Beyond the 'wow factor'? Climate resilient green infrastructure for people and wildlife

Helen Hoyle[1], Ian Mell[2]

[1] Department of Architecture and Built Environment, University of the West of England
[2] Department of Planning & Environmental Management, University of Manchester

1. Abstract

Covid-19 and COP26 both amplified calls from the environment sector for greater support for greenspace management globally. As the future of our planet and population is threatened by a global pandemic, escalating mental health challenges and the interrelated climate and biodiversity crises, there is a growing awareness of the potential for the intersecting roles of *greenspace* (GS), *green infrastructure* (GI) and *nature-based solutions* (NBS) to meet the myriad socio-economic and ecological of modern society (Frantzeskaki, 2019; Venkataramanan *et al.*, 2020). Unfortunately, their potential to address these challenges remains undervalued by many, and thus underfunded, (Mell, 2021).

Presenting examples of 'research into action', we advocate greenspace management to maximise benefits for people and wildlife. We draw on research from UK to consider how and why different people react to landscapes of varying aesthetic and biodiversity quality (Hoyle *et al.* 2017a), proposing an alternative approach to biodiversity-friendly greenspace management under austerity. Next, we emphasise the urgency of 'futureproofing' places to adapt to changing climate, demonstrating the public acceptability of climate-ready urban GI (Hoyle, 2021). Finally, we discuss how socio-cultural variables and values impact on preferences. We illustrate the benefits of co-creating local NBS with reference to 'Futureproofing Luton', a live project engaging diverse partners in the co-production of an educational arboretum-meadow.

We propose alternative options open to all natural and built environment and public health professionals to support knowledge exchange promoting more sustainable forms of urban development. Although framed within a UK context, the processes of engagement, best practice exchange, and more effective dialogue, are meaningful across Europe and beyond.

2. Introduction

Almost 70% of the world's population is set to live in urban areas by 2050 (UN, 2018), where mental health challenges have been highlighted. In 2015, mental ill-health cost the UK economy an estimated 4.1% GDP, with the EU-wide cost estimated to be a comparable percentage of total GDP (OECD/EU, 2018). People living in cities have fewer opportunities to access wild nature and risk being denied its benefits through an 'extinction of experience' (Soga and Gaston, 2016). Access to urban nature via public and private gardens, parks and greenspaces (GS), as part of multifunctional interconnected networks of green infrastructure (GI) is therefore a priority. Covid-19 exacerbated mental health problems associated with social isolation. The benefits of nature contact were highlighted, with populations confined indoors during lockdowns, then allowed progressively to access outdoor exercising and the associated positive mental benefits of nature in parks and greenspaces (Collins *et al.* 2022). Yet 'nature' itself within these spaces is under pressure, from unprecedented global biodiversity loss (WWF, 2020), and the global climate crisis (Hoyle *et al.* 2017b). Draconian

austerity measures have also impacted on maintenance budgets, the UK for example has witnessed drastic cuts to local government budgets since 2010 following the creation of the Conservative-Liberal Democrat government (Mell, 2020). Yet if planned and designed strategically and appropriately, with collaboration between local government, public health and landscape professionals, and local resident stakeholders, and financed creatively (Mell and Whitten, 2021), GI can be delivered and managed for a 'win-win-win'; optimising human mental wellbeing, whilst supporting biodiversity and providing climate change resilience. Here we unpick the complex relationships between people and nature in urban areas to highlight how this might be achieved. To do this we frame our debate via a 'diversity in nature' approach that addresses planting type and people's responses to planting characteristics, such as colour, structural naturalness, and biodiversity, as well as their reactions to climate-adapted urban GI. We then move to considering how 'people matter', focusing on the possibilities of co-creating NBS with local stakeholders.

3. Diversity in Nature

Early research highlighting the benefits of nature contact for people in urban areas treated 'nature' as a homogenous 'green' entity, contrasting positive human reaction to 'nature' with negative responses to the built environment (Kaplan and Kaplan, 1989). In contrast, a growing body of research has sought to understand more nuance, differentiating human reactions to diverse nature with varying aesthetics and biodiversity (Hoyle 2020). This research provides clear evidence that the diversity in nature *matters*, and that planting characteristics provoke and promote specific human reactions supporting invertebrate biodiversity.

3.1. The role of Colour

The plantsman Piet Oudolf once commented, 'the trouble with green infrastructure is that it's green'. Through years of practising as a designer, he understood that colour and flower cover in the urban landscape have a particular impact on human emotion. This intuition was confirmed by research conducted with 1411 members of the public who walked through woodland, shrub and herbaceous planting in public greenspaces and institutional gardens in the UK (Hoyle *et al.* 2017a). Findings from our research highlight that there is a critical threshold flower cover of 27%, over which people perceive planting as significantly more attractive.

"Colours are stunning (at this time of year)"
"Very attractive and colourful"

"Tidy and structured, green and healthy"
"Beautiful in spring but boring after"

Figure 1: The Punchbowl, Valley Gardens, UK (a) in full flower in May and (b) in August after flowering, and comments made by on-site questionnaire participants who walked through the planting.

Whereas people found the colourful flowering planting (Fig. 1a) the most attractive, muted green planting, with a lower percentage flower cover (Fig. 1b) was more calming and

conducive to mental restoration. The lessons learnt for planting design and practice are clear: if the desired effect is to create '*the wow factor*', using vibrant colourful planting achieves this, but if mental restoration is key, then colours should be subtle, with a dominantly green background.

3.2. Structural naturalness

Over the past decade, there has been an increase in wilder, less-manicured and managed planting within urban areas (Figs. 2 and 3). In the UK, urban parks, many planned and designed in Victorian (1837-1901) and Edwardian (1901-1910) times, with avenues of trees and formal herbaceous bedding, now look very different, with areas of perennial and annual meadows and long near-natural grassland. There are several drivers for this, one being an increase in awareness amongst greenspace managers, and the public alike, of the value of wilder planting for biodiversity, especially pollinators (Fischer *et al.* 2020). In the UK, a related stimulus for the increase in popularity of urban meadows was the media attention paid to annual and perennial meadows introduced within the London 2012 Olympic Park (now the Queen Elizabeth Olympic Park). Following the 2012 Olympics some forward-thinking local authorities started to manage greenspaces to recreate the human delight associated with the Olympic meadows, whilst supporting biodiversity and lowering costs via reduced cutting frequencies (Hoyle *et al.* 2017a) Yet how are people reacting to very different landscape aesthetics? We collaborated with local authorities in Bedfordshire (2012-17) to translate the learning from the Olympics to urban greenspaces previously managed as amenity mown grassland (Fig. 2). We found that introducing perennial meadows increased site users' perceived quality and appreciation (Southon *et al.* 2017). Of nine different mixes introduced of three levels of floristic diversity and three levels of structural diversity, site users preferred meadows with the highest floristic diversity and moderate structural diversity. Taller structurally diverse meadows also supported higher levels of invertebrate biodiversity.

Austerity politics has been a further driver for the spreading of a wilder grassland aesthetic across Europe, with the slashing of local authority parks budgets and reduced funding for maintenance. This style of urban planting needs less frequent mowing providing local authorities with the opportunity to cut costs. Across Europe urban publics are prepared to accept this wilder, less manicured greenspace aesthetic, yet with provisos (Hoyle *et al.* 2017c). Welcomed as an alternative to mown grass within some larger greenspaces (Fig. 2), the introduction of tall meadows was not considered appropriate on narrow verges directly outside people's homes (Hoyle et al. 2017c):

> *"The last thing you can do is go into a built-up housing environment with linear, narrow verges, because visually people find it unacceptable. Open their front door, "I pay my council tax, I don't want to see long grass".*

Managers are aware that public acceptance can be enhanced by mowing neat edges and desire lines through areas of longer near-natural grassland or meadows to allow public access, and avoiding uncared-for appearances, creating 'cues to care', (Li and Nassauer, 2020), i.e., the signs that the greenspace is being managed deliberately. Moreover, flowering and colour almost universally increase the attractiveness of planting to the public, they can also be used as a 'cue to care' increasing the acceptability of nature-like planting (Fig. 3).

Figure. 2 Greenspace in Luton, Bedfordshire UK before and after the introduction of native perennial meadows

In further UK research (Hoyle *et al.* 2018) participants perceived annual meadows of high flower colour diversity as significantly more attractive and biodiverse than meadows of low colour diversity. Findings also indicated that colourful non-native annual meadow-style planting can be beneficial to pollinators. These results have considerable relevance for planting designers and managers of GI: if the priority for sown meadows is to maximise human enjoyment and the abundance and diversity of pollinators, high flower colour diversity mixes should be prioritised. We also incorporated the late flowering non-native North American species *Coreopsis tinctoria* (Plains Coreopsis) within our annual mix (Fig. 3b). This was effective in prolonging the attractiveness of the meadows for site users and the availability of resources for pollinators when most native UK species had finished flowering. Our research also showed that introducing signage to explain the invertebrate benefits of tall grass meadows also increases public acceptability (Southon *et al.* 2017).

(a) **Colourful annual meadows are popular with local site users**

(b) **Adding the late flowering *Coreopsis tinctoria* (Plains coreopsis) can prolong attractiveness to people and the availability of pollinator' resources**

Figure 3: Annual meadows in Wardown Park, Luton, Bedfordshire, UK.

European research (see Fischer *et al.* 2020) also showed broad support for converting short cut lawns into meadows to support biodiversity. Comparable findings emerged regarding the need for 'cues to care' and the benefits of public signage. More research is emerging from other parts of the world including in Beijing where a study of public attitudes towards meadows concluded that compared to lawns, flowering monocultures and flowerbeds, urban meadows received the lowest satisfaction rating yet participants welcomed the introduction of

meadows in parks, residential districts, accessory greenbelts, and roadsides (Jiang & Yuan, 2017).

3.3 The need to adapt to a changing climate

There is widespread evidence of the potential for GI to mitigate diverse climate change impacts (Venkataramanan *et al.* 2020). Two examples include the retrofitting of sustainable urban drainage systems (SUDS) - the 'Grey to Green' scheme in Sheffield UK, and the introduction of 'fit for place' GI to mitigate enhanced urban heat island in cities such as Melbourne (Hoyle and Sant'Anna, 2020). Yet GI itself needs to be 'futureproofed'. As the climate changes, the species once planted in urban greenspaces are becoming less suited to these new conditions (Hoyle *et al.* 2017b), so non-native 'climate ready' species must be introduced (McPherson et al. 2018). As well as being better suited to a changing climate, these may bring co-benefits such as attractive aesthetics, and sources of pollen and nectar to generalist native invertebrates, as in the case of *Coreopsis tinctoria*. (Fig. 3b). Reinforced and perpetuated by outdated policy and practice guidance, the perception still holds amongst many in the environment sector that the sustainable urban GI should consist exclusively of native planting, yet research in the UK demonstrates overwhelming support amongst urban publics for the introduction of non-native, climate-adapted planting (Hoyle et al. 2017b). Conducted in diverse greenspaces throughout England, our first study found that 75.3% participants were positive about climate-adapted non-native planting, with climate change identified as the major driver of acceptance:

"I think it's essential that we adjust our planting so that we don't have to use fresh water to sustain our green areas. So yes, I'd accept variation in planting because its evolution in action."

Figure. 4 Introducing climate-adapted non-native planting can deliver greater climate resilience whilst supporting biodiversity and human delight.

A second driver of acceptance was the perceived attractiveness of non-native planting, with participants commenting on unusual plant traits such as interesting bark patterns on a *Eucalyptus* tree. The role of aesthetics was confirmed within a designed garden setting (Hoyle, 2021), where participants perceived exotic, climate-adapted planting as significantly more attractive than a cottage-garden style. Both areas were equally colourful, so colour was not the driver. Ecological evidence for the benefits of introducing climate-ready species combined with widespread public support should give practitioners the confidence to implement changes to GI policy, introducing climate-adapted non-native planting to deliver climate resilience whilst supporting biodiversity and positive human experiences (Fig. 4).

4. People matter: socio-cultural diversity and co-creation

The way people perceive nature is also related to their socio-cultural characteristics, beliefs and values (Hoyle, 2020). Whilst walking though diverse designed urban planting, women gained greater mental restoration (Hoyle *et al*. 2017a), and perceived higher levels of naturalness than men (Hoyle *et al*. 2019). Research (Hoyle 2021) has also highlighted a direct relationship between climate change awareness and educational qualifications. People with no formal educational qualifications had significantly lower awareness of climate change than other participants, suggesting novel approaches to highlighting climate change issues are needed to reach people beyond the formal educational system.

If GI is to meet the myriad socio-economic and ecological needs of modern society, it should be 'locally attuned' (Frantzeskaki, 2019). Co-creating GI with local stakeholders so their characteristics are aligned with local socio-cultural values can produce places where diverse actors within the community can forge new connections, and where people can connect with nature. This applies particularly in deprived areas, where once abandoned sites have taken on new meanings for communities. One example of this process is the 'Futureproofing Luton' Project, where an educational air quality arboretum-meadow has been co-produced on a disused mini-golf site in Wardown Park, an Edwardian park in the High Town Ward of Luton, Bedfordshire, UK. High Town is relatively deprived, with 30.8% women economically inactive and 73% Year 6 pupils classified as obese. It is ethnically diverse, with 41% residents White British, and 59% other ethnicities – with significant Black Asian Minority Ethnic (BAME) communities. The project was initiated by Luton Parks Service in collaboration with University of the West of England (UWE) Bristol and River Bank Primary School, to provide an educational resource for children and the wider community focusing on climate change, and the value of trees and meadows in relation to air quality, wellbeing and biodiversity. The project was developed using 'iterative co-production' whereby partners including a social enterprise, commercial landscape contractor and landscape professionals joined as it developed, contributing expertise, resources and subsequently championing the project.

Initiated in September 2019, climate-ready trees adapted to local conditions were selected in December 2019, then planted in February 2020 by schoolchildren during a workshop day. Multiple stakeholders attended the planting day, which took place before the first COVID-19 lockdown and the school's closure in March 2020. Since then children at the school have been involved in seeding a perennial-annual meadow sward and a further workshop where the trees were measured and flowering meadow species identified. Signage indicating the potential carbon capture of each of the tree species has been introduced, as has an outdoor classroom and seating area. Covid-19 has impacted significantly on the project, particularly with school closures. Whereas local stakeholders perceived this as a challenge to the success of the project, other stakeholders viewed the pandemic as an opportunity, as it had highlighted the value of greenspaces raising the project's profile. This research provides insight into the potential for co-production in a relatively deprived, ethnically diverse context to contribute to the "futureproofing" of towns by fostering connections with nature amongst children.

5. Conclusions and moving forwards.

Covid-19 and the growth of urban areas increase the need for government at the local and national level, landscape managers and local communities to consider how they respond to changing demographic, biodiversity, and climatic needs. Using the evidence discussed above,

local government can work with key local stakeholders to integrate increased flexibility into landscape management. By responding to the perceptions of alternative planting regimes, their role in promoting local use, and their ability to address the "big picture" issue of climate change, we can move management forward. However, we need to remain cognisant of local context in terms of what type of biodiverse landscape works, what it costs to maintain, and how local communities react to diverse changes in environmental aesthetics, and even "*the wow factor*". In addition, there is a need to reflect on the costs of capital investment in GI and the revenue budgets needed to manage these spaces effectively. Without financial oversight local interventions can be ineffectively managed, thus undermining their local popularity. The results discussed above provide guidance on how to address local variation, the promotion of co-produced working practices, and an acceptance that different communities will identify and use different forms of GI. If we are able to reflect on this finding in the design, delivery and maintenance of biodiverse urban landscapes we can effectively address the problems associated with austerity and climate change, as we will be able to draw on a suite of experience to address local needs.

6. References

Collins C, Haase D, Heiland S, Kabisch N. (2022) Urban green space interaction and wellbeing - investigating the experience of international students in Berlin during the first COVID-19 lockdown. *Urban Forestry and Urban Greening* 70:127543.

Fischer et al. (2020) Public attitudes toward biodiversity-friendly greenspace management in Europe. *Conservation Letters*. 12718. wileyonlinelibrary.com/journal/conl.12718

Frantzeskaki, N. (2019) 'Seven lessons for planning nature-based solutions in cities', *Environmental Science and Policy*. Elsevier Ltd, 93, pp. 101–111.

Hoyle, H., Hitchmough, J. and Jorgensen, A. (2017a) 'All about the "wow factor"? The relationships between aesthetics, restorative effect and perceived biodiversity in designed urban planting', *Landscape and Urban Planning*. Elsevier, 164, pp. 109–123.

Hoyle, H., Hitchmough, J. and Jorgensen, A. (2017b) Attractive, climate-adapted and sustainable? Public perception of non-native planting in the designed urban landscape. *Landscape and Urban Planning* 164, 49-63

Hoyle, H., Jorgensen, A., Warren, P., Dunnett, N. and Evans, K. (2017c) "Not in their front yard" The opportunities and challenges of introducing perennial urban meadows: A local authority stakeholder perspective. *Urban Forestry and Urban Greening* 25, 139-149

Hoyle, H., Norton, B., Dunnett, N., Richards, P., Russell, J. & Warren, P. (2018) Plant species or flower colour diversity? Identifying the drivers of public and invertebrate response to designed annual meadows. *Landscape and Urban Planning* 180, 103-113

Hoyle, H., Jorgensen, A., Hitchmough, J.D. (2019) What determines how we see nature? Perceptions of naturalness in designed urban green spaces. *People and Nature* 1(2), 167-180

Hoyle, H. (2020) What Is Urban Nature and How Do We Perceive It? In: Dempsey N., Dobson J. (eds) Naturally Challenged: Contested Perceptions and Practices in Urban Green Spaces. *Cities and Nature*. Springer, Cham

Hoyle, H.E and Gomes Sant'Anna, C. (2020) Rethinking 'future nature' through a transatlantic research collaboration: climate-adapted urban green infrastructure for human

wellbeing and biodiversity, *Landscape Research*, 1-17.

Hoyle, H. (2021) Climate-adapted, traditional or cottage-garden planting? Public perceptions, values and socio-cultural drivers in a designed garden setting. *Urban Forestry and Urban Greening* 65, 127362

Jiang, Y. & Yuan, T., (2017). Public perceptions and preferences for wildflower meadows in Beijing. *Urban Forestry & Urban Greening* 27, 324-331.

Kaplan, R., and Kaplan, S., (1989). *The Experience of Nature: A psychological Perspective*. Cambridge, UK, Cambridge University Press.

Li, J. & Nassauer, J. (2020). Cues to care: A systematic analytical review. *Landscape and Urban Planning* 201, 103821.

Mell, I. (2020). Parks, COVID-19 and the impact of austerity funding on public-service provision in a time of crisis. *Town Planning Review*. https://doi.org/10.3828/tpr.2020.51

Mell, I. (2021) '"But who's going to pay for it?" Contemporary approaches to green infrastructure financing, development and governance in London, UK', *Journal of Environmental Policy and Planning*. Routledge. doi: 10.1080/1523908X.2021.1931064.

Mell, I. and Whitten, M. (2021) 'Access to Nature in a Post Covid-19 World: Opportunities for Green Infrastructure Financing, Distribution and Equitability in Urban Planning', *International Journal of Environmental Research and Public Health*. MDPI AG, 18(4), p. 1527. doi: 10.3390/ijerph18041527.

McPherson, E. G., Berry, A. M., & van Doorn, N. S. (2018). Performance testing to identify climate-ready trees. *Urban Forestry & Urban Greening, 29*, 28–39.

OECD/EU (2018) Health at a Glance: Europe 2018: State of Health in the EU Cycle https://www.oecd.org/newsroom/mental-health-problems-costing-europe-heavily.htm [accessed 31st March 2022]

Soga, M. & Gaston, K.J., (2016). Extinction of Experience: the loss of human-nature interactions. *Frontiers in Ecology and the Environment* 14 (2) 94-101. Doi.org/10.1002/fee.1225

Southon, G.E., Jorgensen, A., Dunnett, N., Hoyle, H. & Evans, K. L. (2017). Biodiverse perennial meadows have aesthetic value and increase residents' perceptions of site quality in urban green-space. *Landscape and Urban Planning, 158,* 105-118. Doi.org/10.1016/j.landurbplan.2016.08.003

United Nations, (2018) Revision of world urbanisation prospects https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html [Accessed February 14th 2022]

Venkataramanan, V. *et al.* (2020) 'Knowledge, attitudes, intentions, and behavior related to green infrastructure for flood management: A systematic literature review', *Science of the Total Environment*. Elsevier B.V., p. 137606. doi: 10.1016/j.scitotenv.2020.137606.

WWF (2020) Living Planet Report 2020 - Bending the curve of biodiversity loss. Almond, R.E.A., Grooten M. and Petersen, T. (Eds). WWF, Gland, Switzerland.