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HISTORY AND ENVIRONMENTAL SETTING OF THE GRAND CALUMET RIVER

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ABSTRACT. The Grand Calumet River lies in an area of great ecological diversity, a result of the convergence of three biomes during glaciation. Over thousands of years the region and the river have changed ecologically due to ice retreat, lake level declines, settlement and industrialization. Settlement and industrialization have greatly accelerated the rate of change, and the Grand Calumet River and its basin are now subject to the added effects of years of direct pollution. For years, industries directly discharged into the waterway; and those contaminants remain locked in the sediment a century later. In order to preserve the remaining surrounding natural areas and to improve the Grand Calumet River, buried contaminants would have to be dredged from the river. Restoration needs to be implemented as part of the clean-up process, and recontamination should be prevented.

Keywords: Grand Calumet River, Calumet region, settlement, industrialization

Only 13 miles (21 km) long and with almost no natural surface drainage, the Grand Calumet River flows through one of the more industrialized areas in the United States. Once, the downstream section of the Calumet River system dominated most of northwestern Indiana (Fig. 1). Today, the highly modified Grand Calumet River forms one of the smallest watersheds in the region (Fig. 2). Despite intensive urban and industrial development, the Grand Calumet River Basin still contains extraordinary vestiges of once highly rich and varied natural communities. These communities, along with other remnant natural areas preserved and protected by both public and private groups, may still possess the potential for at least partial recovery. Any plan for recovery of the Calumet Basin from past damage will require a geologic/ecologic framework within which mitigation targets can be developed.

Changes over the course of Lake Michigan's geological history strongly influenced the landscape of the present Calumet region. Wind, erosion, and fluvial and lake recession helped produce dune and swale ecosystems; and climate and hydrology encouraged the formation of wetlands, forests, savannas and prairies. The convergence of three major biomes (eastern deciduous forest, boreal forest and tall grasslands), succession over a small area and a large variety of hydrological regimes (e.g., streams, lakes, wetlands) all helped make the Grand Calumet River Basin biologically diverse. Although it would seem that biodiversity should be low due to the elimination of local communities by scouring action of the Laurentian ice sheet (12,000 years ago), the present-day diverse communities are the result of recolonization from outside sources.

The habitat destruction seen today is not due to glacial ice but to industrial and urban development and the introduction of non-native, invasive species. The natural and wetland ecosystems have been cleared, drained, fragmented and cut by roads and railways during commercial and municipal development. Human enterprise dominates the landscape and controls the region. The Grand Calumet River has been a dumping site for industrial and municipal wastes. Little natural flow exists anymore due to channeling, deepening and flow augmentation.

Establishing a bond between the industrial, urban and natural areas is necessary to preserve the habitat that remains without destroying the livelihood that supports the Calumet basin region. Only by revitalizing some of the more heavily-damaged areas can the ecological integrity of the basin be restored to approximate its historical natural appearance and

Figure 1.—Aerial photograph, taken in 1938, of a portion of the Grand Calumet River Basin study area, with Lake Michigan to the north. Compare with Figure 2 (facing page).

function. The remaining natural areas that were created over thousands of years by geologic and biologic forces must be preserved from further degradation, or the system's natural integrity might be irretrievably lost. The resiliency of nature is clearly illustrated by the biological recolonization and ecological recovery since the retreat of the last ice sheet. While this much time is not available for ecological restoration, natural restoration demonstrates the feasibility of a parallel human experiment.

Several questions need to be answered before carrying out this experiment in restoration. What is the status of the existing natural areas in the Grand Calumet River Basin? Can the remaining natural areas and present-day cultural pressures co-exist? Can sustainable natural communities be re-established? What is the most effective approach for re-establishing these natural communities? Finally, can enough social, economic, and political support be marshaled to attain these objectives? In an attempt to answer some of these

Figure 2.—Aerial photograph, taken in 1975, of a portion of the Grand Calumet River Basin study area, with Lake Michigan to the north. Compare with Figure 1 (facing page).

questions, the U.S. Army Corps of Engineers developed a remedial action plan with research and consultation conducted by scientists intimately familiar with the ecosystem and its components. The following papers are the culmination of these efforts and an attempt to answer the first four questions; the last question can only be answered after implementation of a restoration plan.

REGIONAL GEOGRAPHY

The natural watershed of the Grand Calumet River is located between Toleston Beach and the present-day shore of Lake Michigan (Fig. 3). The watershed lies within the Calumet lacustrine plain, or lake plain, which extends from the shore of modern-day Lake Michigan to the Valparaiso terminal moraine. After the Wisconsin glaciation, the Lake Michigan lobe of the Laurentian ice sheet began to retreat, and the Valparaiso terminal moraine marks the point of the ice sheet's furthest southward advance before receding. The moraine also serves as the continental divide and the southern boundary of the Lake Michigan watershed. Drainage from areas to the north of the moraine enters the Atlantic Ocean via the Calumet River, Lake Michigan, Lake Huron, the St. Clair River, Lake Erie, Lake Ontario and the St. Lawrence River. Drainage from areas south of the moraine typically flows to the Gulf of Mexico via the Mississippi River. The Calumet Basin lies on the

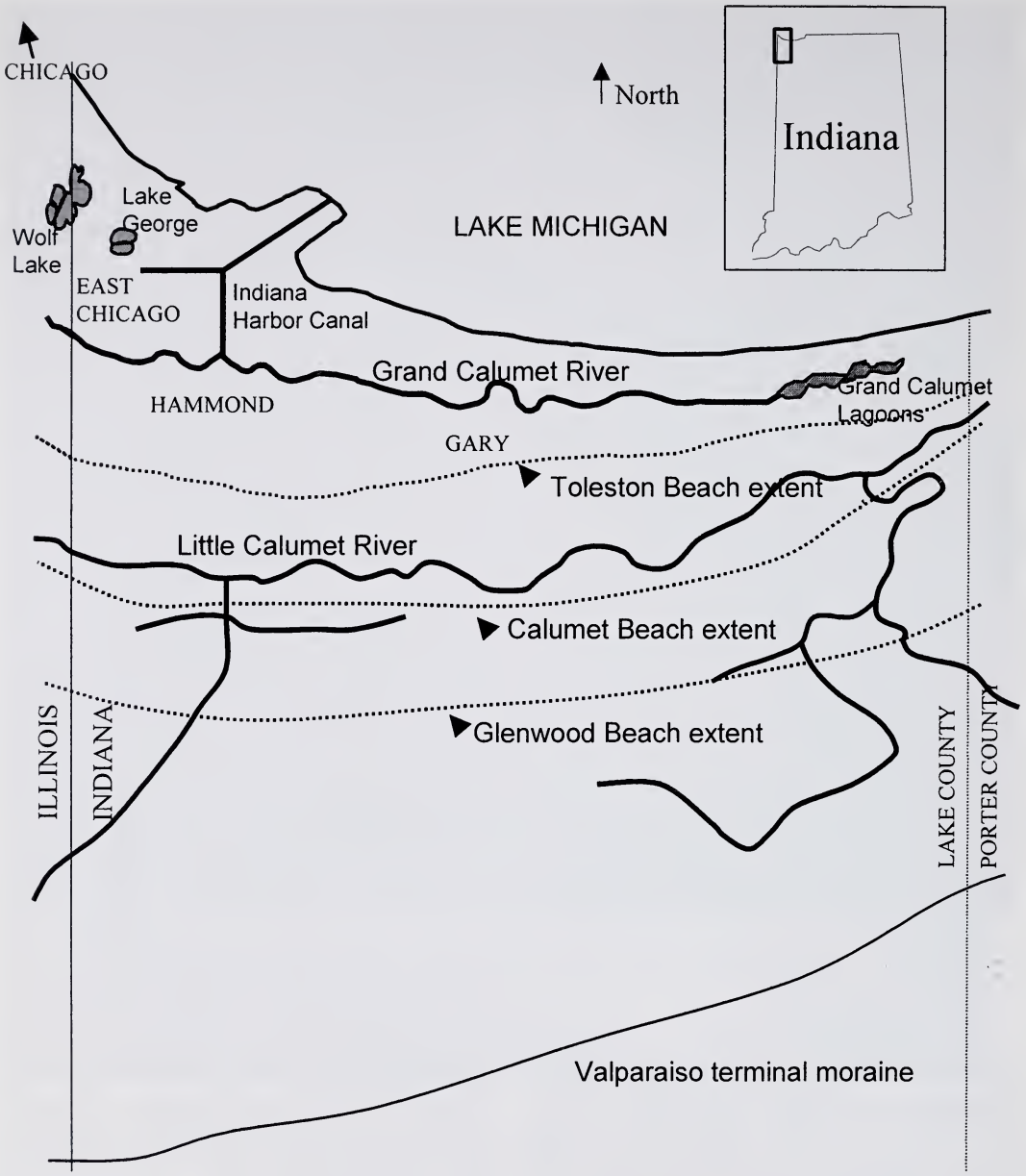

Figure 3.—Diagram of Grand Calumet River study region, with geological features highlighted.

northern side of the Valparaiso Moraine and is drained by the Calumet River system.

The last glacial retreat from the Great Lakes occurred about 18,000 years ago (Chrzastowski & Thompson 1992). As the glacier retreated, isostatic rebound caused lake levels to decline on three separate occasions. The archaic beaches—the Glenwood, Calumet and Toleston Beaches—remain today at 20, 12 and 6 m above contemporary Lake Michigan levels (mean = 176 m above sea level). Many ridges were built by wave activity and windblown dune deposits; and the valleys between them collected water, allowing the formation of marshes, ponds and swamps.

Changes in the drainage pattern of the lakeplain led to the formation of the Grand Calumet River. The Little Calumet River was lo-

cated south of Toleston Beach, and drained into Lake Michigan near the current-day mouth of the Grand Calumet River. As lake levels fell, the Little Calumet began to create a basin moving east toward lower land levels where it could continue to drain into the lake (Chrzastowski & Thompson 1992). This stretch of river eventually reached an outlet near the present-day Grand Calumet Lagoons, and with changes in drainage patterns and the increased size of the new river basin, it was designated as the Grand Calumet River. Presently, the Little Calumet River continues to maintain a confluence with the Grand Calumet River to the west, in Illinois.

After retreat of the ice sheet, many habitats were created in the new, warmer environment. The cold climate biota (Arctic disjuncts, such as spruce and fir) followed the glacier's retreat northward as ambient temperature increased at a rate of 1–2° C every 1000 years (Schneider 1989). A few cold climate plants (e.g., bearberry, *Arctostaphylos uva-ursi*) adapted to the warming conditions. Extensive coastal marshes and wetlands formed between the dune ridges at the southern end of Lake Michigan, providing a rich habitat for shore birds, waterfowl, fishes, mammals, amphibians, reptiles, invertebrates and plants.

According to Bailey (1972), northwestern Indiana was dominated by open spruce forests 12,000 years ago. From 11,000–10,000 years ago, red and jack pines were dominant, and from 10,000–2,500 years ago, the area was covered primarily by oak-dominated hardwoods. Finally, mesic species such as beech, maple, oak and butternut took over. Surveys made during the period 1829–1834 list the most important trees in the dune complex communities as black oak (*Quercus velutina* Lam.), white pine (*Pinus strobus* L.), jack pine (*Pinus banksiana* Lamb.), white cedar (*Thuja occidentalis* L.) and tamarack (*Larix decidua* Mill.) (Bacone & Campbell 1983).

EARLY CULTURE

Early artifacts found on the back dunes of the Calumet Beach Ridge included fire-cracked rock, chipped stone tools, lithic debris and ceramics of the Late Woodland Stage (Lynott 1998). The earliest historic records are of the Potawatomi who occupied the area until about 1833. The Potawatomi were nomadic. During the summer they lived in the Calumet region, where they hunted, fished, foraged and cultivated; then, they moved south for the winter. Food was abundant for the Potawatomi. Wild currants, cranberries, whortleberries, gooseberries, huckleberries and wintergreen berries were plentiful between the dunes and swales. Other abundant foods were grapes, pawpaws, wild plums, crabapples, hazel nuts and sassafras. Honey and maple syrup were collected. Wild game included whitetail deer, black bear, wild turkey, prairie chickens, geese and ducks. Early European settlers traded tobacco and food with the Potawatomi for fur, cranberries, venison and beadwork.

The United States government bought much of the Potawatomi land between 1826–1832, and then extensive European settlement began. In 1832, most of the Potawatomi were removed to a reservation in Kansas, though some remained in the area (Meyer 1956). The settlers eagerly cleared the dense forest and cultivated the land wherever possible; much of the area was too wet to cultivate. The Grand Calumet and Little Calumet Rivers meandered lazily through impassable marshes, making travel in the area difficult as well. Transporting goods to outside markets was costly; and, consequently, the settlers were subsistence farmers of wheat, oats, corn, turnips, buckwheat and potatoes (Meyer 1956).

Traffic across the Calumet Basin became heavy as settlement increased to the west. Any travel from Chicago to the east had to cross the basin because of the presence of Lake Michigan (Cook & Jackson 1978). A mail route was established in 1831; and, in 1833, a stage began operating between Chicago and Niles, Michigan (Cook & Jackson 1978). As a crossroads, the Calumet region was ideally suited for industry and commerce; and eventually, they dominated the landscape.

INDUSTRIALIZATION

The sawmill quickly became the most important industry for the settlers. Mills were located in the heavily-wooded sections of the Calumet Basin; but due to the low flow of the Grand Calumet River, only the Little Calumet was used to transport lumber (Meyer 1956). Gristmills, another large industry, appeared along with cultivation. Though ideally situated near the prairies, the gristmills actually had to be located near the river; therefore, they sprang up near the sawmills in the forested

areas. Other tradespeople, including blacksmiths, wagon makers, coopers, tanners and cabinetmakers, soon moved into the area. As logging continued and sand mining increased, the Grand Calumet River began to be impacted. Forests were removed; and, within 20 years, a 55 m sand dune was leveled (Lerner & Trusty 1977). Understandably, erosion became a problem.

In the 1840s, heavy industry began to enter the Calumet Basin as a result of the area's blooming transportation network. By 1848, the Illinois Central Railroad traversed the Calumet Basin; and, in 1852, the Michigan Southern and Northern Indiana (South Shore) Railroads connected the region to the east and west. The settlement rate increased along with employment opportunities on the railroad. The railroads also made transporting heavy farm equipment into the region possible (Cook & Jackson 1978).

Water transport was also important in settling the Calumet region. The Grand Calumet River was eventually channeled to create a navigable waterway. In 1862, the Calumet Feeder Canal was built to allow the Grand Calumet River to flow east into the Illinois and Michigan Canal (I&M). This project reversed the east flow of the river, causing the Grand Calumet River to flow toward the canal from the east and the west and to empty into Lake Michigan via the canal. This change eventually caused the closing-off of the eastern river mouth. The current Grand Calumet Lagoons are part of, and located near, the former river mouths. Other construction projects included removing sand bars, erecting piers and straightening and narrowing the channel. In 1870, the federal government began constructing the Calumet Harbor to make the river a navigable passage for ships (Moore 1959). By the early 1900s, the Indiana Harbor Ship Canal had been constructed by the East Chicago Company; and the Grand Calumet River was effectively connected to Lake George, Wolf Lake and Lake Michigan (Moore 1959). With several major modes of transport available, further industrial expansion was inevitable. The accumulation of sediment and contaminants became a problem in the Grand Calumet River around 1885. Effluent was directly discharged into the waterway by foundries, refineries, packing plants, inadequate sewage treatment plants and, eventually, steel mills (Moore 1959).

The first major industry in the area was a meat packing company, the George H. Hammond Packing Company, which slaughtered and shipped meats to the eastern United States and Europe with a patented refrigeration process (Moore 1959). The Calumet Basin began to change dramatically and rapidly with the arrival of Standard Oil in 1889 (Moore 1959). Inland Steel was built as a separate plant in 1902, and the city of Gary (the site was selected due to its proximity to Chicago) was established with the building of U.S. Steel in 1905. Another steel company, Midwest Steel, purchased land in the area in 1929; and expansion continued (Cook & Jackson 1978). Dredging the Grand Calumet River was futile because pollutants entered the basin faster than they could be removed. Severe air pollution was evident by the 1920s.

With the growth of industry came population expansion. Small family farms were disappearing due to the urbanization that accompanied industrialization (Meyer 1945). Immigrants from all over Europe and Mexico came to the area for work in industry (Lerner & Trusty 1977). The region was changing quickly.

With the onset of the Great Depression, industrial expansion experienced a lull that extended through World War II and into the 1950s (Cook & Jackson 1978). Nevertheless, the effects of industry already present were still apparent. In 1930, the Grand Calumet River was described by Peattie (1930) as a stagnant lagoon, an "open sewer" devoid of plant life, though bordering marshes still offered "favorable localities for plant growth." In 1966, the chief contributors to air pollution were fossil fuel combustion (41% or 458,000 tons/year), industry (35% or 392,000 tons/year), transportation (22% or 241,000 tons/year) and refuse disposal (0.02%) (Lerner & Trusty 1977).

Industrialization created the landscape we see today. The Grand Calumet River experienced the full force of pollution inherent in industry and urbanization. After years of unmanaged pollution arising from rapid industrial growth and urbanization, numerous pollutants are now buried in the sediments; and the ecological integrity of the watershed has been severely degraded.

POLLUTANTS

The 1972 Federal Water Pollution Control Act required the Indiana Stream Pollution Control Board to issue permits to stream dischargers through the National Pollution Discharge Elimination System, and an opportunity for reviving the Grand Calumet River was granted. The steel mills removed solid and acid wastes from their effluent by installing catch basins and using aeration and filtration techniques. Though numerous cases of noncompliance have been reported, the National Pollution Discharge Elimination System remains a recognized contributor to improved water quality in the basin.

Recognized pollutant sources include urban runoff, landfills, dumpsites, industrial effluent and sewage treatment plants. Historically, the Grand Calumet River has had high levels of bacteria, nutrients, cyanides, lead, arsenic, cadmium, PCBs, phenols, oils, grease, chlorides and other contaminants in both the water and sediments (Lerner & Trusty 1977). Combined sewer overflows from Gary, East Chicago and Hammond sewage treatment plants flush raw sewage and fecal contamination into the Grand Calumet River and also into Lake Michigan via the Indiana Harbor Canal.

The negative effects of these pollutants on humans and the river's ecology are great. Ammonia is released in the coking operation of steel production, and both ammonia (nitrogen) and phosphorus are found in sewage, fertilizer, meat packing and industrial waste and detergents. Nitrogen and phosphorus, when flushed into Lake Michigan, contribute to toxic algal blooms, increased aquatic plant and algal growth and lower oxygen levels. High nutrient levels clearly create problems for the lake's ecology and its fisheries.

Despite successful attempts to improve the river's water quality, the sediments will not be cleaned simply by changing current pollution practices. For over 100 years, contaminants have accumulated in the sediments; and only by removing them completely will the river's ecosystems be improved. The toxic effects on the environment surrounding the river are biologically acute, and many of the river's reaches are still as devoid of life as Peattie (1930) observed years ago.

CONCLUSIONS

The fast pace of industrialization has taken its toll on the environment of the Calumet Basin. Some natural areas still survive, and preserving and expanding these habitat fragments will help to restore the integrity of the Grand Calumet River and its surrounding environs. Dredging the sediment is a first step in the process; and by dredging, years of industrial degradation can be removed from the river. However, merely dredging the main channel is ecologically inadequate. Watersheds are intricate systems that must be restored and managed at an ecosystem level. Components of the Calumet watershed include riparian wetlands, slack water, savannas, prairies, and dune and swale habitats. Restoration should be integrated, proportional and with clearly targeted recovery objectives. Preventing recontamination will be an important part of restoration; and, with the appropriate regulations in place, the Grand Calumet River may eventually regain some of its natural beauty and function.

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