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Gathering plants and fungi along the urban-rural gradient: Uncovering differences in the attitudes and practices among urban, suburban, and rural landowners

Anne G. Short Gianotti [a,*], Patrick T. Hurley [b]

[a] Boston University, Department of Earth and Environment, 685 Commonwealth Ave, Suite 130, Boston, MA 02215, USA
[b] Ursinus College, Department of Environmental Studies, PO Box 1000, Collegeville, PA 19426, USA

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ABSTRACT

Gathering non-timber forest products (NTFPs) in cities and rural areas has received growing attention in research and news media. Yet little is known about the frequency of these activities and how attitudes about and the practice of gathering differ across urban, suburban, and rural areas. We report on findings from a mail survey of landowners across two urban-rural gradients in central and eastern Massachusetts, USA. The survey queried (a) attitudes towards gathering and a variety of other environmental benefits, (b) the practice of gathering, and (c) where gatherers harvest species. Survey responses reveal that gathering is not a controversial use of land and is a relatively widespread activity across urban, suburban, and rural areas. Further, the results show that gathering occurs on a mix of private and public lands and that there are important differences in the practice of gathering among individuals living in urban, suburban, and rural areas. Our findings have implications for understanding the social and ecological dynamics of gathering and suggest that more research on gathering and other natural resource management issues is needed, particularly in (sub)urban areas.

1. Introduction

As the Earth's population becomes increasingly urban, there is growing interest in the ways that people living in different settlement patterns benefit from, interact with, and influence nearby ecosystems. Forests and conservation lands are recognized as important sources of forest products, natural amenities, and a wide range of ecosystem services that benefit both local and distant residents. Growing population density and landscape changes alter the forest structure and the flux of nutrients, organisms, and water in urbanizing ecosystems (Grimm et al., 2000; McDonnell and Pickett, 1990; Pickett et al., 2011). Yet, even in these highly modified urban landscapes, local ecosystems have been shown to be important sources of ecosystem services ranging from flood control to pollination to recreational opportunities (see, for example, Alberti, 2008; Konijinendijk v.d. Bosch, 2008; Haase et al., 2014). In both cities and their hinterlands, scholars continue to draw attention to the myriad ways that ecosystems support subsistence practices, social reproduction, and integration into markets that sustain livelihoods and communities. While knowledge about the importance of local ecosystems and the ways that humans modify those ecosystems is growing, less is known about the variability in the ways that people living in areas characterized by different settlement patterns value and interact with natural resources.

One aspect of human-environment interactions and resource use that has received growing attention in research as well as the media is the gathering of non-timber forest products (NTFPs). Like many natural resource issues, there is a rich body of literature examining the practice of gathering in rural areas. At the same time, a growing body of literature also focuses on gathering in cities, suburbs, and in urbanizing areas (e.g., rural places experiencing suburban and exurban transitions; McLain et al., 2014; Hurley et al., 2008, 2015). Conceptually varied in their research questions, these studies suggest that gathering is an important activity for cultural and material well-being (Jones et al., 2002; Hart et al., 2004; Matthewson, 2007; Hurley et al., 2012) and NTFPs provide economic and social benefits (Emery and Pierce, 2005; Emery et al., 2007; Robbins et al., 2008) to a diverse set of individuals irrespective of cultural, racial, or ethnic identity (Emery et al., 2003; McLain et al., 2014; Poe et al., 2013).

* Corresponding author.
E-mail addresses: agshort@bu.edu (A.G. Short Gianotti), phurley@ursinus.edu (P.T. Hurley).

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Qualitative research on NTFP harvesting in the United States has raised critical questions about where and how NTFP harvesters secure access to key materials. These studies suggest that changes in land management on public and private lands as well as the competing priorities of managers and harvesters affect the ecological availability of NTFPs for gathering (Jones et al., 2002; Hurley et al., 2008; Ginger et al., 2012). In addition, and more importantly for some scholars, changes in landownership, new management goals, and differences in land tenure may shape access to key plant materials (Emery et al., 2003; Hurley et al., 2008; Grabbatin et al., 2011; Hurley et al., 2012).

While this body of research provides important insights into the diversity of gatherers and the challenges of accessing harvest sites that occur in rural as well as urbanizing areas, less is known about the relative importance of gathering for individuals in urban, suburban, and rural environments (Robbins et al., 2008) and what types of land these different groups of gatherers rely on for their harvesting activities. Quantitative studies of NTFPs are rare; yet a better understanding of the frequency of gathering, where harvests occur, how gatherers and non-gatherers feel about gathering, and how these characteristics differ across different settlement patterns is fundamental for understanding the social, economic, and ecological implications of this activity across urban-to-rural areas and identifying areas where policies that intersect with gathering may be productively re-examined.

In this article, we respond to these gaps through an exploration of residents' perceptions and practice of gathering across the urban-rural interface. To do so, we administered a mail survey to landowners across two urban-rural gradients in central and eastern Massachusetts. Our results support previous findings that gathering is a relatively widespread activity and also demonstrate how the practice is anchored in and dependent on a mix of private and public land types. Further, the results suggest important differences in the rates of gathering among individuals living in urban, suburban, and rural areas as well as the relative importance of different land types for supporting this practice.

2. Toward an understanding of gathering across the urban-rural gradient

2.1. Gathering NTFPs in rural, urban, and urbanizing areas

The literature on gathering Nontimber Forest Products (NTFPs) is extensive and a full review of this literature is beyond the scope of this article (see Jones et al., 2002; Laird et al., 2010; Shackleton et al., 2011; Stanley et al., 2012). NTFPs "include 'wild' plants and fungi (that is, species that have not been altered through horticultural techniques or genetic engineering), "feral" plants (cultivars that spread or persist without intentional human intervention), and the fruits or other desired parts of domesticates where these are incidental to the primary reason for which the specimen was planted" (Hurley et al., 2015: 188). Gathering involves the collecting, foraging, or harvesting of entire plants, selected parts of a plant (e.g., fruits, flowers, leaves, cones, seeds, roots), or plant exudates. These products can be extracted from native or non-native species as well as invasive and non-invasive species (see Poe et al., 2013).

Within the United States, there has been relatively sustained scholarly interest in the gathering of NTFPs for over a decade (Jones et al., 2002; Emery et al., 2003; Nolan, 2007; Hurley et al., 2008; Newfont, 2012). Much of this research has focused on rural areas (Emery et al., 2003), considering gathering on both public lands (Emery et al., 2003) and in private forests (Emery et al., 2003; Hurley et al., 2012). While this research seeks to understand the full range of NTFPs that underpin rural livelihoods (Jones et al., 2002; Emery et al., 2003), including insights into the role of floral greens (Emery et al., 2007) and botanicals industries (Vance, 1995; Lynch and McLain, 2003; Butler et al., 2005), the greatest attention has been paid to the harvest of berries, nuts, mushrooms, and other wild food-related items (Molina et al., 1993; Richards, 1997; Liegel et al., 1998; Freed, 2001; Palmer, 2000; Pouta et al., 2006). These scholars have concluded that gathering provides critical social, cultural, and material benefits to indigenous and non-indigenous peoples who are living in and around public and industrial forest lands (Emery, 1998; Jones et al., 2002; Emery et al., 2003; Emery and Pierce, 2005; Robbins et al., 2008).

Recent research from New England, USA suggests that the gathering of plants is not limited to indigenous peoples or people living in rural areas, but may be more widespread than often assumed (Robbins et al., 2008). Using a phone survey of residents living in cities and rural areas in Maine, Massachusetts, New Hampshire, and Vermont, Robbins et al. found that 17.9 percent of respondents had participated in NTFP gathering within the past 12 months and 26.3 percent of respondents had gathered some type of NTFP within the previous five years. They conclude that gathering is a practice that transcends a range of socioeconomic backgrounds and involves diverse individuals "entering environments around them to gather products for their own purposes, directly using and consuming plants" (272).

Likewise, there is growing awareness of urban forests as spaces that provide NTFPs for those living in cities (Jahnige, 2002; McLain et al., 2012, 2014; Poe et al., 2013; Hurley et al., 2015). Drawing on ethnographic methods, this line of inquiry draws attention to the practice of gathering and how its existence fits within the typical management frameworks of conventional urban land management (Jahnige, 2002; McLain et al., 2012; Hurley et al., 2015). This small body of work also examines who gathers in cities, the motivations for and importance of gathering for these individuals, and how diverse types of lands contribute to meeting the needs of those individuals seeking out NTFPs. Gathering research in Seattle, WA; Baltimore, MD; Philadelphia, PA; and New York, NY reveals that diverse peoples gather a variety of NTFPs for multiple reasons. The gathering of these products supports household economies, both of poorer and relatively wealthy individuals (McLain et al., 2012; Hurley et al., 2015); contributes to food security and culturally important foods and medicines (Poe et al., 2013); and contributes to personal interactions with, appreciation of, and learning about nature (Poe et al., 2014).

Urban NTFPs are harvested from a range of locations in the city, including public rights of way, on parklands and in protected areas, on institutional campuses, and from private yards (Jones et al., 2002; McLain et al., 2014). Some people may even gather wild plants, such as dandelions, from their yards for consumption (Robbins and Sharp, 2003; Hurley et al., 2015). In Seattle, indigenous peoples, immigrants, and non-immigrant residents engage in gathering from public and private spaces, including from species that grow as wild individuals, species planted in association with restoration projects, and from species found in ornamental plantings that were likely not intended to provide natural resources for human consumption (Poe et al., 2013, 2014). Meanwhile, in Philadelphia, gathering is part of a growing trend to rediscover the edibility of common weeds, both in grassland and forested areas, as well as to rediscover the edibility of species not generally thought of as providing food (Hurley et al., 2015). Although a full range of NTFPs has been documented in these studies of urban NTFP gathering, the harvest of species for edible purposes is a recurrent finding. Berries, nuts, and to a lesser extent, mushrooms are key items gathered (McLain et al., 2014; Poe et al., 2013; Hurley et al., 2015).

At the same time, there is an emerging interest in the "transitional forests" in between rural and urban areas, a term that seeks to capture forest and forest use dynamics associated with suburban and exurban areas (Colgan et al., 2014). Colgan et al. call for greater

recognition of the challenges that these areas, sites of multiple forest values (e.g., biodiversity, forest products, amenities), face within planning and management arenas. In many ways, the perspectives discussed by Colgan et al. extend key insights from specific ethnographic case studies of traditional NTFP users in California and South Carolina, who have long experienced and dealt with the reality of shifting attitudes toward the use of natural resources in these changing socio-ecological environments. Research on the effects of urbanization on the traditional gathering practices of both Native Americans and African American basket-makers documents the struggle to adapt to new land management dimensions, hostility of new landowners to longstanding practices, and the ecological threats to adequate supplies of NTFPs from the impacts of development (Matthewson, 2007; Hurley et al., 2008, 2012; Grabbatin et al., 2011). To the extent that the importance of NTFP gathering to people living in non-urban and non-rural contexts has been directly studied, the findings generally focus on the importance of harvesting for specific racial and cultural groups, whose traditional livelihoods are dependent on local resources. Still, these studies highlight the importance of non-food related gathering, including grasses and other materials, for the creation of culturally important household utilitarian objects and artworks that can be sold in local, regional, and international markets (Matthewson, 2007; Hart et al., 2004; Grabbatin et al., 2011; Hurley et al., 2012).

A recurrent and critical theme in studies of gathering in all three environmental and development contexts—rural, urban, and urbanizing or transition areas—is access to species of value to particular groups and individual harvesters. Scholars have examined the rights of Native peoples to harvest in traditional lands (Jones et al., 2002; Matthewson, 2007), the conflicts between land management priorities (e.g., timber harvest) and the ecological conditions conducive to prized species (Brown, 1995), the ways that changes in environmental regulations alter the ability to harvest prized species on public lands (McLain, 2008; Newfont, 2012), and the relationship of changing ecological conditions with species availability (Ginger et al., 2012). Legal standing for some groups, including native peoples, can mean that they are assured places to harvest valued species (Jones et al., 2002), but this is not the case for all harvesters. Management decisions as well as the implementation of new management regimes may influence which species are available and/or whether species remain accessible as a function of changing policy (Jones et al., 2002; Newfont, 2012). Ecological characteristics of the ecosystems, that provide key materials may change through time (Ginger et al., 2012). Indeed, whether individual gatherers can find prized species in nearby forest ecosystems and, more importantly, whether they then have access to species is a seen as a key consideration in understanding how well NTFPs support peoples' cultural and material well-being.

Other social factors and dynamics also affect gathering activities and access to key materials. In their 2003 report profiling a diversity of gatherers in the Eastern United States, Emery et al. (2003) found that "land management regimes and social conditions, such as household economies and changing demographics" are a key factor shaping availability of resource supplies (1). They further note that "changes in landownership and management" represent a key factor shaping gatherers ability to harvest species. In her ethnography of rural residents in southwestern Oregon, Brown (1995) pointed to the twin engines of urban in-migration and changes to land management as disrupting access to what she called "rural assets," which included access to NTFPs. Recent research from Maine points to the ways changes in land ownership can compound the effects of ecological changes on access to key species (Ginger et al., 2012). Hurley et al. (2008, 2012) found similar dynamics for African American basket-makers in South Carolina, who have seen the availability of and access to key NTFP supplies diminished and disrupted by proliferating residential subdivisions and commercial development. Not only have harvesters lost access to key materials in some areas, but they may also encounter racist treatment and harassment in places that are still accessible for harvesting efforts. Native American basket-makers in California have experienced similar issues with exurban landowners and other park users when harvesting species important to their art and household uses (Matthewson, 2007). Still, in South Carolina basket-makers report that they may continue to gain access to species through both sanctioned and non-sanctioned means (Hurley et al., 2012). Harvests may occur from wild populations in forested areas unaffected by urban development or in ornamental plantings on private lands. This includes gathering materials from ornamental plantings in typical suburban landscapes (i.e. common areas of subdivisions, parking lot medians). Harvests may also occur in similar situations on local, state, and national public lands (Grabbatin et al., 2011).

While this body of research highlights the diverse functions of gathering and draws attention to issues of access and changing ecological conditions, we lack understanding of the frequency of gathering and the magnitude of the social and ecological challenges linked to accessing prized species. Quantitative approaches to studying gathering and questions related to access are relatively rare (see Palmer, 2000; Cordell et al., 2004; Butler et al., 2005; Robbins and Sharp, 2003 for studies related to species harvests). Studies that explicitly employ a quantitative approach to capture these dynamics across an urban-rural gradient are even less common. A notable exception is the work of Robbins et al. (2008) discussed above. Beyond the demographic insights of the article, this research points out that "[i]n the absence of significant federal lands in the New England region, moreover, this body of gatherers is harvesting from private lands, roadsides, city parks, and other areas" (272). Like the arguments raised by Colgan et al. (2014), these authors highlight the need to expand NTFP research to a wider range of areas. Doing so means exploring the harvesting practices of individuals living in urban, suburban, and rural environments, while paying attention to the ways that access to plants is affected by different ownership types.

2.2. Employing an urban-rural gradient approach

The urban-rural gradient approach was first used in ecology to study urban ecology and investigate the relationships between human activities and ecological processes across different development contexts (McDonnell and Pickett, 1990; McDonnell et al., 1997). The approach recognizes that a variety of socio-ecological conditions change across the continuum from densely populated city centers out to more rural environments and explicitly examines how this variation interacts with and shapes the structure and function of ecosystems (McDonnell and Hahs, 2008). An urban-rural gradient approach to gathering suggests a more holistic perspective on the tendencies of NTFP harvesters to travel within and across cities, suburbs, and the countryside (as documented by Robbins et al., 2008 and suggested by Hurley et al., 2015). At the same time, examining gathering across a gradient means combining the study of these dynamics across different types of land ownerships and in a way that allows a focus on individuals living in diverse settlement patterns. This approach recognizes the relationship of residents to diverse forms of vegetation on their own landholdings, their interaction with and use of diverse forms of vegetation on neighboring landholdings, and the potential to visit and gather from vegetation on protected lands of diverse types, both near and far. Further, this approach allows for the assessment of differences in (a) attitudes about the benefits of gathering, (b) its importance to individuals living in areas with different levels of urbanization that might affect perceptions and use of natural resources, and (c) the

dynamics influencing access in different areas (Emery et al., 2003; Hurley et al., 2008; Colgan et al., 2014).

3. Study context and methods

Our study system includes towns located along two 100 km transects that stretch westward from Boston, Massachusetts to the central part of the state (Fig. 1). Boston is the 10th largest metropolitan area in the US and sits at the northernmost end of the largest megalopolis in the US, the "BosWash Corridor." The study transects reflect the variation in development patterns, land uses, and human communities found in the surrounding areas. The northern transect forms a somewhat idealized urban-rural gradient with development patterns transitioning from urban areas in the east to dense suburbs followed by less dense suburbs and rural areas as one travels west. The southern transect follows a major transportation corridor (I-90) and contains two urban centers, Boston in the east and Worcester (approximately 65 km west of Boston). Development patterns and land use shift between high and low-density suburbs between these two urban centers and quickly transition to more rural characteristics west of Worcester.

To investigate gathering in our study region, we administered a mail survey to landowners across the study transects and analyzed how responses differ across urban, suburban, and rural respondents. The survey asked respondents to self-identify as living in an 'urban,' 'suburban,' or 'rural' location and collected data on respondents' attitudes towards and use of a number of ecosystems services and recreational activities (including gathering). To help respondents understand what was meant by "gathering," all related survey questions included the examples of "berries, mushrooms, etc." The survey also collected basic demographic information for all respondents. The survey questionnaire was developed and pretested through a series of six focus groups that included urban, suburban, and rural landowners.

The survey sample included landowners from 33 towns along the study transects. Five towns along the transects were excluded due to the lack of usable ownership data. Populations in the study towns range from 1277 in Petersham to 617,594 in Boston (2014 US Census American Community Survey) and fifty-four landowners were selected from each town. The sample was drawn from tax assessor records and stratified by town and parcel size: landowners with less than or equal to 10 acres and landowners with greater than 10 acres. Where possible, 27 landowners were randomly selected from each size category for each town. For towns that had fewer than 27 landowners in one of the size categories, additional landowners were selected from the other category to ensure a total of 54 landowners for each town.

A total of 1758 surveys were mailed following a modified Tailored Design Method (Dillman, 2007). Of the mailed surveys, 114 were returned as undeliverable or disqualified because the respondent was deceased or no longer owned land in Massachusetts. A total of 414 surveys were returned and usable, giving an effective response rate of 25.2%. The relatively low response rate is consistent with recent trends for response rates of natural resource based surveys, which show declining response rates particularly for complex surveys and issues with low saliency (Connelly et al., 2003). We suspect that our low response rate is linked both to the complexity of the survey instrument and the broad focus, which was necessary to ensure applicability across the entire study transects and may have resulted in limited saliency. Though we did not have the resources to fully assess non-response bias, the response rate did not vary significantly across towns, which gives us confidence in the ability to tease out differences along the urban-rural gradients in our study area.

Table 1
Demographic characteristics of survey population and population of gatherers[a].

	General population in study towns (%)	All respondents (%)
Income[b]		
Less than $50,000	39.8	19.9
$50,000 to $100,000	26.0	31.6
More than $100,000	34.2	48.5
Education[c]		
High school or less	32.7	8.6
Some college	13.4	10.1
Associates degree	5.3	8.6
Bachelor's degree	25.1	28.4
Graduate degree	23.5	44.3

[a] Our comparison is limited to education and income as we did not collect data on race/ethnicity and our data on age and gender is not directly comparable to census data.
[b] Income data for the general population is based on household income in study towns from the 2014 US Census American Community Survey.
[c] Education data for the general population is based on educational attainment for the population 25 years and older in study towns from the 2014 US Census American Community Survey.

Survey respondents tend to be wealthier and more highly educated than the general population of the study towns (Table 1). This is not surprising since the survey population is limited to landowners rather than the larger class of residents. While we cannot claim that the survey is representative of the general population, we believe it provides a reasonable representation of landowners along the study transects and discuss potential limitations of the sample in the discussion and conclusion.

For analysis of the survey data, respondents were classified as urban, suburban, or rural. Since there is no single classification system that captures the land use, population density, and cultural patterns that create an urban, suburban, or rural environment, we relied on landowners' perception of their own communities. Survey recipients were asked to describe the area in which they live as 'urban,' 'suburban,' or 'rural' and these self-defined classifications were used in the analysis of attitudes and practices (Fig. 1 classifies towns based on the aggregate responses). Slightly more than half of the survey respondents classified their location as rural (n = 218); 41% classified their location as suburban (n = 165); and approximately 6% classified their location as urban (n = 24). The disproportionately small percentage of urban respondents is an artifact of our sampling strategy, which included an equal number of recipients from each town.

4. Results

4.1. Gathering attitudes among all landowners—how do Massachusetts landowners feel about gathering?

Given the importance of access highlighted by previous research, our survey sought to better understand attitudes toward gathering and other ecosystem services and recreational activities. Doing so allows us to place gathering and dimensions of access in the context of wider thoughts about natural resource benefits on private, public, and conservation lands in urban, suburban, and rural environments. The mail survey asked all respondents if they view gathering and seventeen other activities/ecosystem services as 'benefits provided by land.' Approximately two-thirds (63%) of survey respondents view gathering as a benefit from land, 31% are neutral, and 6% do not view gathering as a benefit.

Urban, suburban, and rural respondents differ in their assessment of gathering as a benefit but the differences do not follow a tidy pattern (Fig. 2a; $p < 0.001$, Fisher's Exact Test). Among both

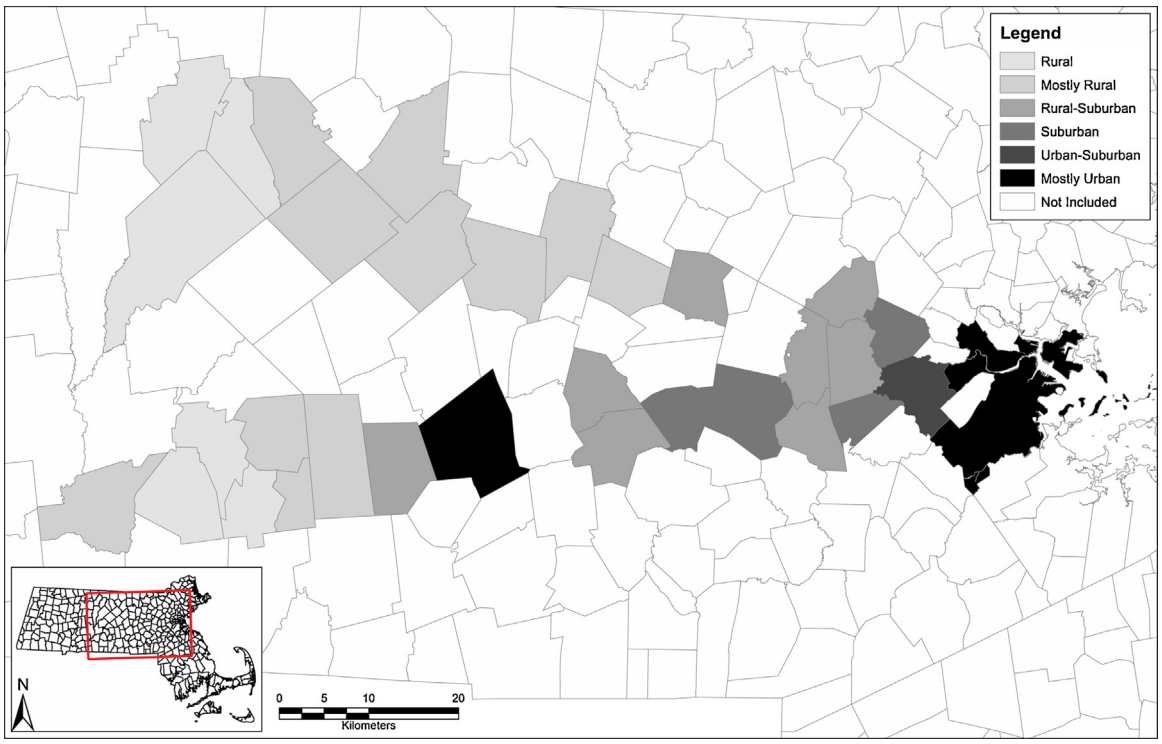

Fig. 1. Map showing the location of study transects and the 'urban-ness' of transect towns. The urban-ness of towns was classified using survey respondents self-perceived classifications of 'urban', 'surburban', and 'rural.' Individual responses were aggregated at the town level and towns were classified in the following categories: *rural*: all respondents selected rural; *mostly rural*: respondents selected a mix of rural and suburban with more than 50% of town respondents selecting rural; *suburban-rural*: respondents selected a mix of suburban and rural with more than 50% of town respondents selecting suburban; *suburban*: all respondents selected suburban, *urban-suburban:* respondents selected a mix of suburban and urban with more than 50% of town respondents selecting suburban, or *mostly urban*: respondents selected a mix of suburban and urban with more than 50% of town respondents selecting urban.

urban and rural respondents, the majority of respondents view gathering as a benefit. However, a substantially greater fraction of urban respondents disagree with the view of gathering as a benefit from land. A large portion of suburban respondents neither agrees nor disagrees with the view of gathering as a benefit. The variation in perception of gathering as a benefit from land may reflect differences in exposure and experience with gathering as a practice as well as different connections to land across the urban-rural gradient.

Perspectives on gathering also differ between gatherers and non-gatherers (Fig. 2b; $p < 0.001$, Fisher's Exact Test). Among survey respondents who indicated that they have not gathered in the past: 38% view gathering as a benefit, 51% are neutral, and 11% disagree with the view of gathering as a benefit. This contrasts with the widespread positive view of gathering expressed by respondents who have engaged in the activity: 90% of those who have gathered view it as a benefit, 9% are neutral, and only 2% disagree with the view of gathering as a benefit.

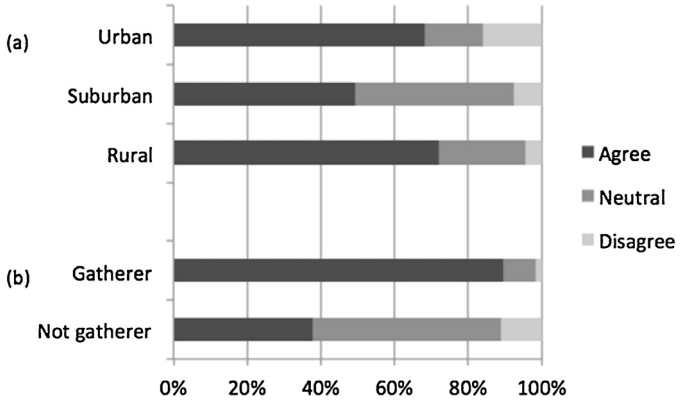

Fig. 2. Agreement with the statement "Gathering (berries, mushrooms, etc.) is a benefit from the land" by (a) urban, suburban, and rural respondents and (b) respondents who gather and respondents who do not gather.

When compared with views of other recreational activities and ecosystem services queried in the survey, we find that gathering has a moderate level of support (Table 2). Respondents expressed more widespread positive views of ecological functions provided by land (e.g., wildlife habitat, clean air) and most recreational activities that are passive in nature (e.g., wildlife observation, aesthetics). However, when compared to opinions on activities that are more similar to gathering—recreational activities that are more active and/or involve consumptive uses of resources—survey respondents viewed gathering more favorably. While gathering does not have the same level of widespread support as more passive activities and ecological functions, it also does not evoke strong objection or the split views of more controversial activities such as hunting and ATV use.

4.2. Gathering practice—who gathers?

Gatherers come from multiple socio-economic groups (Robbins et al., 2008; Hurley et al., 2015). In their investigation of gathering in New England, Robbins et al. (2008) found that gathering is more prevalent among rural residents than those living in cities yet the rates of difference between urban and rural respondents were not as large as expected. However, few other studies have examined differences in the population of gatherers and non-gatherers

Table 2
Survey respondents' views on benefits provided by land.

Activity/ecosystem service	Type of activity/ecosystem service	Is activity/ecosystem service viewed as benefit from land? (%)		
		Yes	Neutral	No
Enjoying nature	Passive recreation	97.5	1.8	0.8
Aesthetics	Passive recreation	96.7	3.0	0.3
Habitat for wildlife	Ecological function	95.0	3.8	1.3
Wildlife observation	Passive recreation	94.4	3.8	1.8
Relaxation/stress reduction	Passive recreation	92.6	6.3	1.0
Clean air	Ecological function	90.8	7.4	1.8
Hiking, Walking and/or running	Active recreation	90.4	5.8	3.8
Clean Water	Ecological function	89.7	8.5	1.9
Privacy	Passive recreation	85.1	14.1	0.8
Dog Walking	Active recreation	65.9	21.6	12.5
Carbon Sequestration	Ecological function	64.7	30.4	4.9
Gathering	Consumptive	**63.1**	**30.7**	**6.1**
Biking	Active recreation	59.2	24.5	16.3
Fishing	Consumptive	58.8	29.3	11.9
Boating	Active recreation	54.3	29.4	16.3
Horseback Riding	Active recreation	50.3	36.5	13.2
Hunting	Consumptive	35.7	28.7	35.7
ATV Use	Active recreation	11.0	19.8	69.1

across the rural-urban gradient. We asked survey respondents if they gather.

Nearly half (49%) of survey respondents report that they gather. Gatherers in our study population come from all levels of education and include men, women, and mixed gender couples who jointly answered the survey (Table 3). Respondents with lower incomes were more likely to gather than those in middle-income brackets ($p = 0.05$; Fisher's Exact Test). The strongest predictor for gathering was self-perceived identity as urban, suburban, or rural ($p < 0.001$; Fisher's Exact Test). Rural respondents were over-represented in the population of gatherers (69% of gatherers self-identified as rural) and a higher fraction of rural respondents report that they gather: 63.5% of rural respondents report that they gather while only 33.1% of suburban respondents and 27.3% of urban respondents report that they gather.

Table 3
Demographic characteristics of survey population and population of gatherers.

	All respondents (%)	Gatherers (%)
Community-environment		
Urban	5.9	3.4
Suburban	40.5	27.3
Rural	53.6	69.3
Income		
Less than $20,000	2.9	4.7
$20,000 to $50,000	17.0	20.3
$50,000 to $100,000	31.6	31.8
More than $100,000	48.5	43.2
Education		
High school or less	8.6	10.1
Some college	10.1	10.1
Associates degree	8.6	9.5
Bachelor's degree	28.4	26.6
Graduate degree	44.3	43.8
Gender		
Male	25.6	23.8
Female	17.6	14.5
Mixed couple	56.8	61.6
Age		
Mean age	60.5	59.7
Parcel size		
Median parcel size (acres)	9.5	16

4.3. Gathering practice—where do gatherers gather?

Previous research has found that gatherers rely on public lands, private lands, and interstitial spaces to harvest the species important to them and found that access to these sites is important and often contested. Little is known about how different groups of gatherers rely on different types of land for their gathering activities. Our survey asked respondents who gather to indicate if they gather on their own land, other private land, and/or conservation land.

Across the entire population of gatherers, we found that gatherers' own property is the most common site of gathering: 82% of surveyed gatherers report that they gather on their own land; 33% report that they gather on land set aside for conservation or open space; and 19% report that they gather on other private land. However, the picture is significantly different when looking at the sub-populations of urban, suburban, and rural gatherers (Fig. 3). Since the number of urban respondents who gather is small (n = 6), we consider the mixed group of urban and suburban gatherers in contrast to rural gatherers in the analysis that follows. Nearly half (44.4%) of (sub)urban gatherers harvest species on conserved land while only 27.9% of rural gatherers harvest on conserved land. In contract 68.5% of (sub)urban gatherers harvest on their own land and a full 87.7% of rural gatherers harvest on their own lands.

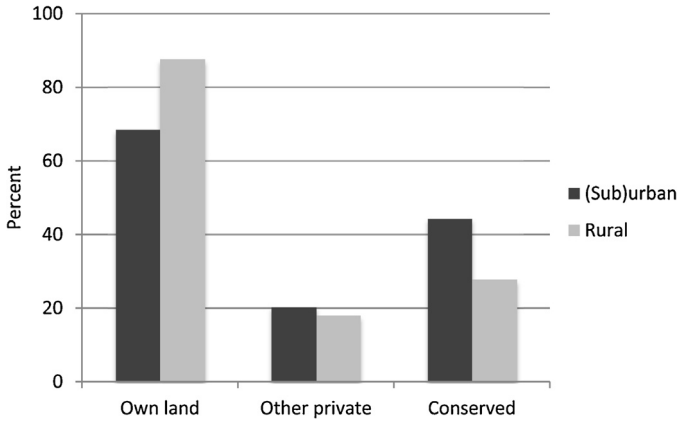

Fig. 3. Percent of (sub)urban, and rural landowners gathering on different land types.

5. Discussion and conclusion

This study is one of the first to quantify attitudes towards and the frequency of gathering NTFPs with a consideration of issues of access along urban-rural gradients. Nearly one-half of the survey respondents report that they gather. While gathering is most common among rural respondents, it is a relatively common activity for survey respondents across the entire urban-rural gradient. The widespread nature of gathering demands further attention from both an ecological and social perspective and has implications for the management of natural resources on private and public lands in urban, suburban, and rural areas.

We find that gatherers in Massachusetts include individuals from all education levels, genders, and economic circumstances. Mirroring the findings of Robbins et al. (2008), our results show that gatherers are a diverse population with participants coming from all levels of education, genders, and income groups. Though gathering is a common practice across urban, suburban, and rural respondents, we find that it is more common among the rural landowners in this study – a result consistent with Robbins et al. (2008). The overall rate of gathering we found (49%) is much higher than other estimates of the prevalence of gathering. Robbins et al. (2008) found that 26.3% of surveyed New England residents gather and the 2002–2006 National Woodland Owners Survey (NWOS) for Massachusetts found that 23.5% of surveyed woodland owners report that NTFPs have been collected on their land. This discrepancy may stem from the particular demographics of our study population as well as our linkage of gathering to edibles (e.g., mushrooms, berries) in the survey questionnaire, which potentially points to a broader interpretation of 'gathering' by our respondents than is prevalent within the existing literature.

Although our study did not explicitly explore the diversity of species that individuals harvest or the significance of the practice to individual gatherers, previous research from rural, urban, and transitioning regions has shown that there is lot of variation in what it means to 'gather.' Gatherers range from occasional berry pickers to commercial harvesters, with the species targeted and the frequency and magnitude of harvest varying with the goals and interests of the gatherer (Jones et al., 2002; Poe et al., 2013; Hurley et al., 2015). This study demonstrates the widespread nature of gathering among landowners in the region, which highlights the importance of additional quantitative research to examine the variation in the species and quantities harvested, the frequency of gathering, and how these factors relate to location and the reasons individuals gather. Rounding out this picture of the linkages between land types, species, and personal significance through future studies would increase our understanding of the variation in the material and cultural significance of gathering. Further, this information would enable estimation of the ways and degree to which gathering practices alter local ecosystems through gatherer-initiated stewardship practices (such as the tending, weeding, planting or dispersal practices) and the range of harvest techniques associated with particular plants.

This study demonstrates that gathering occurs on both private and public lands, albeit at different rates. Qualitative research suggests that gatherers sometimes manage and modify their own landscapes to increase opportunities to gather (Emery et al., 2003; Hurley et al., 2008; Grabbatin et al., 2011). This includes planting species of value; tending these plantings using a variety of stewardship practices; and altering harvest frequency, timing, and methods. At the same time, emerging research on urban foraging suggests that areas of vacant land that are characterized by so-called "spontaneous vegetation" (Del Tredici, 2010) may provide opportunities for gatherers to access prized species (Hurley et al., 2015). Yet the effect of different management regimes on foraging opportunities remains an area of inquiry that is relatively understudied, except insofar as it applies to commercial harvests and management (Jones et al., 2002; McLain et al., 2014). Open questions include: To what degree are gatherers actively modifying local ecosystems? How do these practices differ when harvesting occurs on gatherers' own property, other private property, conservation lands, or other public property? How do these practices influence relationships and attitudes toward different species and nature more broadly?

Across the entire study region, we find that the majority of gatherers utilize their own land as a site for gathering. While gathering on one's own property is most common among rural respondents, it is particularly striking that more than two-thirds of urban and suburban gatherers also report that they gather on their own property. The prevalence of gathering in one's own (sub)urban backyard suggests that many landowners are interacting with and possibly managing for natural resources in their backyard. This result links to work by Hurley et al. (2012) and Grabbatin et al. (2011) who found that suburban landowners, including residential and commercial properties, both planted and allowed harvest of species that are critical to the persistence of African American basketry. As these scholars note, the relationship of (sub)urban landowners to the natural resources in their own yards has not received much attention. Head and Muir (2006)'s study of human-non-human engagements in suburban backyards in Australia is a notable exception and highlights important possibilities for how this type of research on foraging and natural resources might be pursued in (sub)urban areas. We see the need for greater consideration of gathering in urban and suburban areas through both qualitative and quantitative studies that further examine social mechanisms of access, landscape stewardship, and the ecological dimensions of supply. These findings strongly suggest that the relationships of (sub)urban landowners and residents to the nature and resources on their property may be more complex than is sometimes portrayed in the literature. This complexity points to the need to further study the dynamics of (sub)urban natural resources.

Beyond private yards, public and private conservation lands are common sites of gathering. Nearly half of (sub)urban gatherers and more than a quarter of rural gatherers in our survey harvest species on conserved land. Though we lack data on the frequency and details of these activities, these results hint at a greater presence of gathering in these areas than may be currently acknowledged. Additionally, the higher rate of harvest on conservation lands by (sub)urban gatherers in our study is not surprising as parcel sizes are typically much larger in rural areas, which provides more opportunities for gathering on private lands. While these differences point to important dimensions of land access among urban, suburban, and rural gatherers, the substantial rate of harvest on conservation lands even by rural gatherers suggests that variations in the ecological availability of specific species on particular land types may also be at play.

The utilization of conservation lands as sites of harvesting brings up important questions of access and its relationship to land management and policy. While our research did not set out to examine the rules associated with gathering in conservation areas within the study area, ongoing research in the Philadelphia Metropolitan area shows that institutional rules often formally prohibit the collection of plants on public lands but gathering still occurs under the radar and through tacit agreements with land managers (Hurley et al. unpublished data). This potential juxtaposition of harvesting on conservation lands and institutional prohibition begs a further examination of access, policy, and management of these gathering sites. When and where is gathering sanctioned? When and under what conditions do managers tacitly allow gathering? With what frequency are gatherers harvesting through extra legal means? In what ways would opening up policies for gathering change harvesting practices and what are the social and ecological implications

of these changes? What benefits might gathering have for conservation lands and their stewardship? How can gathering policies encourage sustainable resource management and enable social benefits to diverse resource users?

Given the relatively high rates of gathering on public lands and other conservation areas among our survey respondents, along with findings from gathering research in other (sub)urban environments, we suggest that natural resource managers examine current policies relevant to gathering as well as the ecological and social implications of the practice. To the extent that gathering is not currently permitted in conservation areas, we see the potential for new opportunities for community engagement and stewardship, which may require revising institutional rules for gathering. Such rules need not be one-size-fits all. As Emery and Ginger (2014) recommend, institutional rules can be tailored to the ecological conditions, harvesting practices, and pressures associated with specific species. Following this strategy, rules can be devised that are more specifically attentive to species in need of active management, restoration, and institutional protection, species that do not need active management or protections to sustain populations, and species that need more research to determine management approaches.

Should land managers find reasons to revisit policies regarding gathering on public lands, our findings suggest that the practice may not be as controversial as some others. For example, our examination of views on gathering reveals that the practice is not a controversial activity in the same vein as other activities that are permitted on some conservation lands such as hunting and ATV use. Among survey respondents who have not gathered, positive or neutral views on gathering are common.

Lastly, while we recognize that this study was limited to landowners and has a small number of urban respondents, Robbins et al. (2008) had a larger response from urban residents and was not limited to property owners (though they did not query land tenure status). Their work, together with these findings, points to gathering as a natural resource activity important across the urban-rural gradient. Future research should include more emphasis on land tenure and explicitly include renters. Renters may be an important population to query because they may be more economically dependent on gathering activities and/or be part of a younger generation of gatherers participating across the urban-rural gradient. In addition, given the frequency with which individuals harvest on their own land, understanding where renters are gathering becomes an important question for understanding management practices on private and public lands and the ecological consequences of those practices.

Gathering and harvesting activities in cities and beyond are becoming prevalent in the U.S. media (e.g., Foderaro, 2011; Hamilton, 2011; Husted, 2013; Johnson, 2015; Smusiak, 2015), while NTFP harvesting in rural areas has long been recognized (Jones et al., 2002). This study reinforces the fact that gathering as a practice transcends the urban-rural divide, with individuals in these locations recognizing the practice as a benefit of land and demonstrating that access to land for NTFPs is a benefit enjoyed by many living in diverse community-environments. The prevalence of this benefit and the ability of individuals to access these benefits, however, still may not be that noticeable to either the public or the managers of public and private conservation lands from which gatherers harvest key resources. These findings call for continued examination of gathering across and within all settlement types as well as the consideration of policies that will ensure sustainable resource management and access to culturally and materially important resources that benefits diverse groups.

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