Brownfield Redevelopment: A Hidden Opportunity for Conservation Biology

Lynne M.Westphal,[1] Jeffrey M. Levengood,[2] Alaka Wali,[3] David Soucek,[2] Douglas F. Stotz[3]

ABSTRACT—Brownfields—lands that are idle due to concerns about contamination—are often prominent features of urban areas. Conservation in an urbanizing world must take brownfields into consideration because regions of heavy industry can harbor areas of ecological significance. The Calumet region of northwest Indiana and northeast Illinois is one such place, where the Calumet Initiative, a partnership of government, industry, academia, nonprofit groups, and local residents, is working toward economic and ecological sustainability. Here partners have developed a research and action program that integrates social, biological, and physical issues to move toward a sustainable future. We discuss three current research projects: planning that considers biodiversity as well as redevelopment goals, research that investigates the viability of state-threatened and state-endangered species, and a social asset mapping project. Using a marsh in Calumet that hosts a rookery of the state-endangered black-crowned night heron, as well as other species of concern, and that borders a potential superfund site, we will outline this integrated research and action program and its wider application for conservation biology.

Brownfields are "abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination" (Northeast Midwest Institute 2001: 1). There are an estimated 580,000 brownfields nationwide ranging from former gas stations to derelict industrial plants covering hundreds of acres (Deason *et al.* 2001).

It may seem counterintuitive, but industrialized regions, including brownfields, can contain areas of critical wildlife habitat. Many industrial areas are buffered with large amounts of open land, and many are sited along water for transportation, energy, and other reasons. In some cases industry and landfills were relegated to the lands no one wanted—wetlands. In these areas, habitat can be found between the smokestacks and loading docks. As a result, brownfields and industrial areas sometimes harbor surprising species richness and are therefore often critical to conserving biodiversity in an urbanizing world.

The Calumet region is a highly industrialized area replete with brownfields and remnant habitats. It runs along the southwest shore of Lake Michigan, including 10 percent of the City of Chicago, cities and towns in northwest Indiana, and the Indiana Dunes National Lakeshore. Several rivers run through the Calumet region, providing riparian habitat. Steel and other industrial facilities have large buffer tracts of native habitat, some of it high quality. Calumet's extensive wetland systems once contained marsh, fen, swale, and bog; today valuable remnants remain. The Calumet region was and is ecologically complex: dune and swale, northern boreal forest, desert, prairie, and savanna ecosystems overlap here (U.S. Department of the Interior, National Park Service Midwest Region 1998).

The Calumet region is historically important for both ecology and industry. In 1898 Henry Cowles first outlined the theory of succession in Calumet's Indiana dunes. At the same time, steel and other industries were moving into Calumet. By the 1920s, Calumet was surpassing Pittsburgh in steel production (and remains the largest steel producing region in the United States today). By the end of World War II, the Calumet region was the largest area of heavy industry in the world.

With the 1970s and 1980s came a drastic global restructuring of the steel industry, and mill after mill closed. Other industries felt these economic shifts too, as the region hemorrhaged jobs, and communities and local families faced hard times. More than 40 percent of the jobs in southeast Chicago were lost between 1970 and 1990 (Jones 1998). As a result of this decline in the region's industrial base, thousands of acres of brownfields were created.

The steel industry and other uses dramatically changed the land. Slag, a gravel-like byproduct of steel-making, was used as landfill in Lake Michigan and in wetlands to create "useful" land. Human-made mountains of municipal and industrial landfills now rise from former wetlands. Rivers have been straightened and deepened to support commercial shipping. Railroads and highways crisscross Calumet, connecting the region to the country and the world. Because of this nexus of transportation resources, the Calumet region is the largest intermodal shipping hub in the United States (City of Chicago Department of Planning and Development 2002).

[1] USDA Forest Service North Central Research Station, 1033 University Place, suite 360, Evanston IL 60201-3172; e-mail: lwestphal@fs.fed.us
[2] Illinois Natural History Survey, Champaign, IL.
[3] Field Museum of Natural History, Chicago, IL.

Citation for proceedings: Bengston, David N., tech. ed. 2005. Policies for managing urban growth and landscape change: a key to conservation in the 21st Century. Gen. Tech. Rep. NC-265. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 51 p.

Through the region's industrial growth and decline, wildlife and native vegetation persisted. Although many natural areas have been seriously degraded, enough habitat is left to support a variety of species of conservation interest. Outdoor activities have remained popular in Calumet, too. A hunting and fishing hotspot in the late 1800s and early 1900s, today Calumet still provides some of the most accessible hunting and fishing opportunities in Chicago. Bird watchers and wildlife watchers flock to the area to see state-endangered birds like the black-crowned night heron (*Nycticorax nycticorax*) and snowy egret (*Ardea alba*). Anglers come for the bass and pike, and hunters come for the only remaining legal hunting in Chicago. Local residents have been active for decades on behalf of local wildlife and recreation, arguing for protection and enhancement of Calumet's natural riches.

In 2000 the City of Chicago and State of Illinois announced a major initiative to revitalize the economy while also conserving and enhancing the biodiversity of the Illinois part of the Calumet region. The Calumet Initiative, a partnership of government, industry, academia, museums, nonprofit groups, and local residents, is working toward economic and ecological sustainability in Calumet. One key site in the region is Indian Ridge Marsh.

The 145-acre Indian Ridge Marsh, divided by a street into north (110 acres) and south (35 acre) sections, was a beach ridge used for travel first by Native Americans and then by Europeans. By the late 1800s Indian Ridge Marsh was platted for residential development, and a handful of houses were built. Ironically, being platted probably saved Indian Ridge Marsh, because gaining ownership of the land entailed dealing with hundreds of owners of individual plots and the City of Chicago used a process to reclaim tax-delinquent property to purchase most of Indian Ridge Marsh for public ownership. Neighboring sites include a landfill that is a potential superfund site, an active freight rail line, a heavy truck route, and a former steel coke plant. Indian Ridge Marsh is one of the first Calumet sites to move into public ownership with plans for ecological rehabilitation and is the site for several research projects. It is home to numerous species of marsh-dependent breeding birds, including the black-crowned night heron, native vegetation patches (including jewelweed [*Impatiens capensis*] and pale sedge [*Carex granularis*]), and a buried but viable and rich native seed bank. Unfortunately, like many disturbed urban sites, Indian Ridge Marsh also has significant invasive species populations and contamination concerns (including purple loosestrife [*Lythrum salicaria*], *phragmities* [*Phragmities australis*], DDE, and ammonia).

The black-crowned night heron rookery in Indian Ridge Marsh is one of the two largest remaining heron rookeries in Illinois. Although this species is not threatened nationally or globally, it is a state-endangered species, and this rookery is of great importance for local and regional residents. The number of nests associated with this colony averaged 610 between 1985 and 1993 (S. Elston, USEPA, unpubl. data). More recently, the number of herons comprising this rookery declined from approximately 1,500 adults in 1996 to 559 (approximately 200 nesting pairs) in 2000 (W. Marcisz, pers. comm.), although numbers have been relatively stable since then.

RESEARCH TO SUPPORT CONSERVATION OF CALUMET AREA HABITAT

From population genetics to applied phytoremediation, conservation biology spans a wide continuum of disciplines. Academic exercises and applied research both find a home in this growing discipline. In Calumet, the research program spans this continuum as well, although most research is designed to address specific needs in the Calumet Initiative. That does not, however, preclude work that also addresses theoretical issues in conservation biology, but in the context of Calumet these theoretical issues are folded into research with an applied component as well. In the Calumet region, partners have developed a research and action program that integrates social, biological, and physical issues to move toward a sustainable future. More than two dozen research projects are underway, involving research partners from the Field Museum of Natural History; the Illinois Scientific Surveys (Water, Natural History, Geology, and Waste Management Research Center); the USDA Forest Service, North Central Research Station; and universities. In this section, we will discuss three of the Calumet Initiative research projects, using Indian Ridge Marsh in Calumet as an example. These projects are a planning project that considers biodiversity as well as redevelopment goals, research that investigates the viability of state-endangered species, and social asset mapping to support community goals and facilitate collaboration between local residents and conservation groups.

Planning That Considers Biodiversity as Well as Redevelopment Goals

One of the first steps necessary in the Calumet Initiative was planning, from a regional perspective to site-level designs. The Chicago Department of Planning and Development, in partnership with the Chicago Department of Environment, the Southeast Chicago Development Commission, the Openlands Project, and the Calumet Area Industrial Council, developed the *Calumet Land Use Plan* (City of Chicago Department of Planning and Development 2002). This plan outlines the ideas of ecological and economic growth and redevelopment, designating a significant amount of land for each use. Plans for the natural areas are further outlined in the *Calumet Open Space Reserve Plan* and the *Calumet Area Ecological Management Strategy* (EMS; City of Chicago Department of Environment 2002). Because the EMS addresses ecological rehabilitation priorities and strategies, of the three plans it is most directly related to the goals of conservation biology. The EMS looks in more detail at several sites surrounding Lake Calumet, including Indian Ridge Marsh. The plan was developed with input from more than 160 organizations and individuals who met in theme-based sessions (e.g., vegetation, sediments and toxics, recreation) in which participants outlined what was known about each site, what was not known, and which of these knowledge gaps were most critical. This information was processed and integrated by a 13-member Integration Advisory Team, made up of Calumet Initiative members with diverse specialties including wetland hydrology, ornithology, planning, and recreation.

The EMS planning process resulted in a decisionmaking format called Preserve, Improve, Create, or PIC (figure 1 shows the PIC table for Indian Ridge Marsh). This format allows decisionmakers

to quickly identify the most critical attributes at any site to preserve–providing a litmus test for ecological rehabilitation or other site alterations. If there is a significant risk of harm to something on the "preserve" list or a significant gap in our knowledge that makes it impossible to estimate the risk, then the proposed change will not move forward. At Indian Ridge Marsh, the black-crowned night heron rookery is one of the key attributes to preserve. Next, in the second tier of importance, attributes in need of improvement are identified (including everything that is to be preserved). Finally, the "create" category recognizes areas so degraded that much creativity will be needed to make any headway with ecological rehabilitation. The EMS Integration Advisory Team identified several key knowledge gaps critical to several disciplines; a multisite hydrologic analysis and master plan is one example.

Figure 1.—Preserve, Improve, Create (PIC) Chart for Indian Ridge Marsh. Shading indicates important sites considered in the EMS; a checkmark indicates importance at Indian Ridge Marsh.

Resource Categories	Resource Targets	P Preserve[1]	I Improve	C Create
Wetland Habitat & Wildlife	Marsh habitat	✓		
	• Potential black-crowned night heron habitat	✓		
	• Transitional habitat for birds–includes common reed where it provides critical short-term habitat	✓		
	• Other marsh-dependent breeding birds	✓		
	• Native emergent marsh vegetation	✓		
	• Amphibian habitat (frogs and mud puppies)			
	Existing native seed banks	✓		
	Other habitat critical to species of concern[2]	✓		
	Shorebird habitat			
	Submergent species assemblages			
Upland Habitat & Wildlife	Other habitat critical to species of concern[2]			
	Upland habitat		✓	
	Vegetation quality (Prairie, Woodland)		✓	
	Grassland habitat		✓	✓
	Diverse upland habitat structure (grasslands, brush, small trees, etc.)			✓
	Grassland assemblages of birds and herpetiles			
Aquatic Habitat	Other habitat critical to species of concern[2]			
	Native fish habitat			
Water/Hydrology	Current functional hydrologic connections	✓		
	Other habitat critical to species of concern[2]			
	Water levels (control of fluctuations)		✓	
	Water quality (control of ground water and surface water pollutants)		✓	
Physical Parameters	Native soils	✓		
	Soil quality		✓	
	Sediment quality		✓	
Socioeconomic Parameters	People's attachment to places		✓	
	Regional/interstate access to region		✓	
	Recreational uses that do not conflict with ecological goals or safety concerns	✓		✓
	Opportunities for learning about local nature and native landscapes		✓	

[1] Anything in the "preserve" category will also be "improved."
[2] A critical gap is complete inventories for each site. There may, therefore, be more species of conservative interest on these sites that we do not know about yet.

Nesting Ecology and Contaminant Exposure of the Lake Calumet Black-Crowned Night Heron Colony

With the Calumet region's history of heavy industrial activity, sewage and industrial discharges, landfills, and hazardous waste storage/disposal, sediments here contain elevated concentrations of organic and inorganic contaminants that may pose risks to fish-eating wildlife (Halbrook *et al.* 1999, Hothem *et al.* 1995, Ohlendorf *et al.* 1978, Price 1977). Black-crowned night herons nesting at Indian Ridge Marsh are known to forage throughout the Calumet area, often in areas characterized by elevated concentrations of environmental contaminants. Some of these contaminants may bioaccumulate in the herons via transfer up the aquatic food chain. Herons and egrets have been used extensively as bioindicators/biomonitors of environmental contamination (e.g., Blus *et al.* 1985, Custer *et al.* 1997, Fleming *et al.* 1984, Halbrook *et al.* 1999). Their trophic position and aquatic foraging habits may put them in contact with prey that accumulate/bioconcentrate high concentrations of environmental contaminants such as organochlorine pesticides, PCBs, and metals found in sediments in the Calumet area. Various effects of exposure to such contaminants have been documented in black-crowned night heron, including eggshell thinning and reduced reproductive success (Price 1977, Ohlendorf *et al.* 1978, Henny *et al.* 1984, Findholt and Trost 1985), hatching success (Custer *et al.* 1983), reduced embryo weights (Hoffman *et al.* 1986), responses in biochemical markers of exposure (Rattner *et al.* 1997, 2000), possible teratogenic effects (Hothem *et al.* 1995), and cytogenetic damage (Custer *et al.* 1994).

This research examined various aspects of the ecology of the Indian Ridge Marsh heron colony during 2002 and 2003 breeding seasons to provide information that will aid in conserving the colony. To help with remediation and restoration planning, we determined nesting phenology and nest-site characteristics. We also examined whether the colony's herons were being exposed and harmed by elevated concentrations of priority contaminants present in Calumet sediments. This particular study characterizes the foraging habits of the colony as a whole, determines concentrations of priority contaminants in aquatic prey items (fish, crayfish) at selected foraging sites as well as in regurgitated food items collected at nests, and examines markers of reproduction and health.

Our study revealed that young black-crowned night herons at Indian Ridge Marsh are exposed to a number of organic contaminants at concentrations that induce detoxification enzymes. Although we observed normal productivity and early survival, it is impossible to determine how the enzyme induction might affect juveniles after dispersal and during their first migrational movements, a time of physiological stress and high mortality in young birds. We do know that juveniles feed extensively in the natal marsh and that efforts to reduce contaminant inputs will likely reduce the contaminant burden of young herons. The adults forage throughout the south Chicago region, at both highly contaminated and relatively "clean" sites. Thus, efforts to conserve this population extend beyond the nesting marsh.

Management and rehabilitation activities must consider black-crowned night herons nesting behavior. In recent years this colony has nested exclusively in the emergent *Phragmities* cover; thus rehabilitation efforts need to consider providing alternative vertical structure for nesting if rehabilitation plans call for *Phragmities* removal. Widely fluctuating water levels due to stormwater inputs threaten the nesting effort in most years, thus there is a need for water control to emulate the natural cycle. The long nesting season, from April (first eggs laid) through August (last young disperse) in this asynchronous breeder, dictates that disruptive construction activities be scheduled early or late in the year.

Social Assets in Calumet–Keys to Conservation

The mapping of "social assets" is a useful way to begin involving local residents in conservation efforts. Drawing on the methodology of Kretzmann and McKnight (1993), the mapping project identified significant organizations, institutions, nodes of informal networks, and other local social resources. It also analyzed local perceptions about the environment and nearby natural habitats. Analysis of these data revealed patterns allowing the significant assets to be layered on a physical map of the region, using Geographic Information Systems software. The result is an accessible representation of the sources of civic activism and the links between different types of activism and concerns for the environment (www.fieldmuseum.org/calumet). This information can be useful in promoting citizen participation in conservation programs as well as in drawing active individuals and organizations into the arena of conservation or environmental restoration.

The neighborhood of South Deering, adjacent to Indian Ridge Marsh, provides a specific example of the application of social asset mapping to conservation biology. This neighborhood, as an officially designated community area, actually encompasses three distinct communities from the perspective of residents: South Deering, Vets Park, and Jeffrey Manor. The demographics of the region have changed significantly over the years, and according to the 2000 census, South Deering now has a largely Latino and African American population. Each community within the larger South Deering area has distinctive assets—for example, block clubs were a major organizational form in Jeffrey Manor. Vets Park has an "improvement association," which successfully won modifications to the Agrifine Company's animal fat processing plant in 1995. South Deering has an empowerment association that collaborates with the community policing efforts and other public safety-oriented activities. These volunteer associations indicate a level of activism in the neighborhoods and can be a point of contact for conservationists wanting to reach out to local communities. There also are several key churches in the three neighborhoods of South Deering. Similar to the local volunteer associations, churches provide focal points for social gatherings and for action on social issues and moral deliberation. Gardens (both public and private) are common throughout and are important to residents in improving their communities. This is a potential bridge for conservationists because gardening skills and interests may be readily translated to ecological rehabilitation volunteer efforts. Each of these social assets—neighborhood volunteer associations, active

churches, and public and private gardening—are applicable to conservation in an urban area. They indicate residents' concerns for place and their ability to organize on behalf of their local environments, and they represent opportunities for collaboration with conservation biologists and other environmentalists from outside the community.

DISCUSSION AND CONCLUSION

While the black-crowned night heron is abundant throughout much of its range, this species is important in Calumet for a variety of reasons. First, the black-crowned night heron is not alone in using Indian Ridge Marsh as a breeding and foraging area. Understanding this colony and improving its habitat will quite likely help other marsh-dependent birds such as the snowy egret (*Egretta thula*), common moorehen (*Gallinula chloropus*), and American bittern (*Botaurus lentiginosus*), species of broader conservation interest.

But more to the point of this paper is the important role that the black-crowned night heron plays in the social landscape of Calumet, and the intertwining of social, biological, and physical issues represented by this species' management. The black-crowned night heron has captivated the local and regional communities. It is a rare, and for many an exhilarating, experience in an urban area to witness a large flock of nesting birds at sunset. Residents want to see these birds, to follow their nesting habits. This offers an opportunity to educate people about conserving habitat, including foraging territory as well as nesting areas. Although we have not tested this hypothesis, it is quite possible that these educational opportunities could broaden people's interest in and support for conservation practices, and for species not near home. If this proves true, the conservation efforts aimed at a relatively abundant species could result in support for conserving more endangered species far from urban population centers.

Local residents' interest in this species is reflected in how the black-crowned night heron colony and Calumet's other natural riches serve as a rallying point for organization and action. Much of the conservation efforts going forward now in Calumet would not be happening were it not for the ongoing hard work of local residents on behalf of the many species of animals and plants that survive in the area. In this way, the fascination with the black-crowned night heron has a ripple effect for other local species in need of habitat improvements.

Yet there is a more subtle, perhaps even more important, issue related to the local interest in this black-crowned night heron colony, one less instrumental for conservationists and more important for local well-being. This aspect rests in the potential social-psychological impact of this colony on the local residents. Calumet has an image problem. The remaining industry and waste disposal facilities create smells and haze and other negative impacts on the area. Past industry left behind toxic dumps and literally tons and tons of slag and other fill. Calumet's local reputation has made this an area avoided by most, which may have increased the feeling of isolation of local communities. In short, many local residents feel they are living in a forsaken area, and some perceive disdain and contempt from the broader Chicago metro community. In environmental psychology, researchers have articulated many of the ways in which the environment in which people live impacts their sense of self. As one of the founders of the field, Harold Proshansky, sums it up, "People not only project onto their environment, they introject from it" (Proshansky 1976). *Projecting* onto the environment can be seen in front yards, styles of homes, and other ways in which people express themselves in their environment. *Introjecting* is the reverse—people defining and valuing themselves based on what they see around them. The connection to the rookery is this: the black-crowned night heron colony and the other natural riches can mitigate the negative influences of *introjecting* from the landfills, sludge drying facilities, and industrial waste that is all too common in Calumet. The Field Museum social asset research team discovered that despite the negative associations that residents know come from the contamination of their environment, both newer and older residents found ways to maintain or create positive associations to place. The older residents drew on the historical memories of a rich fabric of social life constructed during the steel mill era, while newer residents were proud of their nascent efforts at economic revitalization and beautification. The growing awareness of Lake Calumet's rich biodiversity and natural habitats is fast becoming part of residents' armor for defending their way of life and for maintaining their communities. In this way, the black-crowned night heron colony can make meaningful contributions to community well-being. And in this way, conservation biology can contribute to species survival *and* human quality of life.

Renewed interest in economic development in Calumet could have been coming at the expense of the remaining natural areas. But, instead, there is a real effort (with some struggle) to coordinate economic development with ecological rehabilitation. This is not unlike getting conservation to work in developing countries by building in economic opportunities for local residents. This brings us to a final point: in Calumet it is obvious that conservation cannot move forward without taking into account the local social landscape. This is equally true, however, in more remote places. It is true for cultural stability period—be it the cultural stability of the southeast side of Chicago or in the mountains of Peru. Field Museum of Natural History researchers have found that incorporating local interests and expertise in conservation projects in Peru is the only way to have a chance for successful conservation. There seems to be little choice because long-term stewardship of the area depends on it. If local people do not feel ownership, then external agents are less and less likely to succeed in achieving sustainability or conserving remaining flora and fauna.

A key finding in the social asset study suggests one reason why this is true, one that is different from the common wisdom of the need to honor the livelihoods of locals. Field Museum researchers found that local people in Calumet view "environment" more holistically than do many conservationists—integrating open space or natural area protection with health, safety, and other issues. In this sense, by paying attention to broader ecological issues, such as contamination issues and remediation (that benefit peoples' health as well as biodiversity), conservationists are more likely to get people to support the conservation issues—a "natural" alliance can be formed between local residents and conservationists.

Urban areas make the connection between social issues and conservation biology particularly clear. But even in pure conservation terms, the patches between smokestacks and abandoned factories, between loading docks and rivers, along freight lines and next to landfills, can provide rich opportunities to preserve and increase biodiversity. These are opportunities best not ignored.

LITERATURE CITED

Blus, L.J.; Henny, C.J.; Anderson, A.; Fitzner, R.E. 1985. Reproduction, mortality, and heavy metal concentrations in great blue herons from three colonies in Washington and Idaho. Colonial Waterbirds. 8: 110-116.

City of Chicago Department of Environment. 2002. Calumet Area Ecological Management Strategy. Chicago: City of Chicago, Department of Environment. 170 p. [Available online: http://www.ncrs.fs.fed.us/4902/focus/calumet/recovery/default.asp]

City of Chicago Department of Planning and Development. 2002. Calumet Land Use Plan. Chicago: City of Chicago. 16 p.

Custer, T.W.; Hensler, G.L.; Earl, T.E. 1983. Clutch size, reproductive success, and organochlorine contaminants in Atlantic coast black-crowned night-herons. Auk. 100: 699-710.

Custer, T.W.; Bickham, J.W.; Lyne, T.B.; *et al.* 1994. Flow cytometry for monitoring contaminant exposure in black-crowned night-herons. Archives of Environmental Contamination and Toxicology. 27: 176-179.

Custer, T.W.; Hines, R.K.; Melancon, M.J.; *et al.* 1997. Contaminant concentrations and biomarker response in great blue heron eggs from 10 colonies on the Upper Mississippi River, USA. Environmental Toxicology and Chemistry. 16: 260-271.

Deason, J.P.; Sherk, G.W.; Carroll, G.A. 2001. Public policies and private decisions affecting the redevelopment of brownfields: an analysis of critical factors, relative weights and areal differentials. Report submitted to: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. [Available online: http://www.gwu.edu/~eem/Brownfields/index.htm]

Findholt, S.L.; Trost, C.H. 1985. Organochlorine pollutants, eggshell thickness, and reproductive success of black-crowned night-herons in Idaho. Colonial Waterbirds. 8: 32-41.

Fleming, W.J.; Pullin, B.P.; Swineford, D.M. 1984. Population trends and environmental contaminants in herons in the Tennessee valley, 1980-81. Colonial Waterbirds. 7: 63-73.

Halbrook, R.S.; Brewer, R.L.; Buehler, D.A. 1999. Ecological risk assessments on a large river-reservoir: 7. Environmental contaminant accumulation and effects in Great Blue Heron. Environmental Toxicology and Chemistry. 18: 641-648.

Henny, C.J.; Blus, L.J.; Krynitsky, A.J.; Bunck, C.M. 1984. Current impact of DDE on black-crowned night-herons in the Intermountain West. Journal of Wildlife Management. 48: 1-13.

Hoffman, D.J.; Rattner, B.A.; Bunck, C.M.; *et al.* 1986. Association between PCBs and lower embryonic weight in black-crowned night-herons in San Francisco Bay. Journal of Toxicology and Environmental Health. 19: 383-391.

Hothem, R.L.; Roster, D.L.; King, K.A.; *et al.* 1995. Spatial and temporal trends of contaminants in eggs of wading birds from San Francisco Bay, California. Environmental Toxicology and Chemistry. 14: 1319-1331.

Jones, E.L. 1998. From steel town to "ghost town": a qualitative study of community change in southeast Chicago. Masters thesis. Chicago, IL: Loyola University, Department of Sociology. 108 p.

Kretzmann, J.P.; McKnight, J.L. 1993. Building communities from the inside out: a path toward finding and mobilizing a community's assets. Evanston, IL: Asset-Based Community Development Institute, Northwestern University. 376 p.

Northeast Midwest Institute. 2001. Brownfield basics: an issue primer. Washington, DC: Northeast Midwest Institute. 5 p. [Available online: http://www.nemw.org/BFprimer.pdf]

Ohlendorf, H.M.; Klaas, E.E.; Kaiser, T.E. 1978. Environmental pollutants and eggshell thinning in the black-crowned night heron. In: Sprint, A.; Ogden, J.C.D.; Winkler, S., eds. Wading birds. Research Report 7. New York, NY: National Audubon Society: 63-82.

Price, I.M. 1977. Environmental contaminants in relation to Canadian wildlife. Transactions of the North American Wildlife and Natural Resources Conference. 42: 382-396.

Proshansky, H.M. 1976. The appropriation and misappropriation of space. In: Korosec-Serfaty, P., ed. Appropriation of space. Proceedings of the Strasbourg Conference. Louvain-la-Neuve, Belgium: CIACO: 31-45

Rattner, B.A.; Melancon, M.J.; Rice, C.P.; *et al.* 1997. Cytochrome P450 and organochlorine contaminants in black-crowned night-herons from the Chesapeake Bay region, USA. Environmental Toxicology and Chemistry. 16: 2315-2322.

Rattner, B.A.; Hoffman, D.J.; Melancon, M.J.; *et al.* 2000. Organochlorine and metal contaminant exposure and effects in hatching black-crowned night-herons (Nycticorax nycticorax) in Delaware Bay. Archives of Environmental Contamination and Toxicology. 39: 38-45.

U.S. Department of the Interior, National Park Service Midwest Region. 1998. Calumet ecological park feasibility study. Omaha, NE: USDI, National Park Service Midwest Region. 73 p.