



Research Paper

Exurban residential household behaviors and values: Influence of parcel size and neighbors on carbon storage potential



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HIGHLIGHTS

- Parcels >0.53 ha (just over 1 acre) (LP) have proportionately less mown lawn.
- LPs have more big trees, more trees planted, and less fertilization or irrigation.
- LP owners are less concerned that their yard fits neighborhood norms.
- Demographic variables alone do not account for differences in landscape behaviors.
- Large exurban lots may provide more carbon storage than smaller lots.

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ABSTRACT

To learn how household characteristics might affect carbon storage on exurban residential parcels, we conducted a web survey of 126 southeast Michigan exurban homeowners. We measured several behaviors that may affect carbon storage: the proportion of parcel mown (or left unmown with woody vegetation), the number of large trees retained, the number of trees planted, how leaf litter was managed, the use of fertilizer, and the use of irrigation. We investigated whether these behaviors might be related to parcel size, homeowners' concern for having a yard that fits neighborhood norms, or household demographic characteristics. We found that owners of large (>0.53 ha) parcels were consistently different from small and medium parcel owners in their management behaviors. Large parcel owners mowed a smaller proportion of their parcels. They also were less likely to fertilize and irrigate, had planted more trees, and had more large trees on their parcels. In addition, they reported being less affected by a desire for their yard to fit neighborhood norms. Our results suggest that parcel size and neighborhood norms together affect landscape behaviors that affect carbon storage. We conclude that for large parcels, size alone may promote carbon-storing management behaviors. However, for smaller parcels, governance should promote appropriate design at the scale of whole blocks or subdivisions in order to drive adoption and acceptance across neighborhoods.

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1. Introduction

Residential landscapes can be considered as social-ecological systems with interactions among ecology, legacy effects, multi-scalar human drivers, and design and management (Cook, Hall, & Larson, 2012; Fissore et al., 2011; Grimm et al., 2008; Pickett,

Cadenasso, McDonnell, & Burch, 2009). Exurban residential landscapes, which we define as “low-density settlements that are contiguous with metropolitan urbanized areas but disconnected from city services of sewer and water” (An, Brown, Nassauer, & Low, 2011), are of particular interest as socio-ecological systems because of their extent and continued growth. In 2007, about 5% of the U.S. land area—41.7 million ha—was estimated to be in nonfarm, rural residential uses, while there were only 24.7 million ha in all urban land uses (including residential) (Nickerson, Ebel, Borchers, & Carriazo, 2011). This study of household behaviors is part of a larger project investigating carbon storage in exurban landscapes in southeast Michigan as coupled natural and human systems.

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We investigated drivers of household behaviors that may enhance landscape carbon storage including: aesthetic preferences (Nassauer, 1988, 1993; Peterson et al., 2012), ease of maintenance (Carrico, Fraser, & Bazuin, 2012), neighborhood norms (Chowdhury et al., 2011), and parcel history (Donnelly & Evans, 2008).

We investigated these behaviors:

- Proportion of the parcel mown, which in southeast Michigan implies that the remaining proportion of the parcel is in forest or brush.
- Irrigation.
- Fertilization.
- Retention on the parcel of leaves, needles, and lawn clippings.
- Retention of large trees that appear to pre-date construction of the residence.
- Planting of trees by the current homeowner.

Our overarching research questions were:

- Is parcel size, which is determined in the development process, related to these behaviors?
- Does concern about fitting in with neighborhood-scale norms for landscape appearance affect these behaviors?
- Do demographic characteristics, including respondent age, number of children, income, and house age, affect these behaviors?

The remaining sections of the introduction review relevant literature regarding parcel size legacy effects, neighborhood-scale norms, demographics, and household carbon storage behaviors.

1.1. Parcel size

Several studies suggest that parcel size, which is a legacy of past development decisions, may be related to residential land cover or landscape management behaviors. Zhou, Troy, and Grove (2008) studied fertilization behavior of 73 Baltimore County, MD, households, and they found that owners of larger parcels applied larger total amounts of fertilizer N but less per unit area. This relates to their observation that homeowners with larger parcels manage the lawn near their house (the “primary lawn”) very intensively, while leaving the rest of the parcel untended in tall grass or fields (Zhou et al., 2008). While this study did not specify the size of “very large lawns” or the “primary lawn,” it included parcels ranging from less than 0.25 ha to larger than 1 ha. Further supporting the idea that parcel size affects residential vegetation, a comparison of land cover in two Morgantown, WV, suburbs with small parcels (0.12 ha and 0.04 ha), found that larger parcels had a higher proportion of land covers that were not bare or impervious (Kim & Zhou, 2012). A study of 360 homeowners in the Twin Cities, MN, area sampled a more complete gradient of housing density in which area in turf grass ranged from 0.02 ha to 3.76 ha, with a mean turf area of 0.15 ha; it found carbon storage to be related to the number of trees and parcel size, with larger parcels having more trees (Fissore et al., 2012).

Studying land cover of exurban townships in southeast Michigan, Robinson (2012) found that the proportion of parcel mown decreased with increasing parcel size, while the proportion in forest cover increased exponentially with increasing parcel size. He concluded that there may be limits to anthropogenic management with large parcel size. Based on homeowner interviews and site sampling of southeast Michigan exurban residential parcels, Nassauer et al. (2014) defined the mown area that extends continuously from the house as the “Zone of Care” (ZOC). They concluded that a threshold effect may occur at approximately one acre (0.45 ha): parcels smaller than approximately one acre have a proportionately larger ZOC than larger parcels. The area beyond the ZOC typically is

wooded in the temperate forest biome of southeast Michigan, storing more carbon per unit area (Hooker & Compton, 2003). Further, Nassauer et al. (2014) suggest a typology of exurban homeowner behaviors that implies that parcel size and neighborhood norms interact to affect residential landscape behaviors (Table 1).

1.2. Neighborhood norms

Several studies have shown that homeowners’ landscape management decisions may be influenced by conformity with neighborhood norms. While broad cultural norms for residential landscapes to look neat or tidy may affect homeowners’ decisions, the influence of their neighbors, including homeowners’ beliefs about their neighbors’ opinions, may have an even stronger effect (Peterson et al., 2012; Nassauer, Wang, & Dayrell, 2009). A survey of 487 Perth, AU, residents largely confirmed Nassauer’s et al. (2009) finding that neighborhood-scale social norms have a significant impact on preferences (Kurz & Baudains, 2012). Grove et al. (2006) note that residential landscape management decisions may be influenced by a desire to express membership within “lifestyle groups” in Baltimore, MD. In Nashville, TN, Carrico et al. (2012) found that when residents were strongly identified with a community having specific social norms, residential landscape decisions were partly motivated to conform to surroundings. A study of Miami, FL, Boston, MA, and Phoenix, AZ, found that “in all locations. . . neighborhood standards function as a constraint on management decisions, often driving yard management choices that households’ report would not be their own preferred choice” (Harris et al., 2012, p. 743). In Leeds, UK, a mixed methods study involving 533 respondents concluded that keeping front yards neat was very important in part as a response to neighborhood standards (Goddard, Dougill, & Benton, 2013).

Spatial aggregation or “clumping” of similar home landscape styles also suggests that homeowners may be responding to norms implied by the appearance of nearby neighbors’ yards. For example, Hunter and Brown (2012) identified a contagion effect in front yard easement gardening styles among adjacent neighbors in Ann Arbor, MI. In addition, Henderson, Perkins, and Nelischer (1998) observed that similar styles of residential landscapes (e.g., lawns that were managed in an unconventional or “alternative” style) tended to be spatially aggregated in Guelph, ON.

Neighborhood-scale influence on parcel management can also be codified through neighborhood and homeowner associations (Lerman, Turner, & Bang, 2012). With varying levels and types of control, these associations can control plant height, lawn management, and numerous other management techniques with implications for ecosystem services (Fraser, Bazuin, Band, & Grove, 2013; Cook et al., 2012).

1.3. Demographic characteristics

Several studies have investigated the relationship between household landscape behaviors and demographic characteristics (e.g., income, education, age), but no significant relationships have been found consistently, and results from different studies sometimes contradict one another. Some studies have grouped demographic variables to explore their relationship with residential land cover (Boone, Cadenasso, Grove, Schwarz, & Buckley, 2010; Giner, Polsky, Pontius, & Runfola, 2013; Troy, Grove, O’Neil-Dunne, Pickett, & Cadenasso, 2007). “Lifestyle groups” (defined by the proprietary PRIZM measure) were found to predict percent realized stewardship within ZIP code areas of Baltimore, MD (Troy et al., 2007). Giner et al. (2013) used the same lifestyle group variables in their study of suburban Boston. Analyzing at the scale of census block groups, they found no relationship between “social stratification” variables—income, home value, education, ethnicity, or

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