



This is a repository copy of *The magic of the mundane: The vulnerable web of connections between urban nature and wellbeing*.

White Rose Research Online URL for this paper:
<https://eprints.whiterose.ac.uk/167685/>

Version: Accepted Version

Article:

Dobson, J., Birch, J. orcid.org/0000-0003-0155-0242, Brindley, P. orcid.org/0000-0001-9989-9789 et al. (5 more authors) (2021) The magic of the mundane: The vulnerable web of connections between urban nature and wellbeing. *Cities*, 108. 102989. ISSN 0264-2751

<https://doi.org/10.1016/j.cities.2020.102989>

Article available under the terms of the CC-BY-NC-ND licence
(<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

Reuse

This article is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND) licence. This licence only allows you to download this work and share it with others as long as you credit the authors, but you can't change the article in any way or use it commercially. More information and the full terms of the licence here: <https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



eprints@whiterose.ac.uk
<https://eprints.whiterose.ac.uk/>

The magic of the mundane: the vulnerable web of connections between urban nature and wellbeing

Published in *Cities* Volume 108, January 2021, 102989 doi.org/10.1016/j.cities.2020.102989

Julian Dobson^a Jo Birch^b Paul Brindley^b John Henneberry^c Kirsten McEwan^d Miles Richardson^d Anna Jorgensen^b

^a Centre for Regional Economic and Social Research, Sheffield Hallam University, UK

^b Department of Landscape Architecture, University of Sheffield, UK

^c Department of Urban Studies and Planning, University of Sheffield, UK

^d College of Life and Natural Sciences, Centre for Psychological Research, University of Derby, UK

Abstract: Cities are sites of human, ecological and institutional stress. The elements that make up the city – its people, landscapes and processes – are engaged in constant assemblage and disassembly, joining and pulling apart. Reporting the findings of a three-year multi-disciplinary deep case study, this paper examines the role of urban nature in mediating the relationship between stressed humans and stressed places. It applies assemblage theory to show how such relationships can be understood in contexts of multiple pressures. From empirical findings it shows how urban nature contributes to mental wellbeing, but also how institutional stresses linked to austerity policies shape efforts to reconnect humans and nature. Across five strands of research, this article foregrounds the importance of multiple everyday experiences of urban nature and practices of care and maintenance. It calls on researchers, policymakers, planners and practitioners to pay closer attention to the ‘magic of the mundane’ in supporting human wellbeing; in caring for spaces and places; and in providing the services that link people and the natural environment.

The magic of the mundane: the vulnerable web of connections between urban nature and wellbeing

There is a wealth of research showing how the natural environment supports human wellbeing (for reviews, see World Health Organization 2016; Pritchard et al. 2019). Yet despite the concentration of the population in urban environments, investment in urban green spaces in the UK continues to decline (House of Commons Communities and Local Government Committee 2017). Surprisingly, little recently-published research considers the benefits of urban nature for human wellbeing in conjunction with the local decisions and investments that determine the health of urban nature itself. This article seeks to bridge that gap, applying assemblage theory to show how policy and practice can enhance wellbeing through effective use and management of urban green spaces, despite a context of multiple pressures.

The authors' research through the three-year Improving Wellbeing through Urban Nature (IWUN) project¹ is an intensive inquiry into the complex relationships between urban nature and wellbeing through multiple lenses in the context of one city. It focuses on Sheffield, a large city in northern England. Using a 'deep case study' approach (Yin 2009) to investigate urban complexities and interactions, the project brings together landscape, experiences and practices and shows their interconnected contributions to mental wellbeing. Using multiple methods, the study reveals how everyday encounters with the natural world underpin human mental and physical health; how simple policy interventions can improve the contexts for wellbeing; and how the beneficial effects of urban nature are vulnerable to institutional neglect. Such findings could not have been achieved through traditional multi-site comparisons.

By emphasising context and collective effects, we focus attention on the totality of the 'nature' found within a city as defined by its residents and decision-makers, the variety of its effects, and the issues this raises for policy and practice as well as for future research. We focus on nature as an environment within which wellbeing effects may be obtained, rather than as a cause of wellbeing. The healthier the overall environment, the higher the potential for wellbeing effects (Rabinowitz et al. 2018). Our approach draws on the concept of affordances articulated by Gibson (1979) and Heft (1988) and more recent international approaches to urban complexity using the lens of assemblage theory (DeLanda 2006; Dovey 2012; Porqueddu 2018). Assemblage theory, coupled with insights from urban studies in the global South, focuses attention on the need to understand urban space and human wellbeing from a grounded perspective, working with the grain of variety and subjectivities.

This paper challenges the atomisation, essentialisation, and homogenisation of 'nature' (Robertson 2012) and the notion that a 'dose of nature' (Shanahan et al. 2015) may be used instrumentally to achieve wellbeing. Such thinking is often driven by a desire to relieve the public purse of demands on healthcare resources. Rather, we argue that the wellbeing effects of exposure to and connectedness with nature rely on a multiplicity of factors. We call for attention to the 'magic of the mundane', under-valued but essential everyday experiences, in supporting human wellbeing. We argue that policy and investment should focus on caring for the totality of the naturally

¹ [explanatory footnote removed for the purposes of peer review]

occurring and humanly constructed green fabric that supports human wellbeing in the 21st century city.

The context: urban challenges and research background

We begin by considering briefly why urban nature matters. Its role in mitigating mental ill-health and supporting wellbeing is important (Villeneuve et al. 2012) because the urban environment spawns multiple stresses (Sundquist et al. 2004). Three dimensions are particularly relevant.

First, cities have long been thought of as sites of psychological stress and are linked to greater likelihood of poor mental health (Lederbogen et al. 2011; Gruebner et al. 2017). Fitzgerald et al (2019) present a pan-global and historical précis of research which has previously sought to unpick ideas about mental health and urban life. The authors highlight, for example, past debates about whether cities ‘produced’ mental illness or whether people with mental health difficulties ‘drifted’ towards cities (Lewis et al 1992). Since then, a broader set of studies have examined how urbanisation acts as a risk factor for poor mental health. Fitzgerald et al (2019) summarise particular social and physical features of urban environments that can be associated with poor mental health. These include social segregation, low economic status and capital; stresses associated with migration; physical danger; noise; and sometimes urban design. Costs of these urban stressors are not only conceived in terms of detriments to individuals but more broadly to societies. In the UK, mental illness is the largest cause of disability and is often referred to in terms of its economic cost, calculated at £105.2 billion annually (Department of Health 2011). The majority of mental illnesses are thought to begin in during youth (Kessler et al 2005) and at a local case-study level, one in ten 5-15 year olds in Sheffield have a clinically recognisable mental health disorder (NHS Sheffield and Sheffield City Council 2019). A growing number of international studies have highlighted the role of green spaces and natural environments in relieving stress and enhancing wellbeing, as detailed in the literature review below.

Second, cities are sites of ecological stress (IBPES 2019). In responding to this, Hinchcliffe et al (2005:645) remind us how urban natures may be undervalued because they ‘often do not seem to count as good representatives of nature [...] Not pure enough to be true and not human enough to be political’. Yet cities may offer valuable opportunities to reinforce connections and co-evolution between humans and the more-than-human world (Heynen et al. 2006; Alberti 2016). We use the term ‘more-than-human’ here to emphasise that ‘nature’ is heterogeneous, active, and independent of as well as influenced by human activity (see, for example, Gorman 2017). This reinforcement of connections is important if extensive loss of wildlife in the UK – a reduction of 56% since 1970 – is to be addressed (RSPB 2016). Cities provide important habitats for flora and fauna, and people are most likely to encounter ‘nature’ in urban parks and green spaces (Newman & Dale 2013). For Maller, attendance to the ‘things, critters, artefacts and non-human publics’ that make cities more-than-human offers a key challenge to the status quo and a valuable tool in creating healthy cities (2019:7).

Third, cities are sites of institutional stress. This is a particular challenge in the context of prolonged austerity. Lowndes and Gardner (2016) outline the challenge of ‘super-austerity’ in which municipalities must implement successive waves of public service cuts, ‘compounding original impacts and creating dangerous (and unevenly spread) multiplier effects’. Reduced capacity within public services transmits the most severe impacts of austerity to the poorest sections of population (Hastings et al. 2017). These institutional stresses in turn lead to demands to justify activities in terms of value for money. Services such as green space management and the provision of green infrastructure are deemed worthy of investment if they can be shown to reduce the public cost of

healthcare or environmental risks (Moore et al. 2018). Such logic helps to drive a research agenda devoted to identifying the economic worth of the more-than-human world (TEEB 2010). These issues are not unique to the UK. A study of 32 urban green spaces across Europe (Buijs et al 2019) noted a loss of municipal support for green space; more generally, the advent of ‘austerity urbanism’ following the 2007/8 global financial crisis has led to a removal of resources from urban governments, often accompanied by an increasing burden of responsibilities (Peck 2012).

This article signposts a new direction in research on cities, nature and wellbeing by focusing on multiplicity as well as specificity. It uses assemblage theory (DeLanda 2006) and an understanding of the affordances offered by green and natural environments (Heft 1988) to build on extensive existing evidence. The article considers this evidence in terms of complexity and connectivity rather than by examining isolated elements. An overview of recent literature illustrates the current state of knowledge.

Urban nature, wellbeing and complexity

Access to nature is associated with psychological wellbeing and stress relief. A recent international review of 263 studies relating to green space and mental health (Wendelboe-Nelson et al 2019) noted that around 70% of the articles examined reported a connection between a positive association between green space and wellbeing, although study methods varied widely. Earlier relevant reviews include Bratman et al (2012); Douglas (2012); and Maller et al (2006). A study in New Zealand found that proximity to green spaces was associated with reduced anxiety and mood disorder (Nutsford et al. 2013). A cross-sectional study of four European cities found links between time spent purposefully in green spaces and improved levels of wellbeing and vitality (van den Berg et al. 2016). Benefits can include short term spikes in wellbeing (Bowler et al. 2010; Mackerron & Mourato 2013) and the potential to increase resilience against stressful life events (Wells and Evans 2003; van den Berg et al. 2010). However, the proximity of green spaces on its own is not necessarily associated with mental wellbeing (Houlden et al. 2017). Quality of green spaces can have a stronger bearing on health outcomes than quantity (de Vries et al. 2013).

Mental wellbeing is also linked with social activity, including volunteering, in green spaces (Molsher & Townsend 2015). A study in Zurich, Switzerland, found that green spaces can enable newcomers and migrants to feel a sense of belonging (Seeland et al. 2009). So-called ‘green interventions’, often involving volunteering activities, are beginning to be offered as social prescriptions in an attempt to tackle mental ill-health and reduce demands on healthcare providers (Bragg & Atkins 2016).

Findings such as those outlined above have been deployed to support the notion that a ‘dose of nature’ could be a cost-effective substitute for, or supplement to, modern medical interventions (Barton & Pretty 2010; Shanahan et al. 2015). One study from England suggests 120 minutes of ‘recreational nature contact’ as an appropriate ‘nature dose’ (White et al. 2019). This line of inquiry is tempting because potential cost savings may be associated with ‘doses of nature’ or ‘green prescriptions’. Yet it avoids the question of what works for whom in which circumstances (Pawson & Tilley 1997), instead assuming that findings from specific studies may be generalisable. Bell et al (2019) caution against ‘reductionist dose-response frameworks’, instead arguing that individuals’ encounters with nature are ‘relationally emergent’ and dependent on social practices.

Literature that deals with complexity, relationships, and opportunities, rather than seeking to isolate linear causes and effects, may provide a more helpful basis for understanding relationships

between urban nature and human wellbeing. The notion of nature connectedness offers a way to describe the complex relationships between humans and the natural environment: the more connected people feel to nature, the more likely they are to experience the more-than-human world in ways that support mental wellbeing (Nisbet et al. 2011; Pritchard et al. 2019). However, as one study from Australia highlights, nature connections are not always shared between different cultural groups (Agustina & Beilin 2012) and connections with nature are not always positive (Milligan & Bingley 2007).

Literature on nature connectedness tends to show broad, rather than specific, benefits. Nature may support sense(s) of place or home, as evidenced by studies of migrants in Germany (Jay & Schraml 2009) and Sheffield, UK (Rishbeth & Powell 2013). Experience of urban nature may support young people's sense of self and connection with the wider world (Birch et al 2020) but it does not follow that people will feel a sense of community in an ecologically rich environment. Moore et al (2018) ask for a re-reading of over-simplified connections; their review of literature indicates weak evidence for overall positive association between greenspaces or greening interventions and mental health. They highlight problems associated with defining, measuring and isolating variables around human wellbeing and environment. The difficulty of isolating variables, however, should not be taken as a negation of the benefits identified in research. Research accuracy can suffer if confounding factors are not all included in analyses (York 2018), but place-specific decisions and investment choices must generally be made with incomplete knowledge.

The core theme of this paper is that attention needs to be paid to the ways in which a city's more-than-human world provides a network of microfoundations for wellbeing. Alberti (2016) describes cities as 'coupled human-natural systems'. Thus attention should be paid to the decision-making processes that influence the relationships between the human and the more-than-human. This highlights the particular importance of green and natural spaces. Rather than attempting to disaggregate the functions and effects of urban nature, our findings should alert researchers, practitioners and policymakers to the urgent need to attend to the everyday fabric of formal and informal urban green spaces in its totality and diversity. This focus on everyday complexity is required in order to coordinate policy and action on mental health, biodiversity and species loss, the protection of public services and the landscape quality of cities.

Much of the literature on green space and wellbeing relies on a biomedical model that seeks to discover what degree of exposure to urban nature may be most effective in improving health or mitigating ill-health. As one meta-analysis of 143 studies (Twohig-Bennett & Jones 2018) shows, however, the effects attributed to green space can be very broad, ranging from decreased salivary cortisol (an indicator of stress) to lower cholesterol and heart rates, reduced cardiovascular mortality, better self-reported general health, and reduced risks of Type II diabetes. However, these effects will range widely depending on the level and type of use of green spaces. Similarly, they will be mediated by culture and personal preferences. As another international review indicates, 'while the existing evidence affirms beneficial impacts of green space on health, much remains to be learned about the specific pathways and functional form of such relationships, and how these may vary by context, population groups and health outcomes' (Markevych et al 2017). The challenge for urban planners and policymakers is that urban space is not amenable to being prescribed in a simplistic manner as a treatment for particular conditions. Once a space exists, its utility in supporting health and wellbeing depends on how its functions (the qualities of the space) and uses (by the population) are enabled and managed. This is where an understanding of assemblages and affordances, which is absent from much of the literature on green space and health, can offer city planners a basis for decision-making.

Theoretical framing

The backdrop to our research is an understanding of the city as material, social and political. Place, as Gieryn (2000) emphasises, is stuff: not just the stuff that appears on maps, but the stuff that grows, crawls and flies. In our deep case study city of Sheffield this encompasses the badgers living in an embankment originally created from industrial waste to provide a route for trams; the squirrels that have learned to take food from visitors in the city's Botanical Gardens; and the wildflower meadows sown on sites of demolished housing at the turn of the millennium. Environmental and social changes predetermine each other (Heynen et al. 2006); 'urban nature' encompasses complexity and potential, the co-evolution (Alberti 2016) of the human and more-than-human.

To provide a framing for complexity and potential, we call on the understandings offered by assemblage theory of the city as a dynamic mix of the formal and informal. Dovey (2012), drawing on the 'informal urbanism' of the global South, describes an assemblage as 'a socio-spatial cluster of interconnections between parts wherein the identities and functions of parts and wholes emerge from the flows among them' (p353). From studies in Colombia and Chile, Porqueddu (2018) describes assemblages as 'provisional clusters of interconnections'. While assemblage theory is sometimes critiqued for its emphasis on the specificities and particularities of urban places (Scott & Storper 2014), we argue that it provides a valuable framework for thinking about cities, green space, and wellbeing more broadly.

We can thus understand cities and their landscapes as bundles of relationships and possibilities (Massey 2006). From this flows an understanding of relations between humans and 'nature' as hybrid and fluid, involving understandings and 'stories' of place generated by nonhuman species as well as humans (van Dooren & Rose 2012; Gorman 2017). Urban governance and planning, too, is understood as an assemblage of policies, rules and practices that travel and are reconstituted across and between localities (McFarlane 2009). People, places and policy are in constant states of tension and motion. Planners and urban designers, at their best, are 'guardians of the unpredictable' (Porqueddu 2018).

Within this mix, human actors form understandings and relationships with the more-than-human world; this is an 'ecological perspective of the city' that acknowledges the 'multiple intermingling of human and nonhuman entities' (Farías 2011). People form relationships with particular places that affect and sustain their sense of self (Birch et al 2020; Jakubec et al. 2016) through connectedness to nature (Lumber et al. 2017) and sense of place (Raymond et al. 2017). Raymond links the notion of a sense of place to affordance theory, affirming that the immediate perceptions and possibilities offered within a location are as important as long-term relationships, memories and connections. A sense of place, as Raymond emphasises, is a combination of the constantly shifting attributes of a place and of the individuals who experience the place.

Affordance refers to the complementarity between person and environment (Gibson 1979; Roe & Aspinall 2011), and is now commonly seen in terms of the possibilities for action suggested by the material environment. Heft (1988) shows how landscape features provide affordances, or potential, for different forms of play and physical activity. They do not cause children to play, but provide opportunities for them to do so. When we discuss the wellbeing effects of urban nature, therefore, we are considering the combinations of environments and human circumstances that afford possibilities of wellbeing, rather than seeking generalisable rules.

We hope through this article to make specific and new theoretical contributions to urban research and policy thinking. First is to foreground the value of material and more-than-human

thinking and of assemblage and affordance theories in comprehending the interplay between cities, nature and wellbeing. In response to discussions which remain sceptical of assemblage theory as ‘mercurial’ or as most useful for methodological application (Brenner et al 2011), a second contribution is in suggesting the worth of combining assemblage and affordance theories for more materially informed practice and policy based thinking. A third contribution arising from our theoretical framing is to emphasise the *multiplicity* of potential causal mechanisms linking ‘urban nature’ and ‘wellbeing’ rather than seeking to isolate a single pathway. We build on the notion of ‘redundant causality’ (DeLanda 2006: 37) - the increased likelihood of an outcome if there are many ways of reaching it. This is important when considering the mix of methods applied across our research and its range of findings, which are described in the following section.

Research methodology

The IWUN project examined the many ways in which ‘urban nature’ supports mental wellbeing. Sheffield, the case study location, is the UK’s fifth largest city by area, with a rich heritage of green spaces but also high levels of urban deprivation. Natural environments (including part of the Peak District national park) form 70 per cent of land cover, with a total of 947 publicly accessible green or open spaces, 80 of which are public parks managed by Sheffield City Council.

IWUN aimed to identify characteristics of natural environments that promote mental wellbeing; explore the diversity of values and beliefs that influence people’s connections with nature; investigate the potential for assessing the value of natural environments in terms of health and wellbeing outcomes; examine the policy and governance frameworks needed to implement appropriate interventions; and work with stakeholders to translate such findings into practice.

IWUN involved four strands of simultaneous research, one of which had two sub-strands. Fuller details of the methods employed are provided in the papers referenced below. The first was an epidemiological study (Brindley et al. 2018; Mears et al. 2019; Brindley et al. 2019; Mears et al., 2019b). We used a statistical approach to examine the relationships between green spaces in Sheffield and health and wellbeing. To understand whether there were green space variables explaining health inequalities, we accessed GP data for 345 areas of Sheffield, on self reported health, depression, and severe mental illness while controlling for confounding factors such as income deprivation, air pollution and numbers of smokers (Mears et al., 2020). After adjusting for confounders, we found significant relationships between better general health and larger average garden size, greater total green space cover and greater local tree density. We also found lower levels of depression in areas where average garden sizes were larger and where publicly accessible green spaces were cleaner (in terms of graffiti, litter, dog dirt and chewing gum). Separate analyses found an association between greater cleanliness and better general health, and supported the relationship between larger residential garden size and better general health at the national scale, even after controlling for income and other factors known to be related to health. We also found that equity of green space provision was complex: deprived areas in Sheffield were closer on average to green space in terms of physical distance, but there was less green space per person in these areas because the green spaces were generally smaller.

The second strand’s design drew on narrative approaches (Andrews et al. 2008) to explore city dwellers’ experiences of ‘nature’ and natural environments (Birch et al. 2020). We carried out life course interviews with 55 adults and young people aged 17-86 years to explore how urban residents from diverse backgrounds (especially differentiated by age, gender, ethnicity and mental health) narrate their own histories and values around nature, health and wellbeing. Purposive sampling was

used to include more Black, Asian and Minority Ethnic residents (n=32) and people living in areas classified as urban deprived (n=40) to help us hear from people previously considered as 'low users' of nature (Natural England 2015). The interview participants were recruited from a wide range of community groups and services in Sheffield, none of which had nature or environment as their focus. This strand of the study also included 24 'nature and wellbeing' workshops with a total of 35 participants, all of whom had lived experience of mental health difficulties. These workshops used visual art and creative techniques to elicit participants' experiences and feelings about nature and wellbeing. Approximately half the participants had experience of complex and enduring mental illness and most were using or supported by mental health services at the time of the study. Workshops were run with four different groups to include a wide range of mental health experiences and stages of recovery and each group participated in a purposely designed 6 week course (2 - 2.5 hours a week). Each course was run by one or two arts facilitators with lived experience of mental health difficulty and was attended by the same researcher, using focused ethnography (Knoblauch 2005) and swiftly written up and reflexive fieldnotes.

Our third strand explored how urban natural environment characteristics deliver wellbeing benefits. It included a large-scale randomised controlled trial with data collection via a novel smartphone application (McEwan et al. 2019). The app included both an intervention based on noticing the good things in urban nature (Richardson and Sheffield 2017) and wider data collection of users' exposure to natural environments. It recorded users' journey, locations, and duration of stay in natural environments, prompting users to respond within geofenced natural spaces. Participants were prompted over seven days to notice and record the 'good things in nature' with a sentence each day. An active control group were prompted to record good things in the built environment. The app allocated conditions at random, weighted so that 70 percent were allocated the 'nature' condition. Of the 1,112 people who downloaded the app, 582 began the study and provided baseline data. Of these, 322 completed post-intervention measures and 164 completed follow-up measures at one month. Data collection took place between November 2017 and May 2018. Three items measured exposure to nature as a child and in the last year and whether the participant had access to a garden. Measures were taken at baseline and follow-up after one week of app use, and one month after app use. Each day, when recording the good things in nature, users recorded the perceived biodiversity level and their feelings for the locations. They also recorded their activity and who they were with. Sites commonly visited by members in each group were assessed for number of habitats present, avian and vegetation diversity and abundance.

The fourth strand had two parts. First, it sought to identify feasible and acceptable green space interventions that could bring positive mental health outcomes for Sheffield's residents (Dobson & Dempsey 2018). We drew on the professional and tacit knowledge (Pozzali 2008) of stakeholders, engaging with 122 green space managers, members of voluntary and community groups, planners, public health professionals, local physicians and community members. Through a literature review and initial group discussions we identified a long list of 35 interventions. A shortlist of five interventions was finalised following six focus groups involving 28 participants, as well as six semi-structured interviews with individual stakeholders. These centred on three themes: how the proposed interventions would contribute to wellbeing; what decision-making processes would facilitate or prevent interventions being implemented; and the reasons why proposed interventions might be approved or rejected.

The chosen interventions were:

- Improve access to green spaces, including walking and cycling routes
- Provide new or upgraded toilets and cafés in parks and woodlands
- Set and maintain a minimum standard of regular, sustained maintenance

- Employ additional parks staff to encourage outdoor activities and volunteering
- Provide additional support for voluntary and community organisations to animate green spaces, bringing them to life through activities and events

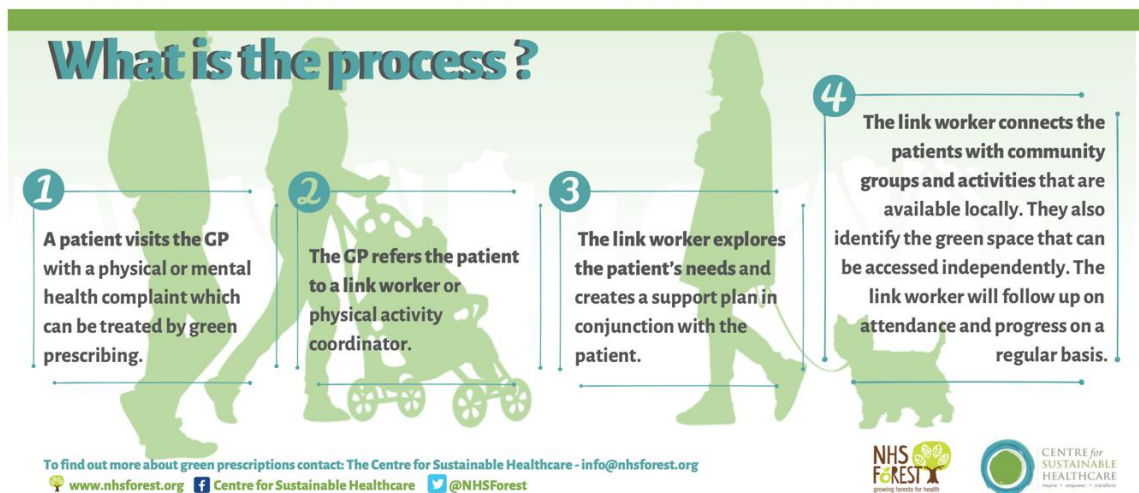
The second stage of the fourth strand of the research (Dobson et al. 2019) aimed to generate a holistic framework to analyse the costs and benefits of the interventions selected by stakeholders (Vandermeulen et al. 2011). Harnessing the expertise and experience of professional and lay stakeholders, we first sought to identify and estimate the costs and benefits of the selected interventions, considering their impact on associated urban ecosystem services. We then sought to determine the extent to which cost-effective interventions may help to generate urban natural environments optimised for health and wellbeing effects. We conducted a thorough review of the empirical literature on Cost-Benefit Analysis (CBA), particularly as it related to the evaluation of green infrastructure (GI) assets and investments. We drew on stakeholders' knowledge of the financial aspects of GI investment and management through individual interviews and a seminar involving municipal staff and voluntary organisations. This helped us to identify the context for undertaking CBA, including the policy, practice and institutional challenges of undertaking the analysis for specific investments at a local scale. A CBA of four GI interventions was carried out. This involved estimating the direct (project) and wider (social) costs and benefits arising from the creation and maintenance of the interventions and associated facilities/programmes, including the impact on urban ecosystem services. In addition, the distributions of the direct and wider costs and benefits were mapped to identify the mis/match between them.

Project findings: the magic and the neglect of the everyday

Across our five strands of research and mix of methods, we consistently found what we term the 'magic of the mundane': the effects of routine or incidental encounters with urban nature in enhancing individuals' wellbeing and outlook on life. Such ordinary experiences, however, are resistant to simple policy interventions. They cut across disciplinary and bureaucratic boundaries, demanding an awareness of the mediating role of urban nature within a web of decision-making bodies and organisations.

Figure 1 provides a simplified illustration of just one of the processes that might activate experiences of urban nature contributing to improved wellbeing. In this example there are three organisational links in the chain: primary healthcare practitioners, link workers, and community-based organisations providing activities in green space. Each relies on different funding sources and has different lines of accountability. For a patient to benefit from a notional 'green prescription' all three links in the chain need to function effectively.

Fig. 1: Illustration of a 'green prescribing' process



Source: IWUN/Centre for Sustainable Healthcare

We could flesh out this illustration by including the potential impacts of the five recommended interventions discussed in the previous section. Experiences of urban nature may be enhanced or prevented if there are suitable routes to and from green spaces – if a person has to cross a busy arterial road to go into a park, they might not bother. So highway engineers and transport planners have a role to play. If there is nowhere sheltered to sit and enjoy a coffee or no toilet facilities in the park, the visitor might not stay very long. Providing such facilities requires a partnership between parks managers and the operator of a café, who might only provide a service if they can make a profit. Regular sustained maintenance requires a team of parks staff with the time and resources to provide a high standard of care; without it, a park may become unkempt and attract antisocial activities. If parks staff are on hand and engaged in organising activities and events, new visitors may be attracted and gain wellbeing benefits. Similarly, support for community-based organisations may enable vulnerable or isolated people who might not leave their homes without assistance to enjoy their local green space.

This brief outline of a few of the people and organisations who activate everyday experiences highlights another factor. Ordinary experiences are adversely affected by barriers erected by and between the institutions that dominate urban life: municipal governments, planning authorities, healthcare providers, and civil society organisations. All of these, through neglect, communication failures, or a lack of capacity, can contribute to the decline of urban green spaces or the exclusion of particular groups. Three interconnected themes stand out from our research.

Everyday experiences matter

The first finding is that everyday experiences matter in terms of human wellbeing. Our randomised controlled trial using a smartphone app (the third strand of our research) found that noticing good things in urban nature over seven days resulted in increases in mental wellbeing and connectedness with nature. These ‘good things’ were everyday experiences - the view of a tree or sky, a flower in a wall or a squirrel in a park. Participants’ improvements in mental wellbeing were sustained when they were surveyed one month later. Participants with mental health difficulties

showed clinically significant improvements in mental wellbeing between baseline and follow-up (McEwan et al. 2019b).

Analysis of the app data showed that among people prompted to notice nature, improvements in nature-connectedness were greater for people who had spent time outdoors as a child. Nature connectedness scores also improved more among participants who spent less time outdoors in the last year, and among those who had lower baseline nature connectedness. Increased nature connectedness was found to be a predictor of increased wellbeing. The research provides experimental evidence that an app to prompt noticing the good things about urban nature has potential as a wellbeing intervention, particularly for those less engaged with nature. Measures of perceived and actual biodiversity, and the relationship to positive emotions, revealed that participants responded much more positively to urban green spaces that support greater diversity of wildlife.

Participants in the workshops organised through the second strand of the study revealed both the magic and the neglect of the everyday in various ways. This was the case across ethnic and socioeconomic groups. One participant, 'Karen', described the scrubland seen on her daily journey as 'always different. It ebbs and flows like the sea'. Noticing the seasonal change of the roadside gave her a positive experience. Very rarely did people report 'epiphany' moments in connection to nature. Yet relatively mundane places and experiences, such as sitting under a tree, watching leaves in a park, or holding a twig in a pocket attained symbolic significance (Evered 2016: 691) as they offered opportunities to reflect on 'life problems' and to gain a sense of 'what is real' and manageable. Workshop conversations, diaries, photos and artwork illustrated how, in times of mental ill-health, nature helped people feel safe, unjudged and connected to the more-than-human worlds (Whitehouse 2017) of trees, pigeons, hills, water and seasons.

Our work with stakeholders investigating decision-making and prospective interventions, part of the fourth strand of the study, reinforced the importance of everyday encounters with nature in generating feelings of wellbeing. The head of therapy at a health trust spoke of her joy at seeing spring flowers or noticing frosty landscapes. A health academic emphasised the value of physical exercise in natural environments in creating a 'sense of perspective, that idea that we're part of something that's much bigger than ourselves'.

Alongside specific improvements in psychological wellbeing, we found that experiences of urban nature contributed to the overall quality of participants' lives. Thematic analysis of the qualitative data from our smartphone experiment revealed ten themes relating to participants' observations of good things in urban nature (McEwan et al. 2020). The dominant theme was wonder at encountering wildlife. Within this theme many 'good things' related to encountering wildlife and enjoying birdsong. The second main theme was gratitude for trees. Participants noticed changes of season, for example, especially on journeys to work. The third was the awe evoked by colourful, dramatic skies and views across the city. The minor remaining themes included: green planting in urban spaces; flowering plants; fields and grassland; water; nature's beauty; feelings of awe; feeling calm or relaxed. Participants were also asked about their worst experiences during the seven days of the experiment. Main themes included uncared for green spaces (e.g. litter); and poor quality green space with limited wildlife, trees and diversity of planting.

The interviews and workshops revealed some problematic nature experiences and negative associations with green space. For 'Becky', an undeveloped area near home was described as a 'wasteland'. The glass and litter she encountered on walks near home was enough to persuade her to use her car rather than walk her toddler to a local park. In one instance, a change of the everyday routine - the closure of a city centre supermarket - caused an older resident to cease visiting a

garden which used to be part of her shopping experience. A handful of negative stories conveyed through local media, friends and family would sometimes raise fears that particular green spaces could be associated with antisocial behaviour or serious crime. While these findings highlight the precarity of everyday nature-contact in the city, more commonly experienced by people living in areas of urban deprivation, positive everyday experiences far outnumbered the negative. Only two of the 35 workshop participants with mental health difficulties and only five of the 55 life course interview participants did not find nature beneficial for their wellbeing.

The everyday matters in design and practice

A second set of findings is that the everyday matters in terms of design and professional practice. As part of our epidemiological research in the first strand of our work we conducted a small-scale ecological study of green spaces in Sheffield, using health data from the 2011 UK Census and green space quality data from field surveys conducted by Sheffield City Council. These were compared with user-generated data from social media (Flickr photograph tags and Twitter comments). Overall, analysis showed that cleanliness of green space is associated with better general health in the surrounding population (Brindley et al. 2019).

This finding was reinforced through our work with stakeholders and practitioners. Of the five interventions selected by stakeholders as most likely to contribute to wellbeing, two related to design in terms of the provision of facilities (toilets and cafés, and walking and cycle routes to connect green spaces with surrounding neighbourhoods) and three related to practice: regular sustained maintenance, the provision of parks staff, and support for community and voluntary organisations to animate green spaces. Similarly, our work on cost-benefit analysis, which examined all the above interventions with the exception of sustained maintenance, showed that these were cost-effective ways of increasing the wellbeing benefits of urban nature: all were everyday interventions that did not require additional specialist knowledge or skills, or particularly high levels of capital investment (Dobson et al. 2019). The relationship between action to care for and animate green spaces and improvements in residents' mental health is not direct or consistent, but is a necessary part of the assemblage through which a network of high quality green spaces and a flourishing human population both emerge. As one voluntary sector worker told us: 'It's not that the toilet improves people's mental wellbeing, it's that the toilet allows them to do the activity that will improve their wellbeing.'

The everyday is vulnerable

Third, we found that the everyday fabric of urban green spaces and the activities within them that contribute to wellbeing are consistently underfunded and under-appreciated by decision-makers. This matters because, as our own and previous research has underlined, poor quality green spaces have negative effects on wellbeing (Lee & Maheswaran 2010; de Vries et al. 2013).

This is not because decision-makers disbelieve the evidence linking urban nature and wellbeing. Rather, our work with stakeholders and practitioners uncovered a series of 'logics of inaction' (Dempsey & Dobson 2020) that the professionals and community workers involved in urban green spaces struggled to overcome. Two of these related to contested evidence: decision-makers would not act because in their view the case for cost-effectiveness had not been adequately made. The others related to priorities and processes. Action was not taken because investment was deemed unaffordable (a financial logic of inaction); investment did not sufficiently contribute to the wider economy (an economic logic); green spaces were a lower social priority than homelessness or child protection (a civic or ethical logic); funding decisions were dependent on other decision-makers (an

organisational logic); and, finally, a perception that investment in green spaces only benefited small sections of the population (an equalities logic).

The dominant logic of inaction in an era of austerity is financial. Investment in green spaces is downgraded to an optional extra, as this exchange between two local authority planners in one of our focus group discussions indicates:

Ethan: It's the economy so it's, let's get it going and everything else can come second, and it really tries to come second because there isn't space for third...

Finn: Often the green stuff is in the third category, just either doesn't happen or it's so watered down that it's meaningless.

Our work to investigate the costs and benefits of interventions underlined the difficulty of making the case for investment purely on value-for-money grounds. The impact of an intervention such as a new café and toilet in a park proves difficult to translate into a financial calculation. While costs are relatively easy to estimate, assessing the benefits is trickier. There are direct benefits in terms of revenue that the franchisee generates from sales. This requires assumptions about the average spend of café users, allowing for seasonal variations and local economic circumstances. There will be wider social benefits if the park is used more, but these are difficult to determine in advance because information about park usage is sketchy and resources for post-implementation monitoring are minimal. The scale of monitoring needed to discover the level of increased physical exercise or mental wellbeing that results from the provision of a café and toilets, and the duration of those benefits, is beyond the means of most park services.

The case of the café illustrates the utility of an assemblage approach, which focuses on the characteristics and effects of totalities, rather than linear relationships between variables. Typical investment cases depend on a return on investment accruing to the investor. Our own analysis shows both the difficulty of identifying a return on investment accurately and the diffuse nature of the return, with a wide variety of indeterminate benefits accruing to individuals and organisations across a locality. Thinking of green spaces as part of an urban assemblage emphasises their dynamic role in contributing to the whole: without them, their benefits would have to be provided in another way.

Discussion: connections, context, complexity and continuity

Our consideration of the 'magic of the mundane' leads us to four observations on the interactions between humans and urban nature that could provide a framework for developments in research, policy and practice.

Connections

Our first observation concerns the importance of connections, as highlighted by the insights of assemblage and affordance theories. Our research has highlighted the multiplicity of connections between the human and the more-than-human worlds and the mesh of links between those connections and improved mental wellbeing. Noticing urban nature, being in natural environments, and having access to those environments through appropriate physical routes and infrastructure, as well as through socially and culturally relevant activities and events, all help to embed humans in the environment, and when carefully designed can help establish connectedness with nature. Early life

experiences and communal enjoyment of nature with other people are also important. The challenge for policy and practice is not to isolate one 'best' connection, but to create 'redundant causality' (DeLanda 2006).

It is not enough for nature to be 'there'. Guidelines that specify an ideal proximity of green space to people's homes may be a starting point, but it is awareness, accessibility and especially *use* of those spaces that matters. Our research shows the importance of biodiversity and interest within green spaces, enabling encounters with the natural world. The research highlights the importance of attentive and properly-funded management and maintenance, and the need for activities within green spaces that reflect the diversity of potential users and encourage people to use the spaces where they live. In a digitally connected world, the potential for enhancing experiences of nature through apps and digital mapping should also be further explored.

Green space management and governance should therefore consider how to develop what we call 'habitats for connection', spaces that bring together natural and social diversity and are maintained and animated to maximise their affordances. This demands a set of skills and knowledge covering ecology, governance and community development that are underdeveloped within UK and much international practice. Integral to such an approach is the creation of improved connections between public services. Healthcare, local government, education and civil society all have roles to play in ensuring urban green spaces fulfil their potential for wellbeing. A model of green space governance that relegates management to a third or fourth-tier responsibility within a hard-pressed municipality risks fracturing the partnerships and collaborative working required to create socially accessible and equitable, biodiverse and welcoming urban green spaces.

Contexts

Second is the importance of context. The wellbeing effects of urban nature cannot be reduced to a one-size-fits-all prescription or dose (Dobson 2018; Bell et al. 2019). Our research, especially on cultures and values and with practitioners and stakeholders, has highlighted the diversity of connections with nature and their dependence on location-specific factors - including the character of a green space, population demographics, and governance arrangements.

There is a difference between identifying a benefit and prescribing an action with the expectation of producing that benefit. Our work has identified a wide range of benefits, from the instantaneous feelings of joy that come from noticing nature and being in natural spaces, to the incremental increase in wellbeing through repeated experiences that reinforce associations between the natural world and a sense of place (be it a sense of 'home' or a sense of an individual's own place in the world). Our work has also identified interventions that can mediate individuals' engagement with the natural environment. The role of the interventions is not directly to produce wellbeing effects, but to increase the affordances offered in any location.

Here the people-centred philosophy of social prescribing (Bickerdike et al. 2017) offers a helpful model. Social prescribing within the UK National Health Service pivots on the role of community-based link workers whose job is to listen to the patient and signpost them towards activities that may help them. Unlike traditional clinical prescribing, it offers patients a greater degree of choice and agency. Places and spaces therefore need to be managed to afford diverse wellbeing benefits. Activities within them should offer multiple pathways to wellbeing within the local cultural, social, ecological and institutional context. Such an approach echoes the concept of redundant causality: there are many ways to arrive at an outcome within different contexts.

Complexity

The third observation concerns the importance of complexity. In practical terms, a simple experience such as delight at birdsong is not reducible to a single intervention. It may depend on a combination of effective green space and environmental management and regulation; access to good quality public green spaces; security and safety arrangements to overcome psychological and cultural barriers; knowledge of wellbeing benefits among healthcare practitioners; and link workers who can signpost health service users to experiences that may improve their wellbeing, and support them in accessing such experiences. Often the elements that enable humans to live well in urban environments are only noticed when they are removed or under threat: the Covid-19 pandemic, for example, has highlighted both the value and vulnerability of the urban spaces that contribute to wellbeing.

Again, we shift the focus here from particularity - the single most important factor - to the potential offered by multiplicity. Complexity theory stresses the importance of emergence, in which novelty arises through the interaction of different actants and agents. That novelty may be evolutionary, social, institutional - or a combination of all of them (Alberti 2016). Within complex systems, change is the consequence of interactions rather than actions and is therefore contingent and unpredictable and characterised by diversity and heterogeneity (Wolfram & Frantzeskaki 2016).

The wellbeing benefits of urban nature are emergent as well as immediate. Short-term feelings of awe and wonder are outcomes of longer term processes that include the urban economics of land acquisition and use; the ecosystem services provided by soil, tree cover and watercourses; the governance of space and regulation of who can use it and how; and the politics of choices about the scale and location of public services and investments of public money. This is why an analysis of the health benefits of urban nature cannot be divorced from a critique of the political impacts of 'austerity localism', which removes resources from local public services while devolving responsibilities (Featherstone et al. 2012).

Continuity

Fourth, our research has highlighted the importance of continuity. Our work on cultures and values has underlined the role of early life experiences in establishing connections with nature (Milligan & Bingley 2007). Our work with stakeholders and practitioners has revealed the need for sustained, consistent investment to support the care of green spaces and the activities that take place within them. While immediate benefits are observable through a seven day experiment and through arts-based nature and wellbeing courses, the capacity of a city to provide those benefits depends on continuous investment in green spaces and the people who maintain them; support for community organisations that offer therapeutic activities; and funding for link workers and facilitators to manage and monitor social prescribing. Our research strands should not be taken in isolation. They reveal the interaction of different factors over an extended timescale in supporting the mental health of the participants in our research.

Conclusion

Overall, our findings offer an indication of promising paths for future research and practice. They emphasise the importance of engaging with the messy and complex, and doing so through deep engagement with the people and spaces connected with a particular location. They highlight the need to examine relationships and interactions, bringing together landscape, personal wellbeing, public policy and professional practices to counter the psychological, institutional and ecological stresses of urban life.

A series of interconnected findings undergird our most ‘simple’ finding that noticing nature is part of a positive wellbeing assemblage. These findings relate to equality: people do not have the same opportunities to notice nature, either because of their personal circumstances, cultures or backgrounds, or because of the way the nature around them is (or is not) cared for. The moment of engagement with the natural world in a park or green space may have a backstory in a lifetime of experiences and struggles. Our findings also relate to the priorities of public policy: despite knowing that connections with nature can help people with mental health problems, we have found numerous ‘logics of inaction’ that stifle progress and prevent investment. Our findings relate, too, to the challenges in linking improvements in personal wellbeing with the financial indicators that govern public bodies’ investment choices. The search for a clinching financial argument to justify investment in green spaces on the basis of savings in mental healthcare costs is likely to prove at best frustrating, and at worst futile.

What flows from this is the need for a changed approach to research, policymaking and practice. Our conclusion for research is that more attention should be paid to the dynamic complexities of interactions between places, people and policies. Whether our disciplinary lens is landscape architecture, medicine, planning or psychology, wellbeing is socially, economically, environmentally and politically mediated. Research needs to focus on potential and be comfortable with uncertainty and fluidity. This requires a shift from the biomedical approach that dominates much research on green space and health. Assemblage and affordance theories provide a basis for such a shift and enable us to take into account the subjective and socially mediated factors linking urban nature and wellbeing. In terms of our recommendations below, assemblage theory also recognises that ‘policy requires labour: the continued effort of human actors and the enrolment and often unforeseen effects of various materials and techniques through activities that range from everyday toil to executive decree. Assemblage methodology explicitly attends to these efforts, enrolments, and effects – these labours of assembling – to reveal policy and policy-making as a laboured-over achievement’ (Baker and McGuirk 2017:432).

Recommendations for policy and planning

Our conclusion for urban policy is that it is easier to prevent beneficial outcomes by withdrawing investment than to guarantee beneficial outcomes by applying investment. Policy, too, needs to be comfortable with risk and uncertainty. Current concerns with efficiency and value for money need to be moderated through an acknowledgement of the importance of redundant causality.

There is value in creating a superfluity of paths to wellbeing. An important aspect of our project was the creation of simple, easy-to-read briefings for a range of policymakers and practitioners to show how this could be done.² We highlight four key messages that should be considered by policymakers working across national government, healthcare and urban planning:

- a. Sustained investment is needed in the everyday physical and social infrastructure of urban natural spaces. This investment should create spaces of interest and surprise, promote social interaction and include funding and support for ongoing maintenance, care and renewal and net improvements in biodiversity.
- b. Green infrastructure should be viewed as social as well as ecological infrastructure. Travellers should encounter nature in everyday journeys. High quality natural spaces should be provided equitably to ensure minorities and people with disabilities or health problems can access them. Policymakers should support the organisations and intermediaries (such as civil society organisations) that bring natural spaces to life.

² See <http://iwun.uk/findings/>

- c. Healthcare providers should make use of green and natural spaces to support recovery from mental and physical illness and to manage continuing health conditions.
- d. The health benefits of green spaces are dependent on a diverse and active network of community-based organisations and groups that link people, places and wellbeing. Such groups need to be included in decision-making and supported by national and local policies and funding.

Takeaways for practice

Our conclusion for practice, echoing the above, is that the ‘magic of the mundane’ is more than just a slogan. Unexpected changes are possible when the ordinary is considered special. An intervention as uninspiring as a toilet in a public park may enable people to enjoy the outdoor environment in comfort who would not otherwise do so. For people with mental health difficulties, an arts workshop or health walk might offer ways of coping, providing valuable connections with nature and the wider world. A green cycling route might change a person’s commuter journey so that they arrive at work refreshed rather than gloomy.

At a local level it is important not only to quantify the provision of green space, but also to measure its quality and its use. This includes understanding why particular groups might not use certain spaces, and working with them to address their concerns and fears. This is a long term task that cannot be delivered if green space managers are overly focused on providing basic maintenance at the lowest possible cost. Community engagement workers who are attached to parks and green spaces can work with local residents to address their needs and develop opportunities for excluded and marginalised groups to benefit from urban nature.

We do not, and cannot, predict that each of these actions will deliver generalisable results. Rather, as assemblage theory and an understanding of affordances would suggest, the creation of additional potential pathways to wellbeing through sustained investment in urban green spaces multiplies the likelihood of health and wellbeing benefits. Our research indicates that this is more likely to happen with appropriate investment and less likely if the ordinary fabric of urban green space and the care of the more-than-human world is neglected.

References

- Agustina, I. & Beilin, R. (2012). Community gardens: Space for interactions and adaptations. *Procedia - Social and Behavioral Sciences*, 36, 439–448.
- Alberti, M. (2016). *Cities that think like planets: Complexity, resilience, and innovation in hybrid ecosystems*. Seattle: University of Washington Press.
- Andrews, M., Squire, C., & Tamboukou, M. (Eds.) (2008). *Doing narrative research*. London: Sage.
- Baker, T. & McGuirk, P. (2017) Assemblage thinking as methodology: commitments and practices for critical policy research, *Territory, Politics, Governance*, 5:4,425-442.
- Barton, J., & Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environmental Science and Technology*, 44, 3947–3955. <https://doi.org/10.1021/es903183r>
- Bell, S., Leyshon, C., Foley, R., & Kearns, R. (2019). The “healthy dose” of nature: A cautionary tale. *Geography Compass*, 2019, 13:e12415. doi.org/10.1111/gec3.12415
- Birch, J., Rishbeth, C., Payne, S. (2020) Nature doesn't judge you - how urban nature supports young people's mental health and wellbeing in a diverse UK city. *Health and Place* doi.org/10.1016/j.healthplace.2020.102296
- van den Berg, A.E., Maas, J., Verheij, R.A., Groenewegen, P.P. (2010). Green space as a buffer between stressful life events and health. *Social Science & Medicine* 2010, 8, 1203-210.
- van den Berg, A.E., van Poppel, M., van Kamp, I., Andrusaityte, S., Balseviciene, B., Cirach, M., Danileviciute, S., Ellis, N., Hurst, G., Masterson, D., et al. (2016). Visiting green space is associated with mental health and vitality: A cross-sectional study in four European cities. *Health and Place* 2016, 8-15.
- Bickerdike, L., Booth A., Wilson P.M., et al. Social prescribing: less rhetoric and more reality. A systematic review of the evidence. *BMJ Open* 2017, 7:e013384. [doi:10.1136/bmjopen-2016-013384](https://doi.org/10.1136/bmjopen-2016-013384)
- Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health* 2010, 1, 456.
- Bragg, R., & Atkins, G. (2016). A review of nature-based interventions for mental health care. Natural England Commissioned Reports 204. Retrieved from <http://publications.naturalengland.org.uk/publication/4513819616346112>
- Bratman, G.N.; Hamilton, J.P.; Daily, G.C. (2012). The impacts of nature experience on human cognitive function and mental health. *Annals of the New York Academy of Sciences*, 1249(1), 118-136.

Brenner, N., Madden, D. J. and Wachsmuth, D. (2011). Assemblage urbanism and the challenges of critical urban theory. *City*, 15(2), 225–240.

Brindley, P., Jorgensen, A., and Maheswaran, R. (2018). Domestic gardens and self-reported health: a national population study. *International Journal of Health Geographics*, 17(31), <https://doi.org/10.1186/s12942-018-0148-6>

Brindley, P., Cameron, R.W., Ersoy, E., Jorgensen, A., & Maheswaran, R. (2019). Is more always better? Exploring field survey and social media indicators of quality of urban green space, in relation to health, *Urban Forestry & Urban Greening*, 39, 45-54, <https://doi.org/10.1016/j.ufug.2019.01.015>.

Buijs, A., Hansen, R., Van der Jagt, S., Ambrose-Oji, B., Elands, B., Lorange Rall, E., . . . and Steen Møller, M. (2019). Mosaic governance for urban green infrastructure: Upscaling active citizenship from a local government perspective. *Urban Forestry & Urban Greening*, 40, April, 53-62.

DeLanda, M. (2006) *A new philosophy of society : Assemblage theory and social complexity*. Continuum: London; New York.

Dempsey, N. & Dobson, J. (Eds.)(2020). *Naturally challenged: Contested perceptions and practices in urban green spaces*. Cham, Switzerland: Springer Nature.

Department of Health (2011). No health without mental health: A cross-Government mental health outcomes strategy for people of all ages. Supporting document - the economic case for improving efficiency and quality in mental health. Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/215808/dh_123993.pdf

Dobson, J. (2018) From contest to context: urban green space and public policy. *People, Place and Policy*, 12(2), 72-83. <https://doi.org/10.3351/ppp.2018.3824435278>

Dobson, J. & Dempsey, N. (2018). Beyond 'green is good' – the policy and practice dilemmas of urban nature and human wellbeing. *Town & Country Planning*, 88, December, 514-518.

Dobson, J.; Dempsey, N.; Ma, J.; & Henneberry, J. (2019). What counts in counting? Thorny questions in valuing green space interventions. *Town & Country Planning*, 89, Mar/Apr, 116-121.

van Dooren, T. & Rose, D.B. (2012). Storied-places in a multispecies city. *Humanimalia* 3(2), 1-27. Retrieved from: <https://www.depauw.edu/humanimalia/issue%252006/pdfs/van%2520dooren%2520rose.pdf>

Douglas, I. (2012). Urban ecology and urban ecosystems: Understanding the links to human health and well-being. *Current Opinion in Environmental Sustainability*, 4(4), 385-392.

Dovey, K. (2012). Informal urbanism and complex adaptive assemblage. *International Development Planning Review*, 34(4), 349-367.

Evered, E. (2016). The role of the urban landscape in restoring mental health in Sheffield, UK: service user perspectives. *Landscape Research*, 41(6), 678-694.

Fariás, I. (2011). The politics of urban assemblages. *City*, 15(3-4), 365-374.

Featherstone, D., Ince, A., Mackinnon, D., Strauss, K., & Cumbers, A. (2012). Progressive localism and the construction of political alternatives. *Transactions of the Institute of British Geographers*, 37(2), 177-182.

Fitzgerald, D., Manning, N., Rose, N., & Fu, H. (2019). Mental health, migration and the megacity. *International Health*, 11(Supplement_1), S1-S6

Gibson, J. (1979). *The ecological approach to visual perception*. London: Lawrence Erlbaum.

Gieryn, T. F. (2000). A space for place in sociology. *Annual Review of Sociology*, 26(2000), 463-496.

Gorman, R. (2017) Therapeutic landscapes and non-human animals: the roles and contested positions of animals within care farming assemblages. *Social & Cultural Geography*, 18(3), 315-335, DOI: 10.1080/14649365.2016.1180424

Gruebner, O., Rapp, M. A., Adli, M., Kluge, U., Galea, S., & Heinz, A. (2017). Cities and mental health. *Deutsches Ärzteblatt International*, 114(8), 121.

Hastings, A., Bailey, N., Bramley, G., & Gannon, M. (2017). Austerity urbanism in England: The 'regressive redistribution' of local government services and the impact on the poor and marginalised. *Environment and Planning A*, 49(9): 2007-2024.

Heft, H. (1988). Affordances of children's environments: A functional approach to environmental description. *Children's Environments Quarterly*, 5(3), 29-37.

Heynen, N., Kaika, M., & Swyngedouw, E. (Eds.). (2006). *In the nature of cities: urban political ecology and the politics of urban metabolism*. London: Routledge

Hinchliffe, S., Kearnes, M., Degen, M., & Whatmore, S. (2005). Urban wild things: a cosmopolitical experiment. *Environment and Planning D: Society and Space*, 23(5), 643-658.

Houlden, V., Weich, S. & Jarvis, S. (2017). A cross-sectional analysis of green space prevalence and mental wellbeing in England. *BMC Public Health*, 17(1), 460.

House of Commons Communities and Local Government Committee (2017). *Public parks: Seventh report of session 2016-17*. Online: <https://publications.parliament.uk/pa/cm201617/cmselect/cmcomloc/45/45.pdf> (accessed 27 June 2019)

Howell, A. J., Dopko, R. L., Passmore, H-A. & Buro, K. (2011). Nature connectedness: Associations with well-being and mindfulness. *Personality and Individual Differences*, 51(2), 166–171.

IBPES (2019) Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Retrieved from: <https://www.ipbes.net/news/Media-Release-Global-Assessment>

Jakubec, S. L., Den Hoed, D. C., Ray., H. & Krishnamurthy, A. (2016). Mental well-being and quality-of-life benefits of inclusion in nature for adults with disabilities and their caregivers. *Landscape Research*, 41(6), 616–627.

- Jay, M., & Schraml, U. (2009). Understanding the role of urban forests for migrants—uses, perception and integrative potential. *Urban Forestry & Urban Greening*, 8(4), 283–294.
- Kessler, R., Berglund, P., Demler, O., Jin, R., Merikangas, K., & Walters, E. (2005). Lifetime prevalence and age-of-onset distributions of dsm-iv disorders in the national comorbidity survey replication. *Archives of General Psychiatry*, 62(6), 593-602.
- Knoblauch, H. (2005, September). Focused ethnography. *Forum qualitative sozialforschung/forum: qualitative social research*, 6(3), 3-5 .
- Lederbogen, F., Kirsch, P., Haddad, L., Streit, F., Tost, H., Schuch, P., ... & Meyer-Lindenberg, A. (2011). City living and urban upbringing affect neural social stress processing in humans. *Nature*, 474(7352), 498.
- Lee, A. C. K. & Maheswaran, R. (2010). The health benefits of urban green spaces: a review of the evidence. *Journal of Public Health*, 33(2), 212–222.
- Lewis, G., David, A., Andreasson, S., & Allebeck, F. (1992). Schizophrenia and city life. *Lancet*, 340, 137-140.
- Lowndes, V. and Gardner, A. (2016) Local governance under the conservatives: Super-austerity, devolution and the ‘smarter state’. *Local Government Studies*, 42(3): 357-375.
- Lumber, R., Richardson, M., & Sheffield, D. (2017). Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection. *PLoS One*, 12(5), e0177186.
- Mackerron, G.; Mourato, S. (2013). Happiness is greater in natural environments. *Global Environmental Change*, 23(5), 992-1000.
- Maller, C., Townsend, M., Pryor, A., Brown, P., & St Leger, L. (2006). Healthy nature healthy people: ‘contact with nature’ as an upstream health promotion intervention for populations, *Health Promotion International*, 21(1), 45–54.
- Maller, C. (2018). *Healthy urban environments: More-than-human theories*. Abingdon, Routledge.
- Markevych, I., Schoierer, J., Hartig, T., Chudnovsky, A., Hystad, P., Dzhambov, A. M., de Vries, S., Triguero-Mas, M., Brauer, M., Nieuwenhuijsen, M. J., Lupp, G., Richardson, E. A., Astell-Burt, T., Dimitrova, D., Feng, X., Sadeh, M., Standl, M., Heinrich, J. & Fuertes, E. (2017). Exploring pathways linking green space to health: Theoretical and methodological guidance. *Environmental Research*, 158, 301-317.
- Massey, D. (2006). Landscape as a provocation: Reflections on moving mountains. *Journal of Material Culture*, 11(1/2), 33-48.
- McEwan, K., Richardson, M., Brindley, P., Sheffield, D., Tait, C., Johnson, S., Sutch, H. & Ferguson, F.J. (2019). Shmapped: Development of an app to record and promote the wellbeing benefits of noticing urban nature. *Translational Behavioural Medicine*. doi: 10.1093/tbm/ibz027

McEwan, K., Richardson, M., Sheffield, D., Ferguson F.J., & Brindley, P. (2019) A smartphone app for improving mental health through connecting with urban nature. *International Journal of Environmental Research and Public Health*, 16(18), 3373-3373.

<https://doi.org/10.3390/ijerph16183373>

McEwan, K., Ferguson, F.J., Richardson, M., & Cameron, R. (2020). The good things in urban nature: A thematic framework for optimising urban planning for nature connectedness. *Landscape and Urban Planning*. <https://doi.org/10.1016/j.landurbplan.2019.103687>

McFarlane, C. (2009). Translocal assemblages: Space, power and social movements. *Geoforum*, 40(4), 561-567.

Mears, M.; Brindley, P.; Maheswaran, R.; Jorgensen, A. (2019). Understanding the socioeconomic equity of publicly accessible green space distribution: The example of Sheffield, UK. *Geoforum*, 103, 126–137. <https://doi.org/10.1016/j.geoforum.2019.04.016>.

Mears, M.; Brindley, P.; Jorgensen, A.; Ersoy, E.; & Maheswaran, R. (2019b) Green space spatial characteristics and human health in an urban environment: An epidemiological study using landscape metrics in Sheffield, UK. *Ecological Indicators*, 106 (2019), 105464, <https://doi.org/10.1016/j.ecolind.2019.105464>.

Mears, M.; Brindley, P.; Jorgensen, A.; Maheswaran, R. (2020). Population-level linkages between urban greenspace and health inequality: The case for using multiple indicators of urban greenspace. *Health and Place*, <https://doi.org/10.1016/j.healthplace.2020.102284>

Milligan, C., & Bingley, A. (2007). Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults. *Health & Place*, 13(4), 799-811.

Molsher, R.; Townsend, M. (2016). Improving wellbeing and environmental stewardship through volunteering in nature. *EcoHealth*, 13(1), 151-55.

Moore, T. H. M., Kesten, J. M., López-López, J. A., Ijaz, S., McAleenan, A., Richards, A., ... & Audrey, S. (2018). The effects of changes to the built environment on the mental health and well-being of adults: Systematic review. *Health & Place*, 53, 237-257.

Newman, L. & A. Dale (2013). Celebrating the mundane: Nature and the built environment. *Environmental Values* 22, 401-413.

Natural England (2015). Monitor of Engagement with the Natural Environment: The National Survey on People and the Natural Environment Annual Report from the 2013-14 Survey. Worcester, Natural England. Retrieved from: <http://publications.naturalengland.org.uk/publication/6579788732956672?category=47018>

NHS Sheffield and Sheffield City Council (2019). Joint Health and Well-being Strategy 2019-2024. Retrieved from: <https://www.sheffield.gov.uk/content/dam/sheffield/docs/public-health/health-wellbeing/Joint%20Health%20%20Wellbeing%20Strategy%202019-24.pdf> (accessed 2 July 2019)

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Journal of Happiness Studies*, 12(2), 303–22.

Nutsford, D., Pearson, A., & Kingham, S. (2013). An ecological study investigating the association between access to urban green space and mental health. *Public Health*, 127(11), 1005–1011.

ONS (2015) Life Expectancy (LE) and Healthy Life Expectancy (HLE) at Birth by Sex for Middle Layer Super Output Areas (MSOAs) in England, 2009 to 2013. Retrieved from: <http://www.localhealth.org.uk>

Office for National Statistics ; National Records of Scotland ; Northern Ireland Statistics and Research Agency (2016): 2011 Census aggregate data. UK Data Service (Edition: June 2016). DOI: <http://dx.doi.org/10.5257/census/aggregate-2011-1>

Pawson, R., & Tilley, N. (1997). *Realistic evaluation*. Thousand Oaks: SAGE.

Peck, J. (2012). Austerity urbanism. *City*, 16(6), 626-655.

Porqueddu, E. (2018). Toward the open city: Design and research for emergent urban systems. *Urban Design International*, 23(3), 236-248.

Pozzali, A. (2008). Tacit knowledge, implicit learning and scientific reasoning. *Mind & Society* 7(2), 227-37.

Pritchard, A., Richardson, M., Sheffield, D., & McEwan, K. (2019). The relationship between nature connectedness and eudaimonic wellbeing: a meta-analysis. *Journal of Happiness Studies*, 1-23.

Rabinowitz, P. M., Pappaioanou, M., Bardosh, K. L., & Conti, L. (2018). A planetary vision for one health. *BMJ global health*, 3(5), e001137.

Raymond, C., Kyttä, M., & Stedman, R. (2017). Sense of place, fast and slow: The potential contributions of affordance theory to sense of place. *Frontiers in Psychology*, 8, 1674.

Richardson, M. & Sheffield, D. (2017). Three good things in nature: Noticing nearby nature brings sustained increases in connection with nature. *Psychology*, 8(1), 1-32.

Rishbeth, C., & Powell, M. (2013). Place attachment and memory: landscapes of belonging as experienced post-migration. *Landscape Research*, 38(2), 160-178.

Robertson, M. (2012) Measurement and alienation: making a world of ecosystem services, *Transactions of the Institute of British Geographers*, 37, 386–401.

Roe, J., & Aspinall, P. (2011). The emotional affordances of forest settings: An investigation in boys with extreme behavioural problems. *Landscape Research*, 36(5), 535-552.

Royal Society for the Protection of Birds (2016). RSPB State of Nature 2016. Retrieved from: <https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/state-of-nature/state-of-nature-uk-report-2016.pdf>

Seeland, K., Dübendorfer, S. & Hansmann, R. (2009). Making friends in Zurich's urban forests and parks: The role of public green space for social inclusion of youths from different cultures. *Forest Policy and Economics*, 11(1), 10-17.

- Scott, A., & Storper, M. (2015). The nature of cities: The scope and limits of urban theory. *International Journal of Urban and Regional Research*, 39(1), 1-15.
- Shanahan, D., Fuller, R., Bush, R., Lin, B., & Gaston, K. (2015). The health benefits of urban nature: How much do we need? *BioScience*, 65(5), 476-485.
- Sundquist, K., Frank, G., & Sundquist, J. (2004). Urbanisation and incidence of psychosis and depression: Follow-up study of 4.4 million women and men in Sweden, *British Journal of Psychiatry*, 184(4), 293-298. <https://doi.org/10.1192/bjp.184.4.293>
- TEEB (2010) The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB. Retrieved from: <http://www.teebweb.org/our-publications/teeb-study-reports/synthesis-report/>
- Twohig-Bennett, C. & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and metaanalysis of green space exposure and health outcomes. *Environmental Research*, 166, 628-637.
- Vandermeulen, V., Verspecht, A., Vermeire, B., Van Huylbroeck, G., & Gellynck, X. (2011). The use of economic valuation to create public support for green infrastructure investments in urban areas. *Landscape and Urban Planning*, 103(2), 198-206.
- Villeneuve, P.J., Jerrett, M., Su, J.G., Burnett, R.T., Chen, H., Wheeler, A.J. & Goldberg, M.S. (2012). A cohort study relating urban green space with mortality in Ontario, Canada. *Environmental Research*, 115, 51–8.
- de Vries, S.; van Dillen, S.M.E.; Groenewegen, P.P.; Spreeuwenberg, P. (2013). Streetscape greenery and health: Stress, social cohesion and physical activity as mediators. *Social Science & Medicine*, 94, 26-33.
- Wells, N. M., & Evans, G. W. (2003). Nearby nature: A buffer of life stress among rural children. *Environment and Behavior*, 35(3), 311–330. <https://doi.org/10.1177/00139165030035003001>
- Wendelboe-Nelson, C., Kelly, S., Kennedy, M. & Cherrie, J. W. (2019). A scoping review mapping research on green space and associated mental health benefits. *International Journal of Environmental Research and Public Health*, 16, 1-49.
- White, M. P., Alcock, I., Grellier, J., Wheeler, B. W., Hartig, T., Warber, S. L., ... & Fleming, L. E. (2019). Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Scientific Reports*, 9(1), 7730.
- Whitehouse, A. (2017). Loudly sing cuckoo: More-than-human seasonalities in Britain. *The Sociological Review*, 65(1_suppl), 171-187.
- Wolfram, M., & Frantzeskaki, N. (2016). Cities and systemic change for sustainability: Prevailing epistemologies and an emerging research agenda. *Sustainability*, 8(2), 144.
- World Health Organisation (2016). Urban green spaces and health: A review of evidence. Retrieved from: http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1 [Accessed 24/10/2018].

Yin, R. K. (2009). *Case study research: Design and methods* (4th Ed.). Thousand Oaks, CA: Sage.

York, R. (2018). Control variables and causal inference: a question of balance. *International Journal of Social Research Methodology*, 21(6), 675-684.