Available online at www.sciencedirect.com
SCIENCE DIRECT®
Landscape and Urban Planning 75 (2006) 282–299
LANDSCAPE AND URBAN PLANNING
This article is also available online at:
www.elsevier.com/locate/landurbplan

The Riverside and Berwyn experience: Contrasts in landscape structure, perceptions of the urban landscape, and their effects on people

Thomas Crow [a,*], Terry Brown [b], Raymond De Young [b]

[a] *USDA Forest Service, Washington, DC 20090, USA*
[b] *School of Natural Resources & Environment, University of Michigan, Ann Arbor, MI 48109, USA*

Available online 6 July 2005

Abstract

Humans not only structure the landscape through their activities, but their perceptions of nature are affected by the spatial and temporal arrangements (structure) in the landscape. Our understanding of these interactions, however, is limited. We explored the relationship between landscape structure and peoples' perceptions of nature in the Chicago, IL, USA, suburbs of Riverside and Berwyn because they offer contrasting paradigms of an urban landscape. Designed in the 1800s by Frederick Law Olmsted, Riverside has several unique design elements (curvilinear streets, ample setbacks, parkways of variable width with mowed grass and naturalistic groupings of trees) that define the structure and composition of this landscape. The urban forest was the keystone of Olmsted's desire to create a harmonious community characterized by "refined sylvan beauty". In contrast, the adjacent community of Berwyn has right-angled streets with small lots and narrow setbacks for houses. Differences in landscape structure between the two communities produced differences in the diversity, size, and composition of woody vegetation. As measured by patch-size distribution, Riverside had greater diversity in landscape structure than Berwyn, and in turn, Riverside had greater diversity in the composition and size of the woody vegetation compared to Berwyn. Riverside tended toward a "natural" appearance with vegetation, while yards in Berwyn tended to be trimmed and edged. Significant differences between the mean ratings of Riverside and Berwyn respondents were found for six of seven community attribute categories. Riverside participants reported receiving greater benefit from the visual and nature-related features of the urban forest than did Berwyn respondents. Berwyn residents ranked social atmosphere for the community and locomotion (wayfinding) highest among the seven community attribute categories. Despite differences between the two communities, residents valued the green residential environment provided by vegetation. However, the more diverse urban landscape as measured by built structures, woody vegetation, and lot size and shape proved to be more satisfying to the residents of these two communities. The design concepts developed and implemented by Olmsted more than century ago in Riverside are still relevant to city planners striving to develop living environments that are satisfying to urban and suburban residents.
Published by Elsevier B.V.

Keywords: Chicago; Urban landscapes; Trees; Landscape design; Frederick Law Olmsted; Natural capital

* Corresponding author.
E-mail address: tcrow@fs.fed.is (T. Crow).

0169-2046/$20.00 Published by Elsevier B.V.
doi:10.1016/j.landurbplan.2005.04.002

1. Introduction

A significant portion of our global landscape is highly designed and managed. Humans dominate these landscapes and the patterns that exist largely reflect their manipulation and intervention (Meyer and Turner, 1994; Andersen et al., 1996). The concept of "nature" depends on the degree to which the intrinsic properties of a landscape result from human activities (Eaton, 1997). Nature as perceived in the context of an urban or suburban landscape will likely be different than that derived in a relatively pristine, unmanaged landscape. In reality, many environments that people consider "natural" exist in highly managed landscapes (Forman, 1995).

A fundamental set of constructs in landscape design and environmental psychology deal with how humans perceive nature, how they affect nature, and in turn, how they are affected by nature (McHarg, 1969; Nassauer, 1995, 1997; Kaplan and Kaplan, 1998). Nearly three-quarters of the American population now lives in metropolitan areas (Martin and Warner, 1997). Cities, with their highly structured landscapes and defining spatial characteristics, are logical places to explore the relationship between people and nature (Holling and Orians, 1971; Martin and Warner, 1997) and the ways in which people experience their environment (Bonaiuto et al., 1999). Trees and other woody vegetation are important contributors to defining the urban environment, to the aesthetic pleasantness, and to a sense of well being in an urban environment (Schroeder, 1991; Henwood and Pidgeon, 2001).

We selected two adjacent communities, Riverside and Berwyn in Illinois, to explore the relationship between people, their environment, and the concept of natural capital in an urban setting. Although natural capital is generally regarded as the benefits provided through ecosystem services, we intend to view natural capital from the perspective of the residents in the two study communities and their perceptions regarding "quality of life" within the communities in which they reside.

Riverside and Berwyn, both suburbs of Chicago, offer contrasting paradigms of an urban landscape. In Riverside (Fig. 1), curved streets, large lots, and ample setbacks create a "harmonious community characterized by refined sylvan beauty" (Frederick Law Olmsted, 1869 Riverside plan). The abundant use of trees in Riverside's design makes the suburb a useful setting for studying the effect of an urban forest ecosystem on a community and its residents. In contrast, the adjacent community of Berwyn has a more traditional design for an urban community in Middle America with right-angled streets, small lots, and narrow setbacks for houses (Fig. 1). Designed with utility and functionality in mind, Berwyn is dominated by roads and houses.

Specifically, the following questions were addressed: Is landscape pattern as measured by its patch structure related to the composition and structure of the woody vegetation (especially trees) on the landscape? Do residents perceive and respond to differences in the composition and structure of urban landscapes? Finally, through comparison with Berwyn, is a mature urban forest ecosystem, as is found in Riverside, more or less preferred psychologically and functionally?

Differences in the organization of the landscape, we hypothesized, will result in differences in the composition and structure of the urban forest between the two communities. For our purposes, the urban forest was considered to be the assemblage of woody vegetation found within the urban landscape matrix. Further, if differences do occur in the composition and structure of the urban forest, do they produce differences in how the residents perceive and respond to their immediate environment? Our objective was to assess empirically the appreciation and effect of the urban environments in Riverside and Berwyn on their residents at the individual and household levels.

2. Study areas

2.1. Riverside

Riverside is a 650 ha planned community of almost 8700 residents along the Des Plaines River west of Chicago. It is nationally and internationally recognized as one of the first planned suburban communities in the United States, designed during the period 1868–1870 by Frederick Law Olmsted, the founder of American landscape architecture, and has associate, Calvert Vaux (Eaton, 1963–1964; Blodgett, 1976). They evoked four central principles in designing Riverside. These were the provision for and perception of open spaces, the preservation and enhancement of natural features, the

Fig. 1. The structure of the urban landscape is determined largely by the patterns created by the individual lots and the road network. The irregular lots and curvilinear streets in Riverside (top) differed markedly from the rectangular grid in Berwyn (bottom).

promotion of improved human health, convenience, and safety, and the choreography of views (Table 1). These principles were achieved through design elements including a curvilinear system of depressed streets, large residential lots with wide front setbacks, small and large public spaces with a naturalistic character, layered plantings in public spaces that block or recreate sightlines, and a core of parks and commons that organized the entire design (Table 1). The planners promoted the use of trees to "soften" the landscape, and trees remain an important part of Riverside today. The original trees are gone, but with their ongoing replacement by the village forester and by property owners, an extensive urban forest remains relatively intact.

According to Olmsted, the properly planned suburb should demonstrate an "aspect of secluded peacefulness and tranquility" far more pervasive than could be found in an unplanned urban community (Sutton, 1971). Olmsted's suburban aesthetic had its roots in the design philosophies of late 18th century English landscape gardeners and writers, including Lancelot Brown, Humphry Repton, Uvedale Price, and William Gilpin, and in Andrew Jackson Downing's American interpretation of their philosophies (Beveridge and Rocheleau, 1995). The works of Brown and Repton inspired Olmsted's pastoral style, marked by expanses of turf interrupted by scattered groves of trees. Olmsted's application of this aesthetic to the suburb was motivated by his belief in the reparative effects of nature on mental and physical health. He believed scenery stimulated the imagination, causing the relaxation of mental and physical faculties made tense from the stresses of urban life. This effect came not from an analysis of the details of the landscape but from an unconscious appreciation of the whole.

Today, much of Olmsted's original design for the land east of the Des Plaines River remains intact, due to the foresight of Olmsted's plan and the continuing, active support of community leaders and village residents. The curvilinear road system has been unaltered in overall form, although the road surface has been raised in all but the first division of the suburb,

Table 1
Olmsted's design principles applied to Riverside, IL, USA

Design principle	Elements
Provisions for and perception of open space	Organization and placement of triangle parks
	30 ft.minimum setback
	Sunken roads
	Visual and physical access to public open spaces
	100 ft. minimum lot frontage
	Roads designed with curving alignment
	Absence of sharp corners and perpendicular intersections
Preservation and enhancement of natural features	Choice of plant materials
	Preference for native plants
	Non-native plants used with discretion
	Avoidance of showy and formal floral displays
	River used as an organizing element
	Naturalistic plant arrangement, not formal or geometric groupings
	Reserve the "best" of the site for public use
Fostering of improved health, convenience, safety	Transportation to urban centers via parkway and railroad
	Separation of uses
	Walking paths from driving
	Active from passive recreation spaces
	Living from working environments
	Generous lot sizes
	600 ft. to public open space from any residence
	Public utilities and infrastructure (water and gas lighting)
	Walks and roads designed and constructed for positive drainage
Choreography of views	Irregular masses of vegetation
	Roads and walks designed with curving alignment
	Absence of sharp corners and perpendicular intersections
	Use of plantings to frame, block, or terminate views
	Variation in vegetative texture and color
	Alternating light and shade patterns
	Use of plantings to create rooms and secret spaces within larger landscape
	Visual access to and across public open spaces

and the original granite gutters have been replaced with concrete curbs. The village continues to enforce ordinances requiring a generous front setback for residential development, although some of the original lots have been divided into two lots. Public furnishings such as benches and gas streetlights have been restored in residential areas and in the central business district.

In addition to its rich design heritage, Riverside has considerable social capital. Its population is affluent and well educated. In 2000, 94% of village residents over the age of 25 had at least a high school education, and 51% had at least a bachelor's degree. Over 67% of residents over the age of 16 were employed, 51% of those in a management or professional occupation. The median household income was US$ 64,931 (source: United State census data).

Despite its many resources, Riverside today faces a number of challenges, complicated by its status as a National Historic Landmark and as an icon of landscape design. The village's tax base, never broad because of the lack of extensive commercial development, continues to erode as businesses leave the central business district. Riverside residents apparently prefer to shop in the strip developments and shopping malls of neighboring suburbs. Between 1990 and 2000, the village's population increased by 1.4%, from 8774 to 8895. Riverside's population lacks racial and ethnic diversity. Minority groups constituted slightly more than 1% of Riverside's population in 2000. The village has been unable to attract a more diverse population, including young families, because of the lack of affordable homing. In 2000, the median home value

was US$ 264,200 and the median monthly rent was US$ 647.

2.2. Berwyn

Directly to the east of Riverside lies Berwyn, a working class community with small, conventional residential lots laid out on the orthogonal grid of streets characteristic of many Midwestern communities. Berwyn has its origins in the late 1800s, and in the first two decades of the 20th century, Berwyn developed in much the same way as other Chicago suburbs. Today, Berwyn is a thriving city of more than 50,000 residents representing a diverse mix of ethnic groups and comprised mainly of middle class families. Chicago-style bungalows and small apartment buildings constitute most of Berwyn's housing stock.

According to the 2000 U.S. Census, 29% of Berwyn residents over the age of 25 had at least a high school degree, and 11% had at least a bachelor's degree. Roughly 64% of residents over the age of 16 are employed, with 26% of those employed working in management or professionally related occupations. The median household income in 2000 was US$ 43,833 (source: United States census data).

In 2000, 15% of residents were over the age of 62. Between 1990 and 2000, the city's population increased by almost 19%, from 45,426 to 54,016. Berwyn's population is more diverse than Riverside's, with minority groups constituting 27% of Berwyn's population in 2000. Berwyn has been able to attract a more diverse population, including young families, because of its affordable housing. Unlike Riverside, Berwyn has several self-developed commercial districts. In 2000, the median home value was US$ 133,900 and the median monthly rent was US$ 593.

Riverside and Berwyn offer two adjacent communities with similar topography and original ecological landscapes, yet different demographic characteristics, and markedly different ecological and aesthetic characters.

3. Methods

3.1. Survey methodology

In August 2001, random samples of Riverside and Berwyn households were selected from household address lists obtained from a commercial vendor, and one resident per household was surveyed by mail. A total of 321 surveys were returned from Riverside and 150 from Berwyn for a total of 471 useable surveys received for the study.

Survey instruments included a photosurvey assessing respondents' perception of and preference for land design elements (results of the photosurvey are not presented in this paper) and a written questionnaire assessing their frequency of interaction with various natural and built environments, perception of and preference for specific community attributes linked to Olmsted's design principles at Riverside, and attitudes toward the benefits and annoyances of the urban forest.

The written survey included four questions. The first question asked respondents to rate their overall opinion of their neighborhood. The second question attempted to measure the frequency of respondents' interaction with the surrounding natural and built environment. Four sub-items further asked respondents to report how often they: visited or walked near local rivers, streams, or lakes; visited or walked in local woodlands or other natural areas; strolled through their immediate neighborhood; strolled through their community's downtown or other business districts. The third item in the written questionnaire asked respondents to rate how much 60 separate features of their town, neighborhood, or residential lot contributed to their preference for their town. Each feature was keyed to one of the four central design principles guiding Olmsted's design of Riverside (Table 1). The element "Public open space kept natural," for example, references the second design principle, "preserve and enhancement of natural features". A follow-up, open-ended question (Question 4) asked respondents to report any other features contributing to their preference for their town.

Another set of items sampled the attitude of residents toward the urban forest in their community. Respondents were asked to indicate the degree of benefit or annoyance they received from the trees growing in their yard or immediate neighborhood. These questions included fixed-response items asking the respondent to rate specific features of the urban forest and open-ended items requesting reports of other beneficial or annoying features of urban trees. Additional open-ended questions asked respondents to describe features contributing to respondents' liking their community; positive features of urban forests, and annoying

features of urban forests. A final open-ended question asked respondents for any additional comments they might have on any subject related to the survey.

Finally, the questionnaire collected background data for respondents and their households, including age, gender, number of household residents, and household income. Background data were collected for use as independent variables in the analysis of other survey data, including preference data and attitudinal data. Background data were also collected from the 2000 U.S. Census for Berwyn and Riverside, to identify potential bias due to unit non-responses.

3.2. Tree survey

As part of the surveys conducted in Riverside and Berwyn, we asked permission to inventory the trees on the respondents' property. For those residents granting permission, we recorded the tree species, stem diameter at 1.37 m (DBH), and general condition (i.e., vigor) for each tree within the private lot. Woody species with a measurable stem diameter at 1.37 m in height were included in the survey. Condition classes ranged from good condition ($\leq$5% of the crown showing dieback or leaf discoloration), fair condition ($>5 \leq 50$% canopy dieback or leaf discoloration), poor condition ($>50 \leq 99$% canopy dieback or leaf discoloration), and dead but standing. Lots were surveyed during the summers of 2001 and 2002. In addition, we compared the inventories for Riverside and Berwyn to those published in Nowak (1994) for the greater Chicago metropolitan area. A total of 86 lots were surveyed in Riverside, while 71 lots were survey in Berwyn. Lot areas were determined from aerial photography.

3.3. Analyses

Respondent data were analyzed in two separate steps. First, for the combined Riverside–Berwyn sample, community attribute ratings, and tree benefit and annoyance items were subjected to factor analysis. Stable categories of items were identified and subsequently tested for their degree of coherence using Cronbach (1951) computed α as a measure of internal consistency. Alpha is an estimate of the correlation expected between two tests drawn at random from a pool of items like the items in the test. In the second step, relationships between these categories and background variables including community of residence were investigated using analysis of variance.

Open-ended responses (and identifying information including town and case identification number) were extracted from returned surveys, reviewed, and placed in one or more of the following subject categories: architecture, central business district, community attributes, Fredrick Law Olmsted, nature, open space, personal property, streets, vegetation, wildlife, or miscellaneous. Opened-responses were coded based on these categories, and both the total number of respondents reporting a particular category and the total number of times a coding category was reported were calculated. The second number could exceed the first number, since a single respondent could report multiple categories of responses. Within each major category, prevalent subcategories (comments constituting five or more percent of the total number of comments) were identified and used to develop an extended definition for the major category.

4. Results

4.1. Community comparison: landscape structure

The 86 residential lots surveyed in Riverside varied in shape and size, ranged from 575 to 1698 m^2 and averaged 990.9 m^2 in area. In comparison, all 71 survey residential lots in Berwyn were rectangular in shape, ranged from 284 to 755 m^2 and averaged 424.2 m^2 in area. The differences in landscape structure between the two communities are best viewed in Fig. 1.

4.2. Community comparison: urban forest

The abundance, structure, and composition of the urban forest differed between the two adjacent communities. Trees were far more abundant in Riverside yards compared to Berwyn (Table 2). In Riverside, the most common woody species is buckthorn (*Rhamnus cathartica*), a native of Europe, western and northern Asia, but is widely naturalized throughout eastern North America. Native species such as American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), and red mulberry (*Morus rubra*) are also common to Riverside. A variety of fruit, ornamental, and introduced trees, common apple (*Malus pumila*), wild crab

Table 2
The 10 most frequently measured yard trees in Berwyn and Riverside and all trees in suburban areas of Cook County

Species	Tree population	
	Sampled (number)	Total (%)
Riverside yard trees		
Buckthorn	503	16.8
Red mulberry	236	7.9
Green ash	198	6.6
American elm	185	6.2
Downy serviceberry	164	5.5
Wild crab apple	138	4.6
Northern hackberry	103	3.4
Silver maple	88	2.9
Redbud	87	2.9
Eastern redcedar	70	2.3
Berwyn yard trees		
Common apple	30	11.1
Wild crab apple	29	10.7
Southern magnolia	27	10.0
Red mulberry	16	5.9
Colorado blue spruce	16	5.9
American elm	13	4.8
Eastern redcedar	10	3.7
Silver maple	10	3.7
Redbud	9	3.3
White spruce	9	3.3
Suburban Cook County		
Buckthorn	4601600	14.5
Green ash	3181900	10.0
Sweet cherry	2619300	8.2
American elm	2126400	6.7
Boxelder	1757800	5.5
Hawthorn	1715600	5.4
Alder	1337200	4.2
Silver maple	1220200	3.8
Red oak	1044100	3.3
Poplar	841400	2.6

Number sampled represents the number of stems measured in 86 lots in Riverside and 71 lots in Berwyn. Figures for suburban Cook County are from Table 8 in Nowak (1994).

apple (*Malus coronaria*), southern magnolia (*Magnolia grandiflora*), Colorado blue spruce (*Picea pungens*) are most abundant in Berwyn (Table 2). Mulberry is common in both communities. As with buckthorn, birds eat the abundant fruit of mulberry (bright-red drupes that turn black) and disseminate the seeds widely throughout the urban landscape (Barnes and Wagner, 2004).

Given the differences in abundance, it is not surprising that the urban forest in Riverside is far more diverse than in Berwyn. For Berwyn, a total of 38 woody species were recorded in 71 lots, with a mean of 1.39 ± 1.44 (S.D.) species per lot. In comparison, a total of 84 species were recorded in 86 lots in Riverside and the mean number of species per lot for Riverside is 8.75 ± 5.60. A weak ($R^2 = 0.46$) but statistically significant correlation ($p < 0.05$) exists between lot size and number of woody species. Larger lots or patches in the urban landscape tend to have a greater number of species than smaller patches, although there was much variation in the relationship.

The structure of the urban forest as measured by tree size differed between the two communities. In comparing the distributions of stem diameters, a negative exponential distribution exists for Riverside compared to a more normal distribution for Berwyn (Fig. 2). The urban forest in Riverside has a higher proportion of stems in smaller diameter classes (buckthorn accounts for many of these small stems) compared to Berwyn, while Berwyn has a greater proportion of stems in the mid-size classes (Fig. 2). The proportional representation in the largest DBH classes was similar for the two communities.

There were also differences in condition classes for trees between Riverside and Berwyn (Fig. 3). Eighty-six percent of the trees in Berwyn were in good condition compared to 53% in Riverside. Fewer trees in Berwyn were in the fair and poor condition compared to Riverside (Fig. 3).

The composition of the urban forest in Berwyn differs from that in Riverside and the broader suburban Cook County (Table 2). The composition of the urban forest in Riverside is similar to that for suburban Cook County. American elm is still abundant in this urban forest. Green ash has been widely planted both as a yard and street tree following the loss of elm to Dutch elm disease in the Chicago metropolitan area.

4.3. Community attributes

Factor analysis of the 60 community attributes yielded seven internally consistent categories: green residential atmosphere, neighborhood built structure, personal trees, social atmosphere, locomotion, recreation, and business/commercial environment (Table 3). In the combined analysis from both communities, respondents indicated that a green residential atmosphere was the most important community quality

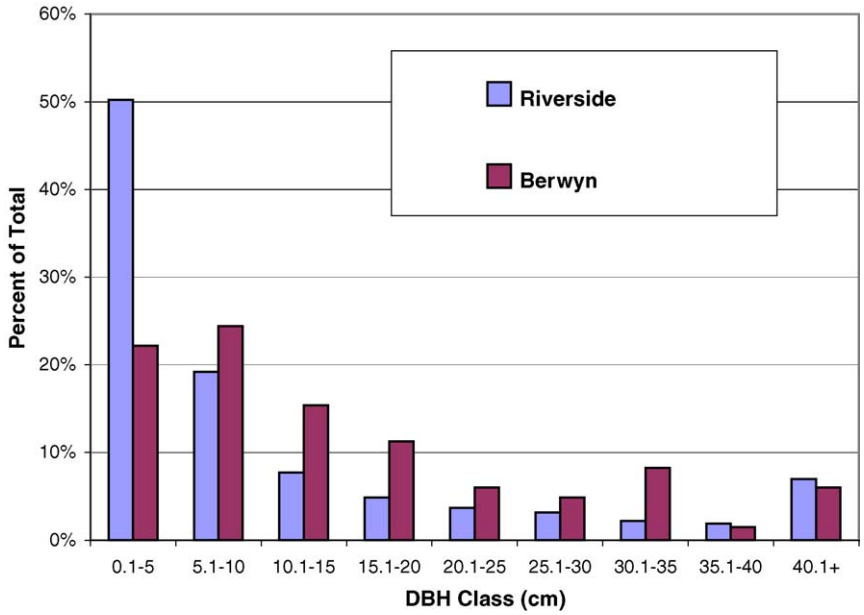

Fig. 2. The distribution of tree diameters in Berwyn and Riverside.

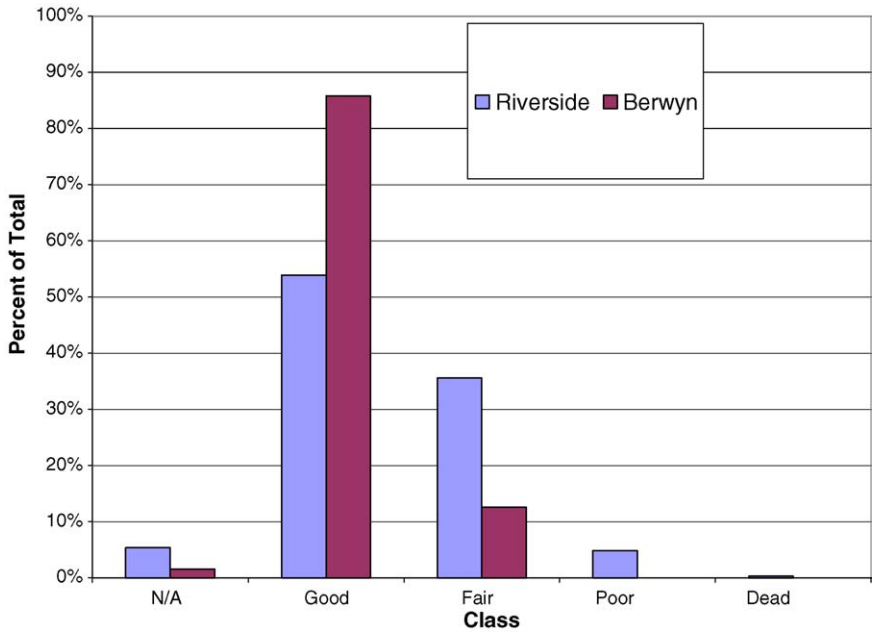

Fig. 3. The condition classes for trees in Berwyn and Riverside.

Table 3
Community attribute categories

Category name and included measures	Mean	S.D.	Alpha (α)
Green residential atmosphere	3.96	0.76	0.92
Nearby river or pond			
Nearness of home to public open space			
Large shade trees			
Having nature right outside my door			
Number of trees in neighborhood			
Landscaping of public space			
Layout of public open space			
Amount of open spaces			
Management of local natural areas			
Trees in public areas			
Public open space kept natural			
Landscaping using native plants			
Neighborhood built structure	3.80	0.79	0.92
Landscaping of private yards			
Nearness of houses to one another			
Views from windows of your home			
Historic structures			
Design of major streets			
Distance from house to street			
Sense of visual openness			
Size of lot			
Architecture of homes			
Design of the town/community			
Layout of streets			
Shape of housing lots			
Placement of houses on lots			
Personal trees	3.66	1.22	0.85
Number of trees in your front yard			
Number of trees in your back yard			
Social atmosphere	3.61	0.93	0.86
Vibrant social community			
Having good friends nearby			
Friendliness of citizens			
Neighborliness of the people			
Locomotion	3.48	0.84	0.59
Ease of finding ways around town			
Walkways being separated from roads			
Placement of sidewalks with respect to roads			
Recreation	3.40	0.97	0.83
Amount of public recreation space			
Nearness of public recreation sites			
Recreation sites to enjoy with family			
Playgrounds			
Ball fields playgrounds			
Business/commercial environment	3.09	0.91	0.87
City services			
Convenient shopping			
Nearby central business district			
Maintenance of downtown areas			
Vibrant downtowns			
Design of central business district			
Thriving commercial districts			

Means, standard deviations (S.D.), and alpha (α) values are based on the combined Riverside and Berwyn samples.
Note: Means are based on a five-point rating scale with larger values denoting greater endorsement.

contributing to their appreciation for their town (mean = 3.96 from a scale of 1–5, where 5 represents the strongest endorsement). Attributes contributing to this quality include the close proximity of managed natural areas and other open space, the presence of mature shade trees, and landscape using native plants (Table 3). The built structures of their community also had a strong, positive effect on respondents liking their town (mean = 3.80). Basic characteristics defining this cluster include: street design, residential lot size and shape, width of the front yard setback, placement of houses on their lots, distance between houses, presence of historic structures, landscaping of private space, architecture of homes, degree of visual openness, and the view from the window (Table 3).

Respondents rated the contribution of personal trees and of social atmosphere somewhat lower (means = 3.66 and 3.61, respectively), and the contributions of locomotion and of recreation lower yet (means = 3.48 and 3.40, respectively). Personal trees, that is, the number of trees in the yard, did have a high variation associated with the mean (Table 3). Respondents rated the seventh and final community quality, business/commercial environment, much lower than any other category of attributes (mean = 3.09) (Table 3).

4.4. Comparisons of attributes between Riverside and Berwyn

Riverside respondents reported significantly higher endorsement for all categories except for the downtown business/commercial environment and the locomotion or ease of wayfinding through the community (Table 4).

Table 4
Community attribute categories: comparisons

Category name	Riverside mean	Berwyn mean
Neighborhood built structure	4.11	3.13
Green residential atmosphere	4.24	3.36
Business/commercial environment	3.00	3.31
Recreation	3.41*	3.36*
Social atmosphere	3.67	3.48
Locomotion	3.40	3.65
Personal trees	3.91	3.12

All comparisons of community means are significant at $p < 0.05$ except those marked with an asterisk (*).
Note: Means are based on a five-point rating scale with larger values denoting greater endorsement.

The categories most closely linked to Olmsted's design principles for Riverside (e.g., design of neighborhood, use of nearby nature, presence of nearby trees, Table 1) are all attributes more highly rated by the respondents from Riverside. The differences in endorsements for the community attributes were significantly different ($p < 0.05$) in all cases except recreation (Table 4).

4.5. Community attributes and background variables

4.5.1. Length of residency

Respondents who reported living in their current community for more than 20 years also reported significantly higher ratings for the personal trees category than did people who had lived in their community 7 or fewer years ($F = 3.149$; d.f. = 2493; $p \leq 0.05$).

4.5.2. Gender

For the combined Riverside–Berwyn sample, females reported significantly higher ratings for all community attribute categories except the personal trees category. Neighborhood built structure and recreation categories differed significantly by gender at the 0.05 level; green residential atmosphere, business/commercial environment, social atmosphere, and locomotion atmosphere categories differed significantly at $p \leq 0.01$. When the Riverside and Berwyn samples were analyzed separately, no significant, gender-based differences were noted for Berwyn respondents. However, female Riverside respondents reported significantly higher ratings for green residential atmosphere and business/commercial environment ($p \leq 0.01$) and for locomotion atmosphere ($p \leq 0.05$).

4.5.3. Age

Respondents between the ages of 20 and 44 reported valuing the recreational attributes of their community significantly higher than did respondents aged 44–55 ($F = 3.229$; d.f. = 2504; $p \leq 0.05$).

4.5.4. Resident children

Community attributes in the recreation and social atmosphere categories made significantly greater contributions to community appreciation among respondents with resident children under 18 years of age than among respondents without resident children

(recreation: $F = 21.646$; d.f. = 1486; $p \leq 0.01$; social atmosphere: $F = 9.118$; d.f. = l484; $p \leq 0.01$).

4.5.5. Education level

Respondents with some college education or less rated attributes in the business/commercial environment category higher than did respondents with a graduate level education ($F = 7.077$; d.f. = 2509; $p \leq 0.01$). Similarly, respondents with some college education or less rated the locomotion category higher than did respondents with either a bachelor's or graduate degree ($F = 13.989$; d.f. = 2509; $p \leq 0.01$). Respondents with graduate degrees reported significantly higher ratings for attributes in the personal trees category than did respondents with some college or less ($F = 7.929$; d.f. = 2, 503; $p \leq 0.01$).

4.5.6. Future residency

Respondents planning to stay in their community for as long as possible reported higher ratings for attributes in the categories of neighborhood built structure ($F = 63.471$; d.f. = 1505; $p \leq 0.01$), green residential atmosphere ($F = 43.715$; d.f. = 1505; $p \leq 0.01$), business/commercial environment ($F = 4.423$; d.f. = 1505; $p \leq 0.05$), social atmosphere ($F = l\,3.780$; d.f. = 1502; $p \leq 0.01$), locomotion ($F = 10.275$; d.f. = 1505; $p \leq 0.01$), and personal trees ($F = l9.082$; d.f. = 1499, $p \leq 0.01$).

4.5.7. Income

Income was also positively correlated with ratings for community attributes in the following categories: neighborhood built structure ($F = 8.441$; d.f. = 4339; $p \leq 0.001$), green residential atmosphere ($F = 4.121$; d.f. = 4339; $p \leq 0.01$), business/commercial environment ($F = 4.194$; d.f. = 4339; $p \leq 0.001$), locomotion ($F = 3.113$; d.f. = 4339; $p \leq 0.05$), and personal trees ($F = 2.814$; d.f. = 4334; $p \leq 0.05$).

4.6. Benefits and annoyances of the urban forest

Factor analysis of the 20 items on benefits of the nearby urban forest yielded four coherent and internally consistent categories of benefits: visual, nature-related, utilitarian, and watchable wildlife (Table 5). Respondents reported receiving the greatest benefit from visual features of the urban forest, including enhanced appearance of their immediate neighborhood and their own yard and home (mean = 4.55). Sample members also greatly appreciated the feeling of connectedness to nature engendered by the urban forest and the utilitarian benefits of the forest, and its modification of the respondent's immediate living environment (nature-related benefits category, mean = 4.30; utilitarian benefits, mean = 4.07). Respondents rated the fourth and final category, watchable wildlife, much lower than any other category of benefits, although a large standard deviation was measured with the mean (Table 5).

Table 5
Categories of benefits of the urban forest

Category name and included measures	Mean	S.D.	Alpha (α)
Visual	4.55	0.6	0.74
Pleasing to the eye			
Enhances look of yard and home			
Enhances look of neighborhood			
Provides shade			
Nature-related	4.30	0.9	0.76
Marks season change			
Brings nature closer			
Filters pollutants from the air			
Utilitarian	4.07	1.1	0.79
Reduces wind speed			
Reduces noise			
Increases privacy			
Cools home in summer			
Screens unwanted views			
Watchable wildlife	2.02	1.4	0.76
Attracts birds			
Attracts wildlife			

Note: Means are based on a five-point rating scale with larger values denoting greater endorsement.

Factor analysis of the 20 items on the annoying features of the nearby urban forest produced three coherent and internally consistent categories of annoyances: upkeep problems, excessive shading, and messy features (Table 6). Upkeep problems associated with trees (not including the inevitable upkeep required by fallen leaves, twigs, and branches) were the greatest source of annoyance (mean = 2.33). Respondents indicated that the messiness of urban trees and their excessive shading of yards and neighborhood streets were somewhat less of an annoyance (excessive shading, mean = 2.28; messy features, mean = 2.25). Large variations were associated with these means. Comparison of mean category ratings for urban forest benefits and annoyances

Table 6
Categories of annoying features of the urban forest

Category name and included measures	Mean	S.D.	Alpha (α)
Upkeep problems	2.83	1.5	0.82
Blocks sun so lawn/plants would not grow			
Branches/suckers grow from tree roots			
Diseases on tree			
Fruits, nuts, or pods fall from tree			
Reduces safety by limiting visibility			
Roots clog sewers			
Sidewalk damaged by tree roots			
Trees block desired view			
Excessive shading	2.28	2.1	0.87
Makes street dark			
Makes yard dark			
Messy features	2.25	1.1	0.75
Attracts squirrels			
Fallen leaves in autumn			
Falling twigs and branches			
Spring flower parts fall from trees			

Note: Means are based on a five-point rating scale with larger values denoting greater endorsement.

indicates that the perceived benefits of urban trees considerably outweigh the inconveniences they cause (Tables 5 and 6). Overall, respondents reported receiving a major benefit and only a minor to moderate degree of annoyance from the trees in their yard or immediate neighborhood.

4.7. Community comparison: benefits and annoyances

Significant differences between the mean ratings of Riverside and Berwyn respondents were found for two of the four categories of benefits (Table 7). Riverside participants reported receiving greater benefit from the visual and nature-related features of the urban forest than did Berwyn respondents. Interestingly, despite the greater preservation of natural features and closer proximity of natural areas to residential areas in Riverside, no significant difference was found between Riverside and Berwyn respondents for the watchable wildlife category.

Table 7
Benefits of the urban forest: community comparisons

Category name	Riverside mean	Berwyn mean
Visual	4.67	4.30
Nature-related	4.38	4 13
Utilitarian	4.10*	4.00*
Watchable wildlife	1.99*	2.06*

Note: Means we based on a five-point rating scale with larger values denoting greater endorsement. Comparisons of community means are significant at $p < 0.05$ except those marked with an asterisk (*).

Despite the maturity, density, and abundance of Riverside's urban forest, Riverside respondents reported receiving a significantly lower degree of annoyance from the trees in their yards or immediate neighborhood for all three categories of annoyances compared to Berwyn residents (Table 8). The greatest absolute difference in category means was found for excessive shading. Riverside respondents reported only minor annoyance from excessive shading, while Berwyn residents reported moderate annoyance. This finding is somewhat ironic, since ecosystem inventory results suggest that Riverside's residential lots are far more heavily shaded man those in Berwyn.

4.8. Demographic variables

4.8.1. Similarities

Survey data suggest that Riverside and Berwyn respondents are similar in terms of gender composition, household size, number of household residents, and length of residency in the community. The gender distributions were statistically identical for the two groups of respondents, with almost equal numbers of men and women from each town returning the survey (Riverside: 49% male, 51% female; Berwyn: 50% male, 50% female). Reported household size was similar for Riverside and Berwyn respondents (Riverside: 2.70; Berwyn: 2.73). However, Berwyn had a statis-

Table 8
Annoyances of the urban forest: community comparisons

Category name	Riverside mean	Berwyn mean
Upkeep problems	2.66	3.17
Messy features	2.14	2.47
Excessive shading	1.97	2.94

Note: Means are baaed on a five-point rating scale with lager values denoting greater endorsement. All comparisons of community means are significant at $p < 0.05$.

tically significant greater percentages of households with resident children less than 18 years of age than Riverside (Pearson's Chi square (χ^2) = 15.173, d.f. = 4, $p \leq 0.01$).

4.8.2. Differences

The Berwyn and Riverside respondent groups are very different in terms of age structure, level of education, home ownership, plans to remain in the community, and the person responsible for yard work. The age distributions for the two groups are significantly different (Pearson's Chi square (χ^2) = 17.979, d.f. = 9, $p \leq 0.05$). The two groups of respondents also differ in terms of reported highest level of educational attainment (Pearson's Chi square (χ^2) = 36.817, d.f. = 5, $p \leq 0.01$). As a group, Riverside respondents are more highly educated than Berwyn respondents. Patterns of home ownership also differ between the two groups (Pearson's Chi square (χ^2) = 12.484, d.f. = 3, $p \leq 0.01$), although in both communities a large majority of respondents own their own homes (94% in Riverside, 84% in Berwyn). Another significant difference between the two respondent groups is the length of time that respondents intend to stay in their communities (Pearson's Chi square (χ^2) = 50.00, d.f. = 3, $p \leq 0.01$). Of the Riverside respondents, 75% indicated that they planned to remain in the village as long as possible. Only 45% of Berwyn respondents reported planning to stay in Berwyn for as long as possible, and 37% indicated that they planned to remain for only 1–5 more years.

4.9. Benefit categories and background variables

4.9.1. Gender

Statistically significant gender-based differences were found for all benefit categories except the watchable wildlife category, with female respondents from Riverside and Berwyn reporting higher levels of benefit than male respondents ($p \leq 0.01$ for respondents from both communities combined and for Riverside alone).

4.9.2. Age

Respondents over the age of 55 reported a significantly higher rating in the nature-related benefits category than did those between the ages of 20 and 44 ($F = 5.066$; d.f. = 2501; $p \leq 0.01$). Respondents over the age of 55 also reported a significantly higher level of benefit in the watchable wildlife category, compared to respondents from age categories 20–44 and 45–54 ($F = 14.005$; d.f. = 2503; $p \leq 0.01$).

4.9.3. Education level

People with higher educational attainment reported significantly higher levels of benefit in the watchable wildlife category ($F = 10.118$; d.f. = 2506; $p \leq 0.01$).

4.9.4. Future residency

Respondents planning to stay in their current communities for as long as possible reported higher benefit ratings for the visual ($F = 24.201$; d.f. = 1503; $p \leq 0.01$), utilitarian ($F = 4.483$; d.f. = 1502; $p \leq 0.05$), and nature-related ($F = 18.726$; d.f. = 1502; $p \leq 0.01$) benefit categories.

4.9.5. Income

Household income was positively correlated with ratings in the utilitarian and watchable wildlife categories.

5. Discussion

5.1. Nature in the city

We studied peoples' perceptions and responses to community character as conveyed through local landscape features. Three specific questions were addressed: Is landscape structure and composition related? Do urban residents perceive and respond to differences in landscape characteristics? Do residents show preferences among differences in landscape characteristics? These questions were investigated in two adjacent but contrasting urban landscapes.

The morphology of the urban landscape did affect the diversity of trees in the urban forest. Riverside, with its greater diversity in sizes and shapes of patches (lots) had greater diversity in woody vegetation as measured by size and species. The urban environment creates the physical space in which trees and other vegetation grows. Thus, the combination of urban morphology, its effect on the urban environment, and human activities (i.e., yard management) determine the composition and structure of the urban forest. The large lots in Riverside provide the opportunity to grow large trees

and for "semi-natural" areas in which large shrubs and large and small trees can dominate. The smaller lots in Berwyn are clipped and cultivated using small shrubs (not measured in our survey), small- and medium-sized trees. In Berwyn, fences not vegetation were used to create privacy.

Differences in responses between residents of the two communities were related to differences in community character. Significantly higher endorsements of the green residential atmosphere (i.e., nature in the urban area) and neighborhood built structures were measured in Riverside compared to Berwyn. Residents in Berwyn stressed the social relationships, the ease of navigation (locomotion, Table 4), and the business/commercial environment in their community. Many factors contribute to a sense of well being in an urban setting (Amerigo and Aragones, 1997). Among these factors, the aesthetic pleasantness, the presence of social relationships, and a sense of personal safety are paramount (Bonaiuto et al., 1999).

A varied response to the urban forest, and more generally to nature, was noted between the two communities. Some respondents in Riverside expressed in their open-ended comments an appreciation for the "wild look" of naturalistic landscapes. A more common response in Berwyn was a preference for "well-landscaped green". In some cases, access to open space with vegetation and trees was identified as an important community feature or an important consideration in purchasing a house. Several Berwyn residents noted the need for more trees and more natural areas within their community.

"I like the 'wild look', but not if the plants are invasive species" – Riverside

"I wish our town had more trees and natural areas" – Berwyn

Stark differences in the structure and composition of landscapes between Riverside and Berwyn did not always produce stark differences in perceptions and responses among the residents. Both Riverside and Berwyn respondents perceived their general environment, including the woody vegetation and the residential landscape, as having a positive effect on their outlook and sense of well being. All respondents held nature in high regard, commenting on the general benefits of a natural environment, including tranquility and improved mental health. Nature was also considered by residents of both communities to offer an escape from the pressures of work and city life. Further, respondents in our study expressed an appreciation for easy access to the peacefulness that residential parks and natural areas can provide.

"Nature is the ultimate goodness" – Riverside

"Well landscaped green is pleasing no matter what" – Riverside

"I intend to move in two years, but I hate to leave my trees and birds" – Berwyn

"We realize how important nature is and recognize it needs to be more of a part of our lives" – Riverside

"Nature should always be a part of any development" – Berwyn

"I am in heaven whenever I am in the midst of trees, flowers, plants and grass. I love nature and need it in my life. We should fiercely protect and nurture all forests; no exceptions" – Berwyn

Comparison of mean category ratings for urban forest benefits and annoyances indicates that the perceived benefits of urban trees considerably outweigh the inconveniences they inflict. Overall, respondents reported receiving a major to very major degree of benefit and only a minor to moderate degree of annoyance from the trees in their yards or immediate neighborhood. Woody vegetation, and more generally nature, was viewed as a desirable community feature influencing the respondents' decision to live as a resident in their community. Such results are not surprising given nature's restorative powers as well as the well-documented preferences for natural settings (e.g., Kaplan and Kaplan, 1989;Hartig et al., 1991; Schroeder, 1991; Kaplan, 1995, 2001).

Although there is an appreciation for trees and other vegetation, respondents did voice concern with their maintenance requirements. Both Riverside and Berwyn residents expressed concern about potential property damage from falling trees or large limbs, but despite

these dangers, they clearly valued their trees. Several Riverside respondents commented on the overgrown character of public parks and walkways and voiced concern about the safety of pedestrians walking along paths engulfed by shrubs. Trees and shrubs growing too close to intersections were also cited as potential safety hazards.

Both positive and negative responses were received on the topic of urban wildlife. Some respondents viewed animals such as raccoons and squirrels as nuisances. Other respondents expressed an appreciation for urban wildlife, including birds, deer, raccoons, and squirrels. Both Berwyn and Riverside residents commented on the presence of birds in their yards. Reports from Riverside residents described a fauna, including deer and fox, more diverse than that found in most urban residential areas.

"Just having a yard with a lot of different birds and wildlife other than pigeons and rats" – Riverside

"I love the birds that live in my yard" – Berwyn

Although prominent, woody vegetation is only a part of the biotic environment in an urban setting. Well-kept lawns and cultivated flower gardens are other features important to the residents of Berwyn and Riverside. In fact, the expansive lawn free of insidious weeds has become the symbol of America suburbia and Olmsted is often credited as its champion (Bormann et al., 1993). Since manicured lawns and gardens were common features of both communities, we considered these biotic features to be constants in our experimental design.

5.2. *Community*

Both Riverside and Berwyn residents reported a number of positive features about their communities, including the aesthetics, layout, general atmosphere, and proximity to Chicago. They also expressed negative feelings about the maintenance of street trees, noting the problems in pruning, leaf litter removal, and general upkeep. Riverside residents provided very positive feedback and were vocal on the topics of community aesthetics and layout.

"I moved here for the country feel and look, not lots of people" – Riverside

"I am thankful everyday to have the privilege to live here" – Riverside

"The village is very slow to responding to request for pruning of branches and removal of downed limbs due to storms and heavy winds" – Berwyn

"Old town feel, not new suburban layout" – Berwyn

Riverside residents had many positive comments on the aesthetics of their community. They remarked how the gas street lamps create a "quaint village feel" and expressed appreciation for the community's landscape and plantings. However, the level of maintenance required to keep the village's urban forest healthy and tidy discouraged respondents. Respondents complained about maintenance costs, maintenance-related noise pollution, organic litter in gutters, and the lack of communication with the village's maintenance department.

Riverside and Berwyn residents indicated an appreciation for neighborhood open space and the preservation of natural areas. Residents welcomed tree-covered open space as a respite from the heavily urbanized areas surrounding Chicago, viewing such open space as a patch of nature surrounded by cement.

"I sincerely appreciate the open areas that haven't been converted to ball fields and kiddy playgrounds" – Riverside

"A welcome relief to the built landscape" – Berwyn

The only negative comment on open space centered on fear that it could provide opportunities for criminal activity.

Residents in both communities responded positively to the diversity of their communities' homes, recognizing their historic relevance. They recognized and appreciated specific architectural designs, such as those of Frank Lloyd Wright and Louis Sullivan.

Residents of Berwyn and Riverside consistently ranked the business/commercial environment low as a favorable attribute for their community. This result

is not surprising. Berwyn has a poorly defined central business district and no traditional downtown area. Unattractive strip development dominates the city's commercial areas. Riverside does have a traditional downtown area, anchored by the village hall, library, and commuter train station. However, the small, surrounding business district cannot be called "thriving" or "vibrant".

5.3. Demographic variables

Survey data suggest that the Riverside and Berwyn respondent groups are similar in terms of gender composition, household size, number of household residents, and length of residency in the community. Statistically significant differences between the two groups were found for age structure, level of education, home ownership, plans to remain in the community, and the person responsible for yard work. Differences in socio-demographic factors such as age and gender as well as length of residency do influence peoples' perceptions of their residential environment (Carp and Carp, 1982; Fried, 1982; Francescato et al., 1989; Bonaiuto et al., 1999).

On average, younger families live in Berwyn; they are less educated, and more mobile compared to the average for Riverside. At the risk of stereotyping, Berwyn can be characterized as a "blue collar" and middle-class community, while Riverside is a "white collar" and upper-middle class community. By-and-large, residents in Riverside are content to stay put; people in Berwyn see themselves as "on-the-way-up" the social and economic ladder.

6. Conclusions

In Riverside during the late 1860s, Olmsted and Vaux created the archetype for the American suburb by attempting to create a pastoral feeling in an urban environment. Given its prominence in the American landscape, it is worthwhile revisiting Riverside and its residents within the context of contemporary living. The adjacent community of Berwyn, developed at about the same time as Riverside, offers a contrast with its more traditional and functional urban design.

Residents of Riverside recognize and continue to value the landscape features (Table 1) created through Olmsted's and Vaux's vision. The strength of the endorsement is best illustrated by their desire to remain in the community. In Riverside, 75% of the surveyed residents planned to remain in the village as long as possible. In Berwyn, only 45% of the respondents planned to stay as long as possible.

Although differences in endorsements within and between communities by gender, age, presence of children, education levels and income were apparent, and substantial differences in the abundance, composition, and structure of the urban forest occurred between the two adjacent communities, residents in both communities ranked the presence of a green residential atmosphere as an important community attribute. There is a wide range of characters for the green residential atmosphere that are acceptable and pleasing. The small lots in Berwyn limited the presence of large mature trees, but residents valued their clipped shrubs, manicured lawns, small- and medium-sized ornamental trees, and small gardens and flowerbeds. In contrast, residents in Riverside valued their large shade trees, their open spaces, and the privacy created by vegetative screens (albeit often from the invasive species buckthorn). Clearly, residents in Riverside found the variation in the form and function characteristic of their landscape (produced by both human-made and natural capital) to be pleasing, thus contributing to their quality of life.

Residents in both communities perceived having "nature right outside my door" and residents in both communities found this perceived proximity to nature as contributing to their sense of well being, satisfaction, and comfort. Further, our results suggest that the physical, biological, and psychological values of trees and other perennial vegetation come in many forms and are realized in varied settings.

The Riverside experience has been applied, and in some respects even amplified, in suburban developments throughout North America. Larger house are being built on larger lots at ever-increasing distances from the center of the city. As a result, small increases in urban population create large increases in the urban footprint. The challenge remains for urban planners and designers to create an appealing urban environment with "nature at the doorstep" under high-density living conditions. To meet this challenge, we have as much to learn from Berwyn as Riverside.

When rethinking approaches to urban designing and planning, it is important to consider the larger context in which we live (Hawken et al., 2003). Much of this context depends on the valuation placed by people on both natural capital and human-made capital. Natural capital, however, is not perceived in terms of ethereal processes such as production of oxygen, maintenance of biological diversity, purification of water, or decomposition of organic wastes, but as attributes that characterize what we call the "green residential atmosphere". The composition and structure of the green environment in which we live provide a more palpable form of natural capital.

Acknowledgements

We thank the following students at the University of Michigan, School of Natural Resources and Environment, for their valuable contributions to this study: Jessica Kenzie, Lybra Lindke, Keith McDade, Tom Sweeney, Christopher Charles, Paul Coseo, Christopher Cox, Greg DeVries, Erica Kovacs, Julyk Kiyoko, Grace Manubay, Karla Rogers, Clea Rome, Jennifer Smith, Stan Szwalek, and John Taylor. The research was funded through a McIntire-Stennis grant from the Ecosystem Management Initiative, University of Michigan. The United States Department of Agriculture Forest Service, North Central Research Station, also supported the study. Herb Schroeder, North Central Research Station, and Rachel Kaplan, University of Michigan, provided advice and counsel in developing the survey instruments used in our study. Comments from Marion Potschin and two anonymous reviewers greatly improved the manuscript. S. Faikes, A. Szot, J. Kest, and M. Vendura conducted a Master's Project "Revisiting Riverside, A Frederick Law Olmsted Community" prior to our research. We benefited from their work in planning and conducting our study.

References

Amerigo, M., Aragones, J.I., 1997. A theoretical and methodological approach to the study of residential satisfaction. J. Environ. Psychol. 17, 47–57.

Andersen, B., Crow, T.R., Lietz, S.M., Stearns, F., 1996. Transformation of a landscape in the upper mid-west, USA: the history of the lower St. Croix river valley, 1830 to present. Landscape Urban Plann. 35, 247–267.

Barnes, B.V., Wagner Jr., W.H., 2004. Michigan Trees, A Guide to the Trees of the Great Lakes Region. The University of Michigan Press, Ann Arbor.

Beveridge, C.E., Rocheleau, P., 1995. Frederick Law Olmsted: Designing the American Landscape. Rizzoli, New York.

Blodgett, G., 1976. Frederick Law Olmsted: landscape architecture as conservation reform. J. Am. Hist. 62, 869–889.

Bonaiuto, M., Aiello, A., Perugini, M., Bonnes, M., Ercolani, A.P., 1999. Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. J. Environ. Psychol. 19, 331–352.

Bormann, F.H., Balmori, D., Geballe, G.T., 1993. Redesigning the American Lawn. Yale University Press, New Haven.

Carp, F.M., Carp, A., 1982. Perceived environmental quality of neighborhoods: development of assessment scales and their relation to age and gender. J. Environ. Psychol. 2, 245–312.

Cronbach, L.J., 1951. Coefficient alpha and the internal structure of tests. Psychometrika 16, 297–335.

Eaton, L.K., 1963–1964. The American suburb: dream and nightmare. Landscape 13, 12–16.

Eaton, M.M., 1997. The beauty that requires health. In: Nassauer, J.I. (Ed.), Placing Nature, Culture and Landscape Ecology. Island Press, Washington, DC, pp. 85–106.

Forman, R.T.T., 1995. Land Mosaics, the Ecology of Landscapes and Regions. Cambridge University Press, Cambridge.

Francescato, G., Weidemann, S., Anderson, J.R., 1989. Evaluating the built environment from the users' point of view: an attitudinal model of residential satisfaction. In: Preiser, W.F.E. (Ed.), Building Evaluation. Basic Books, New York, pp. 151–171.

Fried, M., 1982. Residential attachment: sources of residential and community satisfaction. J. Soc. Issues 38, 107–119.

Hartig, T., Mang, M., Evans, G.W., 1991. Restorative effects of natural environment experiences. Environ. Behav. 23, 3–26.

Hawken, P., Lovins, A., Lovins, L.H., 2003. Natural Capitalism: Creating the Next Industrial Revolution. Rocky Mountain Institute, Snowmass, CO.

Henwood, K., Pidgeon, N., 2001. Talk about woods and trees: threat of urbanization, stability, and biodiversity. J. Environ. Psychol. 21, 125–147.

Holling, C.S., Orians, G., 1971. Toward an urban ecology. Ecol. Soc. Am. Bull. 52, 2–6.

Kaplan, R., 2001. The nature of the view from home, psychological benefits. Environ. Behav. 33, 507–542.

Kaplan, R., Kaplan, S., 1989. The Experience of Nature: A Psychological Perspective. Cambridge University Press, New York.

Kaplan, R., Kaplan, S., 1998. With People in Mind: Design and Management of Everyday Nature. Island Press, Washington, DC.

Kaplan, S., 1995. The restorative benefits of nature: toward an integrative framework. J. Environ. Psychol. 15, 169–182.

Martin, J.A., Warner Jr., S.B., 1997. Urban conservation: sociable, green, and affordable. In: Nassauer, J.I. (Ed.), Placing Nature, Culture and Landscape Ecology. Island Press, Washington, DC, pp. 109–122.

McHarg, I.L., 1969. Design with Nature. Natural History Press, Doubleday, Garden City, NY.

Meyer, W.B., Turner II, B.L. (Eds.), 1994. Changes in Land Use and Land Cover: A Global Perspective. Cambridge University Press, Cambridge.

Nassauer, J.I., 1995. Culture and changing landscape structure. Landscape Ecol. 10, 229–238.

Nassauer, J.I., 1997. Cultural sustainability: aligning aesthetics and ecology. In: Nassauer, J.I. (Ed.), Placing Nature, Culture and Landscape Ecology. Island Press, Washington, DC, pp. 65–84.

Nowak, D.J., 1994. Urban forest structure: the state of Chicago's urban forest. In: McPherson, E.G., Nowak, D.J., Rowntree, R.A. (Eds.), Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project. United States Department Agriculture Forest Service, pp. 3–18, General Technical Report NE-186.

Schroeder, H.W., 1991. The psychological value of trees. Public Garden 6, 17–19.

Sutton, S.B. (Ed.), 1971. A Selection of Frederick Law Olmsted's Writings on City Landscapes. MIT Press, Boston.

Thomas Crow is the national program leader for ecological research with the USDA Forest Service, Washington, DC, where he is on the Wildlife, Fish, Water, and Air Research Staff. From 1998 to 2000, he was a visiting professor in the School of Natural Resources and Environment, University of Michigan. He is the past president of the U.S. Section of the International Association of Landscape Ecology and is the current Chair of the IUFRO Working Party for Landscape Ecology. His research has focused largely on applying principles and concepts from landscape ecology to managing natural resources.

Terry Brown is a professor, Landscape Architecture Program, School of Natural Resources and Environment, University of Michigan. He received his degrees in landscape architecture from the University of Wisconsin and Harvard University. At the University of Michigan, he teaches in the areas of landscape planning, geographic information systems, site engineering, and design. His research interests include the interrelationships of landscape design and landscape planning processes, with special focus on the role of aesthetic analysis in scenic management.

Raymond He Yonag is an associate professor in the School of Natural Resources and Environment and a faculty associate in the Program in the Environment, University of Michigan. He received engineering degrees from the Stevens Institute of Technology in New Jersey and his PhD in environmental planning from the University of Michigan. Much of his research is conducted in the area of environmental psychology as it relates to the interaction between people and nature.