Urban residents' perceptions of birds in the neighborhood: Biodiversity, cultural ecosystem services, and disservices

Authors: Belaire, J. Amy, Westphal, Lynne M., Whelan, Christopher J., and Minor, Emily S.

Source: The Condor, 117(2) : 192-202

Published By: American Ornithological Society

URL: https://doi.org/10.1650/CONDOR-14-128.1

THE CONDOR
Ornithological Applications
AmericanOrnithology.org

Volume 117, 2015, pp. 192–202
DOI: 10.1650/CONDOR-14-128.1

RESEARCH ARTICLE

Urban residents' perceptions of birds in the neighborhood: Biodiversity, cultural ecosystem services, and disservices

J. Amy Belaire,[1,a]* Lynne M. Westphal,[2] Christopher J. Whelan,[3] and Emily S. Minor[1]

[1] University of Illinois at Chicago, Department of Biological Sciences, Chicago, Illinois, USA
[2] U.S. Forest Service, Northern Research Station, "People and Their Environments" Research Program, Evanston, Illinois, USA
[3] Illinois Natural History Survey, c/o Department of Biological Science, University of Illinois at Chicago, Chicago, Illinois, USA
[a] Current address: Wild Basin Creative Research Center, St. Edward's University, Austin, Texas, USA
* Corresponding author: jbelaire@stedwards.edu

Submitted August 9, 2014; Accepted February 9, 2015; Published April 22, 2015

ABSTRACT

As our world becomes increasingly urbanized, cities are often where we come into contact with the natural world—not just in parks and urban nature preserves, but in more familiar places like residential yards. We conducted bird surveys and social surveys in Chicago-area residential landscapes near forest preserves (primarily in middle- and high-income areas) to examine residents' perceptions of the birds that co-inhabit their neighborhoods and the relationship of those perceptions with characteristics of the bird community. We found that residents value many aspects of neighborhood birds, especially those related to aesthetics and birds' place in the ecosystem. Our results indicate that while birds were generally well liked and annoyances were minor, several common and visible urban species, such as the House Sparrow (*Passer domesticus*), European Starling (*Sturnus vulgaris*), and Blue Jay (*Cyanocitta cristata*), may attract attention for their negative qualities, such as their sounds and effects on personal property. The results also indicate that residents' valuations of ecosystem services are linked to their perceptions of bird species richness rather than the actual species richness, and people may perceive only a subset of the birds in their neighborhoods. Although birds provide many important ecosystem services, perhaps one of their most important roles in cities is as a relatable and likable connecting point between city dwellers and the broader environment.

Keywords: Chicago, ecosystem services, residential landscapes, urban bird

Percepción de los residentes urbanos de las aves del vecindario: Biodiversidad, servicios ecosistémicos culturales y perjuicios

RESUMEN

A medida que nuestro mundo se urbaniza cada vez más, las ciudades son usualmente los lugares donde nos ponemos en contacto con el mundo natural– no solo en parques y reservas naturales urbanas, sino en lugares más familiares como los jardines residenciales. Realizamos muestreos de aves y encuestas sociales en los paisajes residenciales del área de Chicago cercanos a las reservas forestales (principalmente en áreas de ingresos medios y altos) para examinar la percepción que tienen los residentes de las aves que cohabitan sus vecindarios y cómo estas percepciones se relacionan con las características de las comunidades de las aves. Encontramos que los residentes valoran muchos aspectos de las aves del vecindario, especialmente aquellos relacionados con valores estéticos y el rol de las aves en el ecosistema. Nuestros resultados indicaron que aunque las aves fueron generalmente apreciadas y que las molestias fueron menores, muchas especies urbanas comunes y visibles, como *Passer domesticus*, *Sturnus vulgaris* y *Cyanocitta cristata*, llaman la atención por sus cualidades negativas, como sus sonidos y sus efectos sobre la propiedad personal. Los resultados indican también que los valores de los residentes vinculados a los servicios ecosistémicos están relacionados a la percepción que tienen de la riqueza de especies más que a la riqueza real de especies, y que la gente percibe solo un subconjunto de las aves de sus vecindarios. Aunque las aves brindan muchos servicios ecosistémicos importantes, tal vez uno de sus roles más importantes en las ciudades es la conexión positiva que generan entre los habitantes de la ciudad y el entorno ambiental más extenso.

Palabras clave: aves urbanas, Chicago, paisajes residenciales, servicios ecosistémicos

INTRODUCTION

Today's ecologists recognize that humans—both as agents of change and as recipients of environmental benefits—must be explicitly included in our research framework (Daily 1997, Pickett et al. 2001). Human–nature interactions are a two-way relationship (Fuller and Irvine 2010). People affect birds, both intentionally and unintentionally,

through management activities at a range of spatial scales, from residential yards (e.g., Lerman and Warren 2011) to fragmented forest landscapes (Marzluff and Ewing 2001). In turn, birds affect people in many important ways, from controlling agricultural pests to inspiring art (Kellermann et al. 2008, Whelan et al. 2015). Human–nature interactions increasingly occur in our cities, because the majority of people now live in urban areas (UNFPA 2011). These interactions between people and nature in urban areas can have important implications for public support of conservation, but we know very little about how urban residents perceive the birds that co-inhabit their neighborhoods.

The "ecosystem services" that birds provide to people have been increasingly investigated over the past decade (Sekercioglu 2006, Whelan et al. 2008). Some ecosystem services provided by birds are relatively straightforward to quantify. For example, when birds' consumption of insects controls pest populations, the resulting benefit may be quantified as an increase in agricultural yield and net profit (e.g., Mols and Visser 2002, Maas et al. 2013). Birds also benefit humans in ways that are more challenging to commodify in economic or biophysical terms, such as through their indirect effects on ecosystem services (e.g., scavenging affects nutrient cycling, which in turn benefits plants) or the spiritual or symbolic value they may hold for people (Wenny et al. 2011).

The ecosystem-services approach is focused on clearly identifying and accounting for the contributions of nature to human health and well-being, with the goal of aiding decision making. There are several ways to quantify the benefits of ecosystem services. The utilitarian approach, which is most prevalent in recent ecosystem-services research, examines the utility that people derive from the actual or potential use of ecosystems and often quantifies that utility with economic valuation methods (Millennium Ecosystem Assessment 2005). However, the utilitarian approach does not fully capture the complexities of human–nature relationships (Kumar and Kumar 2008, Schroeder 2011). Increasingly, researchers have begun to explore ecosystem-services valuation methods that shed light on the values perceived by those who benefit from the services; some of these techniques involve participatory mapping and/or social-preference surveys for ecosystem services (Raymond et al. 2009, Sherrouse et al. 2011, Calvet-Mir et al. 2012, Martín-López et al. 2012). In addition to expanding valuation methods to include nonutilitarian values, researchers have also noted the importance of increased understanding and inclusion of the intangible benefits that ecosystems provide to people (Chan et al. 2012a, Daniel et al. 2012, Milcu et al. 2013). The Millennium Ecosystem Assessment (2005) recognizes the category of "cultural ecosystem services," which include "the nonmaterial benefits people obtain from ecosystems." For example, cultural ecosystem services are associated with benefits such as spiritual enrichment, aesthetic experiences, inspiration, and educational value (Millennium Ecosystem Assessment 2005, Chan et al. 2012b). Cultural services are primarily related to human perception and can be broadly conceived as ecosystems' contributions to generating knowledge and supporting human experiences (Satterfield et al. 2013). However, many ecosystem services—not just those in the "cultural" category—may have some nonmaterial or intangible benefits for people (e.g., emotional attachments or sense of identity associated with natural resources; Chan et al. 2012a). Although these types of benefits and experiences can be difficult to quantify, they may be just as important to people, if not more so, than the more tangible services or economic benefits (Chan et al. 2012a).

Although the ecosystem-services framework has been widely applied in more undeveloped natural environments, ecosystem services can occur in urban areas (Windhager et al. 2010, Gómez-Baggethun and Barton 2013). Cities are precisely where ecosystem services, including those in the "cultural" category, are especially relevant because they can enhance the health and quality-of-life of large populations of people. Intriguing studies in urban ecosystems have recently suggested a link between bird richness (either real or perceived) and benefits like psychological well-being and neighborhood satisfaction (Fuller et al. 2007, Luck et al. 2011, Dallimer et al. 2012, Shwartz et al. 2014). Despite their importance, the ecosystem services provided in urban areas remain relatively unexplored, especially those related to urban birds.

A few studies have provided some general insight into urban residents' perceptions of birds and their benefits and annoyances. In France, these perceptions varied with the level of urbanization and the associated bird communities. Most respondents indicated that birds were a source of personal pleasure, yet they also commonly agreed that birds caused disturbances by generating dirt and noise (Clergeau et al. 2001). This ambivalence toward birds was echoed by another study of urban residents in Norway: Although small birds were the most liked among 24 common urban animal species, including domestic dogs and cats, respondents also reported problems with several common birds, including gulls and Rock Pigeons (*Columba livia*; Bjerke and Ostdahl 2004). The benefits and problems associated with birds could be linked with the concept of ecosystem services and disservices, respectively. Although ecosystem disservices have not been well explored in recent literature, the concept includes components of ecosystems that are perceived as negative for human well-being (Lyttimäki and Sipilä 2009).

Here, we integrate ecological field methods and social surveys to investigate urban residents' perceptions of the birds that co-inhabit their neighborhoods. We focused on 3 primary research questions. First, what aspects of local birds do residents most value, and what aspects do they find most

annoying? In particular, we focused on intangible goods or experiences that birds provide, such as cultural services related to spiritual enrichment, aesthetic experiences, and educational value, as well as problems such as damages to personal property or concerns about health and safety. Second, are residents' perceptions of biodiversity related to the actual bird diversity in their neighborhoods? Recent studies in Europe have suggested that urban residents are unaware of the biodiversity around them (Dallimer et al. 2012, Shwartz et al. 2014), which supports the "extinction of experience" hypothesis with regard to city dwellers and their relationships with nature (Pyle 2003, Miller 2005). Third, are residents' perceptions of the benefits and annoyances of birds influenced by the characteristics of local bird communities or by characteristics of the residents themselves? Understanding how and why birds matter to people can open the door to public conversations about conservation and management strategies at both broad and local scales.

METHODS

Study Sites

Cook County, Illinois, USA, is home to the city of Chicago and >5 million residents. Our study sites were 25 transects in residential neighborhoods across Cook County; each transect began 100 m from the outer edge of a Cook County forest preserve and extended into the neighborhood for 900 m along residential streets. The residential neighborhoods in our study area were dominated by single-family homes, yards, and street trees. Transects were located ≥500 m apart to minimize spatial dependencies. Our study sites were primarily located in middle- to high-income neighborhoods; this sample characteristic was an artifact of selecting sites near forest preserves for a related study (Belaire et al. 2014) and was not an intentional design. We collected data about both bird communities and human residents along each transect.

Bird Surveys in Residential Neighborhoods

We conducted bird surveys during the peak breeding season in the Chicago area, from June 4 to July 6, 2012 (described in Belaire et al. 2014). Point-count locations were designated every 100 m along each transect, where all birds seen and heard within 50 m of the point were recorded during a 5-min point count (Ralph et al. 1993). Each transect was surveyed twice during the breeding season, on clear, calm mornings between sunrise and 1000 hours. Birds observed flying over the point and species with broad-scale daily movement patterns (e.g., hawks) were not included in analyses.

We described the bird communities in residential neighborhoods at 2 complementary spatial scales. First, we estimated species richness near *each residential parcel* by calculating the total number of species observed at the 4 point-count locations closest to the home (i.e. within ~200 m of each residence). This allowed us to evaluate the bird species richness most likely experienced by a person around his or her home.

Second, we derived a "commonness" index *at the transect scale* for 10 common and highly visible bird species: American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Black-capped Chickadee (*Poecile atricapillus*), Blue Jay, Cedar Waxwing (*Bombycilla cedrorum*), Common Grackle (*Quiscalus quiscula*), Downy Woodpecker (*Picoides pubescens*), European Starling, House Sparrow, and Northern Cardinal (*Cardinalis cardinalis*). The commonness index is a count of the number of points at which a species was observed on each transect. A bird species was scored as "present" at a point if it was observed during either survey. This metric estimates the likelihood that residents on a particular transect would encounter that species. Thus, a bird's commonness index could range from 0 (not observed at any point) to 10 (observed at all point-count locations) for a transect.

Residents' Perceptions of Birds

We invited residents in all single-family homes within 50 m of each transect to participate in a social survey (n = 1,751). We developed a survey (following the guidelines of Dillman et al. 2009) to collect information from residents about their yards and perceptions of birds in their neighborhood (the full survey is available as Supplemental Material Appendix A). We requested that the survey be completed by 1 adult with some responsibility for decisions about managing the yard. Surveys were distributed, along with a $1 token financial incentive, using the "drop-off/pick-up" method (Steele et al. 2001, Allred and Ross-Davis 2011), during July–September, 2012. A token financial incentive has been demonstrated to increase response rates and decrease bias associated with nonresponse (Groves et al. 2006, Dillman et al. 2009). After surveys were collected, we checked for nonresponse bias by comparing respondents to nonrespondents in 2 ways: grass and canopy cover in yards (using 0.6-m QuickBird imagery) and household income (comparing survey responses to American Community Survey data for block groups, which are the smallest geographic units for which the U.S. Census Bureau publishes sample data). These 2 methods were selected because they allowed us to determine whether the results were influenced by lack of response from some segment of the population (Dillman et al. 2009).

The survey included several questions about residents' perceptions of biodiversity in their neighborhood, including an open-ended question that asked residents to estimate the number of bird species on their block. We did not specify a time interval over which residents should

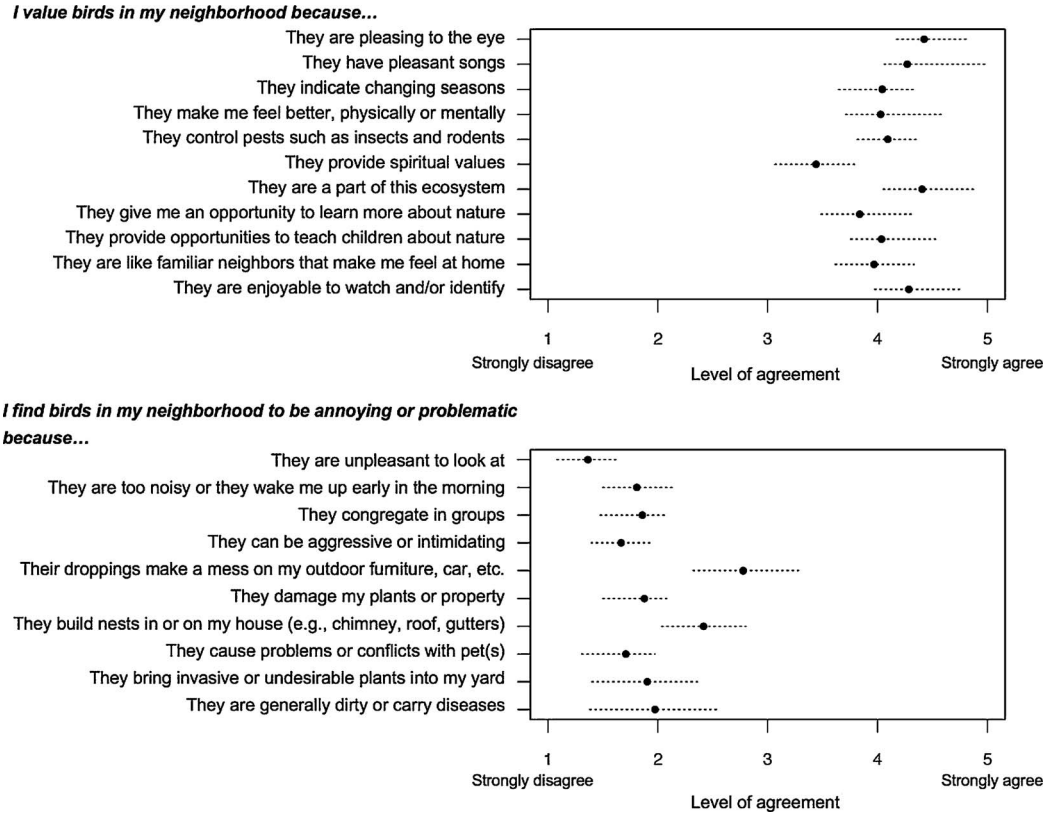

FIGURE 1. Residents' level of agreement with statements about positive (top) and negative (bottom) aspects of birds in in their neighborhoods. Filled circles indicate average response across all respondents, and dotted lines indicate the range of average responses between transects.

estimate the number of species. We used the phrase "types of birds" instead of "bird species" to minimize confusing terms and gave examples (e.g., "cardinals, robins, grackles, woodpeckers") to clarify our meaning. When residents entered a range (e.g., 5–10 or 5+; $n = 95$), we retained their lowest estimate. Lastly, we calculated a measure of each resident's accuracy by subtracting his or her perceived species richness from the observed species richness at the 4 point counts nearest the residence (within ~200 m).

The survey also asked about aspects of neighborhood birds that residents might value or find annoying or problematic. This portion of the survey was adapted from a tested set of questions regarding benefits and annoyances of trees (Sommer et al. 1990, Schroeder and Ruffolo 1996) and is therefore grounded in environmental psychology. The goal of this part of the survey was to gain information about people's perceptions of the birds in their neighborhood. The survey included the statement "I value birds in my neighborhood because…", which was followed by a list of 11 positive aspects of birds (e.g., "They have pleasant songs") (Figure 1). Each of the positive statements describes benefits that urban birds may provide in residential neighborhoods; most of the statements reflect nonmaterial benefits that can be linked with cultural ecosystem services (Table 1). Residents were asked to indicate their level of agreement with each statement on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." The survey also included a question about the negative aspects of birds: "I find birds in my neighborhood to be annoying or problematic because…." This statement was followed by 10 negative items ("They are too noisy or they wake me up early in the morning"), reflecting potential ecosystem "disservices" associated with urban birds (Table 1), and the same 5-point Likert scale for each. For all positive and negative statements, respondents indicated their level of agreement with each and we converted these to numerical values for analysis purposes ("strongly disagree" = 1 and "strongly agree" = 5).

We conducted a series of Spearman's correlation tests to examine the links between biodiversity measures and residents' valuations of the services and disservices of neighborhood birds. The first part of our analysis, with individual resident as the unit of analysis, focused on observed species richness within ~200 m of each home, perceived species richness as indicated on the survey, residents' socioeconomic characteristics (income, age, and education level, as indicated on the survey), and their levels

TABLE 1. Positive and negative statements about birds included in the social survey, with links to the ecosystem-services framework.

I value birds in my neighborhood because...	Ecosystem service type	Type of benefit or value
They are pleasing to the eye	Cultural	Aesthetic value [a]
They have pleasant songs	Cultural	Aesthetic value [a]
They indicate changing seasons	Cultural	Aesthetic value [a]
They make me feel better, physically or mentally	Cultural	Therapeutic value
They control pests such as insects and rodents	Regulating	Reduce nuisance populations
They provide spiritual values	Cultural	Spiritual value [a]
They are a part of this ecosystem	Cultural	Existence value [a]
They give me an opportunity to learn more about nature	Cultural	Educational value [a]
They provide opportunities to teach children about nature	Cultural	Educational value [a]
They are like familiar neighbors that make me feel at home	Cultural	Place value [a]
They are enjoyable to watch and/or identify	Cultural	Activity value [a]; recreation value
I find birds in my neighborhood to be annoying or problematic because...	**Ecosystem service type**	**Type of negative effect**
They are unpleasant to look at	Disservice	Aesthetic
They are too noisy or they wake me up early in the morning	Disservice	Aesthetic
They congregate in groups	Disservice	Aesthetic; fear and stress [b]
They can be aggressive or intimidating	Disservice	Fear or stress [b]
Their droppings make a mess on my outdoor furniture, car, etc.	Disservice	Negative effects on personal property [b]; health or safety concerns [b]
They damage my plants or property	Disservice	Negative effects on personal property [b]
They build nests in or on my house (e.g., chimney, roof, gutters)	Disservice	Negative effects on personal property [b]
They cause problems or conflicts with pets	Disservice	Negative effects on personal property [b]; fear and stress [b]
They bring invasive or undesirable plants into my yard	Disservice	Negative effects on personal property [b]
They are generally dirty or carry diseases	Disservice	Health or safety concerns [b]; fear and stress [b]

[a] Indicates category of benefits associated with cultural ecosystem services, as discussed in Chan et al. (2012b: supplementary data).
[b] Indicates types of disservices, as discussed in Lyttimäki and Sipilä (2009) and Gómez-Baggethun and Barton (2013).

of agreement and disagreement with each statement about birds. In the second part of the analysis, we focused on transects as the unit of analysis, with the "commonness" indices and average bird valuation scores for all residents on each transect. Results are presented as means ± SD.

RESULTS

We received responses from 924 residents (52.7% response rate). Twelve surveys with missing addresses or incomplete responses were excluded, leaving 912 surveys for the analysis. Household income in our study sites ranged from around $45,000 to $191,000 (American Community Survey data, 2005–2009), and the median income class for all respondents was $100,000 to $150,000 (Table 3). Respondents included all potential age groups (normally distributed around the mean age of 55; range: 18–100 yr old), and the majority of respondents were college educated (69.4% of all respondents). Checks for nonresponse bias (using paired *t*-tests) indicated that residents who did not respond to the survey did not differ significantly from respondents with respect to yard composition (grass cover, $P = 0.42$; canopy cover, $P = 0.54$). Similarly, income of respondents did not differ significantly from that of residents in the block group (as summarized in 2005–2009 American Community Survey data; paired *t*-test for income, $P = 0.60$). Although it is possible that some groups of people were more likely to respond to the survey than others, these tests suggest that the survey results were not biased by lack of response from a particular group of residents. Because our study sites were selected as part of a related study, these demographics are not necessarily representative of Chicago residents.

What Are the Benefits and Annoyances of Birds in Residential Neighborhoods?

We found that residents agreed or strongly agreed with many of the positive statements about birds, and they indicated strongest levels of agreement with the statements "I value birds in my neighborhood because they are pleasing to the eye" (4.42 ± 0.92 across all respondents; 1 = strongly disagree, 5 = strongly agree) and "I value birds in my neighborhood because they are a part of this ecosystem" (4.40 ± 0.80) (Figure 1). Residents indicated the least agreement with the positive statement "I value

TABLE 2. Spearman's rank correlations of services and disservices and measures of bird diversity. Relationships with socioeconomic characteristics are shown for comparison. Symbols indicate whether r_s was negative (–) or positive (+). Only statistically significant relationships ($P < 0.05$) are shown. For full text of services and disservices, see Figure 1. Scientific names of birds are given in the text.

	Pleasing to the eye	Pleasant songs	Indicate changing seasons	Make me feel better	Control pests	Spiritual values	Part of this ecosystem	Opportunity to learn about nature	Opportunity to teach children	Like familiar neighbors, feel at home	Enjoyable to watch–identify	Unpleasant to look at	Noisy–wake me up	Congregate in groups	Aggressive or intimidating	Droppings make mess	Damage my plants–property	Build nests on my house	Conflict with pets	Bring unwanted plants into yard	Dirty or carry diseases
Bird diversity measure																					
Observed species richness [a]	+						+														
Perceived species richness [b]	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–		–
Socioeconomic characteristics																					
Income [c]	+					–	+														
Age [d]	+	+	+	+	+	+		+		+	+	–	–	–	–	–	–		–		–
Education level [e]	+						+														
Commonness measure [f]																					
American Goldfinch																					
American Robin													+								
Black-capped Chickadee																					
Cedar Waxwing																					
Downy Woodpecker																					
Northern Cardinal																			–		
House Sparrow	–	–		–				–			–			+		+					
European Starling												+		+			+				
Common Grackle											–						+				
Blue Jay		–	–	–		–												+		+	

[a] Observed species richness within ~200 m of resident, calculated as total of all species observed at nearest 4 point-count locations (i.e. within 200 m of resident's home; $n = 912$). Surveys conducted during the peak breeding season (June 4–July 6, 2012) in the Chicago area, Cook County, Illinois, USA.

[b] As indicated on resident's questionnaire; correlation conducted with individual resident as the unit of analysis ($n = 849$, after removing responses in which "estimated species richness" was left blank).

[c] As indicated on resident's questionnaire; correlation conducted with individual resident as the unit of analysis ($n = 526$, after removing responses in which "income" was left blank).

[d] As indicated on resident's questionnaire; correlation conducted with individual resident as the unit of analysis ($n = 843$, after removing responses in which "age" was left blank).

[e] As indicated on resident's questionnaire; correlation conducted with individual resident as the unit of analysis ($n = 836$, after removing responses in which "education level" was left blank).

[f] "Commonness" index for each bird species on a transect, as described in the text. Correlation conducted with residents' value scores averaged across transect ($n = 25$). Surveys conducted during the peak breeding season (June 4–July 6, 2012) in the Chicago area, Cook County, Illinois, USA.

TABLE 3. Summary statistics for our survey respondents from the Chicago area, Cook County, Illinois, USA.

	Median	Mean ± SD
Income category [a]	4	3.52 ± 1.17
Age	54	55.0 ± 14.90
Education level [b]	3	3.41 ± 1.30

[a] Survey included the following categories for household income: (1) <$25,000; (2) $25,000–50,000; (3) $50,000–100,000; (4) $100,000–150,000; and (5) >$150,000. By comparison, the current median household income for Chicago is $47,270.

[b] Survey responses were coded into the following categories for highest level of education completed: (1) high school; (2) some college or vocational school; (3) 4-yr college degree; (4) some graduate school; or (5) graduate degree.

birds in my neighborhood because they provide spiritual value" (3.43 ± 1.09).

Residents generally did not agree that birds in their neighborhoods were annoying or problematic. For all but 2 of the negative statements, the average rating was between "disagree" and "strongly disagree." The 2 exceptions were "I find birds in my neighborhood to be annoying or problematic because their droppings make a mess on my outdoor furniture, car, etc." (2.77 ± 1.28) and "I find birds in my neighborhood to be annoying or problematic because they build nests in or on my house (e.g., chimney, roof, gutters)" (2.41 ± 1.21). But even for those statements, the average response was between "disagree" and "neutral."

How Is Perceived Bird Diversity Related to Observed Bird Diversity?

We observed a total of 36 bird species across the study sites during the breeding season. Bird species richness at the transect scale ranged from 11 to 21 species (mean = 16.0). This represents only breeding bird communities in the neighborhood and, thus, is less than if we had considered passage migrants and winter residents.

For all survey respondents, the mean perceived species richness was 9.51 ± 13.14 (range: 0–200). Prior to analysis, we removed responses that were left blank ($n = 63$). We found no relationship between perceived and observed bird species richness (Pearson's $r = 0.06$, $P = 0.07$). We also found a weak trend, in that perceived bird diversity became increasingly inaccurate (observed minus estimated species richness) as the observed species richness increased (Pearson's $r = 0.11$, $P = 0.001$).

What Are the Links between Services and Disservices and Measures of Bird Biodiversity?

We found that residents' perceptions of species richness were significantly related to their level of agreement with all 11 positive statements (Table 2). In other words, when residents perceived more bird species in their neighborhoods, they agreed more strongly with positive statements about birds. However, observed species richness was related to only 2 of the 11 positive statements. For the negative statements about neighborhood birds, perceived species richness was significantly correlated with 9 of the 10, whereas observed species richness was associated with none (Table 2). As for socioeconomic characteristics, resident-reported age was significantly correlated with 9 of the 11 positive statements and 8 of the 10 negative statements; income was significantly correlated with 3 of the 11 positive statements, and educational level was significantly correlated with 2; neither income nor education was correlated with any of the negative statements (Table 2). Although both age and perceived species richness were correlated with many of the positive and negative statements, age was not correlated with perceived species richness (Spearman $r = 0.03$, $P = 0.39$).

We also examined commonness indices to determine whether any particular bird species was associated with positive and negative statements averaged across the transect. This analysis was conducted at the transect scale because commonness was determined for each bird species along each transect. None of the bird species was positively linked with the positive statements, but 3 species were negatively related to those statements (House Sparrow, Common Grackle, and Blue Jay; Table 2). In addition, 5 bird species were positively related to statements about birds' annoying or problematic aspects (American Robin, House Sparrow, European Starling, Common Grackle, and Blue Jay). For example, when House Sparrows were more commonly encountered on a transect, residents were less likely to agree with positive statements about birds and more likely to agree with negative statements (Table 2).

DISCUSSION

We found that residents value many aspects of neighborhood birds, especially those related to aesthetics and birds' place in the ecosystem. Residents also noted several key negative aspects of birds, especially droppings and nests on personal property; however, residents indicated that these annoyances were only mildly bothersome. We found no relationship between residents' perceptions of bird richness and the observed species richness near their homes. Residents' valuations of the benefits provided by birds were often positively related to their perception of species richness yet unrelated to observed species richness. Lastly, we found that several individual bird species were related to many problems or annoyances (and inversely related to positive statements), which suggests that a few common

bird species may get noticed more for their negative than for their positive qualities.

How and Why Birds Matter

Wenny et al. (2011) called for increased research in describing and quantifying the ecosystem services provided by birds to inform policymaking and land-use decisions that affect bird conservation. The present study contributes to that research agenda by exploring many of the intangible benefits that birds in urban areas provide and how those benefits are perceived. We found especially high levels of agreement among our respondents regarding the aesthetic benefits of birds in neighborhoods. The value of an aesthetic experience, such as the view of a cardinal out the kitchen window, is difficult to quantify but is nonetheless a valued experience. In the ecosystem-services framework, this type of nonmaterial benefit or experience would fall under the category of "cultural services." However, some researchers argue that the ecosystem-services framework cannot fully describe the range of benefits, experiences, and values that people may perceive in natural environments (Schroeder 2011). Consider that residents in our study area indicated a high level of agreement with the statement "I value birds in my neighborhood because they are a part of this ecosystem." Agreement with this statement could reflect the "existence value" that residents attribute to birds, which some researchers have linked with cultural ecosystem services (Chan et al. 2012b). But this statement may also reflect valuation of what birds *are*, in and of themselves, rather than what they *do* for us (or what they could do for us in the future; Schroeder 2011). Schroeder (2011) and Satterfield et al. (2013) discussed in more detail the challenges of the ecosystem-services framework with respect to cultural dimensions and environmental decision making.

Urban Residents' Perceptions of the Nature Experience

Recent studies in urban areas suggest that "people experience nature differently than ecologists" (Shwartz et al. 2014). Our results provide some insight into the state of human–nature connections and imply that efforts to conserve or restore biodiversity in our cities may not translate into enhanced human experiences. Our findings join a growing body of research in suggesting that people link cultural services with their perceptions of biodiversity rather than with actual biodiversity. For example, Dallimer et al. (2012) found that psychological well-being of visitors to urban parks was more strongly influenced by the perception of biodiversity than by the actual biodiversity observed during ecological surveys. Likewise, Shwartz et al. (2014) found that people related their well-being to species diversity in public gardens, but they did not actually notice species richness in those gardens, even when it was experimentally enhanced. We found that residents' valuations of birds were linked to their perceptions of bird richness rather than to the actual species richness, which they generally underestimated. In each of these studies, people seemed to appreciate and desire high species richness, but their perceptions of biodiversity were weakly linked (or not linked at all) to actual biodiversity. Alternatively, people with a greater appreciation for birds may estimate higher species richness (whether accurately or not).

People seem to underestimate the bird diversity in their neighborhoods, which has implications for the "extinction of experience" problem. "Extinction of experience" refers to a theorized cycle of increasing separation between humans and nature over time, wherein biological impoverishment leads to lowered expectations of environmental quality and to apathy in human residents, followed by greater degradation and losses (Pyle 2003, Miller 2005). Our results showed that people do not fully experience the biodiversity in their own neighborhoods, and increased species richness in a neighborhood does not translate to increased perceived species richness by residents. Thus, efforts to increase urban residents' awareness of the nature around them may be a key strategy for combating the extinction of experience problem. Citizen science programs have been shown to enhance city dwellers' awareness of the "everyday biodiversity" in their yards and neighborhoods (Cosquer et al. 2012). In addition, new web-based and smartphone applications make citizen science and identifying backyard wildlife species easier than ever. For example, the iNaturalist platform allows users to snap a photo or record the song or call of a species on their smartphone and upload the observation along with its location, even if they are unsure of the species identity. Then other iNaturalist users help identify the species in question. The Cornell Lab of Ornithology's free Merlin app (http://merlin.allaboutbirds.org/) draws on citizen science observations along with the user's location, time of year, and bird characteristics to provide a "bird ID wizard." This allows users to easily narrow the list of possible matches for the bird observed through the kitchen window. These types of platforms offer engaging ways for people to connect with nature in their own neighborhoods that may be more accessible for the layperson than traditional wildlife field guides.

Our results indicate that while birds were generally well liked and annoyances were minor, several common and visible urban species, such as the House Sparrow, European Starling, and Blue Jay, may attract attention for their negative qualities. The House Sparrow and European Starling are both nonnative species that tend to congregate in noisy groups. The Blue Jay, although colorful and native to the United States, has a raucous, harsh call and is sometimes seen as a "bully" that dominates birdfeeders.

Interestingly, we did not see trends indicating that people link individual bird species with positive qualities. There is some evidence from other studies that people exaggerate negative effects of birds to a point that their perceptions do not accurately represent reality (e.g., in causing crop damage; Weatherhead et al. 1982, Basili and Temple 1999, Triplett et al. 2012). It is possible that negative qualities of certain common bird species may "stick" with residents (more so than positive aspects) and affect their perceptions of other birds in the neighborhood.

It is important to recognize that our study sites were located outside of forest preserves, primarily in middle- to high-income neighborhoods (Table 3), and all transects but 1 were in areas with a median household income greater than that of Chicago ($47,270). However, income may not be a large factor in explaining human–bird relationships. Our results generally indicated a neutral relationship between income and valuation of birds, although income was positively correlated with 2 values for birds and negatively correlated with 1. Not surprisingly, we found that age was often related to positive perceptions of birds, which aligns with other studies in highlighting (1) increasing interest in bird watching with age (Bjerke and Ostdahl 2004) and (2) age as an important predictor for bird feeding (Davies et al. 2012). Another recent study found that socioeconomic variables did not significantly predict residents' valuation of urban birds (e.g., income, education, and age were not significant variables in models predicting Seattle residents' willingness to pay for finch or corvid conservation; Clucas et al. 2014). More work is needed to shed light on this question.

Conservation Implications

Although birds provide many important ecosystem services (Whelan et al. 2008, Wenny et al. 2011), perhaps one of their most important roles is as a relatable component of the broader environment to which people can develop attachments. Our results suggest that birds are highly likable urban species; residents value their neighborhood birds for many different reasons, while the negative aspects of birds are not seen as significant problems. As such, birds may represent an important connecting point between urban residents and the land managers and environmental policymakers focused on enhancing ecosystem services.

There is some evidence that values for birds are linked with yard stewardship activities. Although much analysis on wildlife-friendly activities in yards has focused on socioeconomic characteristics (e.g., the relationship between age and bird feeding; Davies et al. 2012, Clucas et al. 2014), residents' values for birds may be just as important. For example, in a related study, we found that residents' bird valuation scores were more important than socioeconomic factors in explaining the number of wildlife resources and the vegetation complexity in yards (J. A. Belaire et al. personal observation). Other studies have suggested that people and birds may engage in a sort of positive feedback loop, in which people enjoy bird observations in their yards and thus increase their wildlife gardening efforts to draw even more birds (e.g., Head and Muir 2006, Goddard et al. 2013). Birds have also been linked with environmental behaviors beyond the yard scale: Framing climate change in terms of potential harm to birds significantly increases people's interest in activities that reduce carbon footprints (Dickinson et al. 2013).

More broadly, human relationships with nature can affect public support for conservation or management strategies (Fischer et al. 2011). Understanding cultural ecosystem services may provide a "foot in the door" for conservation scientists and managers to begin discussions about real-world problems in ways that are relevant to society (Milcu et al. 2013). Many people already hold strong concerns and values regarding nature, and strategies that highlight those existing values may be most effective in changing environmental behavior (Clayton et al. 2013). For example, if we wanted to appeal to residents in our study area to improve the bird habitats in their neighborhoods, we could emphasize the aesthetic benefits of birds while simultaneously addressing residents' concerns about droppings or nest building.

Humans and nature are intertwined in complex ways that are becoming increasingly important to understand (Turnhout et al. 2013). People and birds will overlap in space more and more frequently as urban growth accelerates worldwide, and the character of our interactions with one another will shape our shared future. As Mark Cocker eloquently notes in his book *Birds & People*, "environmentalists cannot by themselves oversee the protection of birds. It is only when whole societies collectively believe in the goal that it is attainable" (Cocker 2013:10). The results of the present study suggest that urban residents already value birds' contributions to their lives. Efforts to strengthen people's connections to birds could lead to even greater "intangible" benefits for people—and conservation support for birds.

ACKNOWLEDGMENTS

We thank C. Watkins for advice in social survey design and delivery and H. Gin for help with survey distribution and pick-up. We also thank the many residents of Cook County, Illinois, who graciously participated in the survey.

Funding statement: This study is based on work supported by the National Science Foundation (grant DGE-0549245) and by the University of Illinois at Chicago's Department of Biological Sciences Elmer Hadley Graduate Research Award.

Ethics statement: The methods for this research follow institutional ethics protocols and were approved by the University of Illinois at Chicago Institutional Research Board (no. 2012-0434) and Animal Care Committee (no. 12–066).

LITERATURE CITED

Allred, S. B., and A. Ross-Davis (2011). The drop-off and pick-up method: An approach to reduce nonresponse bias in natural resource surveys. Small-Scale Forestry 10:305–318.

Basili, G. D., and S. A. Temple (1999). Dickcissels and crop damage in Venezuela: Defining the problem with ecological models. Ecology 9:732–739.

Belaire, J. A., C. J. Whelan, and E. S. Minor (2014). Having our yards and sharing them too: The collective effects of yards on native bird species in an urban landscape. Ecological Applications 24:2132–2143.

Bjerke, T., and T. Ostdahl (2004). Animal-related attitudes and activities in an urban population. Anthrozoös 17:109–129.

Calvet-Mir, L., E. Gomez-Baggethun, and V. Reyes-Garcia (2012). Beyond food production: Ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees, Northeastern Spain. Ecological Economics 74:153–160.

Chan, K. M. A., A. D. Guerry, P. Balvanera, S. Klain, T. Satterfield, X. Basurto, A. Bostrom, R. Chuenpagdee, R. Gould, B. S. Halpern, N. Hannahs, J. Levine, et al. (2012a). Where are *cultural* and *social* in ecosystem services? A framework for constructive engagement. BioScience 62:744–756.

Chan, K. M. A., T. Satterfield, and J. Goldstein (2012b). Rethinking ecosystem services to better address and navigate cultural values. Ecological Economics 74:8–18.

Clayton, S., C. Litchfield, and E. S. Geller (2013). Psychological science, conservation, and environmental sustainability. Frontiers in Ecology and the Environment 11:377–382.

Clergeau, P., G. Mennechez, A. Sauvage, and A. Lemoine (2001). Human perception and appreciation of birds: A motivation for wildlife conservation in urban environments of France. In Avian Ecology and Conservation in an Urbanizing World (J. M. Marzluff, R. Bowman, and R. Donnelly, Editors). Kluwer Academic, Norwell, MA, USA.

Clucas, B., S. Rabotyagov, and J. M. Marzluff (2014). How much is that birdie in my backyard? A cross-continental economic valuation of native urban songbirds. Urban Ecosystems 18: 251–266.

Cocker, M. (2013). Birds & People. Random House, London, UK.

Cosquer, A., R. Raymond, and A.-C. Prevot-Julliard (2012). Observations of everyday biodiversity: A new perspective for conservation? Ecology and Society 17(4):2.

Daily, G. C. (1997). Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, DC, USA.

Dallimer, M., K. N. Irvine, A. M. J. Skinner, Z. G. Davies, J. R. Rouquette, L. L. Maltby, P. H. Warren, P. R. Armsworth, and K. J. Gaston (2012). Biodiversity and the feel-good factor: Understanding associations between self-reported human well-being and species richness. BioScience 62:47–55.

Daniel, T. C., A. Muhar, A. Arnberger, O. Aznar, J. W. Boyd, K. M. A. Chan, R. Costanza, T. Elmqvist, C. G. Flint, P. H. Gobster, A. Grêt-Regamey, R. Lave, et al. (2012). Contributions of cultural services to the ecosystem services agenda. Proceedings of the National Academy of Sciences USA 109:8812–8819.

Davies, Z. G., R. A. Fuller, M. Dallimer, A. Loram, and K. J. Gaston (2012). Household factors influencing participation in bird feeding activity: A national scale analysis. PLOS One 7(6): e39692.

Dickinson, J. L., R. Crain, S. Yalowitz, and T. M. Cherry (2013). How framing climate change influences citizen scientists' intentions to do something about it. Journal of Environmental Education 44:145–158.

Dillman, D. A., J. D. Smyth, and L. M. Christian (2009). Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method, third edition. Wiley, Hoboken, NJ, USA.

Fischer, A., B. Bednar-Friedl, F. Langers, M. Dobrovodska, N. Geamana, K. Skogen, and M. Dumortier (2011). Universal criteria for species conservation priorities? Findings from a survey of public views across Europe. Biological Conservation 144:998–1007.

Fuller, R. A., and K. N. Irvine (2010). Interactions between people and nature in urban environments. In Urban Ecology (K. J. Gaston, Editor). Cambridge University Press, New York, NY, USA.

Fuller, R. A., K. N. Irvine, P. Devine-Wright, P. H. Warren, and K. J. Gaston (2007). Psychological benefits of greenspace increase with biodiversity. Biology Letters 3:390–394.

Goddard, M. A., A. J. Dougill, and T. G. Benton (2013). Why garden for wildlife? Social and ecological drivers, motivations and barriers for biodiversity management in residential landscapes. Ecological Economics 86:258–273.

Gómez-Baggethun, E., and D. N. Barton (2013). Classifying and valuing ecosystem services for urban planning. Ecological Economics 86:235–245.

Groves, R. M., M. P. Couper, S. Presser, E. Singer, R. Tourangeau, G. P. Acosta, and L. Nelson (2006). Experiments in producing nonresponse bias. Public Opinion Quarterly 70:720–736.

Head, L., and P. Muir (2006). Suburban life and the boundaries of nature: Resilience and rupture in Australian backyard gardens. Transactions of the Institute of British Geographers 31:505–524.

Kellermann, J. L., M. D. Johnson, A. M. Stercho, and S. C. Hackett (2008). Ecological and economic services provided by birds on Jamaican Blue Mountain coffee farms. Conservation Biology 22:1177–1185.

Kumar, M., and P. Kumar (2008). Valuation of the ecosystem services: A psycho-cultural perspective. Ecological Economics 64:808–819.

Lerman, S. B., and P. S. Warren (2011). The conservation value of residential yards: Linking birds and people. Ecological Applications 21:1327–1339.

Luck, G. W., P. Davidson, D. Boxall, and L. Smallbone (2011). Relations between urban bird and plant communities and human well-being and connection to nature. Conservation Biology 25:816–826.

Lyttimäki, J., and M. Sipilä (2009). Hopping on one leg—the challenge of ecosystem disservices for urban green management. Urban Forestry & Urban Greening 8:309–315.

Maas, B., Y. Clough, and T. Tscharntke (2013). Bats and birds increase crop yield in tropical agroforestry landscapes. Ecology Letters 16:1480–1487.

Martín-López, B., I. Iniesta-Arandia, M. García-Llorente, I. Palomo, I. Casado-Arzuaga, D. García Del Amo, E. Gómez-Baggethun, E. Oteros-Rozas, I. Palacios-Agundez, B. Willaarts, J. González, F. Santos-Martín, et al. (2012). Uncovering ecosystem service bundles through social preferences. PLOS One 7(6):e38970.

Marzluff, J. M., and K. Ewing (2001). Restoration of fragmented landscapes for the conservation of birds: A general framework and specific recommendations for urbanizing landscapes. Restoration Ecology 9:280–292.

Milcu, A. I., J. Hanspach, D. Abson, and J. Fischer (2013). Cultural ecosystem services: A literature review and prospects for future research. Ecology and Society 18(3):44.

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC, USA.

Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. Trends in Ecology & Evolution 20:430–434.

Mols, C. M. M., and M. E. Visser (2002). Great Tits can reduce caterpillar damage in apple orchards. Journal of Applied Ecology 39:888–899.

Pickett, S. T. A., M. L. Cadenasso, J. M. Grove, C. H. Nilon, R. V. Pouyat, W. C. Zipperer, and R. Costanza (2001). Urban ecological systems: Linking terrestrial, ecological, physical, and socioeconomic components of metropolitan areas. Annual Review of Ecology and Systematics 32:127–157.

Pyle, R. M. (2003). Nature matrix: Reconnecting people and nature. Oryx 37:206–214.

Ralph, C. J., T. E. Martin, G. R. Geupel, D. F. DeSante, and P. Pyle (1993). Handbook of Field Methods for Monitoring Landbirds. USDA Forest Service General Technical Report PSW-GTR-144-www.

Raymond, C. M., B. A. Bryan, D. H. MacDonald, A. Cast, S. Strathearn, A. Grandgirard, and T. Kalivas (2009). Mapping community values for natural capital and ecosystem services. Ecological Economics 68:1301–1315.

Satterfield, T., R. Gregory, S. Klain, M. Roberts, and K. M. Chan (2013). Culture, intangibles and metrics in environmental management. Journal of Environmental Management 117: 103–114.

Schroeder, H. W. (2011). Environmental values and their relationship to ecological services. In Make no Little Plans: Proceedings of the 42nd Annual Conference of Environmental Design Research Association, Chicago, IL (D. Mittleman and D. A. Middleton, Editors). Environmental Design Research Association, McLean, VA, USA. pp. 212–217.

Schroeder, H. W., and S. R. Ruffolo (1996). Householder evaluations of street trees in a Chicago suburb. Journal of Arboriculture 22:35–43.

Sekercioglu, C. H. (2006). Increasing awareness of avian ecological function. Trends in Ecology & Evolution 21:464–471.

Sherrouse, B. C., J. M. Clement, and D. J. Semmens (2011). A GIS application for assessing, mapping, and quantifying the social values of ecosystem services. Applied Geography 31: 748–760.

Shwartz, A., A. Turbé, L. Simon, and R. Julliard (2014). Enhancing urban biodiversity and its influence on city-dwellers: An experiment. Biological Conservation 171:82–90.

Sommer, R., H. Guenther, and P. A. Barker (1990). Surveying householder response to street trees. Landscape Journal 9: 79–85.

Steele, J., L. Bourke, A. E. Luloff, P. S. Liao, G. L. Theodori, and R. S. Krannich (2001). The drop-off/pick-up method for household survey research. Journal of the Community Development Society 32:238–250.

Triplett, S., G. W. Luck, and P. G. Spooner (2012). The importance of managing the costs and benefits of bird activity for agricultural sustainability. International Journal of Agricultural Sustainability 10:268–288.

Turnhout, E., C. Waterton, K. Neves, and M. Buizer (2013). Rethinking biodiversity: From goods and services to "living with." Conservation Letters 6:154–161.

UNPFA [United Nations Population Fund] (2011). State of the world population 2011: people and possibilities in a world of 7 billion. http://www.unfpa.org/swp

Weatherhead, P. J., S. Tinker, and H. Greenwood (1982). Indirect assessment of avian damage to agriculture. Journal of Applied Ecology 19:773–782.

Wenny, D. G., T. L. DeVault, M. D. Johnson, D. Kelly, C. H. Sekercioglu, D. F. Tomback, and C. J. Whelan (2011). The need to quantify ecosystem services provided by birds. The Auk 128:1–14.

Whelan, C. J., C. H. Sekercioglu, and D. G. Wenny (2015). Bird ecosystem serivces: Economic ornithology for the 21st century. In Why Birds Matter: Bird Ecosystem Function and Ecosystem Services (C. H. Sekercioglu, D. G. Wenny, and C. J. Whelan, Editors). University of Chicago Press, Chicago, IL, USA. In press.

Whelan, C. J., D. G. Wenny, and R. J. Marquis (2008). Ecosystem services provided by birds. Annals of the New York Academy of Sciences 1134:25–60.

Windhager, S., F. Steiner, M. T. Simmons, and D. Heymann (2010). Toward ecosystem services as a basis for design. Landscape Journal 29:107–123.