteria for various functions and tasks and facilitate training to ensure expertise in them.
- ✓ Certification is appropriate for some activities, including applying herbicide on public land and participating in prescribed burns. In such cases it is important to establish clear requirements and the means of meeting them such as training or testing at convenient times and places.
- ✓ Leadership among volunteers develops as people gain experience and knowledge. Those willing to accept and provide leadership should be encouraged to do so and should be given added responsibility and recognition.
- ✓ The Volunteer Stewardship Network (see below) should be supported and recognized as a valuable asset in developing leadership, expertise, and overall membership in conservation programs.

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