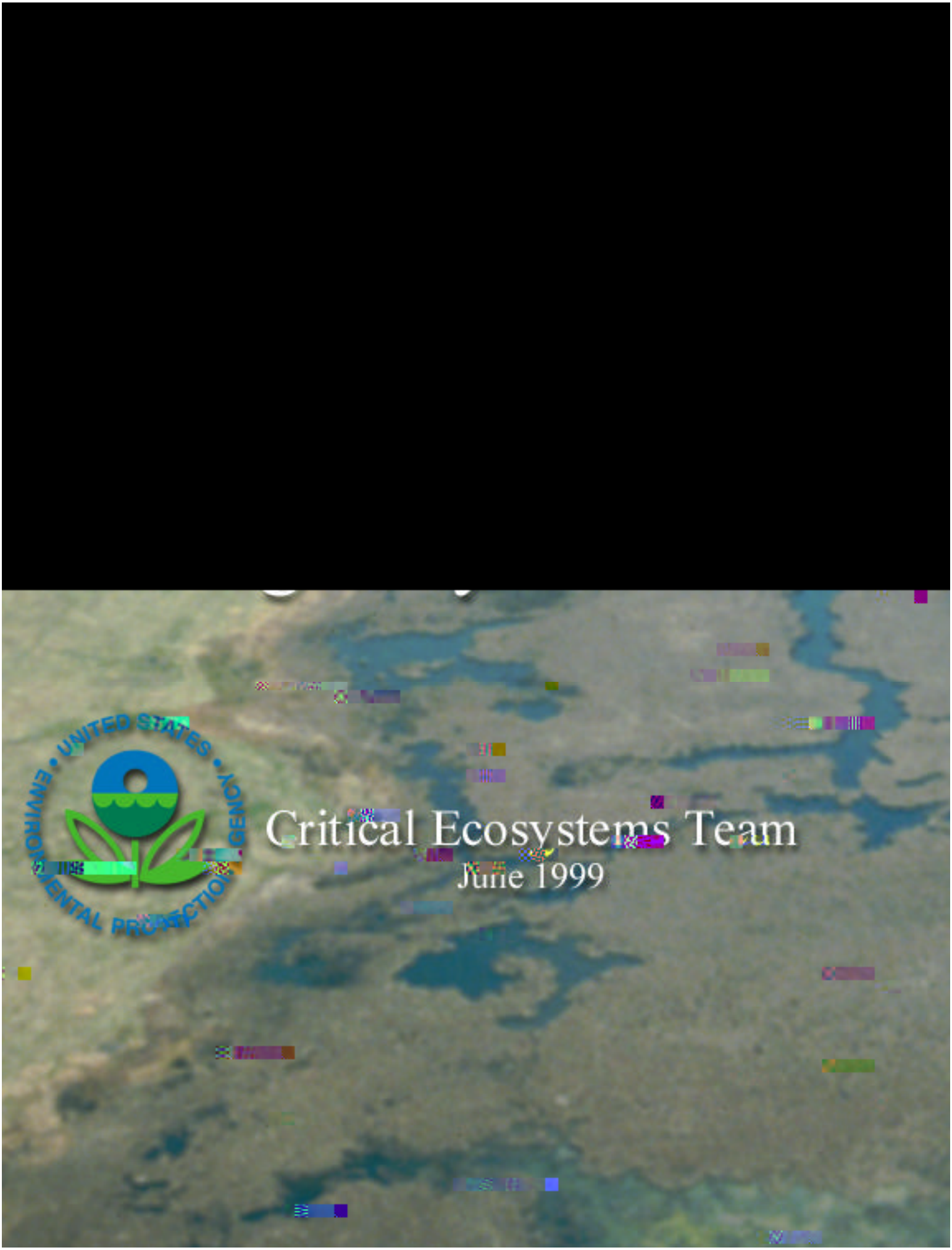
UNITED STATES • ENVIRONMENTAL PROTECTION AGENCY •
Critical Ecosystems Team
June 1999

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Ecologically Rich Areas

Ecologically Rich Areas are geographic places having clusters of ecological community types and species and their associated landscapes that are unique, rare or threatened or that are valued for their long-term services to keep our environment healthy. Over the past year, the Critical Ecosystem Team met with over 175 people from over 30 agencies and organizations and interviewed more than 50 partners by phone in order to begin to identify, gather information about, and map the Ecologically Rich Areas of Region 5. This report is a first attempt to characterize partner information from an EPA perspective for EPA staff. The areas identified are not the only areas of ecological richness in Region 5. Numerous other high quality, but smaller, areas exist. From a regional perspective, however, our partners have identified the Ecologically Rich Areas as warranting special attention.

Contents of this Report

Each chapter of this report will contain a characterization of one state's Ecologically Rich Areas. The draft chapters for Indiana and Ohio are included in this folder. Drafts for Illinois, Michigan, Minnesota and Wisconsin are forthcoming by the end of this fiscal year.

At the beginning of each state chapter, the number of ecosystems per county as identified by partners is shown on a map. Counties are grouped together to form the Ecologically Rich Areas. The pages following each state map contain details regarding the ***ecological values***, ***stewardship*** and ***human-induced stressors*** of each area. Preliminary conclusions about the ecological health of each area precedes the details. Based on these conclusions, recommendations for ***EPA's contribution*** to each area are listed. We welcome suggestions and corrections to the format as well as content, particularly in regard to EPA's present and possible roles. A clarification of chapter sections follows.

Ecological Values

Natural areas have monetary as well as esthetic value to society. The ecosystem services that can be performed by a healthy ecosystem include[1]:

- purification of air and water
- mitigation of floods and droughts
- detoxification and decomposition of wastes
- generation and renewal of soil and soil fertility
- pollination of crops and natural vegetation
- control of agricultural pests
- dispersal of seeds and translocation of nutrients
- maintenance of biodiversity
- maintenance of genetic library

[1] from Nature's Services, 1997, G.C. Daily, editor, Island Press

- protection of ultraviolet rays
- partial stabilization of climate
- moderation of temperature extremes
- support of diverse human cultures
- aesthetic beauty and intellectual stimulation

Multi-Partner Stewardship Efforts

Although the natural resources of ecologically rich areas have been heavily impacted, small and rich fragments remain. Stewardship of these areas is multifaceted, with local, State, Tribal, and Federal partners working toward the goal of managed but healthier ecosystems. Efforts to protect biodiversity and critical ecosystems from further degradation include buying land to prevent development, restoring impaired ecosystem functioning on public and private lands, and continuing to build the partnerships to allow the work to continue. In each Ecologically Rich Area an attempt was made to describe current partnerships active in restoration and protection.

Human-Induced Stresses Impacting the Area

Five major types of stress that are impacting ecosystem functioning and biological diversity are:

- alteration of the chemical regime
- alteration of hydrology
- alteration of physical processes
- direct alteration of habitat
- alteration of biological structure

These categories of stress may be natural or human-induced. Human-induced stress has had the greatest impact on ecosystems and biodiversity. The human-induced stressors are listed for each area.

Major sources of human-induced stress are:

- poor agricultural practices
- draining of wetlands
- channelization of streams and rivers
- management of lake water levels for human uses
- development of all kinds
- invasive species
- air emissions
- in-place pollutants

In each of the Ecologically Rich Areas partner data was used to highlight the most severe stressors. No doubt, when additional information becomes available, the lists will grow.

EPA's Contribution

The following general recommendations are intended to spur discussions among EPA staff as well

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Indiana

NORTHWEST INDIANA

No region in the Midwest has been as greatly impacted by human activity as Northwest Indiana. Pre-European settlement, a series of white pine and jack pine-covered dunes, and swales rich in wetland species, paralleled Lake Michigan. Inland, the dune and swale topography met the Calumet marshes. Further south, the Great Kankakee Marsh was a resting and nesting place for thousands of birds. Oak savannas and tall-grass prairies interspersed dune and swale and marshes. East, to the Valparaiso Moraine, a high ridge marking the edge of the last glacier, eastern woodland plant species met western prairie and remnant boreal forest.

Although it is undoubtedly still the richest region in Indiana and in the Great Lakes basin in terms of biodiversity, Northwest Indiana ecosystems are fragmented and under constant, diverse stress from multiple sources. Without restoration of ecosystem functions and structures, their long term viability is severely threatened.

The good news is that the stressors and their sources, for the most part, have been identified and agencies and organizations are working together to set priorities and remedy problems. In spite of the small sizes of some of the sites and the distance between them, management strategies have

woodland species, and western tallgrass prairie species. Insect and amphibian species, some rare, still abound. Specific rare species are the Federally endangered Karner blue butterfly and Massasauga rattlesnake.

The Kankakee River Basin once included one of the largest wetlands in the continental United States, the 500,000 acre Grand Kankakee Marsh. Though most of the wetland has been drained for agriculture, this area is still important habitat for breeding and migrating waterfowl, as well as other wildlife species. The Kankakee River Basin supports five Federally threatened or endangered species, 10 candidate species for a Federal threatened or endangered listing, and 220 State threatened or endangered species. The Jasper-Pulaski and Willow Slough Fish and Wildlife Areas provide nesting and resting habitat for large populations of sandhill cranes during spring and fall migrations.

The Calumet Watershed is part of the old glacial Lake Chicago lakeplain and is defined by continuous beach ridges interspersed with swales. Today, most of the original landscape is gone, covered with residential and big industrial complexes. The remaining fragments contain a high level of biodiversity, including rare and endangered plant species. The dune and swale Clark and Pine complex has more than 350 plant species. Birds also abound here, and include the black-crowned night heron and sora rail. Hoosier Prairie Nature Preserve is rich in tallgrass species. The Grand Calumet River, reversed in the last century to flow toward the Mississippi River, is a degraded, channelized remnant of its former self, but with restoration, has the potential as habitat for numerous aquatic species.

East of the City of Gary and along the southern Lake Michigan shoreline lies an area of beaches and dune ridges paralleling the Lake. The endangered pitcher's thistle is an early colonizer on foredunes. The low areas between each ridge are swales, pannes, and marshes. These wetlands are diverse and contain many rare and endangered plants and animals. Secondary dunes, inland from the Lake, were once covered with white and jack pines. However, after years of logging, these dunes today contain black oak savannas with a grassy understory. The endangered Karner blue butterfly with its lupine caterpillar-host plant favors the oak environment. Birds stop at the dunes on their migrational pathways. Porter Beach and Lake Street Beach are prime spots to observe shorebirds, gulls, and the spring hawk migration.

The Valparaiso Moraine is a rugged area south of the dunes. It is the terminal point of the Wisconsin glacier. This area contains higher, rolling woodlands containing small, peaty lakes and streams.

Near the Indiana-Michigan state line in northeastern LaPorte County are eastern deciduous forest remnants. These beech-maple communities have a rich, spring flora, distinctively different from their dune, oak savanna neighbors.

The Lake Michigan shoreline is a major bird migration stopover, with publically owned beaches and dunes stretching for miles. The lake itself is a significant sport fishing area.

Multi-Partner Stewardship Efforts

A series of ***publicly owned parks and preserves, and privately owned natural-state fragments*** dot the Northwest Indiana region (see Appendix A). However, even though some of these areas are in public ownership and designated "parks" does not mean they are being managed well or in a coordinated fashion. Likewise, because something is in private ownership does not mean it is necessarily degraded or mismanaged.

The following ***initiatives*** focus on the protection and restoration of ecosystems in Northwest Indiana. Although led by different agencies or organizations, all of the initiatives require cooperation of partners (see Appendix B).

Calumet Ecological Park Feasibility Study:
Although the designation of the Calumet area as an "ecological park" is not imminent, community groups who called for a 1998 feasibility study by the National Park Service are continuing to pursue park designation through Federal Congressional representatives.

Chicago Wilderness:
Chicago Wilderness is a partnership of more than 75 public and private organizations that have joined forces to protect, restore and manage the natural lands of areas in the Chicago region, including Northwest Indiana. The organizations have pooled their resources and their expertise and enlisted the help of thousands of volunteers to develop management plans, monitor changes in ecological conditions, conduct scientific research, and act to protect and restore more than 200 areas.

Coffee Creek Development:
Coffee Creek of Chesterton, Indiana is a 600-acre development incorporating single family residences, high density apartments, a commercial district, and a riparian stream restoration corridor. One third of the development area is preserved in perpetuity as a nature preserve. Management responsibility for the preserve has been given to a not-for-profit land trust made up of members from area environmental groups and supported by property assessments. The buildings will all be constructed with the latest energy efficient and environmentally sound materials. The development exemplifies an alternative to traditional "sprawl" development.

Grand Calumet River/Indiana Harbor Ship Canal Remedial Action Plan:
All 14 beneficial uses in this Great Lakes basin Area of Concern (AOC) are impaired. In 1990 the Indiana Department of Environmental Management (IDEM) opened an office in Gary to begin to restore impaired uses in the area. A public advisory committee, the Citizen's Advisory for the Remediation of the Environment Committee (CARE) was formed to assist in implementing the Remedial Action Plan (RAP) to address the impairments. The Habitat Subcommittee of the CARE Committee is working to identify priorities for restoration.

Greater Calumet Wetlands/Indiana Dunes Ecoregional Planning:
A project manager has been hired and has begun to manage The Nature Conservancy (TNC)-owned preserves, work with public and private landowners to develop management plans for properties with significant biodiversity elements, and identify strategies to restore the ecological function and structure of degraded areas. TNC is fund-raising to support protection and restoration activities in this region, identified as one of Indiana's "last great places." TNC is in the process of formulating an ecoregional plan. With numerous partners, important sites have been

traditional enforcement efforts. The Northwest Indiana Team plays a coordinating role for the area, working with many agencies and organizations. The Lake Michigan Team incorporates Northwest Indiana concerns into Lake Michigan Lakewide Management Planning (LaMP) activities. The Sediments Team has been working on Indiana Harbor dredging issues. The Critical Ecosystems team has identified Northwest Indiana as one of five Indiana "Ecologically Rich Areas." The Water Division's Wetlands and Watersheds group is completing an Advanced Identification of Wetlands for northern Lake and Porter Counties. The non-point source group has funded numerous projects in the area. Superfund spill mapping of the region will be a reality soon. EPA helps foster Supplemental Environmental Projects and Natural Resource Damage Assessment settlements in coordination with other agencies to hopefully have a positive impact on natural areas in Northwest Indiana. The Great Lakes National Program Office has identified Northwest Indiana as part of the Chicago Wilderness Biodiversity Investment Area and has awarded numerous grants for protection and restoration projects over the years.

Human-Induced Stresses Impacting the Area

Alteration of the Chemical Regime:

- In aquatic systems, including Lake Michigan, streams, inland lakes, and wetlands, the addition of toxic compounds from point and non-point sources has caused death or chronic impairments to wildlife. Several toxic chemicals have bioaccumulated in top aquatic predators, affecting reproductive functions.
- The introduction of nutrients – phosphates and nitrogen compounds – has caused an increase in microorganisms that deplete oxygen required by aquatic fauna.
- Atmospheric deposition of acids has damaged plants and animals that depend on surface water.
- Salinity changes brought on by road salting threaten both upland and aquatic habitats.

Alteration of Hydrology:

- Human induced lake level changes and natural fluctuation interruptions, particularly on the Lake Michigan shoreline, have disrupted the dynamic functioning of shoreline systems.
- The flushing of nutrients and organic matter from tributaries has been severely disrupted. As a result, beach and dune nourishment has been altered.
- Alteration in stream flows has caused stress to fish and other organisms.
- Widespread irrigation and drainage have altered water tables, impacted soil moisture, and affected wetlands and prairies and the species that depend on them.

Alteration of Physical Processes:

- Removal of riparian vegetation has altered the flow regimes of streams and destroyed wetlands. This has resulted in a rise in water temperature and changes in ecological conditions, and has adversely impacted aquatic species.

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- Maintain a strong Northwest Indiana Regional Team to coordinate EPA efforts and with the regional Critical Ecosystems Team to protect and restore ecosystems.
- Assist the region with technical support whenever possible. There are numerous occasions when a wetlands expert, a toxicologist, or an ecologist could be of service. Good will could be engendered by offering our expertise through the Community-Based Environmental Protection (CBEP) approach.
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Appendix A–Northwest Indiana Protected Natural Areas

The following is a list of *publicly and privately protected natural areas* in the Region, some of which have been identified as critical by conservation partners active in the area.

Federal:
Indiana Dunes National Lakeshore

State:
Bass Lake
Berns-Meyer Nature Preserve
Clark and Pine State Nature Preserve
Cressmoor Prairie State Nature Preserve
Hoosier Prairie
Indiana Dunes State Park
Jasper-Pulaski Fish and Wildlife Area
Kankakee Fish and Wildlife Area
Kingsbury Fish and Wildlife Area
LaSalle Fish and Wildlife Area
Tippecanoe River State Park
Tolleston Ridges
Willow Slough Fish and Wildlife Area
Winamac Fish and wildlife Area

County:
Deep River (Lake)
Gibson Woods Nature Preserve (Lake)
Oak Ridge Prairie (Lake)

Local:
Brunswick Center South (Gary)
Grand Calumet Lagoons (Gary)
Marquette Park (Gary)
Migrant Trap (Hammond)
Wolf Lake (Hammond)

Private:
Beemsterboer
Clark and Pine Dune and Swale
Clark and Pine General refractory
Clark Junction (USX)
Clark Junction East (USX)
Cline Avenue Dune and Swale
(conservation easement between DNR and South Shore RR)
Coulter Sand Prairie (Shirley Heinze)
DuPont Natural Area (DuPont)
Explorer Pipeline
Gary Enterprise Zone (USX)
Gary Works (USX)
Grand Calumet Tern Site

Appendix B–Northwest Indiana Agencies, Organizations, Universities and Corporations

The following *agencies, organizations, universities and corporations* have roles in the protection and restoration of Northwest Indiana ecosystems.

- Dunes-Calumet Audubon
- DuPont Corporation
- Friends of Gibson Woods
- Friends of Indiana Dunes
- Gary Parks Department
- Grand Calumet Task Force
- Hammond Parks Department
- Hoosier Environmental Council
- Illinois-Indiana Sea Grant
- Indiana Department of Environmental Management
- Indiana Department of Natural Resources
- Indiana Division of Nature Preserves
- Indiana University
- Isaak Walton League
- Lake County Parks
- Lake Michigan Federation
- LaPorte County Parks
- Midwest Steel
- National Park Service
- Northwest Indiana Public Service Company
- Northwest Indiana Regional Planning Commission
- Potowatomi Audubon
- Purdue University
- Save the Dunes Council and Fund
- Shirley Heinze Environmental Fund
- Sierra Club
- The Nature Conservancy
- U.S. Coast Guard
- U.S.D.A. Natural Resource Conservation Service
- U.S. Environmental Protection Agency–Great Lakes National Program Office
- U.S. Environmental Protection Agency–Region 5
- U.S. Fish and Wildlife Service
- U.S. Geological Service

CENTRAL INDIANA

The central Indiana region was once a beech, maple and oak forest which is now largely fragmented. The Wabash River is one of the longest free flowing rivers east of the Rocky Mountains. Although agriculture dominates this region, aggressive management of private lands with a consideration for wildlife and forest values can help restore the area and provide wildlife corridors and water quality protection. Farming practices can include conservation measures, such as buffer zones and erosion controls, in order to protect biological diversity through protection of riparian zones (ELI 1995).

Habitat loss is a problem in central Indiana. Currently less than one thousandth of one percent of native prairies remain in Indiana, some only protected where they are found in cemeteries. Numerous Federal and State listings of species as endangered or threatened are closely linked to the loss of habitat in the region. Over 120 plants which naturally occur in wetlands and over 60 species of animals which are wetland-dependent are listed as endangered, threatened or of special concern by the Indiana Department of Natural Resources. Most significantly, erosion, sedimentation and run-off from agricultural activities is threatening aquatic species, including fresh water mussel species, in the area.

Ecological Values

Central Indiana contains the counties of Parke, Fountain, Montgomery, Putnam, Hendricks, Boone, Warren and Tippecanoe. Due to numerous rivers and creeks, riverine values are often cited as the region's greatest ecological value. At-risk fish and mussel species are highlighted in The Nature Conservancy "Rivers of Life" publication. In the Middle Wabash-Little Vermilion area in the North Central Tillplain, there are 14 such imperiled species; in the Vermilion Central Tallgrass Prairie, there are 9 such imperiled species; and in the Tippecanoe North Central Tillplain, there are 21 such imperiled species. Of these imperiled species, six are listed under the Federal Endangered Species Act as either threatened or endangered. Sugar Creek contains a high diversity of aquatic species. Mud Pine Creek, Fall Creek, Indian Creek, Bear Creek and Big Pine Creek are designated as "exceptional use" streams by Indiana Department of Environmental Management. Prairie habitat is also critical in the area.

Big Walnut Preserve is an outstanding scenic area with steep sided ravines along the Big Walnut Creek, containing glacial-relict stands of eastern hemlock and Canada yew. It also contains areas of virgin forest and one of a few remaining examples of a beech-sugar maple-tulip poplar climax forest in Indiana.

Multi-Partner Stewardship Efforts

Over 40 neotropical migratory bird species are under special management in Indiana. Several areas have been designated Natural Community Campaign Areas. Sugar Creek has been targeted for protection under the "Saving our Last Great Places" fund established by the The Nature Conservancy. This fund has also targeted Big Walnut for protection in a program which will leverage public resources and new and existing partnerships. The restoration of riparian

vegetation along Big Walnut Creek is being conducted by The Nature Conservancy and Cinergy, a large energy company. A variety of federal programs exist which protect erodible farmland, wetlands and wildlife.

The Natural Resources Conservation Service (NRCS) has identified several areas, including Sugar Creek, Fountain County, Wea Creek, Lower Big Raccoon and BigWalnut/Deer Creek, as Environmental Quality Incentives Program (EQIP) areas. In this program, the NRCS will provide technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water and related natural resource concerns in an environmentally beneficial manner.

- EPA can share knowledge about its activities with local, state and federal agencies. The type of knowledge that EPA can share with partners includes information about toxic releases, clean-up of abandoned hazardous waste sites, permitted landfills, recycling centers and other environmental data.

SOUTHEAST INDIANA

into the Muscatatuck Wildlife Refuge. The U. S. Geological Survey has funded a study of the cave-dwelling species in the Blue River. Hoosier National Forest protects contiguous forested areas, some of them virgin, and harbors endangered Indiana brown bats.

Human-Induced Stresses Impacting the Area

- Exotic and invasive species threaten the fish and mussel diversity of the river ecosystems. Illegal harvesting of mussels is a threat to this imperiled biota.
- The region is at high risk to groundwater contamination due to its hydrology. Sinkholes formed as a result of the Karst topography provide a direct link to groundwater. Sinkholes that are hydrologically connected to cave systems are often used as trash pits. The cave ecosystems in this area are dependent on clean groundwater for their survival.
- Heavy recreational use degrades cave ecosystems.
- Sedimentation and runoff are threatening all of the aquatic systems. Non-point source pollution in the form of nitrate and pesticide enrichment may adversely affect these systems.
- Fragmentation and development threaten forested habitat.
- Levels of ozone pollution in Floyd and Clark counties are high.

EPA's Contribution

- Non-point source pollution issues need to be considered in permitting activities.
- Ozone pollution should be carefully monitored in this region.
- Review of wetland permits in this area should focus on the importance of riparian wetlands and water quality.

SOUTHWEST INDIANA

Southwest Indiana was once dominated by cypress swamps, oak forests and bottomland swamps. Nearly all of the natural features of this region exist as an indirect result of the meandering nature of the Wabash and Ohio Rivers, including numerous oxbow lakes and sloughs. The 1998 Indiana State of the Environment Report identified more than 20,000 acres of wetland habitat in each of Gibson and Posey Counties, 10-20,000 acres within Warrick County and less than 5,000 acres of remaining wetland habitat in Vandenburg County. Much of the area is being impacted by land use changes, loss of habitat and air and water pollution. A regional strategy for ecosystem protection, management and restoration should be developed to preserve natural resources in the area.

Ecological Values

Few areas in Indiana foster the natural complexity and biological diversity of southwest Indiana, encompassing the counties of Gibson, Pike, Vanderburgh, Posey and Warrick. Within this region, bald cypress swamps remind us of a once common ecosystem. Bottomland and floodplain forests and oak-dominated flatwoods predating European settlement are rare but treasured. Plants and animals that are more typical of the deep South are only found in this small region of the State, as are many rare, threatened and/or endangered species. The Bottomlands are part of the Mississippi Flyway and are productive breeding, resting and feeding grounds for migrating birds. Some of this habitat is included in the Patoka National Wildlife Refuge.

In Gibson County at the Cinergy Gibson Power Generating Station and at Gibson Lake, a colony of Least Terns, an endangered species, thrives and is expanding its population throughout the Wabash River basin.

The East Fork of the White River in Pike County and a portion of the White River in Gibson County supports a high diversity of aquatic species. The Ohio River is one of the most important riverine resources in United States.

Multi-Partner Stewardship Efforts

The Indiana Department of Natural Resources has identified Community Campaign Sites in the area. The following is a summary of the sites, by county.

Gibson County: Coffee Bayou Site; Hemmer Woods Site; and Saunders Woods
Pike County: Slackwater Bottoms Site

Posey County: Section Six Southern Flatwoods Site; Slim Pond Flatwoods; and the Twin Swamps/Styrax Site

Warrick County: Bloomfield Barrens Site

The Pigeon Creek watershed overlaps Gibson, Vanderburg and Warrick Counties and is identified by the Natural Resources Conservation Service as an Environmental Quality Incentive Program area. The Nature Conservancy has nominated the Wabash/Ohio Lowlands as a candidate bioreserve in Indiana. The Patoka River National Wetlands Project will protect the river and adjacent wetlands and restore the degraded floodplain.

Human-Induced Stresses Impacting the Area

- Threats in this area include fragmentation of habitat, land use changes leading to alteration and/or loss of habitat, point and non-point pollution and the invasion of exotic species.
- Impairment to aquatic resources include discharges from industrial and municipal facilities.

- There are no identified contaminated sites in extreme southwest Indiana, although there are voluntary cleanup sites in Gibson (1) and Vandenburg (2) Counties. Only one solid waste landfill exists in this area; however, it is located very close to the Ohio River. Small scale waste tire dumps exist in Pike (1), Posey (2), Vandenburg (2), and Warrick (1) Counties.
- Information also indicates that the counties of Posey, Vandenburg and Warrick are subject to higher than average toxic air releases.

EPA's Contribution

- Regional ecosystem team needs to work with Water, Air and Waste Divisions to characterize EPA's presence in this region to formulate a strategy for ecosystem protection..

NORTHEAST INDIANA

Northeast Indiana, extending westward from the Black Swamp of Lake Erie, historically contained many fens, bogs, marshes, prairies, lakes and forests. The aquatic habitats supported a diversity of plant and animal species, including numerous freshwater mussels. Today, most of the ecological values in this region are related to aquatic systems. Non-point source pollution is a concern in this area. Land use in this area should be considered with the goal of the improvement of stream quality in mind. Riparian zones should be restored to protect water quality. Buffers around remaining quality wetlands should be established to shunt runoff from roadway and rural housing developments, minimizing runoff and septic impacts.

Ecological Values

The counties of Steuben, LaGrange, DeKalb, Allen and Noble in northeast Indiana contain a number of significant habitats. The landscape is level to gently rolling, in a mosaic of land uses. These include primarily pasture, soybean and corn agriculture, and residential areas interspersed with streams and bottomland hardwoods, upland central hardwood forest, and occasional riparian marshlands. The upland soils are primarily well drained, rich and loamy, while bottomlands vary from sands and gravels to clays and humic soils. The St. Joseph River, Fish Creek and Pigeon River provide habitat for threatened and endangered fish and mussel species and contain high biodiversity. The Pigeon River ecosystem contains an array of bogs, fens, sedge meadows and marshes, as well as the state's largest tamarack swamp. Cedar Creek is designated as an outstanding state resource water. Fish Creek supports the richest aquatic community in the Great Lakes watershed and is the only known location of the federally endangered White Catspaw mussel.

Multi-Partner Stewardship Efforts

A number of "Community Campaign Sites" protect representatives of important ecosystems in this region. The Nature Conservancy and Indiana Department of Natural Resources support efforts to preserve the Pigeon River and Fish Creek ecosystems. The Indiana Department of Environmental Management recognizes Cedar Creek as an outstanding resource water. The Natural Resources Conservation Service has identified several watersheds, including Pigeon Creek, Crooked Creek, Buck Creek and Cedar Creek, as Environmental Quality Incentives Program (EQIP) areas. In this program, the NRCS will provide technical, educational, and

- Non-point source pollution in the form of nutrient and pesticide enrichment may adversely affect these systems.
- Phosphorus from agricultural activities is responsible for eutrophication of surface waters, including impacts to Lakes Michigan and Erie and their tributaries.
- Runoff impacts from highways and urban areas are typical of the north central states. Surface and groundwater near highways and developed areas experience elevated chloride levels, with deleterious local effects on native wetland species.

EPA's Contribution

- Wetland permits in this area should be reviewed with the importance of riparian wetlands to water quality in mind.
- EPA has ongoing assistance programs for the state via its Section 106 surface water quality and 319 watershed management programs, and it provides habitat protection and restoration and water quality research and demonstration grants to sections within the Great Lakes basin.

Ohio

CENTRAL OHIO

Central Ohio was formerly a combination of unique features including beech-sugar maple forests and a variety of wetland types, such as bogs and fens. The region of central Ohio has four watersheds containing large contiguous forests (including old growth forests), sphagnum bogs and boreal fens. These ecosystems are threatened by invasive exotic species, nonpoint source pollution and development. Some of these ecosystems support unique plant and animal habitats that are not found anywhere else in the world. Central Ohio also has a significant number of endangered plant and animal species. However, there has been improvement in these ecosystems because of the activities under federal, state and local programs. Water quality can be improved by stream restoration, including restoration of more natural flow regimes and channel alignment, restoration of quality in-stream habitat conditions and improvement of riparian corridor vegetation and land use.

Ecological Values

Several important ecosystems are found in the counties of Coshocton, Knox, Wayne, Licking, Muskingum, Holmes, Ashland and Richland in central Ohio. The watersheds of the Muskingum River, Walhonding River, Killbuck Creek, and Wakatomika Creek are on the Ohio Department of Natural Resources (ODNR) Division of Wildlife's "List of Priority Watersheds" in Ohio based on aquatic wildlife diversity. The Muskingum River watershed, one of Ohio's ten largest watersheds, provides a wealth of mussel and fish diversity. In a review conducted by The Nature Conservancy national office, the Muskingum watershed was listed as one of the most critical watersheds in North America to conserve fish and mussel diversity.

Boreal fens occur in Holmes County in the glaciated part of Ohio. Fens are especially valuable due to the high number of rare plant species they harbor. Sphagnum peat bogs, more rare in Ohio than fens, are found around kettlehole lakes that remain from the Wisconsinan Glacier.

Remnants of contiguous old growth forests that once covered 90% of this region are also important ecosystems. Central Ohio is home to a number of State listed endangered plant (1-5) and animal (15-27) species.

Multi-Partner Stewardship Efforts

There are numerous federal, state, and local agencies, as well as private organizations that are active in conservation efforts around the State. Activities include land acquisition and management.

River otter, a species once abundant in Ohio, has been reintroduced in several Ohio watersheds, including Killbuck Creek and Little Muskingum River. Through programs such as the Wetland Reserve Program, Wildlife Habitat Incentives Program, Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Program, the Natural Resources Conservation

Service is focusing efforts on ecosystem protection and restoration. The Western Muskingum River has been designated as an EQIP area. The protection and restoration of forested corridors along streams is one of the primary goals of many watershed plans. Currently, there are more than 50 agencies and organizations in Ohio involved with the long-term protection of stream corridors. Other protected segments occur in many state and national forests and state wildlife areas. An example includes more than seven miles of corridor protected along Killbuck Creek in the Killbuck Wildlife Area in Wayne and Holmes Counties.

Many of the high-quality bogs, fens and old growth forests that remain in Ohio are protected by Ohio Department of Natural Resources (ODNR), Division of Natural Areas and Preserves and The Nature Conservancy. Preserves managed by the Ohio Division of Natural Areas and Preserves include Fowler Woods, Cranberry Bog, Brown's Lake Bog, Morris Woods, Knox Woods, Johnson Woods, Clear Fork Gorge and Blackhand Gorge.

The state government plays a major role in how Ohio's biological diversity is protected, managed and restored. It works directly to protect biological diversity by acquiring and managing lands. The state also offers a variety of programs to local governments, private landowners, and citizens concerned about biological diversity protection. By providing technical assistance, financial assistance and educational information, the state helps to promote the protection and restoration of biological diversity on public and private lands.

Ohio has a diverse and active array of local park districts and metroparks that contribute indirectly or directly to the protection of biological diversity through management activities and programs. Park activities include working with ODNR, private conservation organizations and the Ohio Department of Transportation on native plant collection and propagation projects.

Human-Induced Stresses Impacting the Area

- Diffuse sources of pollution, such as runoff or nonpoint source pollution from urbanized areas, agriculture, and modification of water resources, have emerged as the primary sources of continued threat to aquatic systems.
- Many of streams have been affected by in-stream modification, non-point source pollution such as sediment and organics and the loss of beneficial riparian vegetation.
- Almost all of Ohio's forests have been logged at some time. Development further fragments remaining forested ecosystems.
- Ohio's fens are threatened by dredging, flooding, road construction, urban and agricultural development and the invasion of non-native species.
- Exotic species in Ohio, both plants and animals, have disrupted natural communities across the state.

EPA's Contribution

- Air Division could promote natural landscaping to private and public landowners in the

EAST CENTRAL OHIO

The only region in Ohio not shaped by glaciers, pre-European settlement the Western Allegheny Plateau ecoregion contained mixed oak forests, with steep valleys and ridges. Mining and timber harvesting have since impacted natural resources in the region.

Today, water and aquatic habitat quality are a key concern. The Little Muskingum River with its lack of urban development provides an opportunity for protection and continued restoration, such as the reintroduction of river otter. Non-point source pollution is a present concern in this area, but degradation of this system through point-source pollution in the form of power and chemical plants also occurs. Natural flow regimes, riparian vegetation and natural channel alignment in these aquatic systems should be restored. Land use should be considered with the goal of the improvement of stream quality in mind. The designation of Muskingum River as a scenic river by the Ohio Department of Natural Resources could increase awareness of the special importance of the Muskingum River and protect this valuable resource.

Ecological Values

The counties of Washington, Monroe and Noble, as well as part of Belmont County, contain a

Human-Induced Stresses Impacting the Area

- Exotic and invasive species threaten the fish and mussel diversity of the Muskingum River. Illegal harvesting of mussels is also a threat.
- Aquatic habitat alteration, caused in part by lock construction, is a concern in the Muskingum River, as well as heavy recreational use.
- A number of power plants in the Muskingum River watershed increase the possibility of thermal pollution in the Muskingum River. In addition, the release of atmospheric pollutants from these power plants and the resultant acid rain can adversely affect both aquatic and terrestrial resources.
- Sedimentation and runoff are threatening all of the aquatic systems. Non-point source pollution in the form of nutrient enrichment may adversely affect these systems.
- All terrain vehicle activity is degrading habitat in Captina Creek.
- Fragmentation and development threaten forested habitat.
- In Washington County, a "chemical corridor" of chemical plants have the potential to negatively affect resources in this region.
- Coal mining and timber harvesting are among the major land uses in this region.

EPA's Contribution

- The environmental effects of the many power and chemical plants should be considered in light of the ecological importance of this area.
- Review of wetland permits in this area should be assessed with the importance of riparian wetlands to water quality in mind.

WEST CENTRAL OHIO

West central Ohio is part of the Eastern Corn Belt Plain ecoregion, which was once covered by beech-sugar maple forests interspersed with prairie openings. Most of the historical habitat has been replaced by agriculture, yet some natural areas remain. This area is in need of preservation and restoration of natural habitats, coupled with control of nutrients, chemicals, erosion and stream water temperatures. The high water quality of the area's watersheds must be maintained.

Ecological Values

For the purposes of this project, the following counties were considered as the west central Ohio region: Champaign, Clark, Greene, Logan, Madison, Union, Franklin and Pickaway. Prairie fens are an important ecosystem in this region. They contain a number of rare plant and animal species, including many state-listed species. The Darby Plains area contains remnants of tall-grass prairie. The Big Darby creek is one of the most pristine waterways in Ohio and one of the top five freshwater habitats in the nation. The Darby Creek watershed is home to one of the richest and most diverse assemblage of aquatic life anywhere on earth with 86 species of fish and 40 species of mussels, many of them rare or endangered. A remarkable diversity of species is also found in the forests and remaining prairies that line the creek's banks. The Little Miami River has "very good" water quality and Little Darby Creek has "exceptional" water quality, based on the Ohio Environmental Protection Agency's biological assessment of water quality. The Little Miami River supports endangered species and also contains areas of relict boreal habitats, which support northern species rare in this area.

Multi-Partner Stewardship Efforts

Native plant and wildlife species are being introduced and managed to create more diverse habitats. Farmland is being re-forested for habitat development. Land use practices are being improved for the long term protection of critical habitats such as streams, riparian corridors, preserves and wetlands. Buffer strips are being placed along areas to minimize environmental impacts. A carbon sequestration process (carbon sink) is being developed. Burns are being prescribed to restore the natural balance of areas. Watershed protection strategies which focus on improving land uses by reducing pollution and watershed plans are being developed. Big and Little Darby Creek, as well as the Little Miami River are designated as state and national scenic rivers.

The Little Miami, Inc is a non-profit organization consisting of many individuals, foundations and corporate supporters who actively protect riparian corridors through acquisition and conservation easements. The Little Miami, Inc. also negotiates protection strategies with developers, landowners and public officials whose actions impact the Little Miami River.

Darby Creek has many partners (see Appendix A) working to protect it. The Nature Conservatory is a nonprofit organization dedicated to preserving plants, animals and natural communities by protecting the lands and waters they need to survive and is actively involved in the protection and conservation of the Big Darby Watershed. The Nature Conservancy is creating

a Freshwater Initiative program intended to employ scientific knowledge and expertise to drive community based conservation approaches. Wetland restoration will take place along Darby Creek as a part of the Freshwater Initiative. An effort to create a Darby National Wildlife Refuge is underway. Hidden Creek is a environmentally sensitive planned development incorporating portions of Little Darby Creek. More than 320 acres of river corridor have been set aside under permanent conservation easement as a nature preserve in this development. The Dayton Power and Light company provided funding to plant native trees on 40 acres of privately owned land along Little Darby Creek. EPA has played a continuing role in the protection efforts in this watershed.

The Ohio Nature Preserves protects the following important habitats: Cedar Bog, Davey Woods, Kiser Lake Wetlands, Siegenthaler-Kaestner Esker, Crabill Fen, Gallagher/Springfield Fen, Prairie Road Fen, Clifton Gorge, Travertine Fen, Zimmerman Prairie, Owens/Liberty Fen, Bigelow Cemetery, Smith Cemetery and Milford Center Railroad Prairie.

Human-Induced Stresses Impacting the Area

- Land development, point sources from industrial operations, the spread of urban areas, and agricultural activities are stresses in west central Ohio.
- This region contains Ohio's prime farmlands and as a result, phosphate enrichment and sedimentation is threatening water resources.

EPA's Contribution

- EPA can contribute through its base programs by aiding and supporting current state programs and ensuring the protection of these areas.
- Agricultural runoff is a concern for EPA's non-point source program.

Appendix A–Members of Darby Creek Partnership

- Soil and Water Conservation Districts
- Natural Resources Conservation Service
- U. S. Geological Survey
- Operation Future Association
- The Darby Creek Association
- Rivers Unlimited
- U. S. Fish and Wildlife Service
- Mid-Ohio Regional Planning Commission
- Farm Services Agency
- Ohio State University Extension
- Ohio Department of Natural Resources
- Columbus and Franklin County Metropolitan Park District
- Ohio Environmental Protection Agency
- U. S. Environmental Protection Agency
- Honda Corporation
- Procter & Gamble
- Darby Creek Advisory Council
- Ohio Farm Bureau
- The Ohio State University Division of Urban Planning
- Franklin County Zoning Commission
- Smallmouth Alliance
- Open Space Alliance
- Battelle Corporation
- The Ohio State University Department of Landscape Architecture
- City of Columbus Division of Water
- U. S. Forest Service
- Columbus Area Chamber of Commerce
- The Columbus Foundation
- The Nature Conservancy

SOUTH OHIO

Southern Ohio is a part of two Ohio ecoregions, the Interior Plateau and the Western Allegheny Plateau. Pre-European settlement, the area's limestone bedrock held prairie and cedar barren communities as well as oak forests on steep hillsides. This area still contains rare ecosystems including caves and prairies. The remaining remnants of these ecosystems are small, heightening the need to protect those areas that remain.

Ecological Values

The southern portion of Ohio is located within the Ohio River Valley and consists of the counties of Adams, Brown, Scioto, Pike, Ross, Jackson, Gallia, Lawrence and Highland. Southern Ohio contains a high level of biological diversity and landscape diversity. South Ohio's unique mosaic of habitats include large contiguous forests, prairie fens, prairies, caves, rivers and streams and the Ohio River itself. Caves in the area support populations of the endangered Indiana brown bat. Two species of arthropods are endemic to single caves in Ross and Adams Counties. The Edge of Appalachia system is also a valuable ecosystem which contains cedar barrens and some relict prairie communities. Poor thin soils in this area support many endangered or rare plants (80 species) and animals (20 species) in very diverse communities. The presence of both acid and rich alkaline soils create a series of diverse and unusual community types. Whiteoak Creek, Scioto River, Paint Creek, Scioto Brush Creek, Little Scioto River, Symmes Creek, Ohio Brush Creek and Eagle Creek are all important watersheds in this area and contain high levels of biodiversity. Many of the above watersheds also support endangered species, such as clubshell clam. The Ohio Brush Watershed forms the border of the Edge of Appalachia Preserve and is designated a "near-exceptional" warm water habitat by the Ohio Environmental Protection Agency.

Multi-Partner Stewardship Efforts

The Nature Conservancy and the Cincinnati Museum of Natural History manage areas within the Edge of Appalachia Preserve System, which is designated as a National Natural Landmark by the National Park Service. The riparian corridor is being restored on the Ohio Brush Creek by the Nature Conservancy and Cinergy, a large private energy company. The Indiana bat is a federally listed endangered species, whose existence depends on the protection of caves. Although the caves are not currently protected by the state, the protection of the Indiana bat may indirectly protect the caves, and/or create a need to formally protect the caves. Shawnee State Forest and Wayne National Forest contain large areas of contiguous forest.

Preserves managed by Ohio Division of Natural Areas and Preserves include Miller Nature Sanctuary, Adams Lake Prairie, Chaparral Prairie, Davis Memorial, Strait Creek Prairie Bluff, Unity Woods, Whipple, Raven Rock, Compass Plant Prairie, Lake Katharine, and Betsch Fen.

Human-Induced Stresses Impacting the Area

- The large contiguous forests are highly fragmented and sections of the forests are privately owned.

- There is a lack of formal state protection over the caves present in this area which endangers their future existence.
- The waterways and watersheds are impacted by development and urban and agricultural runoff.
- The prairies in Ohio, of which only remnants remain, are threatened by elimination and replacement by agriculture.
- Continuing stressors include the introduction and expansion of nonindigenous species such as the zebra mussel and purple loosestrife, expansion of urban and suburban areas resulting in the loss of habitat, and poor land-use practices that adversely affect aquatic ecosystems.

EPA's Contribution

- U.S. EPA and Ohio EPA regulate emissions into the air, water, and ground through

NORTHEAST OHIO

Formerly, northeast Ohio was rolling hills and bogs, fens and swampy forests. Today, this region is one of the most heavily populated in Ohio. Because of the historical changes that have occurred and the small amount of land in public ownership, wildlife diversity conservation cannot be approached in northeast Ohio simply by setting aside large reserves representing the original ecosystem types. The Ohio Department of Natural Resources (ODNR), Ohio Division of Wildlife, believes the task of protecting and restoring wildlife diversity has to include private lands. Most of the private lands have been significantly altered from original conditions.

Ecological Values

The Erie-Ontario Lake Plain ecoregion is the most industrialized portion of the state and includes the counties of Ashtabula, Trumbell, Portage, Geauga, Lake, Starke and Summit. Many rare, northern plant species are found in this area in bogs, fens and large swamp forests. The forests have rebounded from their historic low in 1940. ODNR estimates there are only a handful of high quality, sphagnum peat bogs remaining in the state. Some bogs support populations of the rare spotted turtle. The wetlands provide habitat for a number of animal and plant species.

The Pymatuning Creek Watershed, the Grand River Watershed, and the Chagrin River are important water areas in the area. Pymatuning Creek watershed contains a high quality wetland complex with small fen and numerous rare plants. Pymatuning Creek provides habitat for several rare species of mussels.

The Grand River is in good condition with high biodiversity, including endangered species. Wetlands along the river support rare and endangered species, including the river otter. Some portions of the Cuyahoga River contain high biodiversity and support rare species. The headwaters of Chagrin River support Ohio's only population of native brook trout.

The Lake Erie Ecosystem includes the Lake Erie basin, the remaining wetlands and sand beaches that line the lake. It supports a wide variety of fish and wildlife that contribute to the high biodiversity of the area. Lake Erie is the most productive of the great lakes.

of Wildlife and Lake Metroparks are working together on issues facing the Grand River. The Morgan Swamp Preserve, found along the Grand River, protects 900 acres of one of the largest undeveloped interior wetlands in Ohio and is managed by The Nature Conservancy. The Nature Conservancy owns more than two miles of Grand River frontage. The Nature Conservancy owns the following preserves near or on Akron Kames: White Pine Bog Forest, Herrick Fen, Crystal Lake and Beck Fen.

NORTHWEST OHIO

Pre-European settlement, northeast Ohio was part of the Great Black Swamp, a forested wetland on the former Lake Erie lakebed. Today, the Oak Openings–dune, prairie, oak savanna, and wetland remnants–remain in small, scattered fragments. Corrective actions that are needed in northwest Ohio are riparian vegetation improvement, land use that improves water quality, restoration of quality in-stream habitat conditions and more natural flow regimes and channel alignment in areas such as the Maumee River Watershed, and restoration of upland savanna and prairie areas to prevent erosion.

Habitats in the Oak Openings are maintained by two processes, periodic fire and dry, sandy soils. Fire eliminates woody vegetation. The understory of the oaks is a lush grassland. Today, remnants need aggressive management consisting of removal od woody vegetation, conducting prescribed burns, and protecting native species.

While existing protected areas are isolated from each other and have suffered some impairment, they tend to be exceptionally diverse in their flora and fauna, and often in good to excellent condition overall. However, as a whole, the region exhibits a very low percentage of natural landscapes and poor ecological connections. Some decline in biodiversity has already been observed and the risk of long-term species loss appears high. The key need is a long-term securement of as much of the remaining natural habitat as possible. Invasive species and visitor pressures also need to be addressed. Finally, building public awareness, support, and involvement in biodiversity conservation is a key challenge.

Ecological Values

The Huron Lake Erie Plain ecoregion in northwest Ohio, including the counties of Lucas, Henry, Ottawa, Sandusky, Wood, Erie, Fulton and Seneca, has many important habitats. On the Lake Erie islands and the Marblehead Peninsula, limestone bedrock outcrops come to the surface, creating distinctive and biologically rich habitats. This includes several alvar sites and a unique complex of meadows, prairies, savannas and woodlands on thin soils that shelter over 100 species of rare flora and fauna. The Marblehead Peninsula has remnants of alvar habitat that supports a population of Lakeside Daisy, a Great Lakes endemic species that is globally endangered.

On the Lake Erie Lakeplain lies a 130 square mile region in Lucas, Henry, and Fulton Counties of Ohio known as the Oak Openings. Post-glacial beach ridges and swales sustain black oak savanna, oak woodland and wet prairie communities. The savanna and prairie communities are considered globally rare. The twig rush-sedge wet prairie is a community unique to the Oak Openings.

The Lake Erie Ecosystem is made up of not only Lake Erie, but includes the islands, sand beaches, dunes and wetlands that line Lake Erie. It supports a wide variety of fish and wildlife that contribute to the high biodiversity of the area. Lake Erie is the most productive of the great lakes.

The Maumee River watershed contains not only the Maumee River but all the tributaries. It supports both a high diversity of aquatic species and several endangered aquatic species. The forests that are in northwest Ohio contain some of the oldest living trees in the state. The prairies are the most significant tall grass prairies in Ohio, and the fens sustain a variety of rare plant species. The Sandusky River contains a high diversity of aquatic species, along with endangered and threatened species.

Multi-Partner Stewardship Efforts

Several nature preserves protect important habitat in the area (See Appendix B). Lakeside Daisy Preserve is home of 12 endangered plant species in Ohio. The Old Woman Creek Nature Preserve is home to the nesting grounds for the bald eagle and Sheldon Marsh sustains a number of unusual plants. The Audubon Islands, which is the only riverine island nature preserve in Ohio, is situated within the Maumee River watershed. The Ottawa National Refuge protects 8,000 acres of marshland, grassland and forest. The Ohio Department of Natural Resources Division of Natural Areas and Preserves, Parks and Recreation, Wildlife, and Forestry provide assistance in this area in a variety of ways. The USDA Natural Resources Conservation Service leads programs such as the Wetland Reserve Program, the Wildlife Habitat Program and Conservation Reserve Program in the wetlands along Lake Erie to combat problems such as fragmentation. The Sandusky and Maumee Rivers are considered state scenic rivers.

The Nature Conservancy is working to preserve the oak openings of this region. The restoration of the Karner Blue butterfly and its associated habitat is being conducted by The U. S. Fish and Wildlife service, Toledo Zoo, The Nature Conservancy and Ohio Department of Natural Resources. The Natural Areas Stewardship is a local land trust dedicated to preserving the Oak Openings. Restoration of savanna and barren communities is underway in Toledo Metroparks.

From Old Woman Creek National Estuarine Research Reserve to Toledo along the southern Lake Erie shoreline, are a number of federal and state wildlife refuges, including Ottawa and Cedar Point National Refuges, which comprise over 30,000 acres. Dikes, pump stations and water control structures are in place at a number of the coastal wetland sites as part of large scale efforts to restore habitat for bald eagles, waterfowl and neotropical migrants as well as fish and other animals.

The Maumee River Area of Concern is focusing on impairments that are the result of agricultural runoff, combined sewer overflows, and contaminated sediments. A Remedial Action Planning process is in place to deal with these water quality problems. Water quality should improve through the implementation of the Maumee River Remedial action plan by such agencies as Ohio Department of Natural Resources, Ohio Environmental Protection Agency and Toledo Metropolitan Area Council of Governments.

Ecoregional Prioritization

The Nature Conservancy (TNC) is undertaking to build a conservation vision in the Maumee Lake Plain of Western Lake Erie. Through a process called ecoregional prioritization, TNC will determine exactly where their conservation efforts need to be focused by determining threats to

key sites and the potential resources to protect them. Part of the process includes filling gaps in existing biological information, databases to ensure that conservation decisions are based on credible scientific information, designing site-specific conservation strategies for key biodiversity

- Lucas county contains a high number (54) of leaking waste sites and landfills.
- Fire suppression and development are adversely affecting habitats in the Oak Openings. In

Appendix B–Northwest Ohio Protected Areas

National Wildlife Refuge/Research Reserves:

- Ottawa
- Cedar Point
- West Sister Island
- Old Woman Creek

State Parks:

- Maumee Bay
- Crane Creek
- Catawba Island
- East Harbor
- Kelleys Island