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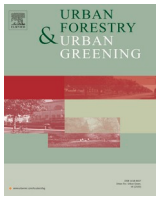

Beyond the 'usual suspects'? Engaging children in diverse communities in co-producing an arboretum-meadow: Professional partner perspectives

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ABSTRACT

Nature-based solutions (NBS) can mitigate the challenges of climate change, biodiversity loss and mental wellbeing prioritised by the global Sustainable Development Goals (SDGs). The advantages of co-producing NBS with local communities have been explored, yet there is a lack of understanding of professional partners' priorities in relation to specific projects, and their perceptions of the opportunities and challenges encountered during the co-productive process. The benefits of co-producing NBS with children are not understood, particularly in deprived, diverse communities. We addressed these gaps by conducting in-depth, semi-structured interviews with eight professional partners in contrasting roles involved in the co-production of an educational arboretum-meadow on a redundant mini-golf site in Wardown Park, within the High Town ward of Luton, Bedfordshire, UK. Here there is considerable ethnic diversity with 41% residents White British, and 59% other ethnicities. There are significant Black and Minority Ethnic communities (38%). A high percentage of households live with overcrowding (24%) and 31% year six children are obese. All partners prioritised *connecting children to nature*. The social benefits of the project were prioritised over ecological and climate-related ones. Most participants perceived *diverse partner expertise and priorities* as an opportunity of co-production. *Covid-19* was considered a significant challenge and an opportunity. Our research provides insight into the potential for co-production of NBS in a relatively deprived, ethnically diverse context to contribute to "futureproofing" towns and cities by fostering nature connection amongst children, whilst providing a novel, creative approach to managing and maintaining GI under austerity. Learning from this project has international transferability as a 'flagship project' illustrating how the global Sustainable Development Goals (SDGs) can be addressed at the local level.

1. Introduction

The past decade has witnessed a step-change in awareness of the potential value of *greenspace* (GS), *green infrastructure* (GI) and *nature-based solutions* (NBS) in addressing diverse environmental and societal challenges prioritised by the global Sustainable Development Goals (SDGs). This applies amongst business leaders, policy makers and wider urban publics across Europe and beyond (Faivre et al., 2017; Frantzeskaki, 2019; Venkataramanan et al., 2020). NBS have been applied increasingly in response to the considerable, concurrent threats of the climate crisis, global biodiversity loss and challenges to human physical wellbeing (Croeser et al., 2021). Implemented locally, NBS are a means to addressing global Sustainable Development Goals (SDGs) (Fox and Macleod, 2021). This is particularly in the wake of Covid-19 and the 26th UN Climate Change Conference of the Parties (COP26), which highlighted the urgency of greater support for greenspace management globally (Hoyle and Mell, 2022). NBS are now widely accepted as a more appropriate and innovative response for cities focusing on building resilience and restoring ecological functions and flows than traditional grey infrastructure or hard engineered approaches (Frantzeskaki, 2019). In contrast to the dominantly built form of inanimate grey infrastructure, NBS are approaches or interventions which harness natural processes, or innovate with nature to deliver multiple ecological, societal and economic co-benefits (European Commission, 2016; Frantzeskaki, 2019; Raymond et al., 2017). Increasing innovation has expanded possibilities and the scope of NBS beyond traditional interventions such as floodplain restoration, pocket parks and green roofs listed in an early inventory (European Commission, 2015). They may now involve

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multiple and complex interventions, such as Sustainable Urban Drainage systems incorporating pollinator planting with human aesthetic and well-being benefits, as in the case of the award-winning 'Grey to Green' scheme bringing colour and sustainable perennial planting to inner-city Sheffield, UK. The primary objective of this scheme is flood mitigation, yet intentionally designed co-benefits include enhanced human well-being, aesthetics and leverage of economic investment. (Hoyle and Sant'Anna, 2020). Unintended disbenefits include an increase in land values pricing out some local businesses and residents. Earlier publications on NBS tended to over-emphasise their ecological, climate-related benefits, whilst neglecting consideration of social benefits (Frantzeskaki, 2019). To promote their mainstreaming as integrated socio-ecological-economic solutions, the International Union for the Conservation of Nature (IUCN) released a Global Standard for NBS (IUCN, 2021) defining NBS as 'actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits' (IUCN, 2021).

Research has shown that approximately two-thirds of what must happen to achieve the global SDGs will need to involve local actors (Cities Alliance, 2015). NBS are local interventions, responding to specific contextual social and ecological challenges and must be 'locally attuned' to these challenges (Frantzeskaki, 2019) and are therefore integral to addressing and achieving the global SDGs. Co-production of NBS with local stakeholders is now accepted as the optimal means to align interventions with the socio-cultural needs and values of local communities. Co-production is 'a reciprocal process of exchange between diverse stakeholders, to generate outcomes that are only possible because of this deliberate intersection of difference', (Durose et al., 2022). The process acknowledges stakeholder complementarity, the value of practical knowledge and experience, and the importance of including local actors, yet it is a conceptually messy term and can refer to a range of processes and practices in academic or policy and practice writing (Durose et al., 2022). These include 'active citizenship' (Buijs et al., 2019), 'adaptive co-management' (van der Jagt et al., 2019), and 'partnership and collaborative governance', (Frantzeskaki, 2019). The latter can produce 'new green urban commons', that is, places where diverse actors within the community can forge new connections with each other and where people can connect with nature. Small scale physical changes to the appearance of a space can generate significant perceived benefits, extending to a completely transformed local narrative, from one of 'abandonment' to 'cherished local space' (Frantzeskaki, 2019). Positive involvement in the co-production of change can promote pro-environmental behaviours (Gaston and Soga, 2020) and supports the aspiration to create a long-term solution, as local communities take ownership of NBS and are prepared to contribute to their ongoing maintenance and care.

If greater equity is to be achieved, planners must seek to go beyond the 'usual suspects', they have relied on repeatedly (Frantzeskaki, 2019), such as the 'Friends of parks' groups in the UK, co-producing NBS with the 'unusual suspects', diverse, deprived communities. We addressed this gap by engaging children in deprived diverse communities to co-produce an educational arboretum meadow on a disused mini-golf site in Wardown Park, an Edwardian Park in the High Town Ward of Luton, Bedfordshire, UK. We explored professional partners' priorities in relation to the project, and their perceptions of the opportunities and challenges encountered during this co-productive process.

We ask:

i) What are the priorities for the arboretum-meadow project as perceived by the different professional partners involved?
ii) What are the opportunities and challenges associated with the co-productive process as perceived by the partners themselves?

Our findings highlight transferable learning for local actors seeking to "futureproof" towns and cities by co-producing NBS with children in diverse, deprived communities, and national and international and decision makers aspiring to address the global SDGs at the local level.

2. Methods

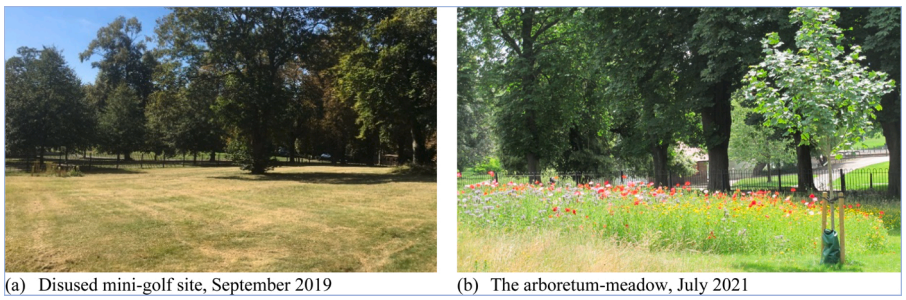
2.1. Background: the Futureproofing Luton Project; local actions towards the global SDGs

The Futureproofing Luton Project was initiated in September 2019, by Luton Parks Service in collaboration with an academic partner and River Bank Primary School. Luton is a medium-sized town, 50 km north of London, UK. The project aims to provide an educational resource for children and the wider community focusing on the value of trees and meadows in relation to climate change, air quality, wellbeing and biodiversity, and involves co-producing an educational arboretum meadow on a disused mini-golf site in Wardown Park, an Edwardian park in the High Town Ward of Luton (Fig. 1).

'Futureproofing Luton' emphasises acting locally to achieve the global SDGs, aligning explicitly with SDG Goals: 4) *Quality Education*; 3) *Good Health and Wellbeing;* 10) *Reducing Inequality*; 13) *Climate Action*, and 15) *Life on Land*; (United Nations, 2015). Because the overarching aim of the project was to create an educational resource (SDG 4, *Quality Education*), it was crucial to involve children via the local primary school. Focusing on SDGs 3) *Good Health and Wellbeing*, and 10) *Reducing Inequality*, High Town is relatively deprived, with 24% households living with overcrowding and 31% Year 6 pupils obese, one of the highest rates in England. It is ethnically diverse, with 41% residents White British, and 59% other ethnicities. There are significant Black and Minority Ethnic (BME) communities (38%) (Office for Health Improvement and Disparities, 2022).

SDG 13) *Climate Action* Goal 13 prioritises taking urgent action to combat climate change and its impacts (United Nations, 2015). Targeting the role of urban trees as NBS, in November 2021 COP26 highlighted a global prioritisation of urban forests to sequester and offset carbon, with 97% carbon storage in tree biomass and only a small amount in shrubs and herbaceous plantings (Derkzen et al., 2015). Street trees are also prioritised to mitigate atmospheric particulate and nitrate pollution, thereby reducing the risk of respiratory problems (Fowler, 2002), and to address the enhanced heat island effect (Norton et al., 2015). There is a growing call for the need to introduce 'fit for place' urban trees (Langenheim et al., 2020; Norton et al., 2015), and care must be taken to avoid introducing species which produce highly allergenic pollen where possible (Laia and Kontokostab, 2019). In addition, as climates change globally there is the need to introduce 'climate ready' trees as these are better adapted to future climate scenarios (McPherson et al., 2018).

Goal 15 of the SDGs, 'Life on Land' targets halting biodiversity loss. Urban meadows and grasslands have been introduced widely across Europe over the past decade, as part of a trend towards wilder, less-manicured planting within urban areas (Hoyle, 2020), an increase in awareness amongst greenspace managers, and the public alike, of the value of wilder planting for biodiversity, especially pollinators (Hoyle et al., 2017a; Fischer et al., 2020). This is also in response to an urgency amongst greenspace managers to lower maintenance costs via reduced cutting frequencies (Hoyle et al., 2017a) in the face of drastic austerity measures (Mell, 2021) and central government cuts to local planning authority funding. Research in the UK has shown that introducing perennial meadows increased site users' perceived quality and appreciation (Southon et al., 2017), with site-users preferring meadows with the highest floristic diversity and moderate structural diversity. Tall structurally diverse meadows also supported higher levels of invertebrate biodiversity than short meadows (Norton et al., 2019). Meadow-style planting has been supported by urban publics across Europe, (Fischer et al., 2020) with acceptability enhanced by the mowing of neat edges to frame the messier meadows – 'cues to care', showing deliberate management (Li and Nassauer, 2020), as well as



(a) Disused mini-golf site, September 2019 (b) The arboretum-meadow, July 2021

Fig. 1. The disused mini-golf site before and after the introduction of the arboretum-meadow, Wardown Park, Luton.

on-site signage explaining the biodiversity benefits of this approach to greenspace management (Fischer et al., 2020; Southon et al., 2017). Widespread public appreciation has also been expressed for colourful annual meadows with a visually exciting 'wow factor' (Hoyle et al., 2017b; Hoyle et al., 2018). Incorporating late flowering non-native annual forb species such as *Coreopsis tinctoria* (Plains Coreopsis) prolongs the attractiveness of annual meadows for site users and the availability of resources for pollinators when most native UK species had finished flowering (Hoyle et al., 2018).

As is the case with local planning authorities across Europe and beyond, green infrastructure is under-funded in Luton. The Parks Service had been working in the context of the drastic UK central government austerity measures since 2010 (Mell, 2021). Parks were no longer able to fund the minigolf site, which closed in 2014 and had been used temporarily as an experimental meadows area (2015). There were fears that it might be converted into a car park. Futureproofing Luton developed in a process of 'iterative co-production'. Initial partners (Luton Parks Service, an academic partner and River Bank Primary School) reached out to additional partners including a social enterprise, commercial landscape contractor and landscape professionals who joined then contributed expertise, resources and championed the project. Climate-ready trees adapted to local conditions were donated to the project as a carbon offset in November 2019, selected on the advice of a local authority tree officer in December 2019, and then planted in February 2020 by children from River Bank Primary during a workshop day facilitated by university academics and a teacher at the school (Fig. 2). Multiple partners attended the planting day, which took place before the beginning of the first Covid-19 lockdown and closure of the school in March 2020.

During the first year of the project (Summer 2020) children were unable to participate in sowing the meadows, due to lockdown and the school closure, although an 'art in the park' competition was launched by the academic partner in collaboration with the school. Our research with professional partners took place in July and August 2020. Since then children from River Bank Primary School have been involved in seeding a perennial-annual meadow sward (Spring 2021) and further workshops where tree growth has been measured and flowering meadow species identified (Summer 2021, 2022). The children have contributed to signage indicating the potential carbon capture of each of the tree species and have been in the design of an outdoor classroom and seating area (Fig. 2). The project continues to develop and evolve through 2023, with additional signage due to be installed in spring and further workshops planned for the spring and summer.

2.2. Semi-structured interviews

To identify the professional partners' priorities in relation to the project, and their perceptions of the opportunities and challenges

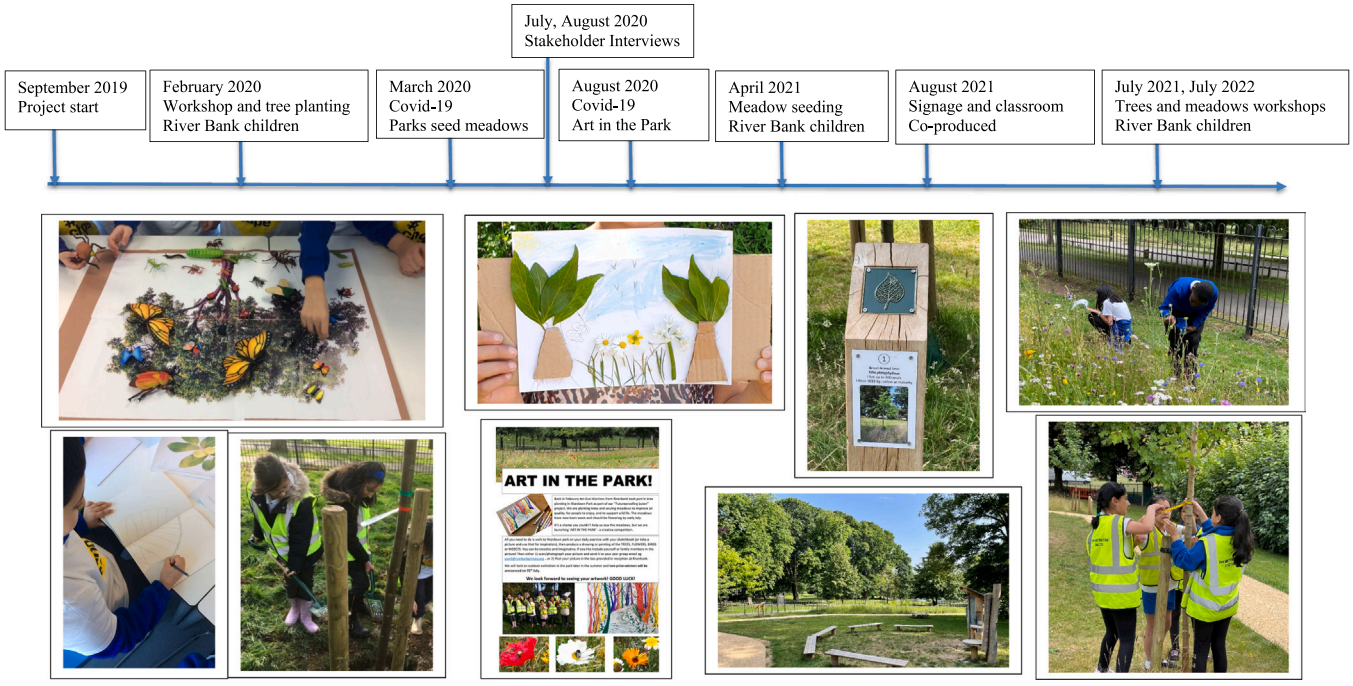


Fig. 2. Timeline showing key points in the progression of the Futureproofing Luton project from its start in September 2019 through to Summer 2022. The project continues to develop, with additional signage due to be installed in spring 2023 and further workshops planned for the spring and summer.

encountered during this co-productive process, semi-structured qualitative interviews (after Hoyle et al., 2017a) were held with eight professional partners (P) involved in the co-production of the project. To gain a wide range of professional perspectives, and to assess whether priorities and perceptions varied with professional role, eight partners (P) involved in the project were interviewed from five contrasting professional backgrounds: Educational (primary school) (P1, P2), Parks Service (P3, P4), Social enterprise CEO, Commercial seed supplier and consultant (P5), Commercial landscape contractor (P6) and Landscape architecture professionals (P7, P8) (Table 1). All participants agreed to take part in the interviews, giving consent for the interviews to be recorded and transcribed.

All interviewees were asked three initial open questions, "How did you get involved in the 'Futureproofing Luton' Project?", "In what way are you involved in the project?" and "What for you is so important about the project?". If not already addressed via the participants' responses to the open questions, key themes including nature connection, climate change mitigation, biodiversity enhancement, partnership working and the impact of Covid-19 on the project were introduced for discussion via an interview guide. The open questions and flexible approach allowed partners the opportunity to focus on the aspects of the project that had been important to them. Partners' own experiences and relationships with others were highlighted, in a form of 'conversation with a purpose' (after Mason, 2002, Hoyle et al., 2017a).

The interviews took place in June-July 2020. They were conducted at this point as they were designed to capture partners' immediate reflections on their initial involvement in the co-productive process, and the focused activities on the ground (tree planting and meadow sowing) involving the children, whilst they were still fresh in partners' memories. Once Covid-19 emerged as a serious threat, we wanted to capture its impact on the project. We had originally intended to conduct interviews in person, but due to Covid-19 restrictions, interviews took place online. This was after the arboretum trees had been planted with the children from River Bank Primary School in February 2020, yet due to Covid-19 restrictions and the school closure in March 2020, the children were unable to seed the meadow area, which was left to the Parks Service. The parents and grandparents of children from the diverse communities were not directly involved in the project as originally planned and were not interviewed and this is a limitation of this research. The original plan was to hold a celebratory meal with them in the arboretum in summer 2020, where interviews would take place but due to the Covid-19 pandemic this did not take place. Few children had laptops, and very few of the parents and grandparents engaged with River Bank Primary School digitally, so online interviews were not carried out.

Qualitative interview data were analysed by content analysis, (after Mayring, 2014; Hoyle et al., 2017a). Main themes were identified and coded in relation to priorities and perceived challenges and opportunities. Further sub-themes were then identified, for example contrasting dimensions of nature-connection.

3. Results and discussion

3.1. What are the priorities for the arboretum-meadow project as perceived by the different partners involved?

Seven key partner priorities emerged from the qualitative content analysis of the interview transcripts: i) *nature-connection*, ii) wider *community engagement and belonging*, iii) *reputation building and professional advocacy*, iv) *placemaking under austerity*, v) *climate resilience*, vi) *biodiversity enhancement* and vii) *flagship project.* (Table 1).

3.1.1. Nature connection

All professional interviewees highlighted the importance of connecting children and other members of the local community with nature as a key priority for the project (Table 1). Two clear dimensions of nature connection emerged from the interviews, first cognitive nature connection, 'knowing nature', whereby interviewees stressed the importance of knowledge and the ability to identify species of trees and flowers, and secondly affective nature connection or 'feeling nature', the emotional connection to nature. Five of the eight interviewees acknowledged the importance of both dimensions, whereas two (P3, P6) focused exclusively on the importance of 'knowing nature', and another (P5) 'feeling nature'. One of the key drivers for the project was the provision of an educational resource for local children and the wider community, so the emphasis most participants placed on 'knowing nature', the importance of cognition and environmental education was unsurprising, particularly from participants working as educational professionals. One of these participants reflected on their own experience as a child and thought that it was important children from diverse backgrounds learnt to recognise the 'conker' from the *Aesculus hippocastanum* (European horse chestnut) tree growing in Luton:

> *The children we have here don't know what a conker is. That to me is a big concern. As a child their age I was going on conker hunts on my way back from school. So, for them to look at me in complete confusion breaks me a little bit.*
>
> *So, for me this tree planting project and the meadow that is involved with it as well is a massive thing. For those children to learn something and put their little stamp on the world that will be there in years to come.* (P1).

The potential for urban NBS to promote communication and mutual learning has been highlighted previously (Kabisch et al., 2022). There is some evidence that "nature-based thinking" via environmental education is a pathway for sustainable urban development (Randrup et al., 2020) and further evidence that enhanced nature-connection promotes pro-environmental behaviours (Nisbet and Zelenski, 2013; Gaston and Soga, 2020).

In contrast, the social enterprise partner, (P5), who had considerable experience of co-coproducing NBS with deprived urban communities elsewhere in the UK, prioritised 'feeling nature', developing an emotional connection with nature amongst children and the wider

Table 1
Summary: The key project priorities of individual partners involved in the Futureproofing Luton Project.

Partner identifier	Partner role	Key priorities							
		Nature connection		Wider community engagement	Reputation building and professional advocacy	Placemaking under austerity	Climate change resilience	Biodiversity enhancement	Flagship project
		Cognition 'knowing nature'	Emotion 'Feeling nature'						
P1	Educational	■	■		■				
P2	Educational	■	■	■	■	■			
P3	Parks Service	■		■	■	■			■
P4	Parks Service	■	■	■	■	■	■	■	■
P5	Social enterprise		■	■		■			
P6	Commercial contractor	■		■	■	■	■		
P7	Landscape professional	■	■		■		■	■	■
P8	Landscape professional	■	■	■	■	■	■	■	

community, exclusively. This was particularly in the case of children and adults from diverse backgrounds who might be completely unfamiliar with nature:

> *What we've used it for is to take people on transitional journeys. So, when people feel a bit uncomfortable about being outdoors or they don't feel it's their place, they don't feel like they have any vocabulary for this, or that you're trying to make a change, and you want to engage people in this process. We found these kinds of projects incredibly valuable. To develop that sense of ownership, but it's also about the confidence to feel like people have the right to talk about this and language to speak it.* (P5).

This resonates with earlier findings (Frantzeskaki, 2019) that co-production in nature can generate 'new green urban commons', places where diverse actors within the community can forge new connections with each other and where people can connect with nature. Spaces and places can grow into 'cherished local spaces' as people invest their time and emotions in transforming them (Frantzeskaki, 2019). Emphasis on the importance of emotional connection with nature and giving local people a sense of ownership is also in line with earlier research (Lumber et al., 2017), which found that emotion, meaning, compassion and beauty were pathways to improving nature connection, but that knowledge-based activities did not predict nature connection. This research also highlighted 'contact' as a key pathway. The significance of 'contact' was reinforced by our findings. Both educational partners (P1, P2) emphasised the role of 'doing' in children's understanding and appreciation of nature – direct contact with nature via practical engagement in acts such as tree planting and sowing meadow seeds as crucial in fostering nature connection and pro-environmental behaviours.

> *The day we went to plant the trees was just wonderful. Those children that were involved in the project were loving it, especially when they were given a spade and they could dig in the ground - they thought it was the best thing in the world.* (P1)

> *Learning at Riverbank isn'tabout regurgitating facts. If you have haven't remembered something it is probable that you haven't done it and it's not in your long-term memory*. (P2)

The same interviewee also emphasised the role of children in educating their parents and connecting them to nature, as means to wider pro-environmental behaviours:

> *What we try and do is teach them enough to the point where they connect their parents about it. They will become the driving force because they believe walking to school is the right thing to do and then they convince their parents. Children can understand the benefits of say recycling, and it's easy for them to go home and get excited about it in front of their parents and say, 'we have to do it'*. (P2).

This concurs with recent research on the increasing role of children in environmental debate and actions, (Hosany et al., 2022) and evidence that one in three children is now environmentally aware (Richardson, 2019), feeling a sense of 'duty to learn, educate others and lead a better world.' (Wallis and Loy, 2021).

3.1.2. Wider community engagement and belonging

Six partners highlighted that wider community engagement was an important aspect of the project for them. This was emphasised particularly by the second educational partner (P2) who saw the project as way to promote a sense of belonging amongst children and communities from diverse parts of the world:

> *We want our children to be involved and feel rooted within the community. 85% of our children speak English as an additional language. 30% of the children we have in our school were born in this country. They are all part of first-generation families that are coming to us from mostly Bangladesh via Italy and Spain, Romania and a lot of Eastern European countries…. having connections within the community themselves is important and feeling rooted in the local area.* (P2).

The importance of community engagement to our participants highlights the role of NBS in addressing wider social benefits (Frantzeskaki, 2019) and illustrates the potential to go beyond the 'unusual suspects' to work within diverse, deprived communities, co-designing urban commons which have meaning and value in the context of their culture (Basu and Nagendra, 2020).

3.1.3. Reputation building and professional advocacy

Reputation building and professional advocacy emerged as priorities and motivators for seven participants (Table 1). River Bank Primary is a relatively new school which opened in 2013. The educational professionals (P1, P2) saw their involvement in the project as a way of building a positive reputation for the school through active participation in a 'feel good' project that promoted environmental awareness and education. Parks service professionals themselves were aware the project had '*protected the space and raised the profile'* (P3), commenting on the successful establishment of the arboretum-meadow on the former mini-golf site, which others in the council had proposed for a car park extension. The industry partner (P6) was aware that their involvement in a project promoting positive pro-environmental behaviours would be good for their company's image.

> *The environmental benefits definitely stand out as the main reason for doing it. It's obviously a PR opportunity for us to be involved in a positive project like that.* (P6)

The landscape architecture professionals celebrated the possibility of going beyond the 'usual suspects', i.e. the white majority in the landscape industry, to promote their pro-environmental values and aspirations and to recruit the landscape professionals of the future from underrepresented non-white minorities. Recent UK research into ethnic diversity throughout occupations revealed that environmental professions were the second least diverse, with only 3.1% environmental professionals identifying as non-white minorities (The Policy Exchange, 2017).

> *One of the things that really pleased me with this project was diversity… We do not attract sufficient people from diverse backgrounds into our landscape or the green space sector so it is really important to have diversity, inclusion around connecting with diverse communities and the use of spaces.…seeing a school with a really diverse backgrounds…showing families and communities that there are jobs in that sector.*(P8)

3.1.4. Placemaking under austerity

Placemaking under austerity was considered a significant priority by six out of eight partners:

> *As always on green space projects is getting insufficient resources for both the capital and maintenance is always important. That does seem to be one of the challenges we have funding challenges in the sector generally.* (P8)

The opportunity to create the arboretum-meadow through engagement with other partners was a particular priority for Parks Service participants because this enabled the transformation of the mini-golf area into an educational resource, avoiding its conversion into an additional parking area for the museum.

> *You'll be aware of austerity and local government. Since 2013 we haven't had a tree planting budget, so although we had enough space to plant trees and we had a mechanism to do it, it was austerity which was the stumbling block, so to be able to identify and work with partners via external funding and work with the likes of River Bank Primary School to do the planting, it's sort of enables us to get the project done and through to where we are now - it has been fantastic to be honest.* (P4)

Previous research in Vejie (Denmark), Burgas (Bulgaria) and Potenza (Italy) showed that involving deprived communities in neighbourhood tree planting to re-establish urban parks and forests also led to extending public participation beyond the planting to co-management in partnership with the city (Ordonez Barona, 2015). This is an asset for local land-managers under austerity politics, where innovative and creative partnership working is essential to the ongoing delivery of GS and NBS (Mell and Whitten, 2021). Co-production of NBS with deprived, diverse communities is also a means to mitigating social and environmental injustice. There is a growing body of evidence highlighting the uneven distribution of GS and NBS within urban areas, with a recent UK study in Glasgow confirming more deprived neighbourhoods less likely to have access to quality greenspace (Baka and Mabon, 2022).

3.1.5. Climate change resilience

Four of our eight participants highlighted climate change resilience as a priority of the project. This was emphasised by the landscape architecture professionals (P7, P8), and commercial landscape contractor (P6) all of whom had been involved in the gifting of the arboretum trees as a carbon offset.

> *The environmental benefits definitely stand out as the main reason for doing it.* (P6).

> *It is an important moment for firms and companies to be seriously considering how they can contribute to the environment going forward. Spending a little bit less on carbon producing activities and a little bit more on carbon offsetting.* (P8)

One Parks Service interviewee was most emphatic about the role of the arboretum in contributing to climate change resilience, demonstrating clear understanding of role of urban trees in terms of carbon storage (Derkzen et al., 2015), mitigation of poor air quality (Fowler, 2002), and need for the need to introduce tree species appropriate to the local habitat (Langenheim et al., 2020), and climate (McPherson et al., 2018):

> *We are responsible for all of the trees in the town so it was important from my perspective as a green space manager to offset the climate change issues within the town. and we have poor air quality in a number of areas within Luton. I'm a great believer of "it's the right tree in the right place". We want to maximise the benefits of the trees and therefore it is important to know which trees are good for carbon sequestration and for air quality.* (P4)

Neither educational professional referred explicitly to climate change resilience per se as a priority, maybe because they were focusing first on the childrens' environmental education and how this might promote future pro-environmental behaviours amongst children and parents.

3.1.6. Biodiversity enhancement

Biodiversity enhancement referred to explicitly as a priority by three partners, three of the four who also referenced climate change resilience: the two landscape architecture professionals (P7, P8) were acutely aware of the wider biodiversity crisis and UK policy in relation to Biodiversity Net Gain (DEFRA, 2019), which aims to enhance biodiversity through development:

> *We've actually made a commitment about improving our biodiversity.* (P8).

The Parks Service manager who was directly involved with delivering the project on the ground referred to the specific biodiversity benefits associated with meadow introduction:

> *The initial concept for that area started with a trial of wildflowers and how the public engage with the wildflowers. Wildflowers that enable environmental benefits. from the habitats and with regards to pollinators.* (P4)

In the UK LPAs have a legal 'duty' to conserve biodiversity (Natural Environment and Rural Communities Act, 2006), and there is evidence of an increase in awareness over the past 15 years of the benefits of wilder meadow-style vegetation for wildlife amongst Parks Service employees (Hoyle et al., 2017a).

3.1.7. Flagship project

One of the main motivations for this project was that learning from the project would have wider value and transferability, informing policymakers and practitioners, with the potential to address global SDGs in a 'locally attuned' manner, to respond to specific contextual social and ecological challenges, (Frantzeskaki, 2019). Three of the eight partners identified it as a 'flagship' project, with potential for replication in a locally relevant context elsewhere. Both Parks Service professionals interviewed described how it was already being used in other contexts throughout the town, with successes and learning from the 'pilot project' feeding into other policies:

> *We have been able to feed that success into other places into the council strategies and plans to try and make sure in the future if there is any funding …It won't stop here.* (P3)

The same manager also reflected on the longer-term benefits once further educational resources had bee introduced, such as the signage and the outdoor classroom:

> *I think as time goes on and we get the educational information in there I think the long-term benefits will be more of a slow burn.* (P3)

In terms of wider societal impact, one of the landscape architecture professionals (P7) who was in a high-profile position in the sector considered the project to have real value and potential transferability:

> *I have spoken to world Congress events in Singapore, in Oslo in Norway, in Kazan, in Lyon and that little project has been my case study project There is the ripple effect…these projects like kids planting some trees in a park in Luton …. the former US president has just heard about it. It goes back to that whole point, what can one person's action do, can it make a difference? ….so why don't we make every school in every country plant 15 trees? Every school, it would be phenomenal, and why should Luton be unique?* (P7).

This highlights the significant transferability of the 'flagship' project, demonstrating the potential for co-production of NBS with children in deprived, ethnically diverse contexts to create educational resources, to address global climate targets and deliver the SDGs.

3.2. What are the opportunities and challenges associated with the co-productive process as perceived by the professional partners themselves?

Our participants perceived five key opportunities and seven challenges associated with the co-productive process of working with other partners (Table 2).

3.2.1. Opportunities

Six of our eight interviewees perceived *diverse partner expertise and priorities* as a positive dimension of the co-productive process. Our partners were aware that including people from different backgrounds with complementary expertise could '*bring more skills and knowledge to the table'* (P3). Professional partners including the social enterprise CEO (P5), commercial landscape contractor (P6) and landscape professionals (P7, P8) who had experience of a wide range of landscape and NBS projects at different scales, expressed the strongest support for the value of diverse ideas and expertise, emphasising the importance of involving the most appropriate partners, at the right time, usually at the beginning of a project, with the view that it was important to go beyond the 'usual

Table 2
Summary: The opportunities and challenges of the co-productive process as perceived by individual partners.

Partner identifier	Partner role	Opportunities					Challenges						
		Diverse expertise & priorities	Covid-19	Social media	Proximity of park to school	Addresses austerity gap	Diverse expertise & priorities	Covid-19	Social media	Educational pressures	Parental and cultural factors	The parachute effect	Connecting the disconnected
P1	Educational			■	■			■	■	■	■	■	
P2	Educational	■					■	■			■		
P3	Parks Service					■	■	■					
P4	Parks Service												
P5	Social enterprise		■					■			■	■	
P6	Commercial contractor	■		■									
P7	Landscape professional	■	■										
P8	Landscape professional	■		■		■						■	■

suspects' (Frantzeskaki, 2019) to align interventions with the socio-cultural needs and values of local communities (Buijs et al., 2019; van der Jagt et al., 2019; Frantzeskaki et al., 2020).

> *The most essential thing with every project is making sure you have the right people around the table at the right time.* (P7)

> *Getting the right groups involved to start with.*(P5)

> *These things are only successful if you pull in members of society that wouldn't normally get involved, who typically wouldn't be involved in these things. I think if anything it widens the interest and gives people a bit of an insight into what goes into these things more than anything else.* (P6)

Social media was viewed as a vehicle to promote positive image and reputation by the landscape contractor (P6) a landscape professional (P8) and the educational professional involved closely with the children (P1). The school was keen to promote itself and to gain a positive reputation, as explained above, and a positive *social media* profile was one way to achieve this.

> *The Twitter feed that was going on was great. When I was posting I was retweeting and mentioning other people's names as much as possible from the original posts that were made on the day and sharing them back as well. So, the school Twitter account has made contact.* (P1)

Although *Covid-19* was perceived dominantly as a challenge for the project itself, the social enterprise CEO (P5) and landscape professionals (P7, P8) presented an alternative perspective. Reflecting on the positive mental and physical wellbeing benefits provided by parks during the first lockdown (Collins et al., 2022) they thought the pandemic had provided a wider opportunity for the greenspace sector to highlight the value of parks and green spaces to central government as evidence towards increased prioritisation and funding for parks and green spaces beyond the pandemic.

A further opportunity of the project as perceived by the educational professionals was *the proximity of the park to the school*, providing learning for future projects involving primary school children. The school is only 200 m from the park, so regular visits to the park on foot could be arranged easily. For the Parks Service managers, a key opportunity of co-production more generally was that is *addresses the austerity gap,* linked to the priority *Placemaking under austerity* as discussed above (Mell, 2021).

> *It gives you better opportunities to try and achieve things. Quite often we can only find external funding for projects by working through external partners like community groups.* (P3).

3.2.2. Challenges

Covid − 19 was viewed as a major challenge to the project, particularly by the educational professionals (P1, P2) and Parks Service managers (P3, P4) involved directly in tree planting and meadow sowing. The practical delivery of the project was impacted. There was considerable relief that the children had been able to participate in the workshop and tree planting in February 2020, before the first lockdown, but then the school closed in March 2020 and the initial meadow sowing had to be completed by the Parks Service staff rather than the children. The biggest concern expressed, was the impact on the children's contact with the project, and thereby connection with it, and ultimately nature-connection:

> *On this project it has broken that link between the participation side of things. I'm assuming the kids didn't actually get to do the sowing, they might of gone on the tree planting but no follow-up. I imagine they've had a complete disconnect. That's the big Covid 19 thing on this project - specifically the disconnect for the children.* (P5).

A further challenge perceived by the Parks Service managers involved in the physical delivery of the project on the ground, was the *contrasting motivations and priorities* amongst partners. They were aware that as land managers they had a duty to deliver projects on the ground and that co-production brought a necessary loss of control:

> *The downside is you don't have as much control than if it was your own project and sometimes it's difficult to let go. You have to do that.* (P4)

One manager highlighted the challenge of being receptive to local community priorities in the context of wider ecological objectives as identified by the Parks Service landscape ecologist.

> *Sometimes people don't see what the what the ultimate goal of the project is. For example we've got a lot of chalk grassland and a lot of our community groups when we start to talk about projects to improve the chalk grassland they perhaps want to plant trees. We don't want that to happen because it will destroy the chalk grassland.* (P3)

Kabisch et al. (2022) advocate the importance of 'communication and learning' as a principle of NBS, that urban NBS should 'support mutual learning', with walks and workshops organised to raise citizen awareness and ongoing dialogue (Frantzeskaki et al., 2020) to mitigate conflicting priorities, (Wamsler et al., 2020), yet the lack of local funding limits the Parks Service ability to deliver these:

> *I don't often have the time and resources to do a lot of education with groups with what we're trying to achieve.* (P3)

Educational pressures provided an additional challenge to children's ongoing nature contact fostering nature-connection (Gaston and Soga, 2020) and were emphasised by the educational professional involved most closely with the children. Although the *proximity of the park to the school* meant that visits were relatively easy to organise, there was still pressure from the national curriculum which meant that time available for external visits to an outdoor classroom was limited:

> *A few times I thought the headteacher was going to say "no let's leave it because it's too much trouble and we want the kids in school".* (P1).

This was exacerbated by *Covid-19* and school closures, which meant that children had missed a significant amount of their formal education. This was felt acutely in this deprived area, where access to technology for home schooling was limited. Children were now required to 'catch-up':

> *Whether we are allowed to take them out, especially now because they need to catch up. It could be a reason not to take them to a park. I think it's more of a reason to take them out somewhere nice to escape from having to catch up with everything because it's going to be really, really hard for them.* (P1).

This same educational professional (P1) described *social media* as a challenge as well an opportunity, because of the school's responsibility to parents and children and the need to protect privacy. They were anxious to prevent others photographing and sharing images of children who did not have parental permission.

Parental and cultural factors were also acknowledged as challenges to ongoing nature contact amongst the children:

> *Often it is not the kids themselves but the parents that are barriers. We do know that BAME (Black, Asian and Minority Ethnic) communities are more excluded, they feel more culturally excluded from nature and maybe the wild areas, they might not necessarily, depending on which generation we are talking about, have the same cultural resonances. So, there is an even greater disconnect so parents often feel very uncomfortable as well, and a grandparent won't let their child go outside to play because they feel uncomfortable or culturally they're worried about things or a lot of the issues we get around here and we get a whole two generations that have not felt comfortable outside I think it is dangerous and dirty and they will not let their children explore.* (P5)

Previous studies have shown that people with a Mediterranean or Islamic migrant background prefer nature as manicured and ordered, as a 'cultivated oasis' (Schouten, 2005). The significance of generational differences in perception is highlighted in previous research (Fischer et al., 2018) from across five multicultural European cities which revealed differences in nature perceptions between first generation migrants and their children and grandchildren. For first generation migrants, perceptions of whether the green areas depicted in the study contributed to creating a liveable city differed significantly from those without a migrant background, yet there were no significant differences between perceptions of their children and grandchildren and non-migrant populations, suggesting increasing exposure and familiarity may promote acceptance of a wilder, less managed form of nature.

Three partners (P1, P5 and P8) were wary of *the 'parachute effect'* and were eager to emphasise the need to engage with the local community beyond the initial co-productive delivery of the arboretum-meadow on the ground. They saw this as integral to the children's nature-contact as well as the management and maintenance of the project on the ground:

> *It can be very frustrating because one of the challenges is the short-term nature of a lot of these interventions. When you just parachuting and do something and bugger off. And then the real downer on some of these projects is it afterwards when they're not managed or maintained, when the garden manager comes in and cuts it all down which has happened an awful lot and kids and people are devastated. They disengage, they don't think it's worth doing after that.* (P5)

Positively, research in deprived communities across Europe (Ordonez Barona, 2015) has demonstrated that neighbourhood tree planting led to extending public participation beyond the planting to co-management in partnership with the city. In the case of the Futureproofing Luton Project children have subsequently been involved in seeding a perennial-annual meadow sward (Spring 2021). Further workshops where tree growth has been measured and flowering meadow species identified have been facilitated by academics and educational professionals from the school, (Summer 2021, 2022) (Fig. 2), fostering ongoing nature-contact amongst the children and a long-term solution, as the local community takes ownership of the arboretum-meadows area and is prepared to contribute to its ongoing maintenance and care.

4. Conclusions and implications for policy and practice

Our findings highlighted that all professional partners involved in the project prioritised *nature-connection*, with varying emphasis on the importance of cognitive (knowing) and affective (feeling) dimensions. Previous research addressing nature-connection has emphasised the role of cognitive understandings of nature (Randrup et al., 2020) or affective, emotional response to nature (Lumber et al., 2017) as mutually exclusive routes to enhanced nature-connection. Our research highlights the importance of both cognitive and affective dimensions of nature-connection and confirms the importance of 'doing' and direct contact with nature (Lumber et al., 2017). This direct contact enhances children's nature connection towards pro-environmental behaviours and sustainable urban development (Nisbet and Zelenski, 2013; Gaston and Soga, 2020). *Wider community engagement, professional advocacy* and *placemaking under austerity* were other priorities of the project highlighted by most partners, with fewer prioritising *climate change resilience* and *biodiversity enhancement*. It is a significant finding that in the case of this project, stakeholders prioritised social benefits over ecological, climate-related ones.

Our professional partners recognised their own *diverse expertise and priorities* as a key opportunity of co-production, yet they were aware that co-production was a messy process, where compromise and loss of control was inevitable. *Covid-19* provided a significant challenge to the practical implementation of the project through 2020 and impacted on the children's sense of continuity and connection to the project, yet ongoing growth of the project with the addition of further signage, an outdoor classroom and on-site workshops through 2021 and 2022 and beyond indicates that recovery is possible.

Approximately two-thirds of what must happen to achieve the global SDGs needs to involve local actors (Cities Alliance, 2015), responding to specific contextual social and ecological challenges. The Futureproofing Luton Project is an individual, small-scale initiative, locally attuned to the challenges of a relatively deprived, diverse area of England, UK. The primary objective of the project was to provide an educational resource for children and the wider community focusing on the value of trees and meadows in relation to climate change, air quality, wellbeing, and biodiversity. We demonstrate that learning from this project has already fed into local policy and practice. Our research provides insight into the potential for the co-production of educational NBS such as the arboretum meadow in a deprived, ethnically diverse contexts to contribute to "futureproofing" towns and cities by fostering nature connection amongst children, whilst providing a novel, creative approach to managing and maintaining GI under austerity. Our research highlights this project as a 'flagship', with transferable learning and the potential to deliver demonstrable international impact in achieving the global SDGs.

Upscaled, and replicated in local areas across the world, using culturally and climatically informed tree and meadow species, the arboretum-meadow approach of the Futureproofing Luton Project has the potential to make a significant contribution to achieving the international SDGs: 4) *Quality Education*; 3) *Good Health and Wellbeing;* 10) *Reducing Inequality*; 13) *Climate Action*, and 15) *Life on Land* (United Nations, 2015). Our research highlights the opportunities and challenges of this co-productive process, providing transferable insights into the process of co-production for other communities and partners aspiring to replicate this process.

Declaration of Competing Interest

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

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