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## The ‘quiet hunt’: the significance of mushroom foraging among Russian-speaking immigrants in New York City

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### ABSTRACT

Urban foraging provides city dwellers with numerous ecosystem services, but this human-nature interaction is largely missing from the urban ecosystem services scholarship. This exploratory study aims to address this gap in the literature and examines the benefits and values associated with foraging in New York City, United States. We focus on Russian-speaking mushroom foragers, a previously unstudied community. Data from 10 interviews reveals that for some groups, foraging is primarily about cultural ecosystem services, with a provisioning attribute. Foraging supports multiple benefits, most notably contributions to social relations, cultural heritage, and recreational experiences; these nonmaterial contributions often intertwine with material benefits. Our findings further demonstrate the mutual exchange of benefits between humans and nature, including services to ecosystems and species. Participants reported engagement in multiple stewardship practices and actively maintained and enhanced ecosystem services. We encourage future ecosystem services assessments to recognize foraging as an urban activity and consider the bi-directional exchange of benefits between humans and ecosystems. To some participants, foraging was an integral part of their relationship with the natural world, intertwined with relational values of connection to nature, kinship, love, and care. Our results suggest that relational values can be central for understanding the value of ecosystem services. Our study further illustrates that some ecosystem services may be associated with practices, rather than places, and future work should examine these links in more detail.

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## Introduction

Urban greenspaces contribute to the well-being of city dwellers in multiple ways. These include contributions to subjective health and well-being (Maurer et al. 2021), psychological well-being (Nghiem et al. 2021), increased physical health (Wang et al. 2021), improved air quality (Kabisch et al. 2021), recreation experiences (Venter et al. 2020), and opportunities to build social connections (Parker and Simpson 2020). These contributions of greenspaces to well-being are often studied under the umbrella of the Ecosystem Services (ES) framework. Existing ES research in cities has largely focused on ecosystem services that are easier to quantify – for instance, habitat provision, contributions to mental health, and aesthetics (Haase et al. 2014; Cheng et al. 2021). The intangible dimensions of ecosystem services, like contributions to cultural heritage or strengthening personal and cultural identity, have received less attention (La Rosa et al. 2016). Additionally, current ES studies seldom consider the role of urban greenspaces in the provision of food and materials (Shackleton

et al. 2017), except for research on urban agriculture (e.g. Lin et al. 2015; Wilhelm and Smith 2018).

Existing ES scholarship on urban greenspaces might thus be missing uses and values central to the well-being of city dwellers. One activity that, with few exceptions, is under-explored in ES scholarship is urban foraging – i.e. the harvesting, gathering, or collection of non-cultivated mushroom and plant materials for food, medicine, and other resource values (Hurley and Emery 2018; Garekæ and Shackleton 2020). One overarching reason for this gap is that until recently, ES scholarship has focused overwhelmingly on non-urban landscapes as service providers (Haase et al. 2014) and has seldom addressed foraging in developed countries or in urban areas (Shackleton et al. 2017). By contrast, urban foraging research outside of the ES literature has described the presence of foraging practices in cities across the world (Poe et al. 2013; Kujawska and Łuczaj 2015; Mollee et al. 2017; Landor-Yamagata et al. 2018; Johnson et al. 2020). Researchers have documented a wide variety of gathered plants and

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mushrooms and diverse values linked with urban foraging (McLain et al. 2012). Urban foraging supports livelihoods (Kaoma and Shackleton 2014), helps transfer local ecological knowledge on edible species (Landor-Yamagata et al. 2018), and contributes to food and medicinal sovereignty (Poe et al. 2013). It also provides opportunities for people to maintain cultural identities (Hurley et al. 2013), connect to nature in culturally meaningful ways (Poe et al. 2014), and recreate (Šiftová 2020), among other benefits. Many of these benefits and plant-people relationships could be considered ecosystem services and therefore, are important to recognize in ES assessments and management.

Another possible explanation of why foraging is missing from urban ES assessments could be that, especially in the North American context, foraging on city lands is prohibited in many, if not most, urban areas (Shortly and Kepe 2020). Concerns about conservation and sustainability, such as threats to species habitat and diversity (Molnár et al. 2017), as well as food safety, are among the reasons for these prohibitions. Yet, foraging impacts vary and may not necessarily conflict with conservation objectives (Ticktin 2004). A closer examination of urban foraging practices reveals overlaps between this human-nature interaction and conservation goals. Indeed, previous research suggests that in addition to extraction of species, foragers often engage in multiple stewardship practices, sometimes similar to practices implemented by conservation agencies (Charnley et al. 2018). These include selective harvesting, removal of invasive species, and pruning diseased parts of plants (McLain et al. 2017). Stewardship and caring relations often form part of the interactions between forager, foraging places, and foraged species (McLain et al. 2017; Himes et al. 2020). Through this exchange of benefits, foragers co-produce and manage the supply of urban ES (Fish et al. 2016). These reciprocal interactions can foment connections to nature (Shortly and Kepe 2020) and could be central to foragers' well-being (Jax et al. 2018).

To address the gap on urban foraging in the ecosystem services literature, this exploratory study examines the benefits and values associated with foraging among Russian-speaking foragers in New York City, United States. Although foraging on lands owned by the city is not allowed, anecdotal accounts, the popular literature (e.g. Chin, 2014; Long, 2019), and previous field research (Emery et al., unpublished data) reveal that foraging may be relatively common in New York City. During preliminary interviews to assess the feasibility of research on urban foraging in New York City, some park managers reported observing mushroom foraging by residents of potentially Russian or Eastern European descent. Our study

follows up on that information, providing the first documentation focused on foragers with cultural roots in Russia or Russian-speaking regions – places with a vast history of mushroom foraging (Yamin-Pasternak 2008; Poe et al. 2014). We explore how that history and tradition does (or does not) persist when individuals reside in novel urban ecosystems, far from those practices' cultural roots. Further, research on urban foraging has largely focused on vascular species (for some notable exceptions, see Poe et al. 2014; Kujawska and Łuczaj 2015). This research thus also seeks to expand scholarly understanding of the breadth of taxa foraged in U.S. cities by examining practices focused on fungi.

Additionally, our work aims to broaden scholarly understanding of the diverse ways people engage with and value urban greenspaces. We focus on capturing the diversity of values and benefits associated with foraging, regardless of their value type. Further, we examine stewardship practices among foragers to understand different ways foragers might be contributing to the supply of urban ES. The main objectives of this work are to:

- (1) Examine the meanings (notably, the benefits and values) associated with mushroom foraging among Russian-speaking immigrants in New York City; and
- (2) Explore whether environmental stewardship practices are associated with foraging

## Methods

### Data collection

Russian is the fourth most common language in New York City; about 2.5% of New York City residents speak Russian (“Data USA”, 2019). However, anecdotal accounts indicate that not all members of Russian or Russian-American community speak Russian as their primary language. We therefore define our pool of potential participants as individuals who live in New York City and meet at least one of the following criteria: (1) they speak Russian; or (2) they identify as Russian or Russian-American. We collected data during September and October 2019, throughout New York City's five boroughs. We supplemented interviews (and connected with potential participants) through participant observation at foraging tours, mycological workshops, and foraging excursions, but do not report in detail on these data. We also connected with potential participants through community centers, social media, and snowball sampling.

We used a semi-structured interview format. We modified and translated an interview protocol previously tested in a larger study on immigrant foraging in New York City (Emery et al., unpublished data).

The protocol included questions about foraged species and practices, knowledge systems, access to land, conflicts associated with foraging, and land management recommendations. We added questions on stewardship practices (McLain et al. 2017) and non-material values (Gould et al. 2015) associated with foraging. Questions about stewardship centered around what that concept meant to the participants, and whether they engaged in any stewardship activities in places where they foraged. Because the word ‘stewardship’ does not translate directly to Russian, we used the phrase ‘taking care of nature’ to capture this concept regardless of the language in which an interview was conducted. Questions on nonmaterial values addressed the reasons participants forage, if and why they consider foraging important, and whether their foraging practices reflect some aspects of their cultural background. We also collected information on participants’ socio-economic characteristics (annual income level, age, country of birth).

Our final sample consisted of 10 individuals. The interviews were audio-recorded and lasted between 45 minutes and 3 hours. The first author (TM) obtained verbal consent before each interview and conducted all interviews. Nine interviews took place in person and one was over the phone. Interviews were conducted in English and/or Russian, according to interviewee preference (we had versions of the interview protocol in Russian and English). Though many participants used both languages throughout the interview, seven interviews were primarily in Russian and three primarily in English. The age of the participants ranged from 25 to 81 years old, with an average age of 49. Women comprised 50% of the participants. Four participants were born in present-day Russia, four in Ukraine, one in Kazakhstan, and one in the United States. Participants’ median household annual income was \$50,000 – \$100,000.

This project received Institutional Review Board approval from the University of Vermont (IRB protocol STUDY00000238).

## Data analysis

### Conceptual framework and epistemological approach

We use the ES framework for ‘intellectual, practical, and ethical reasons’ (Gould et al. 2020b, p. 1094), but acknowledge its potential limitations. We focus on nonmaterial benefits and values but anticipate that nonmaterial and material contributions from foraging will often intertwine, as documented in previous work (Calvet-Mir et al. 2012; Kaltenborn et al. 2017). To recognize that ES often result in interconnected material and nonmaterial benefits, we adopt the Chan et al. (2011) conceptual definition of cultural ecosystem services as ‘ecosystems’ contribution to the

nonmaterial benefits (e.g. capabilities and experiences) that arise from human-ecosystem relationships’ (p. 206). We also recognize that human-ecosystem service interactions are often bi-directional (Comberti et al. 2015; Depietri et al. 2016).

To ensure we can capture the breadth of values people assign to foraging, we complement the ES framework with the concept of relational values (Muraca 2011; Chan et al. 2016). Relational values refer to preferences, principles, and virtues associated with human-nature relationships; they complement intrinsic (nature is valuable independent of people) and instrumental (nature is valuable as means to an end) value framings. Similar to intrinsic values, relational values are non-substitutable (Díaz et al. 2015). The object of valuation for relational value – i.e. the entity that is valued – is the relationships between people and ecosystems (see Himes and Muraca 2018 and Chan et al., 2018 for details). The addition of the concept of the relational values to the ES framework offers a chance to reframe human-nature interactions and recognize reciprocal and caring relations often involved in the co-production of ES (Muraca 2016). In the context of foraging, the relational values concept might help provide a more nuanced understanding of the reasons foraging is valuable to some groups, as foraging practices can, indeed often, extend beyond mere utilitarian, substitutable relations (Poe et al. 2014; Himes et al. 2020; Weiss et al. 2020).

The fields of ES and relational values are both interdisciplinary and complex; they draw not only on multiple disciplines but also on multiple epistemological perspectives (e.g. Stålhammar and Thorén 2019; Gould et al. 2020b). This complexity has led to calls for explicit identification of research approaches applied in studies on these and other multi-faceted environmental topics (Moon et al. 2019; Gould et al. 2020b). Overall, we employ a pragmatic research philosophy which posits that multiple research approaches can be used to understand a phenomenon (in this case, meanings and stewardship practices associated with foraging) (Biesta 2010; Moon and Blackman 2014). In this study, we apply an interpretivist research philosophy – i.e. we consider the data to represent interpretations of reality based on participants’ descriptions of the meaning associated with foraging practices (Schwandt 2000). Aspects of our positionalities especially relevant to this study include being: scholars of cultural ecosystem services and relational values (TM and RG); and scholars of urban foraging practices (ME and PH).

### Data analysis

Interviews were transcribed verbatim. The first author simultaneously translated to English and

transcribed interviews conducted in Russian. We uploaded and analyzed the interviews in NVivo v.12, a qualitative data analysis software, through a combination of *a priori* coding list and open coding for emerging themes. The *a priori* coding list included descriptive and interpretive codes (Table 1). Descriptive codes categorized where and what participants foraged, how they learned to forage, and when they first engaged in this practice. Interpretive codes focused on ecosystem services, relational values, and stewardship practices associated with foraging. The Ecosystem Services code was divided into provisioning ES and cultural ES (participants mentioned no regulating or supporting ES). We also recorded mentions of ecosystem disservices, or negative impacts from ecosystems. We relied on existing typologies of CES (see Gould and Lincoln 2017 for an overview) to create a list of 17 *a priori* codes for CES. We coded references to stewardship practices associated with foraging and drew from McLain et al. (2017) to classify them as ethics of care, biophysical, and knowledge acquisition and sharing. We understand ethics of care as a relational approach grounded in reciprocity, respect, and mindfulness that extends the realm of care beyond humans (Gruen, 2009; Whyte and Cuomo 2017; Jax et al. 2018). Care encompasses both affective concern and practical action (Buch 2015).

We coded ecosystem services and relational values separately, though these frameworks interact in important ways (namely, that relational values can be one way to express the value of ES). We did not attempt to interpret whether reported ES were valued instrumentally or relationally. Specifically, we coded references to benefits from foraging as ecosystem services with a list of *a priori* codes and open-coded for references to relational values around foraging.

Our coding process was as follows. Two authors (TM and RG) coded one interview simultaneously, then discussed coding results and areas of divergent

coding to clarify definitions and coding rules (Patton 2002). Using the refined coding protocol, TM then coded all interviews. As a final step, RG reviewed the coding and suggested a small number of minor modifications (e.g. moving certain references from one theme to another or double-coding references previously coded to only one theme). TM agreed with all suggested modifications; the final coding thus represents consensus between these two authors.

## Results

### Overview

Our participants reported a diversity of foraged species, foraging places, and practices. Participants harvested primarily in forested parks, including sites within New York City, other parts of New York state, and adjacent states. Participants discussed a diversity of ecosystem services and values associated with foraging, as well as ecosystem disservices. They mentioned five benefits from provisioning ES, 13 CES, and four relational values. Material and nonmaterial benefits associated with foraging were often interconnected – for instance, nutritional value of a mushroom intertwined with its contributions to emotional well-being. Foragers collectively reported 14 stewardship activities at foraging sites. We elaborate in the following sections.

### Provisioning Ecosystem Services

Participants reported collecting a total of 18 species of plants (for 12 species, participants consumed the fruit and for six species, other plant parts including roots), and 55 species of mushrooms. Many participants reflected that foraged food tasted better, and one participant noted that it was ‘the cleanest food possible’ and contained ‘better nutrients’. In addition to food, other reported benefits from provisioning ES were medicinal use (1 participant), research material

**Table 1.** List of *a priori* parent codes.

List of parent codes	Definition
<b>INTERPRETIVE CODES</b>	
Provisioning ES	Products obtained from ecosystems including food, fiber, fuel, genetic resources, biochemical and medical resources, ornamental resources (MEA 2003).
Cultural ES	Ecosystems’ contribution to the nonmaterial benefits (e.g. capabilities and experiences) that arise from human-ecosystem relationships (Chan et al. 2011).
Ecosystem disservices	Negative impacts from ecosystems.
Relational values	Preferences, principles, and virtues associated with relationships (Chan et al. 2016).
Stewardship practices	Aspects of stewardship carried out by foragers, including biophysical impacts on species; knowledge acquisition and knowledge sharing associated with foraging; ethics of care (McLain et al. 2017).
<b>DESCRIPTIVE CODES</b>	
Foraged species	All species that participants forage, divided into sub-codes of mushrooms and plants.
Foraging places	Types of places where participants forage (e.g. forest, parks, streets, etc.).
Learning to forage	How the participants learned to forage initially.
Teaching others	Whether a participant taught others to forage.
Starting to forage	Age when participant first started to forage.
Social structure	Whether a participant forages alone, with a group, or both.

(1 participant), use in crafts (2 participants), and use to support psychedelic experience (2 participants). None reported harvesting commercially or earning income from foraging. Several participants, on the contrary, emphasized that they gathered out of pleasure rather than need. One forager stressed that she foraged ‘not because I am poor’ but because ‘it is a craving, I just love it’.

### Cultural ecosystem services

Participants discussed a diversity of benefits associated with foraging that we coded as cultural ecosystem services. We found references to 13 different CES (Figure 1; Table S1), with social relations the most frequently mentioned benefit (89 mentions across all participants) and existence value the least frequently mentioned (once). In this sub-section we discuss the three CES with the largest number of mentions: social relations, cultural heritage, and recreation.

### Social relations

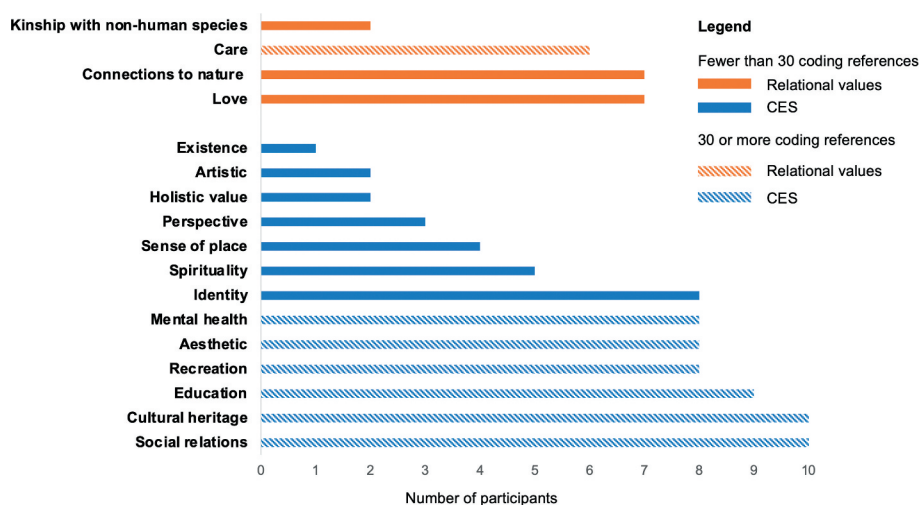
Contributions of foraging to social relations had the highest number of mentions across all interviews. Foraging acted as an axis around which social relationships were constructed. The first author experienced that firsthand – during data collection, three participants invited her on foraging forays and three shared foraged food. Even though some participants occasionally foraged alone, everyone reported foraging with others – friends, family, or in mycological groups. Participants interacted with other people while foraging, sharing knowledge about mushrooms and helping to identify edible species. One participant described mushroom picking as ‘a very active social engagement’ and shared that he ‘liked talking to people when’ collecting mushrooms, as that ‘was

part of the fun’. Some participants engaged in conversation with private landowners outside of the city to access their property for mushroom picking.

The exchange of foraged food was a central element of references to social relations. One participant, for example, received homemade pickled wild mushrooms as a birthday gift. Another brought wild mushrooms to work to give colleagues a chance to ‘try something that they have never, ever eaten before’. One participant sent foraged food to friends and family out-of-state; he also stored mushrooms for special occasions when family came to visit. Another participant noted that she always foraged extra to ensure she had enough to share with friends and family.

### Cultural heritage

All participants discussed cultural heritage associated with foraging. Nine participants had been foraging since childhood and learned to forage from their parents and grandparents. One participant started foraging a few years before the study, learning together with his parents. Participants who had children noted that they have taught, or planned on teaching, their kids how to forage (although some participants noted that their children did not continue the foraging practice). The continuation of foraging in the United States manifested as a way to maintain cultural traditions in a new country. One participant, born in the United States, noted that foraging helped him connect with his roots, including connections to his Russian heritage but also to the times when people in general ‘were just all living off the land and interacting with it more’. Another participant used to forage with her parents in Russia and has continued foraging with them in the United States. She also took her children foraging and taught



**Figure 1.** Number of participants who mentioned each cultural ecosystem service (CES) and relational values. Patterned bars indicate salient themes, that is, CES/relational values that were mentioned more than 30 times across the participants. The solid bars indicate CES/relational values that were mentioned less than 30 times.

them about mushrooms, passing on what she described as ‘a Russian tradition’.

Culture shaped specific harvesting practices and overall views on foraging. Multiple participants contrasted how their mushroom picking practices differed from ‘local’ ones – i.e. practices that non-Russian New Yorkers use. Differences included species they collected and what those species were used for, reasons for foraging, and picking practices. One forager recalled his encounter with a mycological special-interest group and reflected on differences in foraging practices: whereas he only collects edible species, the mycology group gathered diverse nonedible species because their focus was on learning species identification. The participant noted that it was an entertaining way to spend time but ‘this was not considered mushroom picking in the way [he] understood it’.

Other foragers commented that foraging practices reflected their cultural backgrounds. One participant attributed his curiosity and passion for mushroom picking to being Russian. He lamented that ‘people here just don’t trust nature [...] they are afraid of anything which does not come from the supermarket’, reflecting an idea that many people in the dominant U.S. culture distrust mushrooms because some are poisonous or deadly. He added that ‘culturally, Russians are not afraid of mushrooms’.

### Recreation

Eight participants discussed recreational benefits associated with foraging. Participants often described foraging as ‘fun’ and ‘pleasant’; some described it as a ‘hobby’. A female participant, who often goes foraging with her husband and children, discussed that an ability to search for mushrooms provided additional entertainment value: ‘We take kids out, too. Take them out, so it is not just a hike, but also a search for mushrooms. If we find mushrooms – good. If we don’t – at least we went for a hike, good enough’.

Recreational experiences often intertwined with contributions to social relations, as well as mental and physical health. A female forager discussed that foraging provided recreation and a way to recharge, even though at times it was physically straining. This sentiment was shared by another participant who regularly went foraging with her husband on weekends. She discussed that foraging was tiring but it was a way to ‘relax away from people’. Curiously, relaxation included elements of thrill and excitement which gave her strength to keep going despite fatigue:

I like this. I like picking more than eating. I guess, this ... the search, it is like fishing. Sometimes, we go fishing, too. The search itself, hunting. If I just walk in a city, I get tired much faster than in a forest. [In the forest] I feel tired, age, legs hurt, but the desire to

find something wins over. The most important is the process of search. It is like gambling.

Two other participants echoed the comparison of foraging to the adrenaline rush associated with gambling or hunting. They relished the element of uncertainty and surprise. One participant mentioned that mushroom pickers often called foraging a ‘quiet hunt’ because it had the thrill of hunting but not the killing. Another forager commented that pursuit of adrenaline was the main reason she foraged:

It is different. It is like sport. I am an adrenaline junkie. Just going into a forest – I would go with pleasure; I would walk around. But the goal, the main, overarching goal is finding mushrooms. It does not mean I am not going to enjoy it if I don’t find mushrooms. I am still going to enjoy, I am going to love it [...] But when there are mushrooms, it is different.

### Interconnected material and nonmaterial benefits from foraging

Participants discussed numerous intangible dimensions associated with the provision of foraged goods. In addition to food for consumption and materials for crafts, foraging provided ways to connect to nature and relax. One participant discussed the interconnected contributions to nutrition and emotional well-being from eating jerky made from chicken-of-the-woods mushrooms he gathered: ‘Then in the winter, when I have no mushrooms, and I am sad because you know, I have to eat food from the supermarket, I have my jerky, and I think about all the times I spent in the woods and then, like it tastes so good. It is just good for the soul’.

Participants often emphasized that nonmaterial benefits associated with foraging were unique to this practice. A visit to a forest that did not involve harvesting was a different experience. One participant distinguished foraging from other ways of connecting with nature:

It just means connecting to nature in a really healthy way. It means appreciating God’s creation, the physical planet that we live on, that is just so incredible. Being able to appreciate that we don’t just get stuff from Costco or from a supermarket, or from FreshDirect online, we can go directly into a forest, into the wild, and harvest food and at the same time, get some fresh air and some exercise.

One participant shared the search for harvestable species was interesting and stimulating, nothing like buying food at a store. Multiple participants mirrored this sentiment – foraged food is not equivalent to buying the same species at stores. It carries an added value. For some, that value relates to the rewarding experience of finding mushrooms. For

others, foraging allows them to make a statement against unsustainable consumption and food waste.

### Ecosystem disservices

Five participants discussed negative experiences while foraging that we coded as ecosystem disservices. This theme usually came up when we asked participants about types of places that were especially good or bad to forage. Four foragers discussed fears associated with forests, including safety concerns, fears of getting lost, getting a tick bite, and encountering bears. Two of the four noted they avoided going alone into a forest outside of the city because they were afraid of bears; one noted she did not pick certain mushroom species to avoid poisoning. In addition to these fear-related concerns (all mentioned by female participants), one male participant noted that the presence of mosquitos made a place less favorable for foraging.

### Relational values

Our data demonstrate multiple relationships foragers have with nature in general, in addition to with particular foraging places and foraged species (Figure 1; Table S2). The most commonly expressed relational value was a sense of love for nature and its elements. Seven participants discussed love or affection for nature. Participants often had difficulty articulating what specifically they love about, or why they love, the forest. A few of them, after reflection, attributed their love for the forest to childhood experiences. One participant, for example, shared that some of her happiest times spent foraging were during childhood. She loved being in the forest, and mushroom picking was central to that experience. When asked why forest was meaningful to her, she reflected:

Could be from childhood. I do not know. Why does a person love the ocean? I don't know. It must be

some internal state of the soul. For me – it is forest, not ocean. The ocean is nice, but forest ... let me go into the forest, and that is all [I need]. I recharge. It is hard to say. I guess from childhood. In my childhood in the summertime, we would not get out of the forest, it was the freest recreation – go to a forest, fishing, pick mushrooms. I recall my father had been taking us [foraging] since we were 3 or 5 years old.

Other examples of relational values included connections to nature and kinship with non-human species. Eight participants discussed the role of foraging in supporting connections to nature. One participant discussed that through picking and eating mushrooms, 'making it part of the body', he remained connected to nature. To him, the connection to nature intertwined closely with mental well-being – 'remaining like this, in harmony with the world, we stay in peace'. Two participants discussed kinship. One forager described a photo of himself hugging mushrooms because they were 'his babies'. Another participant emphasized the importance of reconnecting with nature because 'nature is our mother. It birthed us'.

We also found multiple examples of care. These included both caring considerations for other beings ('caring about') and practical actions ('caring for'). Because the relational value of care is often intertwined with stewardship practices (Jax et al. 2018), we discuss it in the next section.

### Stewardship

In response to a question about whether they took care of the plants, mushrooms, or places where they foraged, all participants reported engagement in multiple types of stewardship action related to mushroom foraging (see Table 2). Most commonly reported practices related to impact on mushrooms and their habitat. Six foragers said they sought to minimize damage to foraged species and surrounding habitat; however, there was no consensus on which

**Table 2.** Stewardship practices reported by the participants.

Stewardship practices reported	# of participants
<b>Biophysical</b>	<b>10</b>
Picking techniques that minimize damage to mycelium	6
Picking up trash at foraging sites	4
Selective harvest, leaving behind young specimens	3
Leaving behind some of the product for other species, human and non-human	2
Removing invasive species	2
Picking techniques to avoid or minimize damage to plants	2
Timing harvest to reduce impact	1
Using baskets to ensure fungi can spread their spores	1
<b>Knowledge acquisition and sharing</b>	<b>4</b>
Seeking knowledge from others on how to forage sustainably	4
Teaching others to forage sustainably	2
<b>Ethics of care</b>	<b>7</b>
Consideration and reciprocity towards other beings	6
Nature protection is important	6
Relational value of care	6
'Leave no trace'	2

mushroom foraging practice was least damaging to the mycelium (the underground network of fungal threads that supports the growth of mushrooms, among other functions). Some considered that cutting mushrooms with a knife was the correct way to harvest; others reported it was pulling them off ‘with a root’, by which they likely meant a small portion of the mycelium. One participant shared that she conducted extensive research to find out which harvesting practice was the correct one but did not find a definitive answer. This example illustrates one of the knowledge aspects of stewardship – four participants, including this one, actively sought information on sustainable harvesting practices. Two participants demonstrated another knowledge-related aspect of stewardship: they teach others about foraging practices. Participants often continued foraging practices the way their parents taught them. They also exchanged knowledge with fellow foragers. A participant who often forages in groups shared that:

Harvesting knowledge gets passed around. It is kind of learned indirectly. So when you collect it [a mushroom], you are being careful to collect it carefully. Or sometimes you cut it in front of people. So you are gonna pass knowledge to newbies without being overly there. Do it by example.

Participants differed in how, if at all, a plant or mushroom’s status as native, introduced, or non-native influenced their foraging practices. Seven participants were not familiar with the concept of invasive species. Of the three who were familiar with the concept, two participants shared they intentionally removed invasive species. One forager noted that honey mushrooms, although not invasive, were parasitic and damaging to trees. Once this fungus starts growing on a tree or bush, it damages the roots and eventually causes the plant to die. This participant was deliberate about picking this fungus hoping that ‘by eating them one helps prevent their spores from spreading’. Another participant shared that it ‘felt particularly good to harvest wineberries’, precisely because they are invasive.

Seven participants discussed various aspects of care ethics, including consideration and reciprocity towards others and the importance of caring for nature. Six participants mentioned they tried to be considerate and respectful towards other foragers, visitors, and nonhuman inhabitants of natural areas. As one example, a participant regretted having collected mushrooms she eventually threw away: ‘I thought to myself: “Why did you do it? They should have stayed there, beautiful. Someone would have found them”’. Another advised against foraging in national parks and other protected areas as ‘these mushrooms are needed for birds, squirrels, and

foxes, and deer that live there’. He reflected on the importance of reciprocity towards other beings – giving back to the world instead of ‘thinking that someone else is going to take care of it’. Another participant mentioned he did not forage in national parks because other people visited them to enjoy nature, and he did not want to impact their experience. Six participants discussed how care guided their foraging practices. Two of them expressed disapproval of overharvesting and damaging harvesting practices. One of these two participants discussed that experienced foragers who picked for personal consumption collected mushrooms ‘carefully and judiciously’. He contrasted them with commercial pickers who he believed ‘will not care’.

When asked about what taking care of a foraging place meant to them, two participants answered specifically that this meant: ‘leave no trace’. These participants used the statement verbatim, in English, even when the interview was conducted in Russian. These ‘leave no trace’ participants reflected on the importance of ‘caring for a place’ and ‘leaving it the same or better than when you found it’. Six other participants did not use the words ‘leave no trace’, but mentioned that it was important to protect and preserve nature. The importance of not harming nature was often contrasted with mushroom harvesting. Participants noted that foraging on public lands was often prohibited because the government argued that it, among other rationales, could harm surrounding ecosystems. The participants stressed that mushroom gathering, in their view, did not damage ecosystems. One participant, who emphasized the importance of sustainable harvesting practices, described restrictions on mushroom collection as ‘unreasonable’. He compared impacts from picking mushrooms to those of picking fruits: ‘You just don’t damage it. Mushroom [mycelium] is still there, you just collect the fruit’.

## Discussion

Our study documented the importance of foraging to some members of the Russian-speaking immigrant community in New York City. Given that no participant in our study reported foraging for sustenance or income, foraging for these individuals is primarily about nonmaterial values, with a provisioning attribute. In addition to the provision of food, material for research, and crafts, foraging is associated with a diversity of cultural ecosystem services and relational values. Social capital, cultural heritage, and recreation CES were particularly salient for our participants. Additionally, we documented relational aspects of foraging which include connections to nature, love, and caring considerations for other beings. Several foragers engaged in stewardship



actions and sought information on sustainable harvesting methods.

### *Urban foraging and well-being*

Our data are consistent with extensive research that demonstrates that urban green spaces play an important role in supporting the ability of city dwellers to interact with nature (Svendsen et al. 2016; Reyes-Riveros et al. 2021). The existence of green areas alone, however, is not always enough to generate well-being benefits (Dobson et al. 2021). People may need to engage with urban spaces in a meaningful way to receive contributions to well-being (Egerer et al. 2019). Our results suggest that foraging could be an example of culturally meaningful human-nature interaction.

In our study, the cultural importance of foraging manifested in multiple ways. For participants, foraging was a way to maintain cultural identities and uphold family traditions. Several participants stressed that mushroom picking was a Russian tradition, and that it helped them connect to their cultural roots. After immigrating to the United States, participants in our study continued foraging, often gathering the same or similar species they collected before immigrating. Preservation of cultural identity through interactions with nature is common among foragers (Hurley et al. 2013; Poe et al. 2014). Understanding the importance of foraging to cultural heritage may thus be especially important for decision-making, particularly in places where foraging is currently not allowed. Foraging restrictions involve multiple aspects beyond the conservation of ecosystems. They legitimate some ways of engaging with nature while delegitimizing others; this may be a reflection of power dynamics that underpin the recognition and acceptability of urban foraging (Poe et al. 2013; Hurley et al. 2015). This past work, combined with our results, suggest that restrictions on foraging may have a particular impact on some communities.

In addition to cultural heritage, foraging supported multiple other contributions to well-being. These material and nonmaterial benefits were often intertwined and relational. Our findings point to a complex suite of foraging motivations, beyond sustenance or pursuit of recreation. Although we did not explicitly ask about value domains associated with these benefits, our findings hint that many of the reported benefits were valued relationally. To some participants, foraging was an integral part of their relationship with the natural world, and a variety of relational values (including connection to nature, kinship, love, and care for nature) were intertwined with those relationships. Reflecting the fact that relational values are non-substitutable (Himes and Muraca 2018), our participants shared that the

experience of gathering mushrooms could not be compared to store-bought mushrooms or a recreational trip without foraging. These findings are consistent with previous research that suggests non-subsistence foraging is largely associated with relational values (Himes et al. 2020). Given that relational values are often central constituents of a good and meaningful life (Knippenberg et al. 2018; Schröter et al. 2020), researchers and land managers might pay special attention to how land regulations might impact these values and consequent well-being.

### *Implications for ecosystem services research*

Our findings offer multiple insights for ES research. First, they highlight the importance of provisioning ES in urban ecosystems. Second, they suggest a need to focus on ES associated with practices, not only places. Third, they emphasize the deep intertwining of material and nonmaterial benefits. Ultimately, they illustrate that urban greenspaces support a wide diversity of CES, far beyond recreation and aesthetics. We elaborate on these ideas below.

Our findings highlight multiple contributions of urban ecosystems to provisioning ecosystem services. Participants of this study reported gathering 18 species of plants and 61 species of fungi within New York City and adjacent lands for nutrition and use in crafts. Our findings complement previous work that documented actual and potential provisioning ES from U.S. urban greenspaces obtained through foraging (e.g. Hurley and Emery 2018), although we found a significantly larger number of reported species of fungi than has been recorded in other work on urban foraging (e.g. Kujawska and Łuczaj 2015; Landor-Yamagata et al. 2018). Yet provisioning ES, except in agricultural ecosystems, are largely missing from the urban ES literature (Hurley and Emery 2018). This omission of provisioning services might make urban ES assessments and consequent management decisions might be incomplete. As one example, policies and decision-making might prohibit foraging in places currently relied upon for this activity (Shackleton et al. 2017) and thereby negatively impact foragers' well-being (Hurley et al. 2015).

More research is also needed on the benefits and values associated with specific activities – that is, on the ES associated with practices, not only with places (Morse et al. 2020). Research in other disciplines has documented the links between nature-based activities and benefits people receive from them (Holland 2017; Thomsen et al. 2018). In ES scholarship, by contrast, the topic remains largely understudied, with some exceptions (Grima et al. 2019; Kovács et al. 2021). Oftentimes, ES research documents nature-based activities as examples of ES people receive from

nature but does not address what specific values are associated with a given activity (e.g. Bertram and Rehdanz 2015). Using activity as a proxy for values could mask values that underlie that activity (Biedenweg et al. 2019). Our results suggest that in some instances, CES might be connected to a practice, rather than a place. Sometimes, people had places they regularly visited to collect mushrooms. More often, however, foraging sites varied depending on the availability of mushrooms. The fruiting of mushroom species can vary across temporal and spatial scales, and for many people, the practice of foraging was more important than the specific place in which they foraged. Another possible explanation could be related to migrant lifestyle: as people move across states and countries, they might maintain their connections to nature via practices, rather than particular natural sites – in this case, via gathering of wild species. A closer look at how people maintain ties with nature via practices and values associated with them could expand our understanding of the myriad ways nature matters to people.

Our data provided multiple instances of intertwined material and nonmaterial ecosystem services. Ecosystems provided mushrooms and plant materials, opportunities to recreate, a chance to relax and enjoy beautiful landscapes. Examples of such ES bundles – multiple ES produced by the same ecosystem – are well-documented in the literature (Vannier et al. 2019). Our findings support the argument that ecosystem services can simultaneously have material and nonmaterial dimensions which are often inseparable (Chan et al. 2011), with ecosystems but also individual species providing these dimensions. Provision of forageable species has nutritional, material benefits, but it is also connected to an array of nonmaterial benefits, as described above. This complexity of benefits and associated values has implications for ES assessments and management. One ecosystem function or process can result in multiple services and benefits, valued in different ways. These different metrics of values might not be directly commensurable (Satz et al. 2013) and often require different valuation methods (Jacobs et al. 2018). As one example, heritage value associated with foraging is not directly comparable with the nutritional value of mushrooms. Yet both these values arise from the same human-nature interaction. Valuation exercises need to account for this complexity to ensure all benefits and values associated with a given ecosystem service are captured.

Lastly, our results foreground the importance of including a wide diversity of CES in current ES assessments. Our results document 14 CES associated with foraging and hint that for some groups, CES provide a strong motivation to forage. Consistent

with previous work (Campbell et al. 2016; Riechers et al. 2019), these findings illustrate that people derive and value a broad range of nonmaterial benefits from urban greenspaces. However, many ES assessments (in urban and other areas) continue to focus on CES with more tangible, easier-to-measure dimensions like recreation and aesthetics (Milcu et al. 2013; Kosanic and Petzold 2020). Recognition and integration of various needs and wants associated with urban greenspaces is a central aspect of the ES approach (Asah et al. 2012) and a central pillar of urban green equity (Nesbitt et al. 2018). Such recognition has justice and equity implications, as it impacts different groups' abilities to access and enjoy urban nature and its diverse benefits. By focusing on only a subset of CES (such as recreation), ES assessments risk oversimplifying the relationships people have with nature and the importance these relationships have to well-being. We encourage future ES research and urban land management policies to consider foraging as one of the human-nature interactions that take place within a city. Incorporation of foraging can serve as one practice-focused way to recognize and incorporate diverse values, and even diverse value types, in decision-making, as described in recent calls for pluralistic valuation of ecosystems (e.g. Jacobs et al. 2016, 2020).

### *Stewardship and sustainability of foraging*

Our research, like related research in other contexts (McLain et al. 2017; de Jong and Varley 2018), indicates that some foragers engage in stewardship practices. Examples reported in this study include removing invasive species, collecting trash at foraging sites, avoiding overharvesting, and teaching others to forage responsibly. Several participants framed their relationships with nature through the ethics of care – reciprocity, mindfulness towards other species, and the importance of taking care of other beings. These examples illustrate two dimensions of care – affective concern and action (Buch 2015). Much academic work on care suggests that caring relationships with other beings, human and non-human, do not exist separately from actions. Humans care about others (be it an organism, a place, or another entity), and, we express our care through actions, shaped through our perceptions of what constitutes appropriate care (Nassauer 2011). These perceptions can vary across individuals, and our findings provide an example of both how important these differences can be, and how they can rely on scientific information. Specifically, some foragers in our study thought that the removal of mushrooms 'with a root' was the nonharmful, caring way to gather mushrooms, while others argued that it was by cutting mushrooms at the stem. This ambiguity mirrors current scientific

understanding: studies on the least impactful mushroom harvesting techniques (and the impact of harvesting on fungal species richness, in general) are inconclusive (Egli et al. 2006; Luoma et al. 2006). One of our respondents mentioned encountering this ambiguity in her search for information to guide her actions.

We recognize the concerns around safety and sustainability of foraging but note that many foragers engage in multiple stewardship practices, often similar to those by conservation agencies (Charnley et al. 2018). Our findings, along with past work (e.g. McLain et al. 2017; Charnley et al. 2018) suggest that under some circumstances, foraging may be compatible with conservation objectives. This is consistent with analyses of global conservation measures, which show that with appropriate management and governance, extractive uses of wild species can produce both socially just and ecologically sustainable results (Kabra 2019). The impact to species and surrounding habitat depends on species characteristics and on many details of harvest such as frequency, intensity, and methods used (Ticktin 2004).

As one of the first studies to explore the relationship of urban foraging to ecosystem services, our data suggest that foraging can support multiple interconnected ecosystem services through reciprocal human-nature interactions and associated relational values. Examples of contributions to ES supply included helping spread mushroom spores and removing invasive species. However, recognition of mutual exchange of benefits between humans and nature is largely missing from the ES scholarship – with the notable exception of a growing body of work on CES and relational values. By framing human-nature interactions as a one-way flow of benefits, ES research risks overlooking the contributions of people to the sustainability of ecosystems (Comberti et al. 2015). Future foraging research could explore in more detail if and how foragers might benefit ecosystems through their practices. We also encourage a dialogue between land managers and foragers based on a mutual sense of care and concern for ecosystems.

### Limitations and next steps

This study presents several limitations. Similar to previous exploratory projects, this study has a small sample size, which limits our ability to generalize the findings. It provides only a partial view of foraging practices among Russian-speaking immigrants because our participants were predominantly mushroom foragers. Although picking mushrooms is prevalent among this group, foragers who primarily collect other taxa may have a different perspective. Relatedly, some participants in this study reported fishing, which we did not address. Future research

could explore values associated with this and other outdoor activities among Russian-speaking immigrants. Future studies could also examine foraging practices and associated values among other New York City residents who forage mushrooms (e.g. non-Russian-speaking members of the New York Mycological Society).

Almost all participants in this study described mushroom picking as part of their cultural identity. Our findings indicate that people continue harvesting mushrooms as part of maintaining this identity and the knowledge it encodes. However, all were first- or second-generation immigrants. As the acculturation process continues, the cultural importance of practices from the country of origin might fade (Akhtar 2011). It is unclear whether the cultural relevance of foraging will persist in future generations.

In this study, we focused on the perspectives of foragers. We did not examine how New York City park managers view urban foraging. Our participants did not report any confrontational or problematic encounters with park managers. However, a few shared that their acquaintances had been fined for gathering on city lands. Previous research in other locales suggests that views on foraging may vary among park managers – some occasionally forage and others strongly favor foraging restrictions (McLain et al. 2017). Future studies could explore park managers' encounters with and attitudes about urban foraging. Projects could also examine whether park managers and foragers could collaborate on stewardship objectives in exchange for relaxed foraging restrictions.

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