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Urban novel ecosystems as affective landscapes

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Abstract

Intertwined within a patchwork of different types of land use and land cover, novel ecosystems are urban ecosystems that have no historical analogues and contain novel species assemblages. Some researchers and practitioners in the field of conservation and restoration regard urban novel ecosystems unworthy of concern, while other groups call for their preservation due to the rate of biodiversity loss in cities and limited access to nature among some social groups. However, very little is known about how people perceive novel ecosystems (such as informal green spaces, post-industrial or derelict land sites awaiting redevelopment, brownfield sites, vacant lots, interstitial or gap spaces) which are often characterised by assemblages of wild, spontaneous, and overgrown vegetation, but also remanent or derelict urban infrastructure in cities. This paper addresses this gap by firstly asking how people percieve assemblages of wild-looking vegetation and urban infrastructure often found in novel ecosystems and how our affective and aesthetic responses to these ecosystems affects our attitudes towards wildness in cities. To begin to unpack this question, we obtain data from a series of exploratory workshops held in four cities in the global north where we asked people 'what is urban nature?' Our findings suggest that value judgements that people ascribe to novel ecosystems are often deeply polarised, but they are influenced by different ecological and urban conditions that people encounter within them. However, some negative perceptions about novel ecosystems may be mediated by situational cues; these situational cues could have important implications for rewilding and restoration programmes that aim to reconnect urban communities with nature through socio-ecological stewardship. To conclude, areas for further research that could improve our understanding of the social values of novel ecosystems in cities and the influence that these ecosystems may have on affective encounters with urban nature are proposed.

Keywords Novel ecosystems · Societal perception · Photo-elicitation · Affective landscapes

Introduction

It is estimated that by 2050, over 65% of the world's population will live in towns and cities (United Nations 2022), placing further pressure on urban ecosystems that have become intermeshed within different types of land use and land cover. Within this patchwork, novel, anthropogenic or human-created ecosystems have emerged. The definition of a novel ecosystem is a subject of much debate, but in this

paper, we define novel ecosystems as self-organised, self-regulated, or ephemeral urban ecosystem in cities that are often transient in nature or in a constant state of flux. Hence, these ecosystems are composed of complex of assemblages of different plant communities and organisms influenced by the continuous cycle of succession or disturbance caused by anthropogenic activity (Hobbs et al. 2009, 2013; Brun et al. 2018; Higgs 2017; Morse et al. 2014; Teixeira and Fernandes 2020).

These ecosystems are often overlooked or devalued for their biodiversity potential because they have passed a threshold in which a traditional ecological restoration is an appropriate approach (Hobbs et al. 2009; Collier 2015; Backstrom et al. 2018). These sentiments have led some scholars to argue that the inclusion of these less understood ecosystems within biodiversity goals would undermine restoration endeavours. For example, Murcia et al. (2014) claim

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such action would provide a 'license to trash or get out of jail card' (p. 551) to those seeking to avoid action to halt biodiversity loss in pursuit of economic growth and development. While some scholars are critical of calls for their preservation, other scholars highlight the potential biodiversity value of these ecosystems and their role providing refuges for threatened species (Oke et al. 2021; Alexandra 2022; Muller et al. 2018; Connop and Nash 2018).

In addition to their potential value for nature conservation, novel ecosystems are likely to become more important in maintaining well-being (Collier 2014; Barragan-Jason et al. 2023) and resilience (Collier 2015) in urban contexts. This is especially true in urban communities with deep social and economic inequalities where there is often limited access to 'wild' nature or informal green spaces (Ward et al. 2023; Roe et al. 2016). Public health restrictions and travel restrictions across the world triggered by the COVID-19 pandemic have resulted in policies that frequently cite the importance of formal green spaces (i.e. neatly manicured and managed green spaces such as urban parks) (see Lachowycz and Jones 2013) and urban nature for health and well-being (McCunn 2021). Some scholars argue that novel ecosystems have potential to support cultural ecosystem services such as opportunities for biodiversity education, spiritual enrichment, physical exercise or recreation and aesthetic experiences (MEA 2005; see Kosanic and Petzold 2020 for a systematic review of the literature) that are therapeutic and enhance well-being (Collier 2014; Cheesbrough et al. 2019; Bell et al. 2022; Ireland et al. 2019; Wang et al. 2022). However, other scholars (Parker 2022; Potgieter et al. 2019; Aronson et al. 2017) argue people prefer neatly manicured formal green spaces and, hence, the ruderal character of novel ecosystems may affect the quality of the human–environmental interactions resulting in barriers to their use and stewardship. However, very little is known about how society value novel ecosystems and how this is influenced by the affective and aesthetic response to their differing characteristics. Ulrich (1983) argues that affect is central to experience and behaviour in natural environments; in turn, these emotional experiences are the most important for realising the therapeutic and well-being benefits from the natural world (Ulrich 1983; Cooper et al. 2016). Hence in this paper, we explore how affective response and aesthetic judgements of novel ecosystems influence how society value these spaces rather than the cultural ecosystems services they provide (Collier 2014, 2015; Cutts et al. 2024). The paper begins by asking how visual perceptions of novel ecosystems in cities influence affective and aesthetic response by drawing a series of photo-elicitation workshops held in four cities in the global north. To add depth to our understanding, we also explore these values compare with perceptions of neatly managed landscapes and the role that situational cues could play in increasing societal acceptance of wildness in cities. Ultimately, the paper will show that similarly to Nassauer (1995), situational cues that signal care may be a key factor in increasing societal acceptance of wildness in cities and encouraging socio-ecological stewardship in cities.

Novel ecosystems

Most anthropogenic landscapes contain novel ecosystems (Hobbs et al. 2009) or hybrid systems (Serenari 2021) whose ecological structure, function, and species composition and abundance differ substantially when compared to historical conditions in response to species invasions, self-assemblage, or the combined effect of multiple drivers that influence human activity (Truitt et al. 2015; Hobbs et al. 2009; Higgs 2017). These social–ecological systems can be formal or informal (Rupprecht et al. 2015), containing assemblages of native and non-native flora that were intentionally introduced or planted to augment ecosystem services or for ornamental purposes (Hobbs et al. 2009), 'cosmopolitan' plants that colonise naturally without cultivation (Phillips and Lindquist 2021), or ruderal ecologies (Kennedy 2022; Stoetzer 2018). In urban areas, novel ecosystems may manifest themselves as unplanned wild spaces that emerge on post-industrial landscapes (including brownfield sites) (Merwin et al. 2022; Spiering 2019), or as 'informal wild spaces' (Pineda-Pinto et al. 2023) or informal green spaces (Rupprecht et al. 2015) in interstitial or gap spaces (Reis and Mendes 2022). Novel ecosystems may be considered to be part of a city's subconsciousness and subjugated or disregarded as 'waste ground' despite their biodiversity value and subject to varying conceptual definitions such as 'wild spaces' (Threlfall and Kendal 2018), 'urban wilderness' (Kowarik 2018), or 'wildscapes' (Zoderer et al. 2020). Examples of images of different novel ecosystems and how they contrast with formal green spaces can be found in Fig. 1 (and Supplementary Information.xlsx).

Consequently, the value judgements ascribed by communities to these ecosystems can be 'negative' because the socio-ecological thresholds and ecological composition of these ecosystems have changed to such an extent that traditional ecological restoration is highly unlikely (Murcia et al. 2014; Morse et al. 2014). However, as populations continue to grow and the pace of global biodiversity loss continues to rise, novel ecosystems are likely to become more important. Collier (2015) and Collier and Devitt (2016) argue these ecosystems are not only needed to provide new or replace lost ecosystem services, but are likely to play an increasingly important role in resilience, restoring connectivity between people and nature, and rewilding ecosystems (Darnthamromgkul 2023). In parallel, growing scholarship highlights the transformative of novel ecosystems (Cheesbrough et al. 2019) or their role as 'therapeutic landscapes' (Bell et al.

2022) or 'therapeutic assemblages' (Ireland et al. 2019) or a 'therapeutic or oasis experience' (Rodriguez Castañeda 2023). However, scientific and societal attitudes towards assemblages of multiple plant groups frequently demonstrate a bias against those plant groups that are perceived to be 'alien' species or ruderal in character (Lewis et al. 2019). For example, studies have shown that society perceives wild-looking and unstructured vegetation found in novel ecosystems as unkempt, disordered, or abandoned (see Parker 2022; Rink and Arndt 2016). Discussion on novel ecosystems have often been divisive and yet the concept is largely understudied for the wider potential (Collier 2015).

The influence of affect on perceptions of novel ecosystems

For this study, we draw on Wee and Goh's (2019) affect-analytical perspective which draws from novel ecosystems as therapeutic landscapes or assemblages (Cheesbrough et al. 2019; Bell et al. 2022; Ireland et al. 2019) to think through how people respond to different constellations of ecological and urban characteristics that shape perceptions and the values that we ascribe to novel ecosystems. According to Anderson (p. 12, 2023) "affects can be and are attached to things, people, ideas and any number of things". Affect orientates around the body where "a body can be anything" (p. 16. Willox et al. 2013). These can be a socio-ecological entity, a landscape, a space, or object in a relational sense or a source of external stimuli that can cause a physiological or psychological response through interaction between an individual, or a group and their environment (Gregg and Seigworth 2010; Willox et al. 2013; Wee and Goh 2019; Berberich et al. 2013, 2016; Highmore 2013). Anderson (2023) argues that it is through affect that forms of global change and its associated events are lived and felt.

To explore people's perceptions of novel ecosystems and their affects, we also draw on Berberich's idea of affective landscapes to describe the positive and negative affect that different constellations of ecological and urban stimuli that people encounter in novel ecosystems influence their perceptions of often ruderal and wild landscapes. Wee and Goh (2019) and Burlingame (2022) argue that landscapes are constellations of interpretable signs that influence the affective power of natural and built environments, which in turn influence our perceptions of them. According to Li and Nassauer (2020) and Nassauer (1995), how we perceive and the values that we ascribe to the appearance of landscapes are also influenced by the 'aesthetic of care' or evidence of ongoing maintenance or communication that passive wilding is intentional. Li and Nassauer suggest that cues to care are features of a landscape that are recognisable by society which signal that someone takes care of the landscape (such as a mown strip along the edge of a verge). Many argue that

cues to care are highly influential cultural norms through which people interpret, evaluate, and enjoy the visual appearance of the landscape typically associated with well-maintained or manicured landscape features (such as mown grass, trimmed edges, etc.) (Li and Nassauer 2020; Nassauer 1995; Gobster 2012; Aronson et al. 2017). In contrast, cues of neglect may be associated with litter, dead plants, bare ground, or dense understory of overgrown vegetation (Li and Nassauer 2020; Anderson and Minor 2019; Kowarik 2018). According to Häyrynen (2021) and Ulrich (1983), emotional responses to landscapes play an important role in how we interpretate and experience space. In parallel, with societal demands for visible signs of care in natural settings (Nassauer 1995) creating tensions between aesthetics, biodiversity and ecosystem service provision, and socio-ecological stewardship. However, there are a lack of studies that explore how visual perceptions of novel ecosystems and their affective regimes influence the value judgements that society ascribes to them which therefore deserves deeper scrutiny.

Methods

This study utilises a participatory approach to begin exploring how society values novel ecosystems with different citizen groups, hereafter called 'communities of practice'. According to Wenger-Trayner et al. (2002) and Wenger-Trayner and Wenger-Trayner (2015), communities of practice consist of three elements: domain (or concern or passion for a common purpose, activity, event, or interest), a community that is involved and bound together in pursuit of a particular domain; and practice, engagement of the community in a shared or joint set of activities (such as campaigning to prevent the destruction of a novel ecosystems). By adopting a collaborative approach with communities of practice, our research is situated within the 'co-paradigm', a polysemic process that means different things to different people that encompasses the participatory processes of co-production and co-creation (Dudau et al. 2019; Voorberg et al. 2015; O'Donnell et al. 2023). Following approval of an ethics application by Trinity College Dublin Ethics Committee and the European Research Council in 2021, communities of practice were invited to participate in the exploratory focus groups in Valetta (Malta), Dublin (Ireland), Barking, London, and Middlesbrough (UK). A pragmatic multi-city approach was adopted with cities selected based on a common language (English), but also common historical linkages or post-industrial decline and regeneration despite their different cultural traditions. This allowed the researchers to include a range of different types of novel ecosystems across different scales with different combinations of species with different ruderal and urban characteristics. However, it should be noted that it was not the purpose of this study to

explore how different species were perceived across each of the sites due to the limitations of the photo-elicitation methods which do not provide the level of granularity needed to support this kind of study. Workshops consisted of community groups, charitable organisations, activists, artists, and NGOs involved in environmental stewardship at a local level. (See Table 1 for details on the workshop description, location, and participants).

Seven co-design workshops were held with different communities of practice using purposeful sampling (Eitkan et al. 2016). This involved identifying and selecting different communities of practice that had an interest in the care of unused or unmanaged spaces in their cities (Creswell and Clark 2011). Several different communities of practice participated in these groups with a minimum of two held in each city (Guest et al. 2017; Clark et al. 2022). Barron and Mariani (2013) suggest that tensions and power asymmetries may exist within different communities of practice involved in the care of urban wild spaces due to issues of historical legacies of ruination and contamination, inequitable access or development, or different visions for the stewardship for these spaces in cities. While it is not the aim of this study to unpack these tensions, we draw on the experiences of Collier et al. (2023) and Frantzeskaki and Kabisch (2016) and gradually build trust with communities over several months to avoid the repetition of power asymmetries and facilitate knowledge sharing among different individuals with different backgrounds, expertise, and experiences. This process allowed the team to create an environment that encouraged

free expression, but also inclusivity providing spaces where voices that may be suppressed can be heard.

To explore the diverse characteristics of informal wild spaces and how their value judgements and understandings of wild spaces differ from those that people assign to formal green spaces, we integrated standard focus groups (Lowery and Morse 2013) with photo-elicitation exercises (Collier 1957; Warner et al. 2016), which use photographs to elicit thoughts, feelings, and a richer account of the phenomena under study. Thus, photographs taken by authors of the study of formal and informal green and wild spaces formed the basis of the exercise. Prior to each workshop, all photographs were categorised into a type of formal green space or urban wild space based on the typology developed by Rupprecht et al. (2015), Hobbs et al. (2009), and Kowarik (2018). A list of the photographs used in the photo-elicitation exercise can be found in supplementary materials 1.xlsx.

Research by McMorran et al. (2008) and Wartmann and Purves (2018) suggest reference to 'wild-looking' vegetation as increasingly being associated with areas that exhibit wilderness-like qualities despite being conceptually different from the definition of wilderness as an untouched landscape without human modification. In contrast, Zoderer et al. (2020) disagree arguing that wilderness is a continuum concept that acknowledges a gradient of human modification of landscapes. Given the contested nature of these concepts, we began the workshop by asking participants to think about and share their understanding of the question 'What is wild urban nature?' but did not provide a definition of the word wild (Hobbs et al. 2009; Kowarik 2021; Gańko 2020).

Table 1 Description of each participatory workshop in each city including information about the type of community of practice, the number of attendees, date, and location of the space to which the workshop relates

Workshop	Description	Number of participants	Composition of participants	Location/date
1	Co-design workshop held at The Warehouse, London over 2 days	18	Local residents, "friends of" groups, activists, representatives from business, third sector organisations, and local authorities	Ripple Nature Reserve, London, UK. August and September 2022
2	Co-design workshop	6	Local residents, NGOs, and activists	Gorne Wood, London, August 2023
3	Co-design workshop	20	Students, practitioners, and artists	Novel ecosystem and the proposed site of the garden at the National College of Art and Design, Dublin June 2022
4	Co-design workshop	8	NGO, environmental volunteers, third-sector organisations, and activists	Valletta Design studios. June 2022
5	Co-design workshop	8	Architects, NGOs, local authorities, activists, academics	Valletta Design studios, Malta. June 2022
6	Co-design workshop with Barefoot Community Interest Company	4	Third sector gardening charity, teachers, environmental volunteers, and students	Informally managed community garden space, Middlesbrough, UK. August 2022
7	Co-design workshop with Middlesbrough Climate Forum	16	NGOs, third sector organisations, local authorities, an environmental charity, Friends of Group	Informal wild space at a cemetery, Middlesbrough. July 2022

Participants were then encouraged to share their answers with the wider group through discussion. Following that, participants were asked to review 30 photographs of novel ecosystems and formal green spaces and share their thoughts and feelings about these spaces and their differing characteristics and adding this to the rear of the image (see Supplementary materials 1.xlsx). Each photograph was randomly shared with each participant. During the discussion that followed, participants were asked to share their thoughts and feelings or comment on each image. This was designed to encourage knowledge sharing and interactive exchanges about diverse understandings and perceptions of wild spaces in cities and in what ways they may differ from formal green spaces. Drawing on Castleberry and Nolen (2018) and Braun and Clark's (2015) framework, data from each focus group was transcribed and disassembled. Individual quotes were coded and thematically into themes and sub-themes (Braun and Clarke 2015, 2022) based on how they related to the literature on perceptions of different ecological or urban characteristics found in formal or wild spaces and societal affective responses (positive or negative) to these characteristics. Once complete, independent researchers reviewed the analysis to validate the results (Castleberry and Nolen 2018; Braun and Clark 2022). This was an iterative process allowed the research team to identify patterns of similarity and differences in the way that people perceive wild spaces.

Results

The analysis identified three core themes that relate to the influence of ecological aesthetics and urban conditions on the perception of urban wild spaces, and also the affective influence of novel ecosystems that are summarised in Table 2. A table showing how the qualitative data was categorised into each of these themes and their sub-themes can be found in Supplementary Materials 2.xlsx.

The influence of ecological aesthetics on perceptions of wild spaces

When asked 'what is urban nature?' some said that they felt 'repelled' or 'disgusted' when looking at images of novel ecosystems with overgrown or ruderal vegetation. Similarly, evidence of seasonal changes (such as dried, straw like vegetation) or patches of bare ground was described as 'dirty', 'unkempt', or 'abandoned'. Participants also often referred to images of novel ecosystems without flowers as 'just weeds', describing the unattractive aesthetic appearance of some species especially if abundant species had dried out. Evidence of dry overgrown vegetation was also often coupled with terms such as 'messy' or 'untidy' and concerns about attracting other species such as rats or anger at the lack of the perceived lack of effort to care for novel ecosystems. These values were summed up by one participant as: "Look, look at our grass is starting to look like [it's dead] now because it's a summer. So, in the winter, the grasses obviously nice and green. But in the summer, it does die like this." (IDLD2) "People should take more care of it!" (IDLD5).

A perceived lack of care for unkempt vegetation was quite prevalent in many responses to images of novel ecosystems often accompanied by discussions about the role of novel ecosystems as what could be described as 'risk-scapes'. Some people articulated concerns about the risk of or actual presence of deviant activities related to crime or the presence of homeless people or teenagers, while some expressed concern or worries about the risk of harm caused by species with angular-shaped leaves or spikes. In a couple of cases, some even commented that their eyes were watering or that their skin began to itch during the focus groups. In other participants, a sense of fear was felt in response to some species with spikes or thorns, especially if the participant had children or grandchildren unaware of the sting of a nettle or prick from a thorn. These participants described how they had taken action to remove these plants from their garden or prevent access to stop a young person to prevent injury to a young person. One participant exclaimed:

Table 2 Summary of main themes identified by a thematic analysis of exploratory workshop data

Ecological aesthetics	Urban conditions	Affective influence of novel ecosystems
Unkempt ecological practices	If its urban is not nature! Nature–culture divide	Trigger childhood memories of encounters with nature
Perceptions of ruderal vegetation vary based on species	Presence of art or heritage mediates negative perceptions	Negative feelings
Conflict between the desire for orderly versus disorderly ecosystems	Evidence of care, maintenance, or stewardship	Emotional capital
Untidy appearance and eyesore impressions	New nature	Sense of loss
Influence of colour		

"I looked at that photo of the nettles in' the garden, and I think I've got a toddler. What's she going to do? And she started patting everything in your garden. So, when it came to patting nettles, I was like, no, don't do that! And I chopped the top off and then put like a wedge next to it to stop access and left the rest." (IDM12)

Feelings of discomfort were also felt by some participants in response to images of ruderal or wild vegetation leading to expressions of anger and sadness about the perceived lack of care of novel ecosystems. However, the notion of care typically related to maintaining structure, order, or control of unkempt' plants, while expressions of sadness were related to a sense of a 'lost possibilities' (IDM014) or the 'lost potential' (IDM001M24) of novel ecosystems that could be transformed into formal green spaces. However, not everyone that participated in the focus groups agreed with these views; many others expressed a tension between the desire to engage in practices of pruning and 'cutting back' to improve accessibility or reduce risk of harm versus a wish to preserve the beauty and biodiversity value of novel ecosystems. One participant summarised this tension:

"I'm thinking it's really natural, looking over stuff. I'm like it's natural for it's a mess and I want to get in there and sort it out. It's really bizarre!" (IDM13)

However, while there were mixed views about the desire to control ruderal vegetation across the focus groups, our study also found that the mixture of overgrown vegetation with urban infrastructure within novel ecosystems also played a significant role in how people perceive these ecosystems as discussed in the next section.

The influence of urban conditions on perceptions of novel ecosystems

The sight of the presence of urban infrastructure or waste materials led to divergent discussions about what is urban nature. Discussion among participants was divided between those that thought the mix of ecological and urban components found in novel ecosystems could not be considered nature and those that acknowledged their importance for biodiversity and ecological connectivity. Descriptive connotations that accompanied perceptual responses ranged from 'fake nature' (IDLD3) or 'unnatural' or an 'eye sore' (IDM045D21) to participants highlighting the role of novel ecosystems as food sources and 'spaces of shelter' (IDM31) for non-humans. One participant summed up these sentiments:

"We've got areas that are sort of demolished or demolition sites in Middlesborough and the surrounding brick and concrete, and they really stand out. It's been

sort of a haven of diversity and insect life and colour …." (IDM21)

However, whilst remnants of leftover infrastructure such as disused cars or old containers can have negative effects, our study also revealed that the presence of historical features, natural stones, or urban art may mediate negative perceptions. Referring to the difference between the aesthetic appearance of a modern urban and historic infrastructure, one participant affirmed:

"I think it's about the stuff that has been left there; for this one, I think you should be angrier because that's obviously, you know, shipping containers and it's not natural. This is probably the backside of the church that's been sort of left to go and its natural stone." (IDM15)

The juxtaposition of ruderal vegetation and urban conditions also challenged people's desire for maintained and orderly landscapes. Some participants expressed unease because they felt torn between manicuring an urban ecosystem versus their importance as ecological reservoirs of 'new nature' that connect fragments or patches of nature in the city. This led to deeper reflections among participants about the role that urban infrastructure had played in disrupting the relationship between people and 'real' nature (IDLD214) and the importance of recognising the ecological value of novel ecosystems and the importance of these ecosystems. We discuss how a loss of these spaces in cities has influenced people's affective response to novel ecosystems in the next section.

Affective landscapes

Our study revealed that visual perceptions of novel ecosystems can trigger a mixture of positive and negative feelings among participants, but suggest that they may play an important role as affective landscapes, mediating the effects of stress and anxiety. Several participants felt a positive affective experience, reaction, or force that not only had a therapeutic effect on the mind, but also the body. These participants felt that novel ecosystems provide an importance as a source of emotional capital in cities that gave people a feeling of peace or tranquillity with some people suggesting that they felt like they had been 'transported' to another space outside of the city and away from the 'chaos' of the city. A small group of participants also talked about the role of novel ecosystems during childhood and the impact that playing in unstructured environments where they could freely explore had on their mental well-being, but also their role as a source of social capital where families build memories through play. For other participants, novel ecosystems provide a source of comfort and protection that buffers them

from the stress and strain of urban life with one participant describing their 'cushion' effect. These discussions led participants to reflect on what prevents people from connecting with urban nature. Lack of time and the hecticness of urban life were the main reasons, but participants also talked about the difficulty of reconnecting to nature following periods of social isolation due to coronavirus despite its importance for mindfulness.

While many participants commented on the positive impact of urban novel ecosystems on well-being, some participants also reflected on feelings of sadness, anger, loss and grief that they felt as they reflected on memories of the destruction or redevelopment of wild spaces or being denied access due to a fence or boundary. Some participants' voices became quite emotional as they recounted stories of trees and hedgerows being 'ripped away' (IDM14) and the negative impact that the loss of urban nature can have on mental health.

> "Its encroaching all of the time, encroaching our bit of freedom and our forests. It's closing us in and its so it's bad for your mental health." (IDLD25)

In some cases, this led to deeper discussions about why people have developed a fear or suspicion of nature:

> "The thing about that suspicion against nature, I think it is linked to a certain xenophobia, like a hostility towards otherness, because you can't control the birds, you can't control the leaves. And there is an act of hostility towards that." (IDM37)

While other participants reflected on their experiences of playing in novel ecosystems as children and the impact that the destruction of these ecosystems has on future generations who may not have access to nature in the city because of the division between people and nature:

> "Our children do not have the same opportunities. Why? Because our cities, the plots that were vacant in our cities that were local ecosystems, most have been lost, and now everything is very well structured." (IDM21)

Discussion

To gain insight into how society values wild spaces in cities, seven workshops were conducted in four cities (Valetta, Middlesbrough, London, Dublin) to explore how communities of practice perceive urban nature and how the perceptions and values that participants ascribe to novel ecosystems compare to perceptions of formal green space. The study found that the value judgements that people ascribe to urban novel ecosystems follow three thematic areas: (1) the

influence of ecological aesthetics on the perceptions of novel ecosystems, (2) the influence of urban conditions on the perceptions of novel ecosystems, and (3) the affective influence of novel ecosystems. In the sections that follow, we reflect on the perceptual understandings of different ecological and urban conditions found in novel ecosystems and how these influence our affective response to urban nature in cities.

Mediating between perceived messiness and evidence of care in novel ecosystems

In contrast to previous studies (Filibeck et al. 2016; Rink and Arndt 2016; Parker 2022; Mathey et al. 2018) that suggest dense and overgrown ruderal vegetation may be associated leading to negative connotations about the usability and safety of novel ecosystems, our study found that the values that people ascribe to wild spaces in cities are often conflicting and deeply polarised. In many cases, wild spaces in cities of different typologies and scales were perceived as unkempt or untidy. These findings concur with a study by Rink and Emmrich (2005) that suggests ruderal vegetation or weedy vegetation combined with evidence of dirt, rubbish can signal danger or absence of care linked to risk of injury and fear (Soga and Gaston 2022). Furthermore, environmental criminologists (those who study the influence of environment on negative behaviour) argue the fear and perceived risk of encountering social nuisance (crime or vandalism or presence of waste) may also negatively impact psychological well-being (Fleming et al. 2016).

Like Parker (2022), Li and Nassauer (2020), and Nassauer (1995), our study found that images of ruderal or wild-looking vegetation that characterise novel ecosystems consistently created a sense of discomfort and unease among participants, particularly among people that have a clear preference for neat and managed landscapes. Lack of evidence of an intent to care for or manage a wild space also signals to people that a space is neglected or abandoned. Hence, the addition of situational cues within the landscape such as educational panels or mown edges to signal that urban novel ecosystems have been intentionally left unmanaged or 'wild' could help to increase societal acceptance of wildness in cities, and in turn how the impact on affective and aesthetic response influences well-being. Scholars (Nassauer 1995; Ingold 2021; Smith et al. 2022) argue that the more people see neat and managed landscapes, the less tolerant they become of unkempt and untidy landscape components. In contrast, Parker (2022) suggest that the values that people ascribe to wild spaces are based on their perception of the different ecological features of these ecosystems, which are in turn, influenced by order–disorder dualism and social and cultural norms associated with garden practices (Aronson et al. 2017).

Rink and Emmrich (2005) also suggest local physical and cultural contexts combined with social norms associated with neat landscapes may lead some social groups to reject ideas of wild nature in the city, urban nature, or ruined nature as a surrogate for 'true nature'. However, we also suggest that social norms associated with neat landscapes may also have influenced the disconnect between nature and people and resulting in a "hostility towards otherness" (IDM37) and towards non-human species.

Plant traits, stage of succession, or the response of species to environmental conditions influenced perceptions of different types of wild spaces. These findings were similar to those of Filibeck et al. (2016), who found that native Mediterranean ecosystems may be thought of as particularly unattractive to local residents because of the high percentage of short-lived annual plants (Therophytes) that die in the summer and the abundance of thorny growth forms (De Val and Mühlhauser 2014). Preferences for 'smooth' textures was also evident in discussions with participants. Kaplan (1992) argues that people may prefer vegetation that provides functional advantage, e.g. safety or crucial resources, and vegetation that signals other adaptive advantages of the environment leading individuals away from what is perceived to be inappropriate environments and towards more suitable ones (Kaplan 1992). Hareli et al. (2016) suggest people associate curved versus angular stimuli; round shapes are associated with peacefulness, and angular shapes, such as spikes, with anger and aggression. Here, workshop participants also revealed that patches of 'weedy' vegetation may be important as dispersal corridors, habitat connectivity, or 'food pockets' or 'spaces of shelter' for multiple species (Egerer and Philpott 2022; Vanneste et al. 2020). Given the pace of global environmental change, these findings could have important implications for urban biodiversity policy in cities were maintaining the status quo in terms of biodiversity conservation is not realistic. Similarly to Planchuelo et al. (2020), our findings suggest that some participants see a role for novel ecosystems in terms of providing buffer networks or stepping stones between high biodiversity value habits by providing additional foraging opportunities or improving connectivity to improve habitat heterogeneity. However, our findings also suggest that some people may oppose changes to the management of novel ecosystems due to the influence of order–disorder dualism, social and cultural norms attributed to garden practices, and disconnection between nature and people. Therefore, it will be necessary to explore further how and why these perceptions and preferences develop, the implications for conservation and restoration policy, and how opposition to management or maintenance practices may be mediated through the use of situational cues to increase acceptance. Hence, we recommend that future studies investigate how affective and aesthetic response to novel ecosystems may differ based on different type, scale, seasonality, or abundance of different plant communities and the nature of the urban setting and the role that different socio-cultural factors play in influencing the values that society ascribe to wild spaces. This will not only be important for gaining a better understanding of the cause of the disassociation between people and wild-looking nature in cities, but also how rewilding programmes may need to be designed to encourage public acceptance of wildness in cities and prevent hostility towards otherness.

Value of wild spaces for health and well-being

Although our study revealed that the value judgements of different social groups can be deeply polarised, many participants reflected on the therapeutic potential of novel ecosystems (Bell et al. 2022; Ireland et al. 2019; Rodriguez Castañeda 2023). Several participants described these spaces as calming, tranquil, or refuge from urban life. These findings align with the significant body of research that suggests contact with nature in formal green spaces has a restorative effect that ameliorates stress, helping to restore capabilities and build resilience by mitigating the harmful effects of urbanisation (Marafa et al. 2018; Hartig et al. 2014; McMahan and Estes 2015). Tyrväinen et al. (2014) and Van den Berg et al. (2014) suggest that the type and structure of vegetation could play an important role in influencing restoration in urban parks and forests, but the effect size may be moderated by the characteristics of urban settings (such as noise) and differences in the way that different social groups perceive urban nature and its affordances (Taheri et al. 2021). Rodriguez Castañeda (2023) suggests novel ecosystems may have therapeutic qualities that offer a space for relaxation and restoration or an 'oasis experience' away from the city. Exploratory findings from this research support this viewpoint.

Findings show that novel ecosystems in a city may play an important role in buffering the effects of everyday urban life, particularly during stressful events such as the restriction of movement during COVID-19. Since the outbreak of COVID-19, several studies have reported an increase in the use of and time spent in formal green spaces and natural environments (Derks et al. 2020), increasing our relationship with urban nature and non-human species (Vimal 2022). Our study goes further to suggest that urban novel ecosystems may act as a social refuge (Soga and Gaston 2022) as well as for biodiversity or, as one participant described, a "space of relief" (IMD37) to counter the negative effect of psychological stress caused by isolation on affective well-being. Following from Cheesbrough et al. (2019), our study shows that wild spaces indeed have the potential to be transformative not only in terms of reconnecting society with nature, but could also be a catalyst for encouraging society to engage with environmental stewardship. Given that the sample of

participants is relatively low, this supposition needs further exploration with a wider cohort of participants in different locations. That said, very little research has considered the potential of novel ecosystems to be transformative in terms of improving the relationship between people and urban nature and civic ecology practices (Jordan et al. 2019; Krasny and Tidball 2012).

Situational cues to enhance the affective capacity of wild spaces

Participants revealed that value judgements assigned to urban wild spaces are often polarised, but influenced by social norms and preferences for neat landscapes. However, these groups also recognise the value of wild spaces for biodiversity, both as spaces of refuge and secondary habitats, but also as spaces of social and person relief from stress. While many participants reflected on the positive qualities of urban wild spaces, others shared experiences of distress that they experienced in response to the loss of novel ecosystems. Thus, juxtaposition between the positive and negative effects of urban novel ecosystems on well-being created by affective landscapes (Berberich et al. 2013, 2016) may pose a challenge for encouraging society to engage in their stewardship. Li and Nassauer (2020) suggest altering landscape management practices to include certain 'cues of care' that may mediate negative emotions that the loss of nature has created and help facilitate (re)create connections to nature through new place attachments and meanings. However, we hypothesise that different types of situational cues may not only play a role in engagement in pro-environmental behaviour (Li and Nassauer 2020), but may also increase social acceptance of novel ecosystems and encourage place-based socio-ecological stewardship. However, further research is needed to investigate the role of different types of situation cues such as educational panels or varied mowing and maintenance practices to aid understanding of acceptance, indifference, or oppositions to novel ecosystems in cities. Pre- and post-evaluation of educational campaigns such as 'No Mow May' (www.zoosociety.org) could also help us understand how to influence social norms and challenge order–disorder dualism that creates a tension between people and urban biodiversity in cities. These studies should also investigate how the level of acceptability varies across age, ethnicity, and ancestry or gender and the level of biodiversity education.

Throughout our workshops, it was evident that certain references, markers, or cues were highly important to our participants. Such cues include mown pathways or habitat edges to indicate that the space has been intentionally left 'wild', but is also being curated. Certain aspects of wild spaces sparked different memories of playing or exploring in wild nature (such as contaminated spaces or old military

postings) during childhood, but also significant events that evoked a sense of loss or pathos for some participants. For some participants, the presence of street art and legacy infrastructure (such as historical buildings) helped to mediate the negative valuations of these wild spaces. These findings had been speculated upon (Collier 2011) and may suggest that while perceived disorder could precipitate a fear of social nuisance, increasing the amount of ruderal or wild-looking vegetation could mediate these affects. Recent research by Sikorska et al. (2021) and Li and Nassauer (2020) also suggest that increased wilderness in cities can also improve place attachment as well as well-being. Hence, we propose that future studies should examine the role artistic cues could play to help increase place attachment and acceptance of novel ecosystems such as artwork or signage that connects the landscape with historical use of the landscape. Integration of these cues into the landscape could help to mediate the negative affective response to different stimuli that we encounter in novel ecosystems and improve perceptions and acceptability of wild spaces in cities, allowing cities to change management and maintenance regimes that support urban biodiversity agendas.

Similarly to Nassauer et al. (2021), our study found that perceptions of novel aspects of informal wild spaces and their micro-scale landscape characteristics, such as unkempt plants or evidence of waste materials, can influence the value judgements that society ascribes to wild spaces and influence affective well-being. However, we posit that practices of neatness and cleanliness that are associated with urban residential gardening may play an important role in creating opposition to wildness in cities. Hence, future studies should investigate how practices of care and stewardship associated with everyday social practices (e.g. pruning and snipping) influence societal expectations around the coverage, height, and abundance of vegetation on a street scale. This study should examine how this relationship differs across different demographic and social groups, but also pay attention to the level of familiarity with novel ecosystems and the role that the presence of litter and other materials play in influencing everyday affective experiences of these landscapes (such as human comfort).

Conclusion

This study explored the perceptions of urban communities of practice of urban novel ecosystems. Using photo-elicitation workshops, participants shared their stories, memories, and valuations of urban wild spaces. Visual aesthetics, including urban conditions, have a major influence on people's perceptions leading to polarised value judgements. Novel ecosystems as affective landscapes are an important theme in this study and are regarded as spaces of refuge and relief

from the effects of everyday urban life for humans and non-humans alike, but also can induce place-based distress and ecological grief due to a growing awareness of the impact of climate change and biodiversity loss. At the same time, these urban ecosystems can trigger feelings of disgust or anger influenced by social norms, but may be mediated by situational cues such as mown edges or artwork. To increase acceptance of these ecosystems across policy and practice as well as society, it is essential that further work is done to educate these groups on the value of novel ecosystems for urban biodiversity and explore the role of power in the designation of these ecosystems within policy domains. These studies should also investigate the sense of loss that some communities feel due to the loss of nature in cities and how the effects on psychological well-being may be improved by enhancing the affective capacity of these ecosystems.

However, while the literature recognizes the contribution of these spaces for mental health restoration, there is still the need to explore the benefits and contribution of these spaces at the interface of mental health and urban biodiversity. It was also revealed that situational cues could bring people closer to wilder landscapes and foster behaviours of care and affectivity. Another limitation of this research is that co-design workshops were primarily carried out in a limited number of locations and in the Global North, so that value judgements and beliefs are based on limited cultural viewpoints. Furthermore, the use of A4 photographs of formal green spaces or novel ecosystems during the photo-elicitation exercise did not provide the level of granularity needed to explore perceptions of different species. Hence, we suggest that more in-depth ethnobotanical studies are needed that provide people opportunities to engage with wild-looking plants to explore how different communities of practicsocial and cultural groups across the globe globally perceive novel ecosystems, especially in cities. These studies should also explore how societal demand for 'signals' of care interventions can influence societal perceptions of different types and sizes of novel ecosystems and convey information about their ecological function, importance to biodiversity, and their relationship with neighbourhood landscape norms. In doing so, research should also investigate how situational cues such as heritage-inspired artwork may be co-designed by different communities of practice to increase public acceptability of different types of novel ecosystems in cities that include vulnerable and marginalised groups such as the elderly, children, and young people, but also build resilience and capacity to respond to the challenges of urban life.

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Declarations

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