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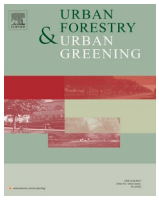

Reviewing the use of research interviews and qualitative inquiry in urban forestry: Understanding human-tree relationships in the built landscape

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ABSTRACT

In most urban areas, residents have regularly occurring experiences of the trees around them. They interact with trees based on those experiences, as well as their own personal values, priorities, and identities. Whether those interactions with trees are active or passive (and whether or not they are conscious interactions), it is necessary to understand them in order to gain a more detailed picture of the urban forest. Qualitative research, and interviews specifically, are an important tool for developing this knowledge as they can uncover a deep understanding of an individual's values, experiences and perspectives; build relationships between researchers, practitioners and community members; and support the inclusion of diverse and nontraditional perspectives in the pursuit of procedural and recognitional justice in urban forestry. In order to understand how and why interview methodology is being used to understand human-tree relationships in the built landscape, we employed PRISMA methodology, multiple screening phases, and NVivo qualitative coding software to identify and analyze 112 manuscripts that employed interviews in their study of human perspectives of, and interactions with, built-landscape urban trees. Findings show that interview methods are a relatively new introduction to urban forestry research, and that they have been primarily utilized to learn about: (1) Civilian perspectives/perceptions, sometimes with regard to diverse groups and those historically underrepresented in urban forestry; (2) Civilian participation/decision-making with regard to activities on their own property and volunteer activities in the community; (3) Urban forest manager and arborist perspectives and decision-making; and (4) Stakeholder collaboration – among government entities, NGOs, businesses and volunteers. Most studies (particularly those based in the Global North) prioritized the perspectives of decision-makers over community members, which highlights the need to find new ways of bringing different voices into urban forestry research and practice.

1. Introduction

Qualitative researchers seek to understand various phenomena through the exploration of human perspectives and individual or group meaning-making (Denzin and Lincoln, 2005). The natural sciences, and urban forestry specifically, have historically emphasized the use of quantitative research methods (Ezzy, 2001; McLean et al., 2007); however, there has been a shift over the past two decades, with a notable uptick in qualitative approaches (Harper et al., 2020; Ordóñez, 2023). This is particularly relevant as the convergence of environmental issues underscores the need for humans to "actively care for and about nature" (Maller, 2023, p. 259) and demands that new research favor "interdisciplinary and inclusive" methods (Elmendorf and Luloff, 2001, p. 149). Without qualitative, human-subjects research, there is no way of gaining a deep understanding as to how and why humans interact with their environments and what compels current – and future – behavioral patterns. Furthermore, qualitative research methods also provide opportunities to learn from individuals who are not traditionally included in research processes and decision-making around natural resources (Elmendorf and Luloff, 2001). They uniquely allow for value-elicitation, which helps to focus academic research on real-world relevancy and guide management outcomes (Ordóñez et al., 2017), especially in times

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of crisis. Indeed, human well-being (McPhearson et al., 2016), values, and action/inaction, as well as "the cross-pollination of scientific skills and approaches" (Ordóñez, 2023, p. 6) are central to sustainability research and practice.

This review aims to understand what urban forestry researchers have been learning through the use of research interviews, from whom they are learning, where gaps in human-subject urban forestry research remain, and how these studies serve to strengthen the case for qualitative research (and interview methods specifically) in urban forestry.

1.1. Qualitative methods are essential to the furthering of urban forestry research and practice

As urban populations continue to expand, the climate crisis intensifies, and the multitude of tree-related benefits and disbenefits (Tyrväinen et al., 2005; Nowak and Dwyer, 2007; Nowak and Greenfield, 2018; Domke et al., 2021) become more widely understood, there has been increased focus on the research and practice of urban forestry (Eisenman et al., 2021). However, as Dwyer et al. (1991) and McPhearson et al. (2016) indicate, the urban forest must be understood as more than simply a provider of the quantifiable benefits that we urgently need in a changing world.

> "Urban trees are living, breathing organisms with which people feel a strong relationship, and in our planning and management we should not think of them just as air conditioners, providers of shade, and ornaments in the urban system" (Dwyer et al., 1991, p. 283).

In short, a comprehensive understanding of this field must holistically regard people as co-producers of the urban forest (McPhearson et al., 2016; Campbell et al., 2022a, 2022b), and as such, ascribe value to their perspectives, whether they are tasked with making management decisions or simply enjoy reading a book in the shade.

This co-production of the urban forest lays out a reciprocal relationship between people and trees in cities – trees and people affect each other (Coleman et al., 2021; Mei et al., 2021; Coleman et al., 2023). Research suggests that city-dwellers develop psychological connections with the trees around them (Dwyer et al., 1991; Ryan, 2006; Tidball, 2014). In places where the built environment creates psychological distance between residents and local ecosystems (Andersson et al., 2014), trees help to create a sense of place and connection with nature, which is essential for fostering community and individual identity (Warsini et al., 2014; Judice et al., 2021; Campbell et al., 2022b). Trees contribute greatly to the aesthetic quality of a streetscape and may represent a large proportion of urban greenery (Schroeder et al., 2006; Hunter, 2011). A row of street trees that frame a major thoroughfare, or large backyard trees that stretch high above the rooflines, might be the main ecological features that residents experience in their day-to-day life (Coleman et al., 2021; Elton et al., 2023). Many city-dwellers have regularly occurring experiences of (and interactions with) the trees around them, and urban natural resource managers are often tasked with making decisions that consider the concerns and desires of their constituencies (Harper et al., 2017). Some even argue that "urban trees are more about people than trees" (Zhao et al., 2018, p. 10), in that a primary purpose of planting and managing trees in cities is for their ecosystem services that improve community well-being and quality of life (Tyrväinen et al., 2005; Nowak and Dwyer, 2007; Wolf et al., 2020). Furthermore, the relationships that individuals and communities have with their urban forest are impactful. People choose to act (or not to act) based on their values and priorities (Behe et al., 2022) – and whether their actions toward trees are active (productive/destructive) or passive, it is necessary to understand them (Heberlein, 2012). Qualitative research, and interviews specifically, can provide us with a more detailed picture of the urban forest (McLean et al. 2007; Harper et al., 2018). And from a management perspective, qualitative, community-centered research can also aid in the building of strong, trusting relationships between stakeholder groups, which may further benefit the urban forest (Elmendorf and Luloff, 2001; Harper et al., 2020; Lass and Harper, 2023).

Recent scholarship has called for qualitative research that not only incorporates the perspectives of those directly involved in natural resource management and research, but that earnestly integrates (and, where relevant, centers) the perspectives of populations that are less-commonly represented in research and decision-making settings (Elmendorf and Luloff, 2001; Ordóñez, 2023). Individuals' knowledge, ideas, and perspectives are shaped by their unique backgrounds, and this uniqueness influences how they act on, or interact with, their environment (Heberlein, 2012; Locke and Grove, 2016; Coleman et al., 2023). Since (a) humans in urban areas interact with trees and are a critical component of urban forest stewardship (Maller, 2023) and (b) the nature of those interactions is borne out of their unique experiences and identities, then it can be concluded that insights from a diversity of human subjects ought to be pursued (Jasny et al., 2021; Campbell et al., 2022b). Not only is the inclusion of diverse perspectives important in the pursuit of procedural justice and recognitional justice in urban forestry (Carmichael and McDonough, 2018, 2019), but according to Danquah (2023), this work also makes urban forestry programs better suited for their unique communities:

> "One of the cardinal principles for the acceptance of environmental policy is legitimacy. For urban residents and landlords to accept tree planting policy, it is prudent to understand their perceptions and attitudes towards trees in built-up ecosystems. This knowledge will serve as a basis for formulating tailor-made policies that will be acceptable to all stakeholders" (p. 239).

1.2. Why focus on interviews?

There is a wide variety of social research methodologies that can be used to elucidate the ways in which humans and their environment influence each other (Creswell, 1998; Ordóñez, 2023). Most often in urban forestry research, various types of survey methods have been employed to gather the perspectives of professionals, volunteers, and community members. Surveys can be relatively inexpensive and quick to implement and produce data that lend themselves (with sufficient sampling and care) to drawing generalizable inferences about larger populations (e.g., all residents of a particular city or area). However, survey methods also possess limitations that include response bias, diminished response rates, and a lack of a depth of story (Elmendorf and Luloff, 2001; Dillman et al., 2014). According to Elmendorf and Luloff (2001),

> "even with good survey tools and instruments, it can be difficult to identify and involve both insiders (traditional participants) and outsiders (nontraditional participants) in information gathering" (p. 139).

Research interviews are a powerful and well-established method that facilitate a one-on-one, free-flowing (but guided) discussion on a given topic, simultaneously providing information on the broadest range of experiences, but within a narrow, defined topic. (Hay, 2016; Gwedla and Shackleton, 2015). They provide the opportunity to gain a clearer understanding of an individual's values, experiences and perspectives within the context of a face-to-face, one-on-one interaction (Leets et al., 2022). This person-to-person information gathering can also offer the co-benefit of helping participants feel more connected to the researcher and research process, thus building stronger relationships between researchers, practitioners, policy-makers and nontraditional participants (Carpenter and Kennedy, 1988; Elmendorf and Luloff, 2001; Harper et al., 2020), though this depends on the type of interview format being used. These relationships can transcend the academic process (Leets et al., 2022) and support ongoing dialogues that build trust and mutual understanding (Elmendorf and Luloff, 2001). Although interviews can be time-consuming, both on the part of the researcher and the subjects (Moskell et al., 2010; Davies et al., 2018; Harper et al., 2020), they may

have the ability to gather more complete responses from participants than other human-subject methods, and are more likely to allow for completion of the research questions at hand – differing from surveys, which are sometimes left incomplete (McCracken, 1988; Luloff, 1999; Rubin and Rubin, 2005; Elmendorf and Luloff, 2006; Bailey, 2007).

2. Methods

2.1. Record identification

Our objective was to retrieve articles that both pertained to urban forestry specifically (not general forestry or other types of urban environmental topics) and the use of interviews as a core methodology. We applied the PRISMA literature search methodology (Page et al., 2021). Four combinations of search terms were employed in the databases listed below: "urban forestry" AND interview*; "urban forest" AND interview*; "street tree*" AND interview*; "urban tree*" AND interview*. 'AND' was utilized to ensure that the databases supplied articles including both search terms. Quotations ensured that terms like 'urban' and 'forestry' were not separated by the databases' algorithms and the asterisk allowed for the databases to supply articles containing alternate endings of the words 'tree' and 'interview' (e.g. 'interviews', 'interviewed' and 'interviewing'). When presented with the option to select where the database would look for each search term within a given record, either 'no field' or 'entire document' was selected in order to retrieve the broadest range of results.

In the process of unearthing the breadth of scholarly articles that cited the use of interviews in urban forestry research, we performed searches in general databases (AGRICOLA, CAB Direct, GALE and Web of Science) and databases that include topics related to the environment more specifically (Environment Index, GreenFILE, and US Forest Service Publications). We also used one biomedical database (PubMed) and three journal-specific databases (*Arboricultural Journal*, *Cities and the Environment* and *Urban Forestry & Urban Greening*). After searching the first database, AGRICOLA, it became clear that the general database results included all of *Urban Forestry & Urban Greening*'s records that mentioned interviews, including records that were not germane to the field of urban forestry, because of the presence of our search terms in the journal's title. In subsequent database searches with advanced search options, the term "urban forestry & urban greening" was excluded, and remaining records from this journal were retrieved in the journal-specific search.

Our searches yielded 1,679 results. Once duplicates were removed, 921 unique records remained. Assessment for relevance to this review occurred through two screening phases.

2.2. Record screening and eligibility

Urban forestry is an interdisciplinary field, both in academic and professional contexts (O'Herrin et al., 2023), and as such, the searches provided numerous records that were connected with –but did not explicitly pertain to– urban forestry. Furthermore, forests exist on an urban-rural gradient (Berland and Manson, 2013), and there is no clear consensus on where the urban forest begins and ends. Parks, green spaces, and urban woodlands can create blurriness between what is "built" in cities and what is not. These spaces may be meticulously groomed and contain built elements, treated as urban wilderness conservation areas, or exist somewhere between those two poles (Cao et al., 2021; Kong et al., 2022). With this in mind, records were included if they met the following two criteria:

(1) The articles concerned trees in the built urban landscape with which people in urban areas cohabitate and manage. These generally included studies involving street trees or yard trees because those are the trees that urban dwellers experience most regularly, regardless of their affinity for nature. Studies involving park, green space, or woodland trees were excluded because of the blurriness around how intertwined they are with the built portion of the city. Additionally, urban dwellers have non-deliberate experiences of built landscape trees (i.e., residents experience street/yard/parking lot trees on a regular basis while going about their lives) while park visitation may be a deliberate and more sporadic choice.

(2) Interviews in the included records were used to understand the practice of urban forestry activities and programs in relation to those managed trees and of people's relationship with (and perceptions of) that practice.

Similarly, this review did not explore records concerning the co-benefits of urban trees, such as studies related to the public health implications of tree canopy, traffic-related behavior, air quality, temperature, or violence. Finally, we excluded papers on broad topics that referenced trees in a minor or tangential way, where understanding related to parks, urban greening or greenery, green infrastructure, nature-based solutions, or urban ecology/biodiversity was more central. Only English-language articles were considered.

The first phase of record screening pertained to the above qualifications. Of the 921 unique search results, 155 were found to primarily address urban forestry in the built landscape and employ verbal interviews as one of their research methods. This was determined by carefully examining the manuscript's title, abstract and methods, and when necessary, further reading of the entire journal article.

The second phase of screening took place during coding. The identified manuscripts (n=155) were placed into one of three relevance categories after a full reading, which aided in a more nuanced understanding of each article's pertinence to this review. The three relevance categories were defined as records that (1) contained methods and results that were based primarily on interviews; (2) utilized a mixed methods approach, including interviews; and (3) mentioned interviews, but they were not integral to the methods or results. The third (3) category of records (n=43) was excluded from analysis due to the fact that these articles only made a cursory reference to the use of interviews and included limited detail on how they were implemented. In some instances, these studies did not employ research interviews but referenced or utilized data from previous research that did employ interviews. In a small number of cases, researchers used the word 'interview' but were in fact describing a written survey or questionnaire.

This occasional conflation of the terms 'interview,' 'survey,' and 'questionnaire' was a point of concern during the second screening phase. While some articles used the term 'interview' to describe a written survey or questionnaire, others did the reverse, employing the terms 'survey' or 'questionnaire' to describe a verbal, structured interview. In this review, if an author employed a verbal (not written) questioning process, which was described as an interview at least once in the article (even if it was described with other terms as well), and it also satisfied the above criteria, the record was included in analysis. The final number of records included in this review following both screening phases was 112 (see Table 1 for information pertaining to manuscript categorization and elimination).

To properly determine the relevance categories, all unique search results were screened to determine final inclusion. This process involved

Table 1
PRISMA flow chart. The identification of studies via databases.

Identification:	Records identified from databases: n=1,679	→	Duplicate records removed before screening: n=758
Screening:	Records screened: n=921	→	Records excluded: n=809
Included:	Studies included in review: n=112		

two passes through the records as described above. In addition to the elimination of records not pertaining to this review, a secondary purpose was to determine coding topics to be utilized during data categorization and analysis.

The second pass implemented an inductive coding strategy using the computer-assisted qualitative data analysis software NVivo 13 (Lumivero, 2020); (see Table 2 for coding topics). Descriptive information about each article (i.e., title, authors, journal name, and publishing date) was collected during the record search and identification phase of the review process. The primary purposes of the coding topics were to identify the types of studies that have utilized research interviews and the ways in which said interviews were designed and implemented.

3. Results

Included in the following subsections are the results from relevance categories 1 and 2. Category 2 records were less likely to have as detailed accounts of interview practices and procedures as category 1 records, simply due to the fact that the authors were covering multiple research methods in one paper. None of the manuscripts provided all of the coding topics that were collected in this review (see Table 2), but each record contained at least some of the details we sought to gather about its interview usage. Where applicable, a denotation regarding the subset of the 112 total records will be included in that section's results, defining the number of records that included the particular category of information being discussed. The purpose of this is to prevent misrepresentation of the analysis.

3.1. Publication journal and date of publication

A majority of records (n= 65) were published in discipline-specific journals, the most prevalent of which was *Urban Forestry & Urban Greening* (n=48), followed by *Arboricultural Journal* (n=9) and *Arboriculture & Urban Forestry* (n=8). Other commonly occurring journals included *Landscape & Urban Planning* (n=7), *Cities and the Environment* (n=3), *Society & Natural Resources* (n=3) and *Sustainability* (n=3). Records in this review were found in a total of 34 individual journals and 23 of these records (21 % of the 112 included records) were the only published manuscript from their respective journal that met the aforementioned criteria (see Table 3).

Table 2
Coding strategy. Coding topics utilized within NVivo 13 (Lumivero, 2020) to support data organization and analysis of interview methods and data. *Nodes* can be understood as organized 'containers' for categorizing different themes or ideas.

Coding Topics	*Nodes*
1: Study Context and Themes →	Study timeline
	Geography
	Research objectives (of the study)
	Interview goals/themes
	Rationale for use of interviews
	Methodology - Study approach/design
	Methodology - Interview type
2: Interview Subjects →	Recruitment/sampling methods
	Recruitment scale
	Number of subjects
	Subject characteristics
3: Interview Process and Data Analysis →	Interview length
	Interview setting
	Subject compensation
	Data recording methods
	Data analysis methods
4: Limitations and Future Research →	Research limitations
	Future research needs

Table 3
Publication journal prevalence.

The number of published manuscripts per journal that employed research interviews.

Journal Name:	*Number of records:*
Urban Forestry & Urban Greening	48
Arboricultural Journal	9
Arboriculture & Urban Forestry	8
*formerly *Journal of Arboriculture* (1975–2005)	
Landscape and Urban Planning	7
Cities and the Environment	3
Society & Natural Resources	
Sustainability	
Ecosystem Services	2
Environmental Management	
Journal of Forestry	
Land	
Australian Geographer	1
Canadian Journal of Forest Research	
Environmental Research	
Environmental Science & Policy	
Forestry Chronicle	
Forests	
Frontiers in Sustainable Cities	
Geoforum	
Geographical Research	
Irish Forestry	
Journal of the American Planning Association	
Journal of Environmental Horticulture	
Journal of Sustainable Forestry	
Kastamonu University Journal of Forestry Faculty	
Land Use Policy	
Landscape Architecture Frontiers	
Scandinavian Journal of Forest Research	
Trees, Forests and People	
Urban Affairs Review	
Urban Analytics and City Science	
Urban Ecosystems	
Urban Geography	
Urban Policy and Research	

3.2. Coding topic 1: study context and themes

3.2.1. Timeline and geography

Since the use of qualitative methods remains emergent within the field of urban forestry, the recency of this literature was not surprising. Only four records out of 112 were published prior to the year 2000 (Tipple et al., 1990; Johnston, 1997, 1998, 1999), and only ten were published between 2000 and 2009. The remaining 98 manuscripts were published from 2010 onward. While all records included the publishing date and some included information approximating when the research activities took place, forty-eight provided additional details about the specific window during which interviews were conducted (including the months or seasons and the year in the timeline description).

The greatest number of studies that employed research interviews were conducted in North America (n=58), however, there was significant representation from other continents: Africa (n=10), Asia (n=11), Australia (n=11), Europe (n=22), and South America (n=1). One study was conducted in both North America and Europe (Kampelmann, 2021). The greater representation of studies from English-speaking parts of the world is likely a result of this review's focus on English-language records. Our findings should not be understood as evidence that interview-based research in urban forestry is not being conducted in zones where English is less commonly used in academic works. North American countries included the United States, Canada and the Dominican Republic; African countries included South Africa, Ghana, Nigeria, Tanzania, and Zimbabwe; Asian countries included Nepal, Hong Kong, Malaysia, China, India, South Korea, Russia and Turkey; European countries included the United Kingdom, Italy, the Netherlands, Denmark, Norway, Iceland, Greenland, Serbia, Bosnia and

Herzegovina, Croatia, Montenegro, Macedonia, Portugal, and Belgium; and the South American country represented among the records was Chile (Escobedo et al., 2006).

Study area type was categorized into the following gradation of geographic categories, from most to least local: neighborhood-level (n=7), municipal (n=33), metropolitan area (n=13), regional or statewide (n=25), multi-municipal (n=18), national (n=10) and multinational (n=6). Studies that fit into the 'multi-municipal' category explored research questions in multiple cities located within the same country. Studies in the 'multinational' category also focused on multiple cities, but in differing countries (Kjeldsen-Kragh Keller and Konijnendijk, 2012; McBride and Douhovnikoff, 2012; Krajter Ostoić et al., 2017; Raum et al., 2019; Shackleton and Mograbi, 2020; Kampelmann, 2021).

3.2.2. Interview objectives and rationale for use of interviews

All one hundred and twelve manuscripts clearly laid out their research objectives – and those objectives were naturally quite diverse. Many had human perspective-centered research goals, but quite a few others did not cite human perspectives within their research objectives, and instead employed interviews as one part of a suite of information gathering tools to learn about a non-human perspective-centered topic. Some of these non-human perspective-centered reasons for interview use were to provide factual information about the history of an urban forestry program (Johnston, 1997, 1998, 1999, 2002; McBride and Douhovnikoff, 2012; Yao et al., 2019) or to supplement tree inventory data with context about planting and maintenance activities (Kuruneri-Chitepo and Shackleton, 2011; Gayo, 2023). However, in manuscripts that employed interviews as the main (or the only) research method, the objectives of the study as a whole were the same as (or very similar to) the objectives of the interviews. Studies that relied on mixed research methodologies showed greater differences between research objectives and interview objectives – with the interview themes speaking to only one part of the larger objectives of the research endeavor.

Sixty-four authors explained, either explicitly or implicitly, their rationale for including research interviews in their methodology. This is particularly relevant, as one of the central goals of this review is to understand how and why interviews have been employed in urban forestry. Gleaning the researchers' perspectives on why they chose these methodologies is telling, as the justification of their methodologies fell into four categories. Interviews were utilized in order to learn about:

(1) Civilian perspectives/perceptions (n=20), including some that deliberately centered diverse groups and those historically underrepresented in urban forestry (n=6)
(2) Civilian participation/decision-making with regard to activities on their own property and volunteer activities in their community (n=8)
(3) Urban forest manager and arborist perspectives/decision-making (n=26)
(4) Stakeholder collaboration – among government entities, NGOs, businesses and volunteers (n=10)

3.2.3. Study approach and design

The majority of the studies were conducted using an exclusively qualitative methodology (n=67). There was a significant number of studies, however, that employed a mixed methods (i.e., both qualitative and quantitative methods) approach (n=29), as well as some that only employed quantitative methods in their study design and implementation (n=14). The mixed-methods and quantitative approaches that were combined with interview methods included: document analysis (n=23), written questionnaires (n=14), census data analysis (n=3), tree inventories or tree health surveys (n=19), urban forest measurements like aerial data and carbon budgets (n=7), and qualitative group research activities like field-work, observation, focus groups and workshops (n=9).

For the purpose of this review, 'survey' is used in reference to a field survey involving data collection regarding trees and site conditions, whereas 'questionnaire' will refer to written, qualitative data collection from human research subjects.

3.2.4. Interview type

The majority of articles that discussed the type of interview they employed (n=95) described their interview style as semi-structured (n=71), in-depth (n=13), or other terms that indicated a somewhat open-ended format (n=5). Many articles used those terms interchangeably. Other articles described their approach as employing key informant interviews (n=7) or verbal questionnaires ("face-to-face survey") (n=15). A number of authors used a combination of open-ended and closed-ended tactics in their interviews, which is why the quantities above equate to a larger number than the number of manuscripts that reported on interview type (n=95). Other researchers employed tactics in addition to their chosen interview style, like q-method survey/interview combinations (Živojinović and Wolfslehner, 2015), Likert scale questioning (Young, 2011; Young and McPherson, 2013; Chen, 2015; Chen and Hua, 2017; Krajter Ostoić et al., 2017; Graça et al., 2018; Ligtermoet et al., 2022; Danquah, 2023), and photo elicitation (Westphal, 2003; Sinclair et al., 2014).

3.3. Coding topic 2: interview subjects

3.3.1. Recruitment and sampling methods

Sixty-eight of the records described their participant recruitment and sampling methods (this category applies to the studies that *did not* have a predetermined list of target individuals to interview). Most authors employed either purposive or snowball sampling, with many utilizing a combination of both (n=43). Other less prevalent methods used were random sampling (naturalistic approach or random selection of addresses) (n=10), subset selection from respondents to a pre-interview mail survey (n=6), stratified sampling (Burcham and Lyons, 2013; Chen, 2015; Krajter Ostoić et al., 2017; O'Herrin et al., 2018), intensity sampling (McLean and Jensen, 2004), transect sampling (Nero et al., 2018; Gwedla et al., 2022), recruitment within a pool of company employees (Kloster et al., 2020), and public recruitment via posters (Sinclair et al., 2014).

3.3.2. Interview subject quantities and recruitment scale

Ninety-five of the 112 reviewed manuscripts featured information on the number of interview subjects. A subset of the remaining manuscripts did not include specific information on subject quantities, instead enumerating the affiliations (governmental, organizational, institutional) of their sources (e.g. "key representatives from five other City agencies" (Locke et al., 2013, p. 3)). In those cases, the intention might have been to allow readers to assume the sample size (based on one source per affiliate), though this was not explicitly stated. This contributed to some vagueness around the final sample size. Some records offered no information relating to subject quantity whatsoever. Of those that did share subject quantity information (n=95), the smallest sample size was one individual (Booth, 2006), and the largest sample size was 2,688 individuals (Krajter Ostoić et al., 2017). The median number of interview subjects was 26. If we exclude the verbal questionnaires ("face-to-face surveys"), which had outlier quantities of subjects because interviews were shorter, more structured, and were generally administered by multiple researchers, the median number of subjects in studies employing more in-depth interviews was 23.

Twenty-two records indicated not only the number of subjects that were interviewed, but also the number of potential subjects that were contacted during the recruitment process (heretofore referred to as recruitment scale). When comparing the recruitment scale to the realized subject quantity, researchers interviewed an average of 64 % of potential subjects. The highest success rate was 100 % (Nguyen et al., 2017) and the lowest was 25 % (Ng et al., 2015).

3.3.3. Interview subject characteristics

Interview subject types could be broken down into five categories. The largest category of studies included interviews only with (i) urban forestry professionals or those who contributed to tree planting and/or management decision-making in their communities (n=55). The remaining subject types included (ii) civilians who did not participate in urban forestry activities (n=28), (iii) urban forest volunteers (n=4), (iv) non-decision-making arborists or members of tree crews (n=4), and (v) professionals not working explicitly in urban forestry but tangentially connected to the work (n=4). The remaining manuscripts included interviews with subjects that fit into two or more of the above categories (n=17).

3.4. Coding topic 3: interview process and data analysis

3.4.1. Interview length and setting

The range of interview lengths found among the studies was not nearly as broad as the range of participant group sizes. While researchers conducting larger, structured studies are able to hire and train additional interviewers to increase sample size, there is only so much time that one can reasonably dedicate to each interview subject. Forty-five out of 112 records identified interview length. The shortest duration was 10 minutes (Nali and Lorenzini, 2009) while the longest was two and a half hours (Ligtermoet et al., 2022), and the average length equated to 49 minutes. Thirty-four records reported interview length in terms of number of questions (either as the only measurement of interview length or in addition to discussing temporal duration), which ranged from as few as 5 (Nali and Lorenzini, 2009) to as many as 60 questions (Young, 2011; Young and McPherson, 2013). Some of these records included interview guide details in an appendix or supplementary data document rather than in the main article.

Over half of the records (n=64) discussed the interview setting (i.e., the place or mode in which an interview was conducted). A total of 13 studies featured interviews that were exclusively face-to-face (location not included), 15 were a combination of face-to-face and telephone or video call (these authors generally cited the non-face-to-face options as accommodations for situations in which it was not feasible to meet in person, though face-to-face might have been preferred); 16 were exclusively remote (via telephone or video call), and 20 were naturalistic. Naturalistic interviews were held in a location that was relevant to the subject matter. For example, urban forestry professionals discussing their work were interviewed in their office or in the field (Harper et al., 2017; Vogt and Abood, 2021), residents reflecting on the trees in their community were interviewed at their homes or within view of the tree(s) in question (Coles et al., 2013; Chen, 2015; Pearce et al., 2015; Jones, 2021; Gwedla et al., 2022), and pedestrians were approached in parks, streets, and university grounds to discuss the trees they experience in their daily lives (Notaro and De Salvo, 2010; Ng et al., 2015; Chen and Hua, 2017; Krajter Ostoić et al., 2017; Graça et al., 2018; Zhao et al., 2018; Fernandes et al., 2019; Basu and Nagendra, 2020). A few of the more recent studies cited the COVID-19 pandemic as one factor that limited the ability to freely select a desired interview mode or setting (Judice et al., 2021; Dickinson and Ramalho, 2022).

The majority of records (n=108) included no mention of the number of interviews that each subject was expected to complete. Most subjects likely completed only one interview, but four records reported that some or all of the subjects completed more than one interview during the course of the study (Pincetl, 2010; Živojinović and Wolfslehner, 2015; Kloster et al., 2020; Butt et al., 2021).

3.4.2. Subject compensation

Few manuscripts that were reviewed (n=4) mentioned compensation for interview subjects or participation incentives. Of those, one included mention only to make clear that subjects were not compensated (Moskell et al., 2010), one thanked their participants by giving them tulip bulbs (Nali and Lorenzini, 2009), another offered an unspecified gift "as appreciation for participating in the interview" (Chen, 2015, p. 800), and only one study provided financial incentive by giving participants a "10-dollar cash voucher…to retain respondents and encourage them to answer the questions truthfully" (Chen and Hua, 2017, p. 172).

3.4.3. Data recording methods

In describing the interview process, 46 records indicated how they recorded their data. The majority (n=36) employed only audio recordings for their data collection, followed by verbatim transcription. Six studies incorporated a combination of audio recording, field note taking and/or reflexive note taking. Only four studies relied solely on field notes (McLean and Jensen, 2004; Nali and Lorenzini, 2009; Krajter Ostoić et al., 2017; Gwedla et al., 2022).

3.4.4. Data analysis

The most prevalent type of data analysis employed by researchers was an iterative, inductive, thematic coding process. Forty-three articles mentioned using a specific coding software, with NVivo (Lumivero, 2020) being the most commonly referenced suite (n=32). Other software cited in data analysis methods included Dedoose, LadderUX, Microsoft Excel, and Text Analysis Markup System.

3.5. Coding topic 4: study limitations

Just under one third of the studies (n=36) expressed the limitations of their qualitative research. These limitations generally fell into the following categories (numerous records cited limitations in more than one of these categories, thus "n" may equate to more than 36):

(1) Scope: Topics or details that were relevant to the central questions of the research were left out of the study due to limited scope. Most of these authors agreed that these outside-of-scope topics would be useful launch points for future research (n=19).
(2) Participant selection bias: Groups of interview subjects included in the research were not necessarily representative of the community/demographic from which researchers were seeking to learn (n=8).
(3) Sample size: Only small pools of research subjects were available due to lack of interest in the research, recruitment challenges, or researcher capacity (n=7).
(4) Location generalizability: The uniqueness of urban forestry practices in various localities sometimes did not lend itself to the generalization of findings across non-researched locales (n=7).

The authors of one manuscript explained a research limitation (which did not fit into any of the above categories) in the following manner:

> "It is important to note that this research was situated within democratic, capitalist governance systems, and should be interpreted in this context" (Nesbitt et al., 2019, p. 10).

Five manuscripts not only mentioned the limitations of their studies, but explicitly called out the importance of clearly stating this information when reporting on qualitative research findings (Vander Vecht and Conway, 2015; Nesbitt et al., 2019; Ordóñez, 2019; Raum et al., 2019; Judice et al., 2021). Statement of limitations provides greater transparency to the qualitative research process and helps to establish the trustworthiness of the researcher, which is particularly important when researchers are working with nontraditional research participants and/or are conducting ongoing research within a community. Research limitations may also help to define opportunities for future research.

In Ordóñez (2023), eight recommendations were made to improve the reporting of qualitative social research in urban nature studies, based on a literature review of studies that explored perceptions of the urban forest using a multitude of human-subject methodological approaches (Ordóñez et al., 2022). Recommendations one through six are

consistent with the methodology of this review (as the below recommendations are in alignment with many of the coding topics in this review) as well as its findings:

> "1) articulating the "why" of the qualitative approach; 2) describing the data analysis procedures and techniques in more detail; 3) reporting the coding framework; 4) reporting results as insights extracted from data instead of describing the data; 5) describing participant recruitment and data collection strategies; 6) describing the participants" (Ordóñez, 2023, p. 1).

The challenges we found in our analysis of the reporting on interview research were similar to the concerns outlined in Ordóñez (2023). For instance, Ordóñez (2023) asserts that, in reporting on qualitative research, inconsistencies in the details provided by researchers may occur and the extent to which methods and results are reported varies greatly. That is certainly the case in this review. Some of the records we found contained minimal information relative to methods and results, while others provided this information in extensive detail. This is why the majority of the subsections within the Results section of this review contained 'n' quantities that summed to less than 112 (the total number of records in the review) – because very few categories of information were provided by all 112 records. This made parts of this review challenging as many records were missing multiple components of information that were central for contextualization and comprehension (see Table 4 for quantity of records that reported information pertaining to each coding category).

4. Discussion

4.1. Methodological approach

A majority of researchers (n=93 or 83 %) employed an open-ended approach to their research interviews, as evidenced by their use of terms like, "semi-structured," "in-depth," "open-ended," "open framework" or "intensive". These open-ended research methods were either used alone or in concert with more closed-ended methods. Only a small minority (n=16 or 14 %) of researchers employed exclusively structured or closed-ended methods, some of which were described as "surveys" or "verbal questionnaires" that were conducted either over the telephone or face-to-face (Nali and Lorenzini, 2009; Moskell et al., 2010; Lamichhane and Thapa, 2012; Chen and Hua, 2017; Zhao et al., 2018; Shackleton and Mograbi, 2020; Danquah, 2023). This aligns with Elmendorf and Luloff's (2001) stance that open-ended questioning facilitates a "better view of the social reality of a person, his or her place, and interactions," (p. 142) and hence is a more popular approach (Creswell, 1998; Elmendorf and Luloff, 2006). Research interviews have the potential to require an increased resource commitment over other methodologies (Harper et al., 2020) and researchers likely chose to avail themselves of the opportunity for a deeper understanding of their subjects. It is worth noting that the closed-ended interview studies that we reviewed typically featured larger numbers of participants, and consequently, larger numbers of interviewers (see Table 5 for the studies that employed exclusively closed-ended methods that also provided subject quantities). With the exception of Moskell et al. (2010), these studies represent the twelve largest sample sizes included in this review. Outcomes of open-ended interviews may be substantially shaped by the interviewer, and there could be risk of inconsistent results due to variations in interviewer style/technique with large scale open-ended interviews utilizing multiple interviewers. Therefore it makes sense that the closed-ended methods accompanied the largest sample sizes and the use of multiple interviewers. Closed-answered interview questions, however, may miss opportunities for depth of story as interviewees are given less opportunity to provide additional details and context.

Another methodological finding was the prevalence of mixed methods. Over half (n=59) of the records employed other research methods in combination with interviews, including but not limited to quantitatively-analyzed questionnaires, urban forest composition data collection and document analysis. This supports the idea that combining qualitative and quantitative data, as well as "the cross-pollination of scientific skills and approaches," is crucial for understanding urban nature (Ordóñez, 2023, p. 6).

The small but not insignificant number of manuscripts that employed naturalistic interviews (n=20) was somewhat surprising, given that they have the potential to be additionally burdensome on researchers. Interviews are already time-intensive, but these researchers saw the value in talking about trees in the vicinity of trees. Naturalistic interviews can pose additional challenges – relating to poor weather conditions, farther travel distances, and the commotion and unpredictability of performing interviews in public. However, in this format, researchers were able to see the "specific urban trees" (Harper et al., 2017, p. 167) that were being discussed, assess participants' real-time impressions and perceptions of their landscape (Nali and Lorenzini, 2009; Coles et al., 2013), incorporate ethnographic research techniques (Basu and Nagendra, 2020), elicit certain sensations or memories in relation to the landscape (Pearce et al., 2015; Jones, 2021), and avoid putting participants in uncomfortable situations (Chen and Hua, 2017). In a dense city like Hong Kong, Chen and Hua (2017) saw the barriers to approaching potential participants during "unsolicited visits to their apartment units in high-rise residential buildings guarded by security checkpoints" (p.

Table 4
Variation in reporting of methods and data information provided by each record, by codes.

	Number of records that:	
	Provided usable detail	*Did not acknowledge this category*
Study timeline	69	43
Geography	112	0
Research objectives (of the entire study)	112	0
Interview goals/themes	104	8
Rationale for use of interviews	64	48
Study approach/design	109	3
Interview type	95	17
Recruitment/sampling methods	68	44
Recruitment scale	22	90
# of subjects	95	17
Subject characteristics	112	0
Interview length (minutes)	45	67
Interview length (number of questions)	34	78
Interview setting	64	48
Subject compensation	4	108
Data recording methods	46	66
Analysis methods	81	31
Research limitations	36	76
Future research needs	59	53

Table 5
Closed-ended interview subject quantities source numbers in studies employing primarily closed-ended interview methods.

Author	*Year of Publication*	*Number of Subjects*
Chen	2015	593
Chen and Hua	2017	1,075
Danquah	2023	600
Graça et al.	2018	819
Gwedla et al.	2022	800
Krajter Ostoić et al.	2017	2,688
Lamichhane and Thapa	2012	207
Moskell et al.	2010	30
Nali and Lorenzini	2009	944
Ng et al.	2015	509
Notaro and De Salvo	2010	308
Shackleton and Mograbi	2020	1,100
Zhao et al.	2018	2,337

172), thus opting to perform interviews in a public setting.

4.2. Interview subjects

The five interview subject types into which each study was categorized were: urban forestry professionals or those who contributed to tree planting and/or management decision-making in their communities; civilians who did not participate in urban forestry activities; urban forest volunteers; non-decision-making arborists or members of tree crews; and professionals not working explicitly in urban forestry but tangentially connected to the work.

Only 25 % of all the studies focused primarily on civilians who are not active participants in the work of urban forestry (i.e., were not volunteers). This demonstrates an apparent weighting of the perspectives of individuals in their professional and/or volunteer roles (as opposed to the "non-engaged civilian" role). As mentioned in Elmendorf and Luloff (2001; 2006), this allows the interviewer to avail themselves of "insider" founts of knowledge and information, but excludes "outsider" input. This weighting is likely a combination of researchers' priorities and objectives, as well as subject accessibility (individuals who are already involved in the work or part of established networks are easier to reach and more likely to participate in research). Interestingly, 64 % of the twenty-two studies situated in the Global South incorporated "outsider"/civilian perspectives, while only 27 % of the ninety studies in the Global North incorporated those types of individuals. Potential explanations for this may include the Western fixation on knowledge being derived from academic and professional experience over local/-alternative ways of knowing, or the more established resources in Global North communities to hire professionals in the realm of urban forestry.

Sixty-four percent of American studies exclusively interviewed individuals speaking in their professional capacities as urban forestry decision-makers. Demographic studies of urban forestry professionals in the United States demonstrate that they are overwhelmingly male and white (O'Herrin et al., 2020; Kuhns et al., 2002) which speaks to the barriers to uncovering diverse perspectives when professional perspectives are emphasized. The costs of excluding sectors of community stakeholders from urban forestry research include:

> "poor information and planning, increased conflict and cost of conflict, poor collaboration, and increased mistrust and apathy" (Elmendorf and Luloff, 2001, p. 139), and

> "[omission of] some of the most prominent socio-cultural values associated with trees like beauty and cultural heritage that cannot be as easily quantified," lack of consideration for "costs associated with maintenance of different species of trees and how those costs will be distributed across different actors over time," as well as the perpetuation of environmental injustices and inequitable "access to sustainably managed environmental benefits" (Carmichael and McDonough, 2018, p. 222).

Every record shared the researchers' broad study objectives and the goals of the interview itself, but most did not share the specifics of their interview guides. This creates a potential barrier to understanding, since according to Ordóñez (2023),

> "the questions show the logistical and narrative structure through which participants engaged in the research process, or even what kind of information they shared or co-generated. In many cases, the questions define appropriate analysis, since many analytical techniques derive from the questions" (p. 6).

Thus, it would be preferable for qualitative researchers to proactively include a broad swath of interview details in their reporting. Nearly every record that included a section pertaining to "Limitations" cited the need for further qualitative study in urban forestry. Increased detail shared by qualitative researchers supports future qualitative works.

4.3. Subject compensation

It is also worth noting the minimal usage (or even mention) of interview subject compensation or participation incentives. Part of the reason for this might be that many (n=55) of the reviewed studies centered those being interviewed in their roles as natural resource professionals, and it is possible that their participation may have fallen within the scope of their work, and additional compensation was not viewed as being necessary. All four studies that did mention compensation or incentives interviewed civilians that were operating outside of their professional roles (Nali and Lorenzini, 2009; Moskell et al., 2010; Chen and Hua, 2017). There were, however, 44 remaining studies that involved civilians but made no mention of compensation. In light of the need to increase the involvement of underrepresented groups in urban forestry research (Elmendorf and Luloff, 2001; Ordóñez, 2023), offering compensation to subjects with limited time and resources (i.e., barriers to participation in research) might prove fruitful.

While there is debate in the biomedical field regarding the ethics of using the promise of financial compensation when recruiting from vulnerable or marginalized communities (Denny and Grady, 2007), participation in qualitative urban forestry research is generally a low-risk activity and monetary incentives (or assistance related to transportation, meals, or childcare) may help someone justify the time and expenses required to offer their perspective. It also demonstrates tangible investment on the part of the researcher and research institution in centering voices of those traditionally excluded from this type of study. Research on participation incentivization done by Kelly et al. (2017) showed that monetary incentives made potential participants more willing to engage in research than those who were offered non-monetary compensation or no compensation at all. While non-monetary compensation (such as a prize or a donation to charity in the participant's name) did not help to increase the likelihood of participation, it can still be worth incorporating simply to display gratitude after the interview has been completed as a way to foster mutual appreciation between researcher and participant – as Nali and Lorenzini (2009) demonstrated with their gift of tulip bulbs "as a sign of gratitude" (p. 88).

5. Conclusions

This review has explored how researchers in urban forestry have approached uncovering the complex ways that people in cities interact with and think about trees in the built landscape. We know that whether an individual's feelings and actions toward the trees in their community are active or passive, productive or destructive, they have the potential to impact the urban forest. Beyond understanding human impacts on the urban forest, interviews have also shown to aid in understanding how people relate to the trees around them, and how that connects to their needs from urban forestry programs in their communities. We cannot expect to deeply understand the urban forest nor engage in the meaningful growth of our field without human perspectives. In engaging with real-time (often face-to-face) qualitative research, it has been possible to better understand, (i) how civilians interpret their landscape, (ii) how and why civilians actively engage with and make decisions about the urban forest, (iii) how arborists and urban forest managers feel about their work and weigh tough decisions, and (iv) how multiple stakeholder groups collaborate to positively impact the urban forest.

It has also become apparent through this review that urban forestry studies that center in-depth research interviews are still relatively few, and those that center non-traditional civilian voices are even fewer. However, many of the researchers included in this review explicitly called out the need to expand qualitative inquiry in urban forestry, and to more robustly involve diverse perspectives in that work. As these dual objectives are pursued, it is imperative that researchers clearly share their methods, recruitment and analysis techniques, outcomes, and obstacles.

It is important to note that the authors of this review limited the manuscript search to only those that were available in English. This is likely to have affected our findings and skewed them towards countries where the usage of English is more prevalent in academic research – i.e., the Global North. Eighty % of the records in this review studied the urban forests, practitioners, and community members of the Global North. A future literature review could look at qualitative urban forestry research in regions of the Global South specifically, and incorporate multi-lingual sources to boost the diversity of perspectives.

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CRediT authorship contribution statement

Candace B. Powning: Conceptualization, Data curation, Formal analysis, Methodology, Writing -original draft, Writing - review & editing. **Richard W. Harper:** Conceptualization, Supervision, Funding acquisition, Methodology, Writing - review & editing. **David V. Bloniarz:** Supervision, Methodology. **Katherine J. Kahl:** Supervision, Writing - review & editing. **Ezra M. Markowitz:** Supervision, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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