Ecosystem Restoration Strategy Paper

Photo by CMAP photography contest participant, Kurt Kramer

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Introduction

Beneath the complexity of our cities and towns many natural systems are constantly working to provide essential functions and elements that support life on Earth. Although these systems have been in place for billions of years, they are often seen as separate and distant, when in fact they are more closely intertwined in our everyday life—from the goods we buy to the air we breathe. The term "ecosystem" defines the complex interactions between these natural systems (geology, topography, climate and living things) in a defined geographic area (Sullivan, 2003). Ecosystems vary in both size and complexity but are usually referred to in larger functional units such as forests, wetlands, lakes, streams or watersheds (USEPA, 2008). The extremely integrated and symbiotic relationships in an ecosystem are the key to its survival and growth whereas even the displacement, absence or new presence of one species can alter an entire ecosystem (Sullivan, 2003).

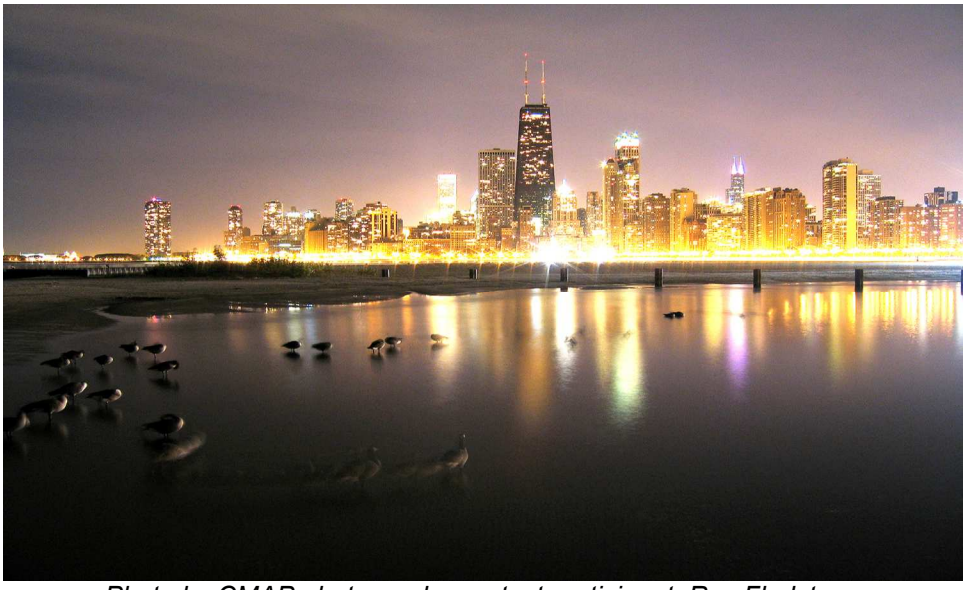


Photo by CMAP photography contest participant, Rex Flodstrom

As humans we are an integral part of every ecosystem either directly or indirectly through our actions. Although we represent one species among millions, our effects on ecosystems are comparably exponential (USEPA, 2008). Restoration is one way humans can positively influence the natural environment. Ecosystem restoration is an intentional activity that initiates or accelerates the recovery of an ecosystem that has been degraded, damaged, or destroyed yielding a site that "more closely emulates conditions which prevailed before disruption of natural structures and processes" (SERI, 2004)(Covington et al.). In most cases, this would resemble a historic stable and functioning ecosystem with a diversity of plants and animals with minimal required maintenance (Illinois State Museum Society). Restorative strategies include removing or modifying the disturbance(s), reintroducing native species and eliminating invasive species (SER, 2007). Invasive species are defined as non-native species that have uncontrolled growth in a new environment (INHS, 2001). However, ecosystem restoration is not just a straightforward list of tasks to be completed but a multifaceted process involving balancing delicate biological systems and human interaction specific to a region and its varying communities (Covington et al.).

Bergamot in bloom, Forest Preserve District of DuPage County.

Illinois, once well known as "The Prairie State" is fortunate to have a history of abundant and varying grasslands, woodlands and wetlands. Over 350 different species of plants grew on the prairies of Illinois, Indiana, and Wisconsin during the pre-settlement era (Sullivan, 2003). Additionally, this 3-state region has almost a dozen different types of wooded communities as well as a variety of wetlands including marshes, fens, bogs and swamps. Each landscape has a unique combination of plants and animals and thus unique challenges when implementing ecosystem restoration (Sullivan, 2003). This diversity of landscapes supports a diversity of genes, species, and ecosystems in our region, which is commonly described as biodiversity (Chicago Region Biodiversity Council, 1999). This region's unique biodiversity can be linked back to the beginning of the Wisconsin glacial period (~70,000 years ago) that created the Lake Michigan shoreline (Sullivan, 2003). The deposits and materials left behind by the receding glaciers formed the raw material for our soil and landscapes (Sullivan, 2003). This developing environment was nurtured by Native American tribes such as the Illini, Miami, Dakota, Shawnee, Chickasaw, and Ho-Chunk that inhabited the land (Native Languages of the Americas). Over time a healthy regional ecosystem came to fruition with a variety of communities that serve as habitats to the region's plants and animals as well as provide an ecological setting for the spaces in which we work and live. The table below describes these communities in more detail.

Table 1: Living Communities in the Chicago Wilderness Ecosystem
Source: *An Atlas of Biodiversity (Sullivan, 2003)*

Living Communities	Characteristics
▪ **Prairie**	Dominant plants are grasses and develop on flat lands; fire dependent communities.
▪ **Wooded Communities**	A variety of natural communities with variation in tree coverage based on climate and soil moisture (wet, mesic, or dry).
o Savanna	Type of wooded community; grasslands with some trees found in dry climate.
o Oak Woodland	Type of wooded community with the most commonly found trees being of the oak family and

	typical of mesic soils.
o Upland Forest	Type of wooded community with density of trees in both mesic and wet soils.
o Floodplain Forest	Type of wooded community in wet soil in or around floodplain area.
▪ **Dune Complex**	Mountains of sands which sit above glacial drift; formed through sand blown by westerly winds and near shore currents in Lake Michigan.
▪ **Wetlands**	A diverse combination of vegetation, marsh, river, floodplain swamp, plants, sand and gravel etc. that vary in level of water coverage.
o Swamp	Type of wetland with a variation of vegetation, and shallow water.
o Bog	Type of wetland that form in cold, acidic, low oxygen waters; contain plant life.
▪ **Lakes**	Body of water large enough to have at least one wind-swept beach with ecologically complex communities.

In our region, like much of the U.S., significant ecosystem degradation coincided with multiple landuse changes associated with European settlement. Unlike the Native Americans, Europeans were less equipped and less familiar with managing the land. Invasive species were introduced, significant changes in hydrology from urban and rural development were experienced, wetlands were drained for agriculture and land and water systems were mistreated by the introduction of a variety of pollutants (Chicago Region Biodiversity Council, 1999)(SER, 2007). Additionally in the past, naturally occurring and man-induced fires provided ecosystem renewal by controlling invasive species, adding nutrients to the soils and providing additional space for habitat growth (Illinois State Museum Society). Increased settlement promoted fire suppression causing significant disruption to these crucial renewal processes (Chicago Region Biodiversity Council, 1999). These above factors combined with naturally occurring events have compromised our region's ecosystems on various levels including some ecosystems that have completely lost the ability to repair themselves and perform essential functions such as stormwater management (Covington et al.). Today, ecosystem restoration is especially important given the developments and events that have unfolded in the past few centuries.

This paper briefly examines the benefits and challenges, the current status and the potential impacts of ecosystem restoration. The fifth section expands on the link between ecosystem restoration and climate change followed by the conclusion.

Benefits and Challenges

Benefits

Ecosystem services, economic and landuse related benefits are discussed in the following sections.

Ecosystem Services

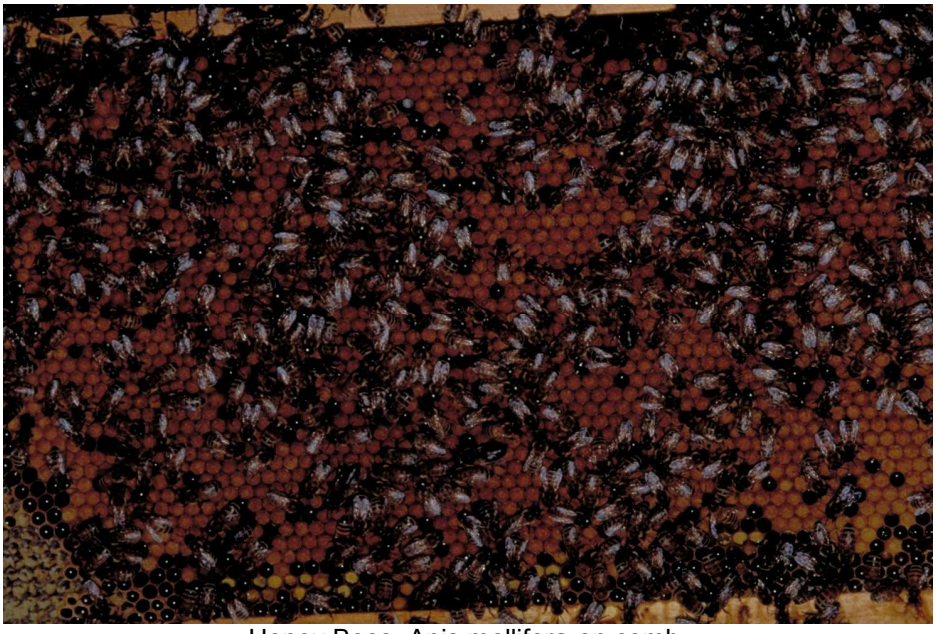
The substantial benefits of ecosystem restoration are well documented and are most easily described in terms of services provided. "Ecosystem services are the processes by which the environment produces resources…such as clean water, timber, habitat for fisheries, and pollination of native and agricultural plants" (ESA). Every ecosystem produces a unique set of resources. By protecting and enhancing ecosystems through preservation and restoration, these resources are also preserved. Below is a sample of ecosystem services.

Table 2: Ecosystem Services

Source: USEPA and Ecological Society of America

Ecosystem Services	
▪ Purification of air and water	▪ Generation and renewal of soil and soil fertility
▪ Protection from ultraviolet rays	▪ Pollination of crops and natural vegetation
▪ Partial Stabilization of climate	▪ Control of agricultural pests
▪ Moderation of temperature extremes	▪ Dispersal of seeds and translocation of nutrients
▪ Support of diverse human cultures	▪ Maintenance of biodiversity
▪ Aesthetic beauty and intellectual stimulation	▪ Maintenance of genetic library
▪ Protection stream and river channels from erosion	▪ Mitigation of floods and droughts
▪ Regulation disease carrying organisms	▪ Detoxification and decomposition of wastes

Ecosystem services support terrestrial, aquatic, and human communities that each depend on the vitality of these services to provide nutrition as well as habitat stability for our homes and businesses (Chicago Region Biodiversity Council, 1999). Although some of the above services are observable, most services are so seamlessly performed that they receive little human acknowledgement. For example one third of all human food originates from plants pollinated by over 100,000 wild pollinators including bats, bees, flies, moths, beetles, birds and butterflies (ESA). Without this service, we could expect a substantial decrease in food variety and nutritional intake in addition to further modifications within those ecosystems. The Midwest is already experiencing a decline in wild pollinators. Wisconsin, Minnesota, Ohio, Iowa and Michigan have already reported decreased numbers of honey bee colonies. In addition to making millions of pounds of honey each year, the U.S. honey bee population (140 billion) is responsible for pollinating our healthiest nuts and fruits crops including almonds, apples, broccoli, cranberries, strawberries, alfalfa, soybeans, and cotton (McFadden, 2007). Companies like Haagen-Dazs are beginning to realize their reliance on ecosystems services and the need to preserve the bee population their products depend on. For more information click here.



Honey Bees, Apis mellifera-on comb.

Economic Benefits

Although the above example demonstrates only a small portion of the total benefits of ecosystem services, in our society it is important to quantify the economic costs and benefits of a strategy as well. Although this applies well in the business world, it is more difficult (and some would argue morally wrong) to place a dollar value on the natural environment and the services it provides. What is the *value* of one acre of prairie? Is it $1000, $2000, invaluable? This difficulty extends to placing monetary value on ecosystems and therefore quantifying the economic benefits of ecosystem restoration. However currently there is research and case studies that attempt to estimate and assign monetary values to ecosystems while incorporating avoided economic costs that already have "value" in our society. For example, it is estimated that honey bees are responsible for pollinating a total of $14 billion of seeds and crops annually in the U.S. (Barrionuevo, 2007). The act of pollination itself has an avoided cost value of $4-$6 billion because the service is currently provided for "free" by natural processes. If ecosystems are further degraded, many of these "free" services will no longer exist. This will result in more costly manmade replacements when and if possible (ESA). Healthy ecosystems, which are currently undervalued, have still been shown to economically outperform man-made solutions in terms of the services they provide. In some cases ecosystems have in essence become cost-effective enough to be preserved. This type of research and effort has caught the attention of conservationists as well as the business community and stands to challenge conventional standards of assessing value as well as serving as a tool to more comprehensively understand the full impacts of our actions and decisions (Boyd 2007, 29).

Land Use Planning

Additionally ecosystem preservation and restoration can also be a beneficial land use decision for municipalities and counties. Local sources state that ecosystem restoration sites pay for themselves along with agricultural, open space, commercial and industrial sites in terms of municipal resources needed. It tends to be residential sites, with their necessity for city services (fire, water, streets, etc) that create a financial burden on municipalities.

Challenges

Many challenges exist in regards to ecosystem restoration. Although this is not a complete list, stressors and threats, development/consumption trends and the necessity of maintenance are discussed below.

Stressors and Threats

Although there are many factors at play in an ecosystem, stressors are identified factors that disrupt equilibrium and include "both natural processes and the human activities that exert stress on natural communities" (Chicago Region Biodiversity Council, 1999). One of the main challenges to the effectiveness of ecosystem restoration is the need to reduce stressors in the environment. Currently changes in hydrology and water quality, the suppression of fire, and changes in competition from the increasing presence of invasive species are a few of the most concerning stressors for the region's ecosystems (Ibid).

Often human actions result in the creation or acceleration of an ecosystem stressor. For example, the draining of a wetland for development (action) results in changes to the natural hydrology, fragmentation of the landscape, and soil modifications (stressors). Natural processes can also cause stress on ecosystems. However the difference between natural and human influenced stressors is the time frame. Native communities have adapted to natural stressors over a much longer time comparably. In addition natural stressors are now being amplified by human influenced stressors. The table below provides examples of stressors and threats to our region's natural communities (Ibid).

Table 3: Ecosystem Stressors and Threats
Source: Biodiversity Recovery Plan (Chicago Region Biodiversity Council, 1999)

Ecosystem Stressors and Threats	
• Changes in hydrology	• Nutrient loading
○ Poor agricultural practices	• Fragmentation of landscapes
○ Wetland drainage	• Increased salinity
○ Impervious surface	• Erosion and increased sedimentation
○ Increased runoff	• Loss of structural diversity
• Changes in topography	• Overabundance of deer and other animal species
• Changes in competition	• Pollution (air and water)
• Fire suppression	

Development/Consumption Trends

As the projected 2.8 million people continue to join our region in the coming decades, the increased conversion of open space and farm land to accommodate development limits potential locations for ecosystem restoration. Furthermore this often sporadic and poorly planned development is one source of ecosystem stressors (Sullivan and Clark 2007, 2). As we change the landscape, we take away the very factor, biodiversity, which assists ecosystems in surviving and adapting to that change.

Photo by CMAP photography contest participant, Donna Lee

In order to combat habitat fragmentation while protecting and restoring biodiversity, Chicago Wilderness and NIPC developed the Green Infrastructure Vision plan for the region. This vision was transformed into a map that displays existing green infrastructure (open space, streams, wetlands, prairies, etc) as well as potential expansion, restoration and connection sites. One of the purposes of this project was the creation of an "interconnected network of land and water that supports biodiversity and provides habitat for diverse communities of native flora and fauna at the regional scale" (Chicago Wilderness, 2004). Despite this effort, "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"(Chicago Region Biodiversity Council, 1999).

Our unchecked consumption of food, products, services, energy and land is another challenge to realizing the full potential of ecosystem restoration. "Today the U.S. public consumes more resources than at any time in its history and also consumes more per capita than almost any other nation" (MacCleery, 1999). Ecosystems produce these goods and services our economy and lifestyle depend on either directly (fish, timber, etc) or indirectly (clean air and water, etc). However there are limits to any system. In 2005, the United Nations reported that 60% of the global ecosystems are not being replenished as fast as they are being used (Boyd 2007, 29). To put it simply, "people are turning resources into waste faster than nature can turn waste back into resources**"** (WWF, 2006). Will we be able to provide goods and services for future generations? By minimizing the rate and quantity of our consumption, the pressure on ecosystems can be relieved and ecosystem restoration can accelerate the regenerative process. However in an increasingly global market, simply reducing pressure on U.S. ecosystems without reducing our net consumption is merely "shifting the burden and impacts of that consumption to ecosystems elsewhere" (MacCleery, 1999). To truly support and protect the world's ecosystem, we need to reduce our net per capita consumption.

Maintenance

Just as maintenance is needed for our built environment, maintenance of our natural environment is also essential. Luckily many ecosystems are capable of a full recuperation with human assistance. Once restored, these sites require time, energy, and attention to on-going relationships with both natural and human communities (Local Sources). A long term commitment is required. Native landscaping can take 3-5 years to fully mature and function as a restored ecosystem. During these beginning years, close supervision is imperative to ensure the long term success of the site. After a site is established, maintenance may be scaled back to include prescribed fires and/or a variety of techniques to control invasive species (NIPC, 2004).

"Fire is an essential force that shaped and sustained the natural ecosystems of the region" (Chicago Region Biodiversity Council, 1999). Fire performs many helpful roles including clearing debris on the ground to allow for new growth, assisting in seed germination and preventing or halting the growth of invasive species. Permits are required from the IL EPA and in some cases by the county or municipality in order to conduct a burn. Properly trained professionals and proper weather conditions are also required. Burn training is offered by Chicago Wilderness. However, if burning is not an option on a site, mowing can be an effective alternative (Ibid).

Prairie Burn at Morton Arboretum

Invasive species inhibit the proliferation of native species and pose a threat in most of the natural communities in our region (Chicago Wilderness). Neutralizing invasive species is a continuous process that should be built into any maintenance program. Integrated pest management (IPM) is often used to achieve this goal. "IPM is a method of weed and pest control that works with natural cycles to most effectively remove undesired species with a minimum of environmental impact" (NIPC, 2004). Herbicides may be used for aggressive weeds. Some of the most harmful invasive plant species in our region include buckthorn, Asian honeysuckle, purple loosestrife and garlic mustard. The thumbnail–sized zebra mussel has invaded the regional

aquatic ecosystem and is competing with native species for food and habitat (Chicago Wilderness). Additionally, the Asian carp, which has invaded much of the Midwest, also poses a threat to the Chicago region if the existing electrical barriers prove inadequate. Addressing invasive species must be a part of all ecosystem restoration efforts.

Current Status of Ecosystems in the Region

Scientists and researchers have conducted regional ecological inventories and surveys over the past few decades which have provided useful data to monitor and analyze the conditions of our ecosystems. Unfortunately data has shown that conditions are critical for some ecosystems in our region. The 1978 Natural Areas Inventory found that less than 1% of the original Illinois landscape (forests, prairies, savannas, wetlands, lakes, and ponds) remained in a relative high-quality undisturbed condition (Chicago Region Biodiversity Council, 1999). Ironically in the "Prairie State" only one one-hundredth of one percent (0.001%) of the original high quality prairie survives. In addition greater than 90% of wetlands have been drained or filled (IDNR) (Sullivan, 2003). For more details on current conditions, click here to view sample data from the Chicago Wilderness Report Card.

The reduction of open space in our region also has compounded effects on animal and plant species. Chicago Wilderness states that "if 50% or fewer sites on which a species occurs are protected, the species is at a much greater risk of being lost" (Chicago Region Biodiversity Council, 1999). Compared to plants, animals face less risk when their habitat is destroyed because they are mobile; however, with increasing fragmentation of the landscape, there is still significant risk.

Illinois has 114 state level endangered or threatened animal species; five of these are federally listed. Furthermore, more than half of the all known animal species found in our state are unprotected including 81.1% of fish, 85.7% of mammals, 23.1% of amphibians and reptiles, 57.5% of birds, and 4.3% of invertebrates (Ibid). Plant species are facing similar situations with about a quarter of plants species unprotected or with semi-protection. The State lists 237 plants species as endangered or threatened. These same species represent "nearly 15% of the region's native plant species" (Ibid).

Ecosystem Protection and Restoration Efforts in our Region

Conservation biologists estimate that between 20 and 30 percent of land cover should be protected as habitat to maintain adequate numbers of plants species (Shore, 2005). Although the region is not there yet, the Chicago Wilderness Region is nationally recognized for ecosystem restoration and preservation. The Chicago Wilderness Region has more than 225,000 acres of protected conservation land with some of the best surviving woodlands, wetlands, and prairies in the Midwest (Chicago Wilderness). The majority of the protected land lies within the region's seven forest preserves and conservation districts. The map below shows protected land as well as restoration sites. These achievements are a result of many partnerships in the region as well as at the state and federal level. The following sections focus on the major players in ecosystem restoration.

Federal Government

The federal government establishes a broad basis for policy guidance, regulation, and protection of natural lands in the nation. The U.S. Forest Service, a unit of the United States Department of Agriculture, manages national forests and grasslands equivalent to 193 million acres (U.S. Forest). Although the U.S. Forest Service only owns 6% of Illinois' forest land, federal involvement assists states with meeting their overarching environmental resource goals (Crocker and Little, 2006). Additionally, the U.S. Army Corps of Engineers operates a district in the

region with several ongoing projects that focus on ecosystem restoration including the Butler Lake Restoration project. Located in Libertyville, the project aims to decrease erosion, restore native plant species and repair fish habitats. This project is currently underway and has a budget is $3.35 million; 70% of the funding is being provided by the federal government (US Army Corps of Engineers). Click here for more detail on relevant federal agencies.

State Government

Illinois establishes specific policies and legislation on managing natural resources within the state boundary. The Illinois Department of Natural Resources (IDNR) is a primary organization for environmental resource protection and planning. Since 1994, IDNR has operated the Critical Trends Assessment Program, which collects and reports statewide data on the conditions of ecosystems to determine the best natural resources policies. For the program, professional scientists monitor 600 randomly selected private and public sites in four habitats (forests, grasslands, wetlands and streams) around the state (IDNR). IDNR also provides several grant programs to encourage ecosystem restoration and the preservation of the region's resource as well as offer educational activities and recreational improvements. Since 1995, the Conservation 2000 (C2000) program has offered grant opportunities based on a broad-based long term approach to protecting and managing Illinois' natural resources. This program seeks to not only involve public agencies but private and corporate landowners while involving the interest and participation of local communities. As of 2008, C2000 now known as Partners for Conservation was extended until 2021 when House Bill 1780 was signed into law (Ibid). The Ecosystems Program is funded through Partners for Conservation to "enhance and protect watersheds through ecosystem-based management. This program consists of Ecosystem Partnerships, coalitions of local stakeholders that are united by the programs purpose. 41 Ecosystem Partnerships are currently active covering 84% of the state's landscape and encompassing 98% of the states citizens.

"To date more than **70,500 acres** have been restored. Nearly **5,600** acres have been protected through conservation easements or simple acquisition. More than **$34.9 million** in project grants have been awarded. Recipients have provided another **$33.4 million** in match. Nearly a half million citizens of all ages have been educated on natural resource protection" (IDNR).

For more information on conservation incentive programs in Illinois, click here.
For more detail on relevant state agencies click here.

Local Governments and Non-Profits

Coordination and cooperation between local governments (county, township, municipal) and non-profit organizations is necessary to protect and preserve local natural resources. These agencies play various roles, including encouraging stewardship, increasing awareness, disputing harmful activities and influencing policies that protect natural resources.

Several non-profit agencies work together to promote and implement ecosystem restoration activities in Illinois. The Chicago Wilderness Consortium is an organization with over 230 members that have all committed to protecting, restoring, and managing Chicago's regional

natural resources (Chicago Wilderness). One such member organization, Openlands, focuses on "preserving and enhancing public open space" in the northeastern Illinois region. Through active leadership, Openlands has assisted with securing more than 45,000 acres of wetlands, forest preserves, parks, bike and water trails and gardens (Openlands). Click here for more detail on relevant local and non-profit agencies.

Forest Preserves, Conservation and Park Districts

The northeastern Illinois region is particularly fortunate because all 7 counties have a well-established forest preserve or conservation district. These districts' acquire land in order to protect and preserve open space and natural communities within their counties. Additionally forest preserves and conservation district facilitate public education and develop resident interest in natural areas as well as provide recreational opportunities. Together they are absolutely essential to ecosystem restoration in the region, with holdings of more than 170,000 acres. Although typically more focused on recreation, many of the 148 park districts in our region also actively participate in preservation and restoration including the St. Charles and Chicago park districts (Chicago Region Biodiversity Council, 1999).

CMAP Region's Forest Preserve and Conservation Districts
Cook County (approx. 67,000 acres)
DuPage County (approx. 25,000 acres)
Kane County (approx. 17,800 acres)
Kendall County (approx. 2160 acres)
Lake County (approx. 26,000 acres)
McHenry County (approx. 20,000 acres)
Will County (approx. 15,000 acres)

Brewster Creek at Pratt's Wayne Woods Forest Preserve, Forest Preserve District of DuPage County.

Private Sector

Private companies are also active in ecosystem restoration. ComEd has several restoration sites in the region including Buffalo Grove Prairie (10 acres) in Lake County and a 100-acre site in DuPage County. These sites utilize a portion of the 40,000 acres ComEd owns under power lines called "right of ways." In comparison only one forest preserve district in the region, Cook County, holds more land. ComEd restored to native prairie landscapes to these sites while still maintaining the functions necessary for the company. Partnerships with local and state government agencies along with the help of volunteers have made these projects possible (Shore 2005). For more information click here.

Volunteers and Public Support

Many of the Chicago Wilderness member organizations, as well as the county forest preserve, conservation and park districts offer volunteer opportunities. Volunteers participate in a wide variety of activities including stream cleanups, bird counting, seed planting and invasive species removal as well as providing guides and docent services for educational programs. As a valuable extension of paid staff, they provide an important benefit to restoration and preservation agencies that have limited resources. Many of the region's restoration projects would not be possible without dedicated volunteers.

The public is also a key player in ecosystem restoration efforts. Our forest preserves, conservation and park districts often have opportunities to gain additional funding to buy new land or increase active maintenance of current preserves through voter approved referendums. Most recently, in November 2008, a successful referendum in Lake County provided the Lake County Forest Preserves with $185 million to "create new trails, restore lost wildlife habitats and improve public access to new and existing preserves-all without a tax rate increase" (Lake County Forest Preserve District). For more information click here.

Kids on Prairie Trail, McHenry County Conservation District

Case Studies in our Region:

Midewin National Park and Waukegan Harbor

1) Midewin National Park, Illinois

Midewin National Park is the first national tallgrass prairie which holds 19,000 acres; this site was once held by the U.S. Army and used as an ammunition plant during World War II. In 1996 the acres were transferred to the U.S. Forest Service which administers the park in cooperation with the Illinois Department of Natural Resources and several private and public partners. A catalyst for this transfer was the Illinois Land Conservation Act of 1995 which mandates that Midewin meet the following objectives:

1. To conserve, restore, and enhance the native populations and habitats of fish, wildlife, and plants.
2. To provide opportunities for scientific, environmental, and land use education and research.
3. To allow the continuation of existing agricultural uses of lands within Midewin National Tallgrass Prairie for the next 20 years, or for compatible resource management uses thereafter.
4. To provide recreational opportunities that are compatible with the above purposes.

Source: http://www.illinois.com/details/parks.php?id=17

The Midewin Land and Resource Management plan was adopted in recent years and it is a long term plan that extends out 20 years and is focused on developing native prairie and woodland communities, as well as habitats.

Restoration activity

- 850 acres of prairie
- 460 acres of wetland area
- 80 species of native plants are in production
- Increasing attraction of rare grassland birds, which have previously been in serious decline

This restoration park is located in southwestern Cook County and offers not only prairie restoration but also a natural landscape for the community. There is a small full-time staff at Midewin National Park including a restoration team, engineering team, and public services team. Additionally none of this achievement would be possible without the numerous volunteers who assist during the year with invasive species control, removal of field drain tiles, drainage ditches, and planting and cultivating species.

http://chicagowildernessmag.org/issues/summer2008/itw_midewin.html

p.36 The State of Chicago Wilderness

Images:
http://flickr.com/photos/reallyboring/2901246315/sizes/o/
Two weeks after burn at Midewin:
http://flickr.com/photos/wilsonious/134391932/sizes/l/in/photostream/

2) Cleaning up Waukegan Harbor, IL

http://www.wttw.com/main.taf?p=1,17,1,7
Segment: 11 min and 30 sec

Chicago Matters: Growing Forward
Cleaning up the Waukegan Harbor
Thirty-three years ago pcbs (polychlorinated biphenyls) were discovered in the Waukegan Harbor, located in Lake County, IL. U.S. EPA representative, Scott Cieniewski, described Waukegan Harbor as one of the "worst PCB sites throughout the Great Lakes." The pcb pollution in the harbor, highly pollutant congener particles, resulted from the operations of OMC (Outboard Marine Corp), once owned by the billionaire George Soros; OMC manufactured engines. Additionally, other industrial organizations still operate on or nearby the harbor. The National Plant for Drywall is nearby the harbor and meets a daily quota of producing 1 million sq feet a day of drywall for the surrounding region. The history of pollution and existing industrial operations has made Waukegan Harbor a prime target for environmental clean-up.

Superfunds were created by legislation in 1980 to assist environmental clean-up; this legislation required companies that were accountable to pay the bill for any identified pollution. Therefore OMC spent $22 million in the early 1990's to clean the pcbs from the sediment and groundwater. This two-year project led to approximately 95% of pcb clean-up, only leaving 5% of contamination. But according to Cameron Davis of Great Lakes Alliance, "5% is still a lot of contamination." In 2002 legislation was passed, The Great Lakes Legacy Act, to remove the remaining 5% contamination through a process called dredging and it was to be a federal and local partnership and matching fund program. The federal government was willing to put forth 65% of clean up costs, $25 million, if the local stakeholders of the Waukegan Harbor put in 35% of project costs, $6 million. Removing the remaining 5% of contamination, making the Waukegan Harbor free of contamination, could have opened up "1600 acres of lakefront, valued at $800 million", according to Illinois Congressman, Mark Kirk. As of spring 2006, this project looked like a winner; however it unexpectedly fell through due the local stakeholders pulling out of the project. Susie Schreiber of the Waukegan Harbor Citizens Advisory Group stated that there was "bipartisan support and every unit was at the table." Needless to say this was disappointing for all parties involved, but the quest for clean-up still continues.

The Waukegan local stakeholders have since made an attempt to dredge the harbor removing ¼ of a million elements and decrease the depth of the harbor but this action was denied by the U.S. Army Corps because the harbor is an authorized federal navigating harbor and must keep its depth. In May 2007 a resolution was passed by aldermen who want to shut out industrial companies from the harbor criticizing these companies for their contribution of pollution; this was also denied by the federal government. Currently, there is a lawsuit pending by Waukegan stakeholders against industrial companies, but no further action has been taken regarding the Great Lakes Legacy Act. If clean-up is completed solely by the federal government, the length of time for clean-up may extend a decade longer vs. the Legacy Act proposal that had a timeframe of 3 years.

Ecosystem Indicators

With knowledge of the past and an understanding of the present, we can look toward the future and the potential role of ecosystem restoration on a regional scale. The following research describes the relationship between ecosystem restoration and several indicators including biodiversity, stormwater quality and quantity, air quality, community character, quality of life and land value. These indicators can be improved by restoration, and the effects of ecosystem restoration efforts on these indicators can be tracked.

Biodiversity

As described in the Biodiversity Recovery Plan, biodiversity "can be measured by the number and variety of natural communities that exist side by side in a given area" (Chicago Region Biodiversity Council, 1999). One purpose of restoration is to create a variety of natural communities, making biodiversity a good indicator of an ecosystem's health. For example, this relationship can be utilized in the recovery of forest ecosystems and bird biodiversity in Illinois. Forests have greatly decreased since the 1800's, when they covered 40.8% of the state; as of 1996, forest covered only 14% (IDNR). The remaining forest tracts across Illinois are noted as "small, fragmented, and degraded," which has caused a loss in bird diversity (Ibid). IDNR found that patterns of bird diversity are best supported by larger tracts of forest area and recommended that forest managers tackle the issue of expanding forest coverage areas wherever possible (Ibid). Ecosystem restoration can be a tool to maintain and increase the region's biodiversity and genetic collection that will aid us as factors like climate and population growth patterns continue to change.

Prairie Flowers at Fermi National Accelerator Lab

Stormwater quality and quantity

Ecosystem restoration increases the quality while decreasing the quantity of stormwater runoff. Native plants' deep root systems are better equipped to filter and absorb stormwater than non-native species. This results in less, better quality stormwater entering our stormwater management infrastructure and natural water bodies as well as decreasing flooding potential (Chicago Region Biodiversity Council, 1999). In September, 2008, rainfall from Hurricane Ike caused flooding throughout the Midwest. Wheaton, IL received 10.51 inches of rain in a two day period and O'Hare International Airport received a record-breaking 6.64 inches in one day (Midwestern Regional Climate Center). Flooding is, unfortunately, a frequent occurrence in various parts of the region. In Lake County, on the Des Plaines River, it is estimated that

flooding costs local governments and property owners an average of $20 million annually (Chicago Region Biodiversity Council, 1999). Ecosystem restoration that enhances wetland and other natural community coverage can be useful in decreasing flooding severity.

Before and after image of a home in Indian Creek, Lake County

The quality of stormwater is also critical to health of ecosystems and their inhabitants. Rivers, streams, lakes and wetlands are all vulnerable to *nonpoint source pollution*. Nonpoint source (NPS) pollution comes from many different sources. It is created when water from rain and melting snow flows across our roofs, streets and landscapes, picking up pollutants and carrying them to the nearest waterbody resulting in stormwater runoff. Some of the biggest contributors to contaminated stormwater runoff are agricultural and residential chemicals (like fertilizers and pesticides) and eroded soil from construction sites and farm fields (Funder's Network 2004, 12).

It is important to engage in actions like ecosystem restoration that improve stormwater management. Studies have also shown that watersheds become degraded when more than ten percent of the acreage is covered by impervious surfaces such as roads, parking lots, and roof tops (Ibid). In warmer months as impervious surfaces are heated by the sun, the runoff temperature increases as it is funneled through watersheds. For example warmer water contains less dissolved oxygen affecting fish and plant species that are sensitive to oxygen levels, causing a decline in those communities (Ibid). A strategy paper focused on stormwater best management practices is forthcoming.

Air Quality

The reestablishment of native plant species through ecosystem restoration improves air quality. Compared to traditional lawns and turf grass, natural landscaping and native plants require less maintenance, and can even clean air more efficiently (USEPA, Green Acres). According to the Clean Air Counts campaign, "for every 1,000 acres of natural landscaping, 50 tons of VOCs and 5 tons of NOx are avoided per year" (NIPC, 2004). If restoration sites replace turf grass with natural landscaping, the pollution from landscape maintenance will be greatly reduced. Fossil-fueled lawn equipment emits high levels of carbon monoxide, hydrocarbons (VOCs) and nitrogen oxides (NOx) contributing to green house gases. According to the USEPA, "a gasoline

powered lawn mower emits 11 times the air pollution of a new car for each hour of operation" (Ibid).

Many air pollutants removed by ecosystem restoration are the same pollutants that can cause harm to ecosystem functions and biodiversity. Atmospheric pollution is a potent threat to ecosystems because it cannot be contained once it is released. Air pollution can travel for long distances before it is deposited back into the earth through particles or precipitation, impacting a variety of ecosystems along the way. The four frequently cited dangerous air pollutants are sulfur, nitrogen, ground-level ozone, and mercury (Lovett and Tear, 2008). These pollutants result from industrial and manufacturing activities; coal-fired power plants; motor vehicle, plane, train emissions; agricultural and construction operations; and small emitters like gas stations and dry-cleaners. Additionally, carbon dioxide is emitted through similar polluting activities and is a major component of greenhouse gases (see Section V: Impact on Climate Change). All of these air pollutants are capable of damaging vegetation, wildlife, and habitat, and some effects on ecosystems are irreversible or immeasurable in the shorter term.

As reported by the Illinois EPA in its Air Quality Annual Report (2006), there has been a decline in air pollution statewide in the last ten years. CMAP's Regional Air Quality Snapshot (forthcoming) looks more specifically at the levels of air pollution in northeastern Illinois, and found similar results. However, the region remains in nonattainment for the Clean Air Act, meaning that air pollution is still at unhealthy levels.

Community Character, Quality of life and Land Value

Residential patterns and recreational activities around the world show that people have a connection to nature and appreciate the landscapes that ecosystems and biodiversity offer. Many of these benefits exist outside the economic realm. Clean air and water as well as improved overall health conditions are just a few of these public goods. Open space encourages physical activity and has been proven to reduce stress and add aesthetic value to everyday life (Costanza et al. 1997, 387).

Photo by CMAP photography contest participant, Kawamura Kazuya

In the Chicago Wilderness Region, we have convenient access and support for open space close to our communities. In 1994, there were an estimated 40 million visits to Forest Preserves in Cook County and in Lake County 75% of residents surveyed stated that they had visited forest preserves within two years of the survey (Richard Day Research 1998, Chicago Region Biodiversity Council, 1999). Across the region, several referendums have been passed to preserve open-space. Collectively between DuPage, Kane, Will, and Lake Counties, a total of $250 million was approved in the late 1990's (Chicago Region Biodiversity Council, 1999).

As evidence to residents' value of open space, the economic value of land tends to increase with proximity to open space and parks. Residents are willing to pay a premium for the positive attributes associated with living close to nature. The CMAP Open Space and Parks strategy paper covers this topic in more detail.

Impact on Climate Change

Ecosystem restoration is threatened by climate change, but can also help mitigate its impacts. Humans are altering the composition of the natural landscape, as well as the Earth's atmosphere. Already, the earth's average surface temperature has increased about 1.3 degrees Fahrenheit during the last century (Snover et al. 2007). A number of repercussions are expected within the next century as a result of rising temperatures, but several effects of climate change can be observed right now. Temperature increases, receding glaciers, disappearing snowpack, premature spring seasons, shifting proportions of plants and animals, and rising sea levels have already been documented (Snover et al. 2007). Along with increased frequency and severity of droughts, flooding, forest fires and disease, these aspects of climate change have direct and indirect effects on ecosystems (Chicago Wilderness)(Sullivan and Clark 2007, 2).

The loss of ecosystems services and biodiversity, the alteration of seasonal events and the increased presence of invasive species are just some of the expected direct effects of climate change on ecosystems. Even a modest increase of a couple degrees can result in an estimated 20 to 30 percent of all known plant and animal species at risk for extinction (Snover et al. 2007). Many species (or their main source of food or habitat) can only survive in a narrow range of temperatures. As temperatures rise, those plants and animals will adapt, relocate or become extinct. In addition, the timing of critical seasonal events could be altered, causing harm to other species. For example, newborn birds depend on springtime caterpillars as food. Climate changes could result in shifted seasons and life cycles. This could also lead to changes in predator-prey relationships altering the food-chain in certain ecosystems (Sullivan and Clark 2007, 2). Increased heat and humidity in the region also perpetuate the development of insect pests and diseases that attack plants and animals resulting in highly adaptive invasive plant and animal species out-competing the native species (Ibid).

The debate surrounding climate change has shifted beyond questioning its existence to one focused on "solutions and adaptation" (Sullivan and Clark 2007, 2). Ecosystem restoration can provide some relief to the effects of climate change through increased native vegetation. Vegetation removes carbon dioxide from the atmosphere and sequesters it in its biomass thus acting as a carbon sink. This process captures gas that would otherwise contribute to global

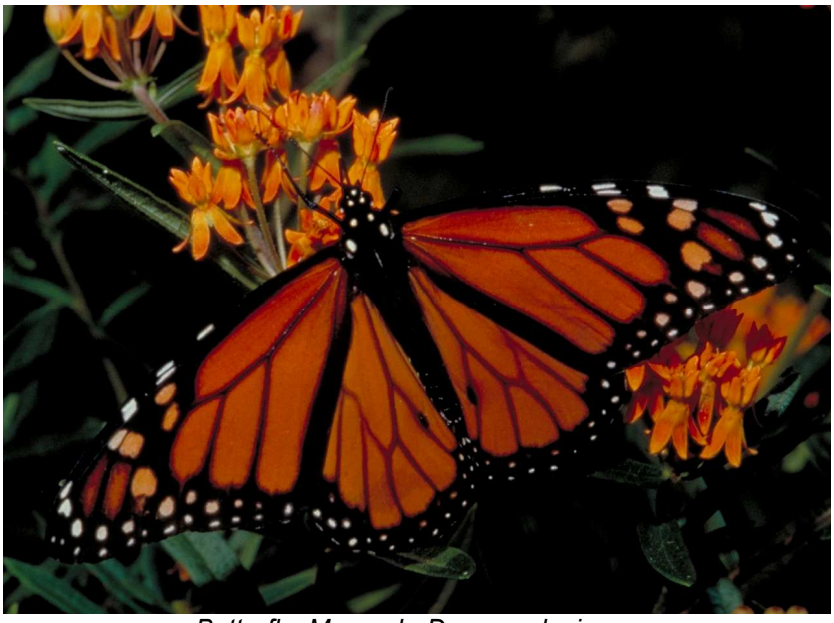
climate change. Grasslands are particularly efficient at storing carbon underground because nearly 90% of their biomass is underground (Chicago Region Biodiversity Council, 1999).

Grasslands at Midewin National Park

CMAP intends to take an active approach to climate change in the *GO TO 2040* plan. The initial approach to the issue is laid out in a white paper on climate change (link to Volpe paper) and additional work is currently underway to inventory the region's greenhouse gas emissions and recommend actions to reduce them.

Conclusion

People, animals and plants depend on healthy ecosystems. Our everyday lives and luxuries would not be possible without their services and resources (SER). In *A Sand County Almanac*, author and ecologist Aldo Leopold states, "We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." Restoration gives us an opportunity to improve our relationship to the ecosystems we depend on, and allows us to become a constructive part of the communities that create our region's natural environment.



Butterfly, Monarch, Danaus plexippus

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