C H A P T E R 5

Analysis of Chicago River Recreation Habitats

Charles Nilon, Principal Investigator
Scott Huckstep, Contributor

SUMMARY OF FINDINGS

This project examined how vegetation and other physical and social factors help provide accessible "recreation habitat" for nearby residents along the Chicago River corridor. Nine neighborhoods identified in a related study of nearby residents' perceptions of the river (Gobster, 1998—see Chapter Two) defined the study sites for this research. The sites spanned the 150-mile corridor and included a representative range of physical and social conditions.

Analysis of physical characteristics at the study sites identified 629 distinct vegetative units and 34 different vegetation classes. In a study site level analysis, significant differences in vegetation cover type and dominant vegetative class were found across study sites. Sites also differed in environmental disturbances such as presence of trash, soil compaction, dumping, and vandalism; and in the way trails and fencing facilitated or inhibited access to the river edge. Differences in vegetation, environmental disturbances, and access between sites were related to how far a site was from the center of the study area, downtown Chicago; with areas closest to downtown having less closed-forest cover, greater environmental disturbance, and less access than more distant, suburban sites.

A block group analysis of social characteristics showed significant differences in social, economic, and demographic make-up of the 109 U.S. Census block groups associated with the study sites. Two categories of block groups were identified; one characterized largely by upper income white homeowners, the other largely by lower income black renters. Paralleling the study site level analysis, a comparison of physical and social factors showed that sites bordering block groups having predominantly lower income black renters tended to have a lower percentage of closed forest vegetation units, a higher percentage of areas with environmental disturbances (trash, dumping, and vandalism), and a higher percentage of fenced areas blocking access to the river than sites bordering block groups having predominantly upper income white homeowners.

Findings from both the study site and block group analyses may help explain results from the study of nearby residents' perceptions, where participants who lived near sites with a low quality physical environment and less access to the river tended to have a more negative overall impression of the Chicago River in their neighborhood. Such findings may help managers identify improvement projects where they are needed most, to better provide all corridor residents with a quality river environment for their enjoyment.

INTRODUCTION TO THE STUDY

Recent research has noted the importance of nearby open spaces to urban residents. Open spaces within 1 mile of a residence are an important source of nature-based recreation for children and adults (Johnston, 1990). The USDI Fish and Wildlife Service (1992) estimated that 3.4 million Illinois residents use these areas each year for non-game wildlife activities.

The ChicagoRivers study area includes a large amount of public and private open space. Little information, however, is available on how open space sites are used by local residents, or what factors influence their use. In May 1993, we began a project to characterize the physical and social features of open space sites. Our goal was to identify variables useful for predicting whether these sites provided "recreation habitat": vegetation and other features that facilitate or inhibit use of and access to open space sites for recreational purposes (Greer, 1990).

OBJECTIVES

1. To classify the vegetative structure, land use history, and current types of disturbances in open spaces found within representative residential neighborhoods in the Chicago River corridor.
2. To determine user access to these open spaces. This assessment includes an analysis of riverbank characteristics that may increase or limit river use, as well as an analysis of access to river-based activities.
3. To identify the social, economic, and demographic characteristics of residential areas that are relevant to the use of nearby open spaces.
4. To determine if open spaces bordered by neighborhoods with different social, economic, and demographic characteristics differ in vegetation characteristics, land use history, current patterns of disturbance, and user access.

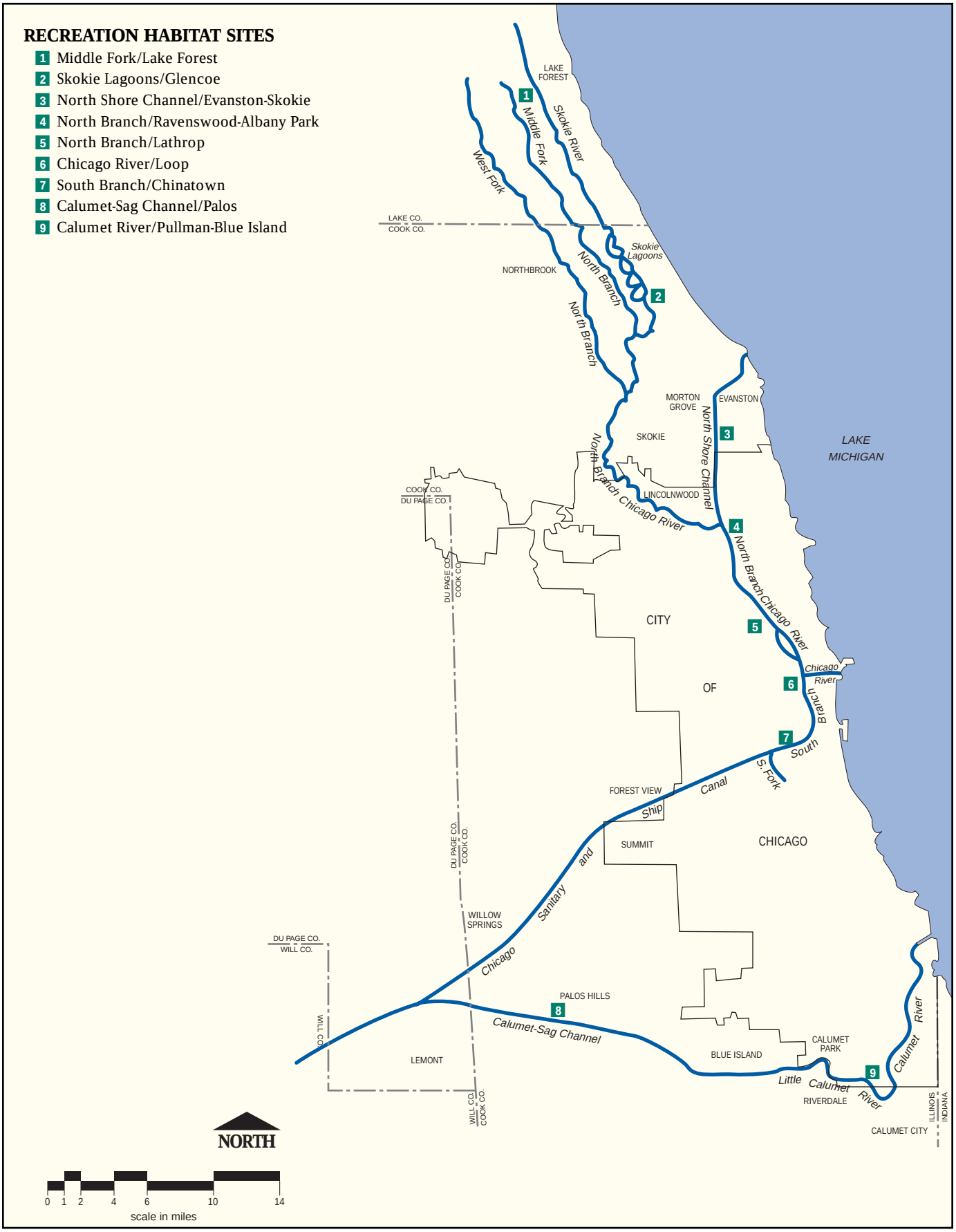

FIGURE 5.1
Location of study reaches with location of recreation habitat sites

METHODS

REGIONAL CHARACTERISTICS AND ACCESS

STUDY SITES

Nine study sites were located within seven reaches of the ChicagoRivers project area (Table 5.1 and Figure 5.1). The study sites were identified by Paul Gobster and Lynne Westphal in their focus group study of river perceptions and uses by nearby residents (Gobster, 1998—see Chapter Two in this report). The focus group areas were selected to represent the range of residential neighborhoods in the Chicago River corridor. Each study site included all open spaces within 0.5 miles (0.8 km) of a branch of the river.

CLASSIFICATION OF OPEN SPACES

Open spaces within each study site were characterized using a vegetation classification system for urban natural areas developed by Rogers and Rowntree (1988). This system classifies open spaces based on plant formation type (cover type) and the dominant life form of understory (< 15 ft. (5 m.)) plants. Each study site was located on 1:2400 scale aerial photographs obtained from the Metropolitan Water Reclamation District of Greater Chicago, Cook County Highway Department, and Lake County Department of Planning and Environment. The boundaries of vegetation units—open spaces at least 1 acre (0.47 ha) in size that were dominated by one of five plant formation types (cover types)—were marked on each map (Table 5.2). We visited each study site between May and August 1993 to verify the plant formation classification and to complete the description of the unit. This description classified each unit based on the life form of vegetation less than 15 feet (5 m.) tall and on the presence of indicators of historical land use and current environmental disturbance (Rogers and Rowntree, 1988; Sisinni and Anderson, 1993) (Tables 5.2 and 5.3).

The percent occurrence of each plant formation type, vegetation class, historical land use indicator, and environmental disturbance category was determined for each study site using the SYSTAT Tables procedure (Wilkinson, 1990). A chi-square test of independence (Wilkinson, 1990) was used to

TABLE 5.1
Location and description of recreation habitat sites

Study Site	River Name	Study Reach	Neighborhood
1	Middle Fork North Branch Chicago River	2	Lake Forest
2	Skokie River/Skokie Lagoons	3	Glencoe
3	North Shore Channel	4	Evanston-Skokie
4	North Branch Chicago River	5A-B	Ravenswood-Albany Park
5	North Branch Chicago River	5B	Lathrop
6	Chicago River/South Branch Chicago River	6, 7	Loop
7	South Branch Chicago River	7	Chinatown
8	Calumet-Sag Channel	10A	Palos
9	Calumet-Sag Channel	10C	Pullman-Blue Island

TABLE 5.2
Plant formation and life form categories used to classify vegetation units

Category	Description
Plant Formation (Cover Type)	
Closed Forest	Trees > 15 ft (5 m) tall with interlocking crowns
Woodland	Minimum of 40% tree cover without interlocking crowns
Scrub	Woody vegetation 1.5 ft-15 ft (0.5-5.0 m) tall
Herbaceous Vegetation	Grass and grasslike plants, woody vegetation vegetation < 40%
Scarcely Vegetated	Bare mineral soil, sand, rock or pavement dominates
Life Form of Vegetation < 15 ft (5 m) tall	
Phanerophytes	Plants that grow taller than 1.5 ft (0.5 m) and do not die back below that height
Chamaephytes	Branches or shoots remain < 1.5 ft (0.5 m) above ground
Hemicryptophytes	Shoots die back to ground level; buds at level of ground
Cryptophytes	Buds or shoots survive below ground

TABLE 5.3
Historical indicators and environmental disturbance variables used to classify vegetation units

Variable	Description
Historical Indicators (Indicators of Previous Land Uses)	
Building	Presence of building or building foundation
Exotic Plantings	Presence of escaped non-native/exotic plant species
Hedgerow	Presence of hedgerow or fencerow plantings
Landfill	Presence of dump site
Road	Presence of paved or dirt road
Environmental Disturbance (Indicators of Current Disturbance)	
Dumping	Dumping of trash or yard waste
Erosion	Evidence of soil erosion
Fire	Evidence of fire or arson
Soil Compaction	Evidence of compaction by vehicles or foot traffic
Trash	Presence of scattered trash or litter
Vandalism	Presence of vandalism or graffiti

test if the percent occurrence of each plant formation type and of the five most frequently occurring vegetation class differed significantly ($p < 0.05$) among the study sites. A Spearman rank correlation test (Wilkinson 1990) was used to determine if the percent occurrence by study site of each historical land use indicator and environmental disturbance variable was significantly correlated ($p < .05$) with its distance from downtown Chicago, also known as the Loop. The Spearman rank correlation test is used to determine if there is an association between a variable (historical land use and environmental disturbance) and another ranked variables (study site distance from the Loop). This analysis is frequently used to show the influence of distance or of a gradient.

ACCESS TO RIVER REACHES

Access to the river was evaluated during the field assessment of vegetation units adjacent to a river reach. We recorded the presence of sidewalks or trails adjacent to the river (foot access), roads or parking lots (auto access), and fences that blocked direct contact with the river. We used the Spearman rank correlation test to determine statistically significant correlations ($p < 0.05$) between the percent occurrence of these features in study sites and distance from the Loop (Wilkinson, 1990).

Potential barriers to river-based activities were identified by characterizing the banks of units adjacent to the river and by identifying river reaches with heavy barge traffic. We recorded the presence of crushed rock, pavement, and vegetation on the banks of each unit adjacent to a river. Again, a Spearman rank correlation test was used to determine if the percent occurrence in each study site of these variables was significantly correlated ($p < 0.05$) with distance from the Loop. Information on high barge traffic areas identified by the U.S. Coast Guard (no date) was used as an additional measure of barriers to access for river-based activities. We compared the number of high traffic areas per mile to identify areas where river-based activities might be restricted.

NEIGHBORHOOD CHARACTERISTICS AND ACCESS

SOCIAL, ECONOMIC, AND DEMOGRAPHIC FACTORS

Social, economic, and demographic factors influence the use of open spaces. Knox (1987) noted that these variables may present barriers that limit the ability of an individual to visit a site or participate in an activity. We wanted to know if there were differences in the characteristics of open spaces and in access to the river among neighborhoods that differed in social, economic, and demographic characteristics. We used 13 variables from the 1990 U.S. Census to describe the economic, social, and demographic characteristics of block groups that bordered vegetation units (U.S. Department of Commerce, 1992) (Table 5.4). Block groups are small subdivisions of census tracts that are analogous to neighborhoods.

Principal components analysis was used to identify the combinations of census variables that explained at least 50 percent of the differences among the 109 block groups associated with study sites (Wilkinson, 1990). Principal components analysis is a statistical procedure that combines several variables into a smaller group (principal components) that explains major trends or differences within a data set. Each block group has a score for each principal component that reflects the response to the associated trend or pattern of difference. We used the SYSTAT K-Means cluster analysis program to classify the census tract block groups into two categories based on major differences in social, economic, and demographic characteristics (Wilkinson, 1990).

RELATIONSHIP OF PHYSICAL AND SOCIAL FACTORS

Finally, we used chi-square analysis to examine the relationship between the two socially defined block group types identified in the principal components analysis, and the physical measures of vegetation, land use, disturbance, and access.

TABLE 5.4
Social, economic, and demographic variables used to characterize 1990 U.S. Census block groups adjacent to sites

Variable	Description
Economic Status	
HH1PKIDS	Percent of households with single parent and children < 19 years of age
MEANRENT	Mean monthly rent ($) of occupied housing units
MEANVAL	Mean value ($) of occupied housing units
Social Status	
POWNER	Percentage of owner-occupied housing units
PRENTER	Percentage of renter-occupied housing units
VEHACCESS	Percentage of occupied housing units with access to a vehicle
Demographic Status	
OVER64	Percentage of residents > 64 years of age
UNDER19	Percentage of residents < 19 years of age
PAMIND	Percent of population that is American Indian
PASIAN	Percent of population that is Asian/Pacific Island
PBLACK	Percent of population that is Black/Non-Hispanic
PHISPAN	Percent of population that is Hispanic
PWHITE	Percent of population that is White/Non-Hispanic

RESULTS

REGIONAL LEVEL

VEGETATION UNIT CHARACTERISTICS

There were significant differences ($p < 0.05$) in the percentage of each cover type among the study sites (Table 5.5). Herbaceous units were the most frequently occurring cover type in six of nine study sites, while woodland units occurred most frequently in the remaining three sites. Closed forest units were restricted to the Lake Forest, Glencoe, Palos, and Pullman/Blue Island study sites. Units scarce in vegetation were common in the Evanston/Skokie, Loop, and Chinatown study sites (Table 5.5).

We identified 629 distinct units and classified them into 34 vegetation classes (Appendix 5.1). More than half the units were classified into one of five categories: lawn with trees (VA2b1) (11.6%), deciduous woodland with herbaceous understory (IIB2a1c) (11.0%), artificial surface (VID) (10.5%), deciduous woodland with woody understory (IIB2a1a) (10.2%), and tall forb (VA3a2) (9.4%). There were significant differences ($p < 0.05$) in the percentage of these top five vegetation classes among the study sites (Table 5.6). Of these differences, the Evanston/Skokie, Lathrop, and Loop sites had a higher percentage of units classified as "lawn with trees" compared to the other sites, and the Evanston/Skokie, Loop, and Chinatown sites had more units classified as "artificial surface."

TABLE 5.5
Percent occurrence of plant cover type by site

		Cover Type[1]				
Study Site	Number of Units	Closed Forest	Woodland	Scrub	Herbaceous	Scarcely Vegetated
Middle Fork/Lake Forest	67	23.9	20.9	4.5	46.3	4.5
Skokie Lagoons/Glencoe	152	23.7	46.1	3.3	24.3	2.6
North Shore Channel/Evanston-Skokie	45	0.0	26.7	4.4	42.2	26.7
North Branch/Ravenswood-Albany Park	58	0.0	50.0	6.9	29.3	13.7
North Branch/Lathrop	26	0.0	23.1	0.0	65.4	11.5
Chicago River/Loop	46	0.0	10.9	6.5	56.5	26.1
South Branch/Chinatown	22	0.0	36.4	0.0	31.8	31.8
Calumet-Sag Channel/Palos	100	13.0	24.0	7.0	39.0	17.0
Calumet River/Pullman-Blue Island	113	7.1	22.1	3.5	48.7	18.6

[1]Significant difference between study sites (Pearson chi-square=148.152, df=32, $p < .001$).

TABLE 5.6
Percent occurrence of five most abundant vegetation classes by site

		Vegetation Class[1]					
Study Site	Number of Units	Lawn w/trees	Woodland w/herbaceous understory	Artificial Surface	Woodland w/woody understory	Tall forb	Other
Middle Fork/Lake Forest	67	9.0	9.0	4.5	7.5	11.9	58.0
Skokie Lagoons/Glencoe	152	4.6	14.5	2.0	13.2	3.3	62.8
North Shore Channel/Evanston-Skokie	45	22.2	2.2	20.0	11.1	0.0	44.5
North Branch/Ravenswood-Albany Park	58	10.3	15.2	10.3	24.1	6.9	32.7
North Branch/Lathrop	26	38.5	0.0	7.7	11.5	3.9	38.4
Main Channel/Loop	46	28.3	4.4	23.9	2.1	8.7	32.5
South Branch/Chinatown	22	0.0	27.3	27.3	4.6	22.7	18.1
Calumet-Sag Channel/Palos	100	6.0	5.0	9.0	13.0	16.0	51.0
Calumet River/Pullman-Blue Island	113	13.3	15.9	15.0	1.8	14.2	39.8

[1]Significant difference between study sites (Pearson chi-square=167.704, df=40, $p < .001$).

There were no significant correlations between distance from the Loop and the percent occurrence of the five historical indicators in each study site (Table 5.7). There were significant correlations between percent occurrence of a disturbance variable in a study site and distance from the Loop for four of the six site characteristics (Table 5.8). Trash ($r = -0.336$, $p < 0.001$) and soil compaction ($r = -0.244$, $p < 0.001$) had the strongest correlations with distance from the Loop. These disturbances were more likely to occur in study sites closer to the Loop. Dumping ($r = -0.173$, $p < 0.001$) and vandalism ($r = -0.079$, $p = 0.048$) showed similar, though less strong trends.

ACCESS TO RIVER REACHES

Fencing and foot access were significantly correlated with distance from the Loop (Table 5.9). Fencing was negatively correlated ($r = -0.440$, $p < 0.001$) with distance, indicating that access to the river was blocked more frequently in central city study sites. Access to river reaches by sidewalks and trails was positively correlated ($r = 0.388$, $p < 0.001$) with distance, indicating that the river was most accessible from more distant, suburban study sites.

We found significant correlations ($p < 0.05$) between all three bank characteristics and distance from the Loop (Table 5.10). Cover by vegetation was positively correlated ($r = 0.412$, $p < 0.001$) with distance, indicating that suburban study sites were more likely to contain this bank characteristic. Cover by paved ($r = -0.356$, $p < 0.001$) and rock ($r = -0.242$, $p = 0.001$) surface was negatively correlated with distance, indicating that units in central city study sites were more likely to contain these bank types.

Six river reaches were designated as high barge traffic areas by the U.S. Coast Guard (Table 5.11). Two of the nine study sites—Palos and Pullman/Blue Island—were located within these high traffic reaches.

TABLE 5.7
Percentage of vegetation units with occurrence of historical indicators

		Indicators of Historical Land Use				
Study Site	Number of Units	Building	Exotic	Hedgerow	Landfill	Road
Middle Fork/Lake Forest	67	3.0	13.4	4.5	0.0	6.0
Skokie Lagoons/Glencoe	152	0.7	10.5	1.3	0.7	0.6
North Shore Channel/Evanston-Skokie	45	0.0	22.2	11.1	0.0	0.0
North Branch/Ravenswood-Albany Park	58	1.7	25.9	1.7	0.0	0.0
North Branch/Lathrop	26	0.0	11.5	0.0	0.0	0.0
Main Channel/Loop	46	0.0	19.6	4.4	0.0	0.0
South Branch/Chinatown	22	0.0	0.0	0.0	0.0	4.6
Cal-Sag Channel/Palos	100	0.0	5.0	0.0	0.0	0.0
Calumet River/Pullman-Blue Island	113	8.9	9.7	4.4	0.0	2.7

TABLE 5.8
Percentage of vegetation units with occurrence of current environmental disturbance

		Current Disturbance					
Study Site	Number of Units	Dumping[1]	Erosion	Fire	Compaction[1]	Trash[1]	Vandalism[1]
Middle Fork/Lake Forest	67	3.0	4.5	0.0	1.5	7.5	0.0
Skokie Lagoons/Glencoe	152	6.6	11.8	4.6	1.3	52.0	0.0
North Shore Channel/Evanston-Skokie	45	4.4	0.0	0.0	6.7	57.8	2.2
North Branch/Ravenswood-Albany Park	58	34.5	24.1	1.7	8.6	56.9	5.2
North Branch/Lathrop	26	15.4	15.8	0.0	19.2	80.8	0.0
Main Channel/Loop	46	2.2	4.4	0.0	30.4	71.7	0.0
South Branch/Chinatown	22	36.4	4.6	0.0	40.9	100.0	0.0
Cal-Sag Channel/Palos	100	23.0	1.0	2.0	19.0	56.0	0.0
Calumet River/Pullman-Blue Island	113	31.9	0.9	0.9	19.5	79.7	3.5

[1]Significant ($p < .05$) correlation with distance from Loop.

NEIGHBORHOOD LEVEL

SOCIAL, ECONOMIC, AND DEMOGRAPHIC DIFFERENCES

Two principal components explained 50.6 percent of the variation among block group social, economic, and demographic variables (Table 5.12). The first component, explaining 32.9 percent of variation among block groups, was characterized by positive loadings for HH1PKIDS, PRENTERS, and PBLACK; and negative loadings for VEHACCESS, MEANVAL, PWHITE, and POWNER. This component described a separation between block groups with upper income white homeowners and lower income black renters. The second component, explaining 17.7 percent of variation among the block groups, was characterized by positive loadings for UNDER19, POWNER, and PBLACK; and negative loadings for PRENTERS. This component described a separation between block groups with black families that were homeowners and block groups dominated by renter-occupied housing.

Scores for the first two principal components were used to classify the block groups into two categories. Residents in block group category one were largely upper income white homeowners. Residents in block group category two were

TABLE 5.9
Percentage of vegetation units with access to reaches and with fencing that blocked access

	Access Category (%)			
Study Site	Number of Units	Fenced[1]	Auto Access	Foot Access[1]
Middle Fork/Lake Forest	10	10.0	0.0	100.0
Skokie Lagoons/Glencoe	55	1.8	16.4	98.8
North Shore Channel/ Evanston-Skokie	12	66.7	0.0	41.7
North Branch/ Ravenswood-Albany Park	39	53.9	0.0	59.0
North Branch/Lathrop	9	77.8	11.1	33.3
Chicago River/Loop	14	45.5	14.3	64.3
South Branch/Chinatown	8	25.0	25.0	50.0
Calumet-Sag Channel/Palos	13	0.0	7.7	92.3
Calumet River/ Pullman-Blue Island	22	35.7	4.6	68.2

[1]Significant ($p < .05$) correlation with distance from Loop.

TABLE 5.10
Percent occurrence of bank characteristic variables in vegetation units adjacent to river

	Presence of Bank Feature in Unit (%)			
Study Site	Number of Units	Paved[1]	Rock[1]	Vegetation[1]
Middle Fork/Lake Forest	10	0.0	0.0	100.0
Skokie Lagoons/Glencoe	55	0.0	0.0	100.0
North Shore Channel/ Evanston-Skokie	12	0.0	0.0	100.0
North Branch/ Ravenswood-Albany Park	39	7.7	20.5	84.6
North Branch/Lathrop	9	44.4	33.3	77.8
Main Channel/Loop	14	71.4	21.4	14.3
South Branch/Chinatown	8	12.5	37.5	62.5
Calumet-Sag Channel/Palos	13	23.1	76.9	76.9
Calumet River/Pullman-Blue Island	22	18.2	77.3	68.2

[1]Significant ($p < .05$) correlation with distance from Loop.

TABLE 5.11
Chicago River reaches with heavy barge traffic (number of high target areas) identified by U.S. Coast Guard

Reach	Name of Reach	Length (mi.)	Number High Target Areas	Number High Target Areas/Mile
8	Sanitary and Ship Canal	8.2	13	1.6
9A	Sanitary and Ship Canal	10.0	5	0.5
9B	Sanitary and Ship Canal	12.5	5	0.4
10A	Calumet-Sag Channel	15.9	3	0.2
10B	Little Calumet River	7.1	1	0.1
10C	Calumet River	6.8	2	0.3

TABLE 5.12
Principal component loadings for socioeconomic and demographic variables

Variable	PC1	PC2
HH1PKIDS	0.804	0.405
UNDER19	0.335	0.677
OVER64	-0.247	-0.365
PRENTER	0.772	-0.538
POWNER	-0.762	0.543
VEHACCESS	-0.771	0.282
MEANRENT	-0.341	0.074
MEANVAL	-0.654	0.230
PAMIND	0.154	-0.053
PASIAN	0.087	-0.343
PBLACK	0.667	0.617
PHISPAN	0.273	-0.396
PWHITE	-0.769	-0.409
Eigenvalue	4.275	2.302
Percent Variation	32.9	17.7

TABLE 5.13
Mean (+ standard error) of selected social, economic, and demographic variables by block group category[1]

Variable	1	2
HH1PKIDS	4.1 + 0.5	23.8 + 2.8
UNDER19	20.4 + 1.0	32.9 + 1.6
PRENTER	34.1 + 3.1	45.4 + 5.8
POWNER	65.5 + 3.2	54.6 + 5.8
VEHACCES	85.2 + 1.9	69.3 + 4.9
MEANVAL	179,110 + 14,355	68,000 + 6,995
PBLACK	4.6 + 0.9	85.6 + 3.5
PWHITE	81.8 + 2.1	10.9 + 2.5

[1] All mean are expressed in percents except for MEANVAL, which is in dollars.

TABLE 5.14
Percent of block groups assigned to each block group category by site

	Block Group Category[1]	
Study Site	1	2
Middle Fork/Lake Forest	100.0	0.0
Skokie Lagoons/Glencoe	99.4	0.0
North Shore Channel/Evanston-Skokie	56.5	43.5
North Branch/Ravenswd.-Albany Pk.	100.0	0.0
North Branch/Lathrop	11.1	88.9
Chicago River/Loop	57.5	0.0
South Branch/Chinatown	100.0	0.0
Calumet-Sag Channel/Palos	100.0	0.0
Calumet River/Pullman-Blue Island	44.1	55.9

[1] Units bordered by nonresidential block groups (n=20) excluded from analysis.

TABLE 5.15
Percent occurrence of vegetation unit cover types by adjacent block group category

	Cover Type[1]					
Block Group Category	Number of Units	Closed Forest	Woodland	Scrub	Herbaceous	Scarcely Vegetated
1	501	13.8	34.7	4.4	35.3	11.8
2	108	3.7	15.7	3.7	54.6	22.7

[1] Significant difference among adjacent block group categories (Pearson Chi-Square= 33.482, df = 4, $p < 0.001$).

largely lower income black renters (Table 5.13). Block groups in category two were found only in the Evanston/Skokie, Lathrop, and Pullman/Blue Island study sites. Twenty vegetation units were located next to non-residential block groups. These units were excluded from further analysis (Table 5.14).

VEGETATION UNIT CHARACTERISTICS

Vegetation cover (plant formation type) differed ($p < 0.05$) between the block group categories (Table 5.15). Vegetation units bordered by category one block groups had a higher percentage of closed forest and woodland cover and a lower percentage of herbaceous and scarcely vegetated cover types than those bordered by category two groups. There were no differences between block group categories in the percentage of units of the most common vegetation classes (Table 5.16).

There were no differences in historical land use indicators among the two block group categories. However, the block group categories did differ significantly ($p < 0.05$) in four of six environmental disturbance variables (Table 5.17). Trash, dumping, and vandalism were more common in vegetation units adjacent to block groups in category two. Soil erosion was more common in units adjacent to block groups in category one.

TABLE 5.16
Percent occurrence of five most abundant vegetation classes by block group category

	Vegetation Class						
Block Group Category	Number of Units	Lawn w/trees	Woodland w/hemic.	Artificial Surface	Woodland w/phaner.	Tall forb	Other
1	501	8.0	12.4	8.8	11.8	10.0	49.1
2	108	24.1	6.5	16.7	4.6	8.3	39.8

TABLE 5.17
Percent occurrence of historical indicators and disturbance characteristics of vegetation units by adjacent block group category

	Block Group Category	
Characteristic	1 (n= 501)	2 (n= 108)
Historical Indicators:		
Building	1.8	4.6
Exotic Plantings	12.4	11.1
Hedgerow	1.8	6.5
Landfill	0.2	0.0
Road	1.4	0.9
Environmental Disturbance		
Dumping[1]	15.9	24.1
Erosion	7.6	4.6
Fire	2.2	0.0
Soil Compaction[1]	10.4	18.5
Trash[1]	53.5	75.0
Vandalism[1]	1.0	2.3

[1] Significant difference between block group categories (Pearson Chi-Square > 5.991, df=2, $p < 0.05$).

No differences were found in bank characteristics of units adjacent to the two block group types (Table 5.18). Access to the river differed ($p < 0.05$) in one of three categories. More units in block group category two had fences blocking access to the river.

DISCUSSION AND CONCLUSIONS

The objectives of our study were to classify and describe open spaces within 0.5 miles of the Chicago River system and to identify factors that may be important in modeling and predicting recreational use of these green spaces. We examined variables related to the physical and social characteristics of the river system at nine study sites in the corridor.

In our first level of analysis, differences in cover type among the study sites follow a pattern found in studies of green spaces in other U.S. cities (Nilon, 1991; Rowntree, 1984). Study sites near older or more densely developed neighborhoods closer to the central city (Evanston/Skokie, Ravenswood/Albany Park, Lathrop, The Loop, and Chinatown) differed from newer or less densely developed city and suburban neighborhoods further from the central city. Also, northern suburbs (Lake Forest, Glencoe) were different from southern study sites (Palos, Pullman/Blue Island). In addition, differences among the study sites were also likely related to the size of open space and the land use history of the sites.

We identified 11 variables that describe differences between vegetation units at the study site or block group level of analysis (Table 5.19). Three of the 11 variables that describe differences between study sites (cover type, vegetation class, bank vegetation) reflect the urban versus suburban pattern described in the previous paragraph. The remaining eight variables represent site characteristics and features that may lead to differences in perception and use of the river and associated open spaces. Four disturbance variables (dumping, soil compaction, trash, and vandalism) identify human activities that may lead to a negative impression of the site or unit. This is supported by the results of focus groups conducted in areas associated with each study site (see Chapter Two). Focus group participants who lived in study sites with the highest percentage of units with these disturbance factors had a negative perception of the Chicago River in their neighborhood.

The access variables indicate that the more urban study sites have less access to river reaches than the more suburban sites. This may also explain a negative perception of the river in some of the more urban focus groups.

Our second level of analysis focused on differences at a neighborhood or block group level that are defined by social, economic, and demographic differences. Race, income, and home ownership described the major differences between block groups in our study area. Relationships between these factors and physical site variables in many cases paralleled results of the study site analysis: Sites bordering block groups occupied largely by lower income black renters (like the study sites closer to the central city) tended to have higher rates of environmental disturbance, less access to the river, and less forest and woodland vegetation than sites bordering block groups occupied largely by upper income white homeowners (like study sites in suburban areas further from the center city). Like the study site analysis, these results may also suggest that differences in perception and use may occur at the neighborhood and block level. In both cases, these findings can help managers identify priorities for environmental improvement so that all residents can benefit from high quality nature access opportunities.

TABLE 5.18
Percent occurrence of bank characteristics and river access variables for units adjacent to river by adjacent block group category

	Block Group Category	
Characteristic	1 (n= 157)	2 (n= 19)
Bank Characteristics:		
Vegetation	84.1	84.2
Paved	9.6	26.3
Rock	22.3	47.4
Access to River		
Auto Access	**8.3**	**10.5**
Foot Access	79.0	31.6
Fence[1]	24.2	84.2

[1] Significant difference between block group categories (Pearson Chi-Square > 5.991, df=2, $p < 0.05$).

TABLE 5.19
Vegetation unit variables that differ ($p < 0.05$) at regional (study site) or neighborhood (block group) level

	Level of Analysis	
Variable	Study Site	Block Group
Unit Type		
Vegetation Cover	X	X
Dominant Vegetation Class	X	
Land Use History and Disturbance		
Dumping	X	X
Erosion		X
Soil Compaction	X	
Trash	X	X
Vandalism	X	X
Access to River		
Access by foot	X	
Fence blocking access	X	X
Paved bank	X	
Rock bank	X	
Bank Vegetation	X	

APPENDIX 5.1

TABLE 5.1.1
Vegetation Classes

Classification	Description	Frequency	Percent
CLOSED FOREST			
1. IB1a1a	Deciduous w/ broad leaved evergreen Understory phanerophytes	40	6.4
2. B1a1b	Deciduous w/ needle leaf evergreens Understory chamaephytes	6	1.0
3. IB1a1c	Deciduous w/ needle leaf evergreens Understory hemicryptophytes	26	4.1
4. IB1b1c	Deciduous w/needle leaf evergreens Understory hemicryptophytes	1	0.2
WOODLAND			
5. IIA2a1c	Evergreen coniferous w/rounded crowns Understory hemicryptophytes	1	0.2
6. IIB2a1	Deciduous w/o evergreen Understory hemicryptophytes	29	4.6
7. IIB2a1a	Deciduous w/o evergreen Understory phanerophytes	64	10.2
8. IIB2a1b	Deciduous w/o evergreen Understory chamaephytes	22	3.5
9. IIB2a1c	Deciduous w/o evergreen Understory hemicryptophytes	69	11.0
10. IIB2d1a	Deciduous w/o evergreen riparian Understory phanerophytes	1	0.2
11. IIB2d1c	Deciduous w/o evergreen riparian Understory hemicryptophytes	6	1.0
SCRUB			
12. IIIA1	Deciduous thicket	13	3.2
13. IIIB1a	Upland deciduous shrubland	7	1.1
14. IIIB2	Evergreen shrubland	1	0.2
HERBACEOUS			
15. VA1b1	Medium tall grassland w/ trees	35	5.6
16. VA1b2	Medium tall grassland w/ shrubs	6	1.0
17. VA1b3	Medium tall grassland w/o woody plants	9	1.4
18. VA1c1	Short grassland w/ trees	3	0.5
19. VA1c2	Short grassland w/ shrubs	2	0.3
20. VA2a1	Meadow w/ trees	1	0.2
21. VA2a2	Meadow w/ shrubs	1	0.2
22. VA2a3	Meadow w/o woody plants	4	0.6
23. VA2b1	Lawn w/trees	73	11.6
24. VA2b2	Lawn w/ shrubs	4	0.6
25. VA2b3	Lawn w/o woody plants	39	6.2
26. VA3a2	Tall forb	59	9.4
27. VA3a5	Perennial—ruderal vegetation on debris	1	0.2
28. VA3a6	Perennial—ruderal vegetation on cultivated land	5	0.8
29. VA3b1	Ephemeral halphytic vegetation	2	0.3
30. VA3b2	Ephemeral ruderal vegetation growing on debris	1	0.2
31. VB1a3	Freshwater vegetation	3	0.5
32. VB1c1	Forb flush	1	0.2
SCARCELY VEGETATED			
33. VID	Artificial surfaces	66	10.5
34. VIE	Compacted surfaces	20	3.2

LITERATURE CITED

Gobster, P.H. (1998). Nearby neighborhood residents' images and perceptions of the river. In Gobster, P.H., and Westphal, L.M.(Eds.). *People and the River: Perception and Use of Chicago Waterways for Recreation* (ChicagoRivers Demonstration Project Report) Milwaukee, USDI National Park Service, Rivers, Trails and Conservation Assistance Program.

Greer, J. (1990). Recreation habitats: a concept for study and management. In O'Leary, J.T., et al. (Eds.), *Proceedings of the National Outdoor Recreation Trends Symposium III* (pp. 339-349). Indianapolis, IN: Indiana University Leisure Research Institute.

Johnston, J. (1990). *Nature Areas for City People.* Ecology Handbook 14. London: London Ecology Unit.

Knox, P.J. (1987). *Urban Social Geography: An Introduction.* (2nd ed.). London: Longman Scientific and Technical.

Nilon, C.H. (1991). Classification of urban forests in three U.S. cities: a test of Moll's urban forest zone model. *Arboricultural Journal,* 15, 255-263.

Rogers, G.F., and Rowntree, R.A. (1988). Intensive surveys of structure and change in urban natural areas. *Landscape and Urban Planning,* 15, 59-78.

Rowntree, R.A. (1984). Forest canopy cover and land use in four eastern United States cities. *Urban Ecology,* 8, 55-67.

Sisinni, S.M., and Anderson, M.O. (1993). Methods and results of natural resource assessments in New York City, New York. *Landscape and Urban Planning,* 25, 95-114.

U.S. Coast Guard, Chicago Office. no date. Statistics on barge traffic (unpublished data). Chicago: U.S. Coast Guard.

U.S. Department of Interior, Fish and Wildlife Service. (1992). *1991 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. State Overview.* Washington, DC: USDI Fish and Wildlife Service, Division of Federal Aid.

U.S. Department of Commerce. (1992). *1990 Census of Population and Housing. Block Statistics, Illinois.* Washington, DC: Bureau of the Census, Data User Services Division.

Wilkinson, L. (1990). *SYSTAT: The System for Statistics.* Evanston, IL: SYSTAT Inc.