“Britain’s rainforests”: engaging the public with brownfield sites for conservation in the U.K.

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Abstract

This small-scale study aims to understand what different environmental organisations are doing to engage people with brownfield sites in the U.K. Interviews with staff members from different environmental organisations found a wide range of initiatives to be in practice, including collaboration with other organisations and local schools and involving volunteer groups with maintenance of the sites. Working with volunteers and partner organisations and the management of sites were often identified as essential contributors to the success of projects. Interesting themes which arose, including the lack of demographic data and issues engaging with developers, could act as springboards for further studies.

Keywords

Community action; Environmental communication; Public engagement with science and technology

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Context

Brownfields are sites that were once used by humans but are now abandoned [Ishimatsu and Ito, 2013]. The majority are on ex-industrial land, but brick-pits, quarries, railway lines and disused airfields are also classed as brownfield sites [Buglife, 2019]. Brownfields are often regarded as “unsightly” areas of land that are dangerous due to the leaching of harmful chemicals such as solvents, asbestos or heavy metals into the soil [Hunter, 2014]. However, ecological research has revealed brownfield sites to be highly important areas for biodiversity, harbouring complex ecosystems that offer habitats for many rare and threatened species [Schadek et al., 2009].

Brownfield ecology

Brownfield wetlands are important for water birds, whose natural habitats are decreasing [Hunter, 2014]. Brownfield dry ground areas have nutrient-depleted soils that discourage fast-growing plants such as hawthorn, bindweed and grasses

from taking over and thus encourage wildflowers. Brownfields also attract plants from domestic gardens, resulting in a greater biodiversity of flora and fauna than that found on less developed land. This abundance of pollen attracts a multitude of pollinators and invertebrates, including bumblebees and butterflies [Hunter, 2014]. Around 12–15% of nationally rare invertebrates are found in Britain's brownfields, with some species being endemic to these sites, such as the Street Bombardier beetle (*Brachinus sclopeta*) and the Distinguished Jumping Spider (*Sitticus distinguendus*) [Small, Sadler and Telfer, 2002; Natural England, 1998].
As brownfields provide conditions akin to natural habitats, they can be havens for species that are becoming rarer in more urban areas [Eyre, Luff and Woodward, 2003] (Figure 1).

Figure 1. Canvey Wick: Britain's Rainforest. Photographs taken at Canvey Wick show the 'mosaic of habitats' that make this one of the most ecologically-valuable brownfield sites in the U.K. (photograph credit: Rosie McCallum).

Despite some brownfields being added to the Natural Environment and Rural Communities Act's list of priority sites in 2006, many face increasing threat from development due to the U.K. government's target of building 60% of new housing on previously developed land [Lorimer, 2008]. The Thames Gateway is home to at least 15 priority species, as well as 74% of the national fauna of bees and wasps, including the rare Shrill carder bee (*Bombus sylvarum*), making it one of the most important areas for brownfields in the U.K. [Robins, Henshall and Farr, 2013]. However, the 2012 London Olympic Game led to the loss of 60% of this valuable land [Hunter, 2014]. Many other brownfield sites face the same threat as, although the National Planning Policy Framework states that brownfield land should be 'prioritised for development as long as it is not of high environmental value', there is currently no real definition of 'high environmental value', leading many brownfield sites rich in biodiversity to be lost to development [Robins, Henshall and Farr, 2013; Grant, 2006].

Urban environments

The vast majority of brownfields are found in densely populated areas such as London, Liverpool, Birmingham and other industrial cities [Longo and Campbell, 2017; Grimski and Ferber, 2001]. Brownfield sites provide an important urban ecosystem service by creating 'green corridors' that allow wildlife to move between habitats [Smith et al., 2006]. Thus, the presence of brownfields in urban areas can be vital for making cities more wildlife-friendly [Miller, 2005]. Although brownfield sites which have known potential for redevelopment are more abundant in the densely populated and wealthy areas in the south of England, most vacant sites are found in the less densely populated and poorer areas of the north [Longo and Campbell, 2017]. This highlights the prevalence of brownfield sites in urban areas but also exemplifies the divide between more and less economically developed areas regarding brownfield restoration. Although many brownfield sites in the south may already be lost to development, the abundance of sites in the north which are completely derelict and with no planning permission suggests the huge potential for conserving brownfield sites in the north of England and other overlooked areas of the U.K. Poorer communities in England are generally located within low-quality natural environments [Mullin et al., 2018] and those in the lowest social grades are the least likely to engage in pro-environmental behaviour [Natural England, 2015]. As brownfields are often located in cities with high levels of economic deprivation [Lorimer, 2008], once restored they can serve as accessible places for nature and environmental education for people from different backgrounds.

Public engagement

There are many challenges associated with engaging local residents and decision-makers with brownfields. The majority of sites are shut away from public view and are considered to be dangerous and unsightly by local residents and developers alike [Lorimer, 2008]. However, engaging with these groups is a vital task if brownfield sites are to be saved [Angold et al., 2006]. By involving planners in public engagement, the planning approaches that can offer recreational functions and best increase the ecological value of brownfield sites can be determined [Mathey et al., 2018]. As the potential users of brownfields, the opinions and perceptions of local community members about how brownfields are used, and communities' preferences for their management, are crucial to help urban planners and policy makers make decisions on the future of these sites [Cilliers, 2010].

Understanding how local residents perceive brownfields will help to inform decisions around how to engage these groups with the sites. Although negative attitudes towards brownfields were found to dominate in a German study, local people preferred this to redevelopment of brownfields [Mathey et al., 2018]. The majority of negative attitudes towards brownfields stem from the impression of neglect. Although most local residents rarely use brownfield sites, those that do tend to be children and teenagers, who use the sites as places of creative expression or freedom [Gandy, 2013]. Therefore with appropriate management, such as at Canvey Wick, the aesthetic value of these sites can be improved and acceptance and usage by local residents will increase [Mathey et al., 2018].

Engagement activities, including communication, education, increasing public awareness and the development of conservation programmes, indirectly support conservation and are instruments for achieving conservation goals [Jiménez et al., 2014]. However, conservation activities tend to mainly address schoolchildren and general audiences; minority groups are not often specifically targeted. Traditional 'outreach' approaches need to be adapted to enable biodiversity conservation projects that encourage the cooperation of multiple stakeholders to develop environmental policy and management strategies [Evely et al., 2011].

Brewer [2002] suggests that using citizen science programmes to engage local communities with brownfields can provide rich opportunities for local community members of all ages to improve their scientific literacy. However, lack of access to, and discomfort in, natural settings prevents many local residents from participating in these programmes [Evans et al., 2005]. Urban ecology projects respond to the priorities of urban communities and represent a move towards community-based and collaborative designs of citizen science efforts. Through this method of collaboration, people who may be unfamiliar with, or lack experience with, the scientific process will be able to take part in scientific activities, thus directly impacting their scientific literacy and openness to science [Pandya, 2012]. Therefore, organisations working with brownfields have the potential to raise awareness and engage a wide audience with science, but steps should be taken to ensure they are accessible to all.

In the U.K., many organisations (including The Wildlife Trusts, the Royal Society for the Protection of Birds (RSPB) and Buglife) have projects and initiatives to engage people with urban ecology and to create more green spaces in cities. Organisations have been exploring the potential for brownfield land to become nature reserves and wildlife havens in urban areas and are connecting people with these sites and other aspects of brownfield ecology [The Wildlife Trusts, 2019; Harper, 2015; Buglife, 2019]. As there is little, if any, research on how organisations working with brownfields are engaging local communities with these sites, and as research shows that engaging with urban ecology has major benefits for the local community and conservation [Doick and Hutchings, 2007; Hunter, 2014], this small-scale study provides an initial overview of what a variety of organisations are doing to engage local communities with brownfield sites in the U.K. in order to aid the sites' conservation.

Methods

A series of six semi-structured interviews was carried out with staff members from environmental non-governmental organisations (NGOs), research institutions and independent businesses who work with brownfields (Table 1). As interviews provide direct access to experiences, opinions and insights of the participants, they are a useful methodology to collect rich interview data, enabling the development of themes [Tong, Sainsbury and Craig, 2007]. Furthermore, semi-structured interviews are useful to prompt detailed and open discussion in order to gain a depth of information that covers all areas [Weitkamp and Longhurst, 2012].

Interviews took place over the phone and in person. Each interview consisted of eleven key questions to gain an understanding of the interviewee's work with brownfields at an organisational level. This included questions on the organisation's success in engagement initiatives, collaboration with other

Table 1. Interview participants.

Interviewee (pseudonym)	*Organisation*
Anna	RSPB
Ben	Grass Roof Company
Colin	University of East London (UEL)
Denise	Nature After Minerals (NAM)
Edward	Buglife
Fred	The Land Trust

organisations and the future of brownfield conservation and engagement. The interviews were audio recorded, transcribed in full, and analysed using thematic analysis to identify emerging themes, providing a rich overview of current approaches to brownfield engagement. The analysis was conducted manually in a bottom-up approach and followed Braun and Clarke's [2006] guidelines on thematic analysis. The themes that were most repeated across the interviews formed the unit of analysis. Initial codes were generated inductively and then refined into two key themes; community and collaboration. Secondary analysis was performed and reviewed by two other researchers to ensure the themes adequately represented the original transcripts.

The research project was approved by the University of the West of England's Research Ethics Committee.

Results and discussion

This study found organisations use a variety of methods to engage publics with brownfield sites and identified some areas that could form the basis of future studies. Community and collaboration were found to be key factors in informing engagement with brownfield sites. The generation of these two key themes also led to the finding of several sub-themes, as represented in Table 2.

Table 2. Main themes and sub-themes.

Collaboration	*Community*
Management	Projects and programmes
Developers	Social, health and economic benefits
Partner organisations	Health and safety
Money	Education
Public perceptions	Volunteers

Collaboration

Collaboration with a variety of stakeholders, including other partner organisations recurred as a key theme throughout the interviews as a vital part of brownfield conservation engagement.

Collaboration: money and management

Collaboration can be used to create a common pool of natural resources and enhance the preservation of ecosystems (cross-boundary collaboration) [Kark et al.,

2015], making it a significant focus area in conservation. In time, collaboration can reduce the area and cost needed to reach conservation targets [Kark et al., 2015], thus making it highly useful for conservation organisations that have small budgets.

Many of the organisations relied largely on public funding for their work with brownfields. The Land Trust takes on an income source when it takes ownership of a brownfield site; often an endowment but this can also be crowdfunding. A university researcher, Colin (UEL) noted the importance of funding with regards to setting up brownfield-related projects: "We're trying to seek ERDF (European Regional Development Fund) funding to set up a business incubator around nature-based solutions".

There has been a push, in more recent years, to move from standard funding channels to crowdsourcing and other grassroots models [Schäfer and Kieslinger, 2016]. Crowdfunding is becoming an increasingly common way to fund conservation programmes, especially for overlooked species including those that are less known or not as 'charismatic' as others, allowing NGOs with low fundraising capacities to access capital [Gallo-Cajiao et al., 2018]. Some interviewees mentioned crowdfunding as being an important source of money, however none of the organisations relied completely on crowdfunding for their projects. As crowdfunding is based on willing donors, it may be unreliable, making it difficult for smaller organisations to depend on it for their entire income. Supporting organisations to work together on projects with similar conservation goals could be utilised as a useful way of maximising their financial resources.

Money appeared to be an important contributor to challenges surrounding brownfield conservation. Furthermore, even when ecological surveys show the biological value of the sites, developers often do not consider them, as Edward (Buglife) noted, "They've already spent hundreds of thousands of pounds or even millions on designing plans for a site".

This suggests a lack of dialogue between conservation organisations and planners. Time and money is being lost on ecological surveys, which are discounted, and people lack an understanding of brownfield maintenance methods. Ben (Grass Roof Company) discussed that although brownfield techniques and materials work out cheaper than other methods, most maintenance companies do not have the skills or budget to maintain the space properly. Conservationists and planners should be in constant discussion to learn opinions and methods of their work from each other. Both sides are limited by their budget and a misunderstanding of the other's work or ideas, and the miscommunication between the two serves only to further restrict potential investment in properly conserving and maintaining brownfields.

Well-restored and well-maintained brownfield sites can be very beneficial to the local economy, and so every measure to improve collaboration between developers and conservationists should be taken to aid in their proper maintenance. Denise (NAM) mentioned that good maintenance "can lead to visitor increase to a certain site and local business can benefit from that". Fred (The Land Trust) also stated that "there's a significant property premium for the developer or for the home owner if the green space around that development is developed well".

Management of brownfield sites was mentioned by every interviewer, with some saying it is important to consider it right from the beginning of the ownership/planning process in order to conserve the ecological value of the site. Colin (UEL) expressed the importance of incorporating maintenance in the very early stages of development. The early successional stages of the sites are highly ecologically valuable but this value is less at later stages of succession. Therefore, Colin's research relies on running workshops to teach others how to maintain the sites, with Colin "working to try and look at how you can manage the sites and maintain them for their biodiversity value in the long term".

Ben (Grass Roof Company) also stated the importance of using brownfield techniques to help reduce maintenance in the long term, and expressed his concern over current management techniques:

> There needs to be more emphasis put on how to look after spaces after their design because that's what makes them truly sustainable. If you don't maintain them then it's pointless.

Nature After Minerals was set up to help brownfield sites be restored in the right way in order for nature and local people to benefit. This has led to restored sites becoming nature reserves, with active friends-of groups helping to manage the sites. Although this study suggests local authorities play a key role in helping to manage and protect brownfield sites, two-thirds of local authorities in the U.K. do not have sufficient ecological expertise [Oxford, 2013]. This highlights the need for appropriate training for authority figures if brownfield sites are to be sustainably managed.

Collaboration: partner organisations and developers

Working with partner organisations is an important and often vital part of the interviewees' work. These partnerships included those between industry, business, schools, environmental NGOs, mineral companies, local authorities, governments, developers, universities, local groups and hospitals. Some interviewees mentioned partner organisations when discussing how sites are maintained by the different organisations. For example, Anna (RSPB) stated, referring to Canvey Wick:

> There's the Land Trust who are the land owner and there's Buglife who are the entomologists, basically who are doing all the entomological surveys. And then there's us who from all of that input, we then carry out all the physical management and all of the health and safety management as well. So we're kind of like the face of the site.

Interviewees often mentioned other interviewees, for example Ben (Grass Roof) was referred to in two separate interviews. Interviewees also mentioned fellow organisations; Buglife frequently recurred as a key partner. Colin (UEL) mentioned his work's connection with Buglife:

> We have a relationship where we provide some of the research that underpins the messages that go out from them and the guidance that goes out from them, so they've always been a key partner.

Successful partnership has led to saving brownfield sites from development, as Edward (Buglife) stated, referring to Canvey Wick:

> The majority of it was designated as a SSSI because of Buglife and some partners lobbying for it when the intention was the whole site to be redeveloped into a business park.

Nature After Minerals is deliberately a 'partnership programme' which works with a range of organisations to:

> bring all of these parties together and try and be an independent source for sharing best practice. [Also] to bring parties together to reflectively work and go in one direction to achieve and realise this potential. (Denise, NAM)

Coordinated management can overcome the problems surrounding brownfield management and conservation by allowing organisations to work more effectively with local authorities and other partner organisations and can even more than double an ecosystem's societal value [White et al., 2012]. Furthermore, social networks can also be highly beneficial in allowing different stakeholders to come together to solve natural resource dilemmas and problems and may allow more effective enforcement and compliance with environmental regulations than formal institutions [Bodin and Crona, 2009]. As brownfield conservation is a relatively niche sector of conservation biology (and brownfield engagement is an even smaller section of this), the effective use of coordinated management, social networks and collaboration is key to the success of these programmes. The interviewees' frequent mentions of each other and their reference to each other's work highlights these partnerships as playing significant roles in protecting brownfield sites and will enable the continual growth of this small but crucial area of conservation.

One of the partnerships most interviewees found to be challenging was that with developers. Ben and Colin suggested engagement with developers should be prioritised over engagement with local communities, as "they're the people that are destroying brownfields" (Ben, Grass Roof Company) and "when it comes to changing hearts and minds, the developer level can be more of a challenge" (Colin, UEL).

Some interviewees said it can be difficult to engage with developers as they often do not take invertebrate surveys into consideration in their planning, however Edward (Buglife) had a different experience: "If you get involved early enough, you can influence what they're doing and potentially build on the least valuable part of the site".

Whilst some interviewees attributed this challenge to developers having a set way of doing their work and not being trained to consider brownfield biodiversity, how developers perceive brownfield sites, compared to local residents, could also be a large factor. Although residents tend to prefer formal parks and more "artificial" green spaces, landscape planners prefer natural areas, with high species richness and low accessibility [Hofmann et al., 2012]. This suggests different engagement

approaches will be required for different groups, which is perhaps not yet the case. Despite the differences, residents accepted urban derelict land as long as there was a minimum of maintenance and accessibility, suggesting developers will need to account for residents' preferences when designing and maintaining green spaces [Hofmann et al., 2012]. This also highlights the need for more dialogue between residents and developers, to share their views on brownfields and learn from each other on how best these sites can be maintained and protected.

Historically, developers have seen brownfields as low priority areas for protection, neglecting them for other areas such as the suburbs and countryside [Lorimer, 2008]. Many planners and developers are genuinely surprised at the biodiversity that can be found in cities, highlighting their lack of knowledge about urban and brownfield ecology [Lorimer, 2008]. Recent work has led to effective collaboration between local authorities, environmental charities and private developers to help promote green urban spaces in the form of living roofs [Livingroofs Enterprises, 2018]. As participation can help increase public acceptance and use of brownfields, through understanding why and how residents use brownfields, policy-makers and planners can make better informed decisions on brownfield management [Cilliers, 2010].

In more recent years, developers have started to recognise conservation targets and, as some interviewees said, they recognise the benefits to their public image if they can give back to the environment. Denise was very positive about her experience of engaging with developers, saying there had been a 'shift' over the past decade in how developers can give back to society and the environment.

Financial incentives can also be an effective way of engaging developers with brownfield conservation. As with the success of conservation development projects [Milder and Clark, 2011], protecting a portion of the project site can be crucial for generating additional sources of funding and may even encourage developers to take a more ecological approach to other projects [Milder, Lassoie and Bedford, 2008].

As more targeted conservation engagement actions focus on specific stakeholders that have a direct influence on environmental management and conservation policies [Jiménez et al., 2014], more focus will need to be placed on developing novel engagement approaches that accommodate policy-makers, planners and developers and strengthen their collaboration with conservation organisations and residents.

Collaboration: image

The appearance of a site can greatly influence how likely someone is to engage with it. Brownfield sites are often perceived as ugly, unattractive areas that do not fit the British idyll of nature [Lorimer, 2008]. However, many people who use brownfields see these sites as the last remnants of wilderness. As Colin says, they have "kind of freedom and a kind of wilderness experience but [that] you just can't have in an urban context".

People's perceptions of beauty and aesthetics can greatly affect conservation. Roque de Pinho et al. [2014] found people's aesthetic judgements of wild animals

influenced their attitudes towards conservation, with a bias towards visually attractive animals. As brownfield wildlife is often floral, invertebrate, or undistinguished, brown and small, it can be difficult to gain widespread public support for the species living on these sites [Lorimer, 2008]. More recent attention has focused on how outreach initiatives can call attention to neglected "ugly" animals that are not as prevalent in public conservation campaigns [Roque de Pinho et al., 2014].

The aesthetic value people attach to wildlife is critical to the conservation of biodiversity [Lindemann-Matthies, Junge and Matthies, 2010]. Plant diversity is attractive, and people's aesthetic appreciation for natural areas increases with true species richness [Lindemann-Matthies, Junge and Matthies, 2010]. This suggests the aesthetic benefits of biodiversity to people should be factored into conservation and land management decisions [Sanderson et al., 2004; Jepson and Canney, 2003]. Moreover, as people respond positively to high species diversity, this suggests the conservation of diverse ecological communities should be a priority [Lindemann-Matthies, Junge and Matthies, 2010]. Despite brownfields often being perceived as not aesthetically pleasing, their high levels of biodiversity suggest there is a potential for people to appreciate these sites and attach value to them.

To increase people's appreciation for and engagement with urban ecology, much focus has been placed on the design and management of green space in urban environments. Spontaneous urban nature has made an important impact in alternative approaches to urban design that aim to enhance biodiversity in more unconventional and less regular ways [Gandy, 2013]. The success of the *Irchelpark* in Zurich and the High Line in New York City show that landscape designers and managers see the potential of producing specific ecological and aesthetic effects in urban environments [Gandy, 2013]. Some interviewees, for example Ben (Grass Roof Company) mentioned the importance of design in motivating engagement with brownfield sites: "it's all about the design it's all about glamour, it's all about taking the picture with the space when it's finished". Colin (UEL) suggested showcasing the wildlife of brownfield sites in formal garden design was "a valuable way of getting that message across".

As a visible and positive human influence is important for potential users to accept derelict land with wild-grown vegetation [Hofmann et al., 2012], unconventional approaches, such as Ben's grass roofs, will need to be taken towards the design and management of brownfields [Mathey et al., 2018]. Aesthetics play an important part in public engagement with conservation, so these motives should be linked with the spontaneous vegetation of brownfield sites, and also with traditional notions of orderliness to best meet the needs of the public and appeal to more residents to use and protect these pockets of urban wildlife [Mathey et al., 2018].

Community

Engagement with local communities is vital for the continued protection and management of brownfields and can also provide economic, health and social advantages.

Community: health and safety

Before specific programmes and methods to engage with local communities are formalised, full health and safety assessments and considerations of potential hazards should be carried out. Brownfields can have many barriers to safe access and engagement [Rupprecht, Byrne and Lo, 2016]. Perceptions of a lack of safety and littering were found to be the most critical concerns for use of informal greenspaces in Melbourne [Mahmoudi Farahani and Maller, 2019]. For effective engagement with local communities, health and safety issues should therefore be taken into consideration when planning management of brownfield sites [Mahmoudi Farahani and Maller, 2019].

Brownfield sites may have contaminated soils, piles of rubble and scrap metal, be covered in pulverised steel ash or have pockets beneath the surface. As Edward (Buglife) noted, people can "fall through the ground. So from a health and safety point of view, you can't really engage people with it".

Due to these hazards, staff roles often include managing the health and safety of brownfield sites to make them more accessible to visitors. As Anna (RSPB) describes part of her role is "making sure footpaths are in order, making sure everywhere is safe for people". As Colin (UEL) put it, often, brownfield sites are "seen as dumpsites for waste". However, part of Colin's research explores how the waste can become valuable habitats for biodiversity. Colin (UEL) explained how he works with others around brownfield waste:

> I link up with colleagues; they're looking at pathways for using waste and we look at creating aggregates because it can be used to create habitats that could be of value for these species.

Brownfields could not be so ecologically diverse without the hazards that accompany them. The contaminated soils allow diverse plant assemblages to thrive and encourage a range of animals to inhabit the mosaic of habitats [Hunter, 2014]. As Colin highlighted, waste and hazards can be effectively managed to not only decrease risk to potential visitors, but also to benefit the wildlife on the land.

Community: volunteers

The importance of volunteers in supporting brownfield conservation and engagement should not be overlooked. Many interviewees described how volunteers play an integral role in the conservation and engagement of brownfield sites. Fred (The Land Trust) expressed how a range of people volunteer on brownfields with The Land Trust, from friends-of groups to elderly people, providing many benefits such as improved resilience within a community.

As the RSPB are responsible for the upkeep of Canvey Wick, Anna (RSPB) stated how important volunteers are to their work maintaining the site: "without our volunteers, we wouldn't be able to do all the work that we do here".

Volunteers can also carry out ecological surveys on site through citizen science and using digital recording tools. Edward (Buglife) noted that this allows people to contact experts online with images for identification.

The increase over the last two decades in the involvement of volunteers in conservation programmes in the U.K. suggests a growing awareness of and interest in biological and environmental issues amongst conservation volunteers of a range of ages [Bell, 2003; Joint Nature Conservation Committee, 2020]. Volunteering may be beneficial not just for organisations, but also for the volunteers themselves and can create a 'community of advocates for conservation' [Bell, 2003]. However, several factors may inhibit people from volunteering, including a poor quality of management and organisation, inadequate training or educational opportunities, and insufficient understanding of the relevance of the project to conservation [Bell, 2003]. Some organisations attempt to overcome these issues. Ben (Grass Roof) spoke of including interpretation in his building work to provide context on the biology behind the work, including on bin shelters he had supplied to a housing estate in Wales. Organisations should offer opportunities for feedback and show appreciation and recognition of volunteers to ensure good relationships between staff and volunteers are maintained and for the programmes to be successful [Bell, 2003].

Edward (Buglife) discussed his work with offenders on community payback teams who help manage brownfield sites. Whilst this allows Buglife to engage people with brownfield conservation who otherwise may not be likely to visit the sites, the opportunity for learning can also facilitate the rehabilitation of inmates [LeRoy, 2015], showing the importance of working with a variety of volunteers and audiences.

Denise (NAM) emphasised the importance of volunteers in actively managing Paxton Pits Nature Reserve, a brownfield site nationally significant for its flora and fauna. As well as physically managing the site, The Friends of Paxton Pits group lead guided walks, organise and publicise events, help promote the reserve, raise funds and carry out ecological surveys [Huntingdonshire District Council, 2018]. The involvement in ecological surveys shows how Citizen Science (the public participation of non-scientists in scientific research; Johnson et al. [2014]) volunteer programmes at brownfield sites can play an important role in collecting ecological data, making science more inclusive, advocating for social change and enhancing connections between society and the environment [Agrawal, 2001; Conrad and Hilchey, 2011]. Volunteering is integral to the success of brownfield conservation and should be supported and encouraged.

Community: programmes and education

Organisations use a variety of activities and programmes to engage local communities with brownfields. Interviewees' activities and programmes that take place on site range from guided walks (Anna, RSPB), formal buggy walk activities (Fred, Land Trust) and bumblebee identification courses (Colin, UEL), and from the individual level to large groups. By offering a mix of conservation-focused activities, such as guided walks that will look for specific species on the site, and buggy walks where members of the public may or may not see different species along their way, organisations can cater to both the scientifically-minded and the non-specialists. This encourages a wide range of visitors to the site, and by offering different forms of activities, actively suggests any participation and engagement with the sites is valued.

Other projects involved organisations going to communities, as Colin described:

> One of my colleagues does a lot of work with the community around understanding why the green space is being designed the way it is, the historical value of it, the wildlife, how some of that wildlife is being retained within the sites and how they can learn to support that wildlife with what they do in their own garden.

Ben (Grass Roof Company) spoke of running events at his house, including a festival, which will allow attendees to "be able to see all the brownfield trials and we're going to do lots of walks and some of the workshops are going to be based on brownfield ideas".

Buglife's National Stepping Stones Project runs on the heels of their 'All of a Buzz in the Thames Gateway' project to show how important brownfields are for wildlife on a national scale. This has led to successful enhancement and conservation of brownfield habitat around the country, as Edward (Buglife) notes: "our stepping stones brownfield project has been successful. We're getting people out on sites, particularly [doing] habitat work and doing training workshops, those are really successful".

Interviewees mentioned projects to use education as an important tool for engaging local communities with brownfields. This can be especially useful, as those in more formal educational systems are more likely to be young people. Anna (RSPB) mentioned the importance of engaging with the younger generation "so [that] there are going to be people in future and beyond them to keep places like this nice".

Using brownfields as settings for outdoor learning can have major educational benefits, increasing the academic achievements of some pupils, as Fred describes:

> Their academic achievements will increase [as] even though they're learning in the same way, it's in an outdoor area. [They are] walking or running around rather than actually being sat in a classroom. For some kids that really works.

This shows organisations are using their sites as learning environments, both physically as outdoor education platforms and also by teaching pupils in schools about their ecological assemblages. Some organisations go into schools to teach pupils about brownfield techniques and processes. Ben described building outdoor classrooms and miniature green roofs in local schools, as well as supplying materials for their gardening clubs. Colin (UEL) spoke of plans to create a brownfield site from scratch, which could be used to teach local communities how brownfield processes happen in real time. People will be able to see exactly how succession takes place and watch the land transform from barren to thriving with wildlife. This is invaluable for putting science into a real-life context, helping people to understand how natural processes take place, whilst also increasing acceptance and appreciation of these sites amongst local communities. The importance of education as a tool for brownfield conservation and engagement should not be understated.

Community: social, health and economic benefits

Engagement with brownfields can provide many benefits for the local community, whether by improving the economy, people's health and wellbeing or public services. Interviewees spoke of working with local communities to help them "Understand the legacy of the sites" (Colin, UEL).

Anna (RSPB) spoke of engaging with local communities to "squeeze out all the anti-social issues [as] if there's more of a presence of good people here [at Canvey Wick] it puts off the negative behaviour".

Fred emphasised the important health benefits brownfields can bring to communities and how these spaces can be used for preventative health: "there are some quite decent health studies there showing the health of local communities really improved because of what we've done there".

The Land Trust has restored a site behind a hospital that is used by staff and patients and has been very successful in providing benefits to the community.

It is harder to find out exactly who is engaging with brownfield sites. When asked about demographics of people engaging with brownfield sites, interviewees gave vague or no answers. Colin (UEL) stated that the ages of who they engage with ranges from "anything from kids up to retirees" (Colin, UEL). Anna (RSPB noted that "people do come here from far around" (Anna, RSPB) and when asked about demographics, Edward (Buglife) replied "we don't actually record that information I'm afraid".

Colin (UEL) expressed interest in widening who they were engaging with:

> There is a very concerted effort to ensure that the people engaging with nature down there aren't the usual suspects. That they're creating a range of engagement opportunities that are suitable for all different interests rather than just events that some people already have that interest in.

The lack of in-depth information provided by the interviewees about the types of people they are engaging with is surprising and concerning. There tended to be a focus on age; while this suggests many brownfields are being used by people of a variety of ages, there is a lack of attention to whether people of different genders, ethnicities, and socio-economic backgrounds are engaging with brownfields. It is particularly important to recognise that people participating in public engagement come from a variety of experiences and backgrounds, rather than just representing a 'singular public' [Wilkinson and Weitkamp, 2016] but it is unclear whether organisations are engaging with people of a variety of 'publics'. Jiménez et al. [2014]'s findings that conservation outreach programmes in Spain were ignoring women and minority groups [Jiménez et al., 2014] is reinforced by Pandya [2012]'s research that Citizen Science participation does not reflect the demographics of the U.S.A. [Pandya, 2012]. Citizen Science, and other science engagement programmes, hold potential for science and society, but only if they remain diverse, open and supportive [Schäfer and Kieslinger, 2016]. Therefore, engagement programmes should be highly inclusive, which demands careful planning and knowledge of who these initiatives have the potential to reach.

Brownfield engagement programmes have the potential to reach those who may be less likely to be exposed to science or to enter the STEM workforce. There is a strong correlation between brownfields and socioeconomic deprivation, with more than 20% of brownfields located in the 10% most deprived areas of England [Wong and Schulze Bäing, 2010; Longo and Campbell, 2017]. As science workers from the highest income bracket are more than five times as likely to progress to a professional level occupation than those in the lowest household income bracket [The Royal Society, 2014], brownfields may be an excellent way of connecting people in more socioeconomically deprived areas with science.

The Thames Gateway is a hotbed for highly valuable brownfield sites, however two of its local authorities rank as the fourth (Tower Hamlets) and fifth (Hackney) most deprived local authorities in England, with high levels of unemployment, a wide disparity of income, poor health and lack of skills and educational achievement [Dixon, Pocock and Waters, 2005]. As residents in lower socio-economic areas tend to have less access to public green spaces, brownfields have the potential to offer unique interactions with nature for residents in these areas [Mahmoudi Farahani and Maller, 2019]. Given the educational, economic, social and even health benefits brownfields provide for communities, managed properly, these sites could greatly improve the value of life in more deprived areas and bring under-represented groups of people closer to nature and science.

The lack of demographic information from the interviewees could be a result of the questions asked being too vague. However, it could also be due to the interviewees being staff members of small businesses and environmental NGOs who may not have the funding or resources to do thorough evaluation and data collection of their engagement work. Nevertheless, this should be an important focus point when considering brownfield engagement, if science is to be an inclusive space.

Conclusions

This small-scale study provides insights into the variety of ways some organisations are engaging local communities with brownfields, with implications of what the future holds for brownfield conservation and engagement. The emergence of significant themes, including working with developers, the lack of demographic information and the design and management of sites could provide the basis for further research in this area. Future research from themes generated by the study could focus on asking a series of specific questions to a wider variety of participants, potentially allowing for a deeper understanding of brownfield engagement and creating a fuller picture of this small but growing area.

The theme of developers was a particularly interesting topic, with interviewees offering mixed responses. To gain further understanding of how developers and urban conservation intersect, engaging with developers and planners could provide insights into how they work with organisations and local communities. Additionally, engaging with residents who regularly use brownfields could also provide more context for how organisations' initiatives are affecting them and if their perceptions of brownfields have changed. Although not explored in this research, the economic divide between the north and south of England and its effects on the redevelopment of brownfields could also be a stepping stone to further research. As there are fewer brownfields in-use in the north of England than in the south it would be interesting to see what potential these have for

engaging local communities with nature, especially as opposed to in the south, where more brownfields are already under planning permission.

As urban ecosystems are becoming more better understood and appreciated by scientists and the public, brownfields are being more recognised for their role as wildlife havens and the benefits they can bring to the environment and society. However, there is still a long way to go before brownfield sites are included when people think about conservation in Britain. The variety of ways organisations are engaging local communities with these sites is vital for their conservation and safeguarding for the future. As more knowledge is built up about these unique ecological spaces, more people can be involved in helping to protect the modern natural world.

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References

Agrawal, A. (2001). 'Common property institutions and sustainable governance of resources'. *World Development* 29 (10), pp. 1649–1672. https://doi.org/10.1016/S0305-750X(01)00063-8.

Angold, P. G., Sadler, J. P., Hill, M. O., Pullin, A., Rushton, S., Austin, K., Small, E., Wood, B., Wadsworth, R., Sanderson, R. and Thompson, K. (2006). 'Biodiversity in urban habitat patches'. *Science of the Total Environment* 360 (1–3), pp. 196–204. https://doi.org/10.1016/j.scitotenv.2005.08.035.

Atkinson, R. and Flint, J. (2001). 'Accessing hidden and hard-to-reach populations: snowball research strategies'. *Social Research Update* 33. URL: http://sru.soc.surrey.ac.uk/SRU33.PDF (visited on 21st July 2019).

Barkham, P. (2017). 'Canvey Wick: the Essex 'rainforest' that is home to Britain's rarest insects'. *The Guardian*. URL: https://www.theguardian.com/lifeandstyle/2017/oct/15/canvey-wick-the-essex-rainforest-that-is-home-to-britains-rarest-insects (visited on 21st July 2019).

Bell, K. (2003). Assessing the benefits for conservation of volunteer involvement in conservation activities. Science for Conservation 223. Wellington, New Zealand: Department of Conservation.

Bodin, Ö. and Crona, B. I. (2009). 'The role of social networks in natural resource governance: what relational patterns make a difference?' *Global Environmental Change* 19 (3), pp. 366–374. https://doi.org/10.1016/j.gloenvcha.2009.05.002.

Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J. and Parrish, J. K. (2014). 'Next steps for citizen science'. *Science* 343 (6178), pp. 1436–1437. https://doi.org/10.1126/science.1251554.

Braun, V. and Clarke, V. (2006). 'Using thematic analysis in psychology'. *Qualitative Research in Psychology* 3 (2), pp. 77–101. https://doi.org/10.1191/1478088706qp063oa.

Brewer, C. (2002). 'Outreach and partnership programs for conservation education where endangered species conservation and research occur'. *Conservation Biology* 16 (1), pp. 4–6. URL: https://www.jstor.org/stable/3061395.

British Ecological Society (2015). *Making urban ecology count*. URL: https://www.britishecologicalsociety.org/making-urban-ecology-count/ (visited on 21st July 2019).

Buglife (2019). *Brownfields*. URL: https://www.buglife.org.uk/campaigns-and-our-work/habitat-projects/brownfields (visited on 21st July 2019).

Ceballos, G., Ehrlich, P. R. and Dirzo, R. (2017). 'Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines'. *Proceedings of the National Academy of Sciences* 114 (30), E6089–E6096. https://doi.org/10.1073/pnas.1704949114.

Chicago Wilderness (2018). *Chicago Wilderness*. URL: https://www.chicagowilderness.org/default.aspx.

Cilliers, S. (2010). 'Social aspects of urban biodiversity — an overview'. In: Urban biodiversity and design. Ed. by N. Müller, P. Werner and J. G. Kelcey. Oxford, U.K.: Blackwell Publishing, pp. 81–100. https://doi.org/10.1002/9781444318654.ch4.

Clarke, V. and Braun, V. (2013). 'Teaching thematic analysis: overcoming challenges and developing strategies for effective learning'. *The Psychologist* 26 (2), pp. 120–123.

Cohen, D. and Crabtree, B. (2006). 'Qualitative Research Guidelines Project. Semi-structured interviews'. *Robert Wood Johnson Foundation*. URL: http://www.qualres.org/HomeSemi-3629.html (visited on 21st July 2019).

Conrad, C. C. and Hilchey, K. G. (2011). 'A review of citizen science and community-based environmental monitoring: issues and opportunities'. *Environmental Monitoring and Assessment* 176 (1–4), pp. 273–291. https://doi.org/10.1007/s10661-010-1582-5.

Dixon, T., Pocock, Y. and Waters, M. (2005). The role of the UK development industry in brownfield regeneration. Stage 2 Report. Volume 2 (of 3): Sub-regional context (Thames Gateway and Greater Manchester). College of Estate Management. URL: https://www.ucem.ac.uk/wp-content/uploads/2016/01/brownfieldvol2.pdf (visited on 21st July 2019).

Doick, K. and Hutchings, T. (2007). Greenspace establishment on brownfield land: the site selection and investigation process. Edinburgh, U.K.: Forestry Commission. URL: https://www.forestresearch.gov.uk/documents/1701/fcin091.pdf (visited on 21st July 2019).

Evans, C., Abrams, E., Reitsma, R., Roux, K., Salmonsen, L. and Marra, P. P. (2005). 'The Neighborhood Nestwatch Program: participant outcomes of a citizen-science ecological research project'. *Conservation Biology* 19 (3), pp. 589–594. https://doi.org/10.1111/j.1523-1739.2005.00s01.x.

Evely, A. C., Pinard, M., Reed, M. S. and Fazey, I. (2011). 'High levels of participation in conservation projects enhance learning'. *Conservation Letters* 4 (2), pp. 116–126. https://doi.org/10.1111/j.1755-263X.2010.00152.x.

Eyre, M. D., Luff, M. L. and Woodward, J. C. (2003). 'Beetles (Coleoptera) on brownfield sites in England: an important conservation resource?' *Journal of Insect Conservation* 7 (4), pp. 223–231. https://doi.org/10.1023/B:JICO.0000021020.66549.1e.

Gallo-Cajiao, E., Archibald, C., Friedman, R., Steven, R., Fuller, R. A., Game, E. T., Morrison, T. H. and Ritchie, E. G. (2018). 'Crowdfunding biodiversity conservation'. *Conservation Biology* 32 (6), pp. 1426–1435. https://doi.org/10.1111/cobi.13144.

Gandy, M. (2013). 'Marginalia: aesthetics, ecology, and urban wastelands'. *Annals of the Association of American Geographers* 103 (6), pp. 1301–1316. https://doi.org/10.1080/00045608.2013.832105.
Grant, G. (2006). 'Extensive green roofs in London'. *Urban Habitats* 4 (1), pp. 51–65.
Grimski, D. and Ferber, U. (2001). 'Urban brownfields in Europe'. *Land Contamination & Reclamation* 9 (1), pp. 143–148.
Harper, M. (2015). 'Brownfield land — for home or nature, but definitely not for climate'. *The RSPB Community. Martin Harper's Blog*. URL: https://community.rspb.org.uk/ourwork/b/martinharper/posts/brownfield-land-for-homes-or-nature-but-definitely-not-for-climate (visited on 21st July 2019).
Hofmann, M., Westermann, J. R., Kowarik, I. and van der Meer, E. (2012). 'Perceptions of parks and urban derelict land by landscape planners and residents'. *Urban Forestry & Urban Greening* 11 (3), pp. 303–312. https://doi.org/10.1016/j.ufug.2012.04.001.
Hostetler, M. and Feinberg, D. (2015). 'What do developers think about managing for biodiversity in conservation developments?' *The Nature of Cities*. URL: https://www.thenatureofcities.com/2015/01/25/what-do-developers-think-about-managing-for-biodiversity-in-conservation-developments/ (visited on 21st July 2019).
Hunter, P. (2014). 'Brown is the new green: brownfield sites often harbour a surprisingly large amount of biodiversity'. *EMBO Reports* 15 (12), pp. 1238–1242. https://doi.org/10.15252/embr.201439736.
Huntingdonshire District Council (2018). *Friends of Paxton Pits & volunteering*. URL: http://www.huntingdonshire.gov.uk/leisure/parks-nature-reserves-and-green-spaces/paxton-pits-nature-reserve/friends-of-paxton-pits-volunteering/ (visited on 21st July 2019).
Ishimatsu, K. and Ito, K. (2013). 'Brown/biodiverse roofs: a conservation action for threatened brownfields to support urban biodiversity'. *Landscape and Ecological Engineering* 9 (2), pp. 299–304. https://doi.org/10.1007/s11355-011-0186-8.
Jepson, P. and Canney, S. (2003). 'Values-led conservation'. *Global Ecology and Biogeography* 12 (4), pp. 271–274. URL: https://www.jstor.org/stable/3697489.
Jiménez, A., Iniesta-Arandia, I., Muñoz-Santos, M., Martín-López, B., Jacobson, S. K. and Benayas, J. (2014). 'Typology of public outreach for biodiversity conservation projects in Spain'. *Conservation Biology* 28 (3), pp. 829–840. https://doi.org/10.1111/cobi.12220.
Johnson, M. F., Hannah, C., Acton, L., Popovici, R., Karanth, K. K. and Weinthal, E. (2014). 'Network environmentalism: citizen scientists as agents for environmental advocacy'. *Global Environmental Change* 29, pp. 235–245. https://doi.org/10.1016/j.gloenvcha.2014.10.006.
Joint Nature Conservation Committee (2020). *A2. Taking action for nature: volunteer time spent in conservation*. URL: http://jncc.defra.gov.uk/page-4253.
Kallio, H., Pietilä, A.-M., Johnson, M. and Kangasniemi, M. (2016). 'Systematic methodological review: developing a framework for a qualitative semi-structured interview guide'. *Journal of Advanced Nursing* 72 (12), pp. 2954–2965. https://doi.org/10.1111/jan.13031.
Kark, S., Tulloch, A., Gordon, A., Mazor, T., Bunnefeld, N. and Levin, N. (2015). 'Cross-boundary collaboration: key to the conservation puzzle'. *Current Opinion in Environmental Sustainability* 12, pp. 12–24. https://doi.org/10.1016/j.cosust.2014.08.005.

LeRoy, C. J. (2015). 'Bringing science inside prison walls'. *Science* 348 (6234), p. 511. https://doi.org/10.1126/science.348.6234.511-b.

Lindemann-Matthies, P., Junge, X. and Matthies, D. (2010). 'The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation'. *Biological Conservation* 143 (1), pp. 195–202. https://doi.org/10.1016/j.biocon.2009.10.003.

Livingroofs Enterprises (2018). *The UK's leading independent green roof website*. URL: https://livingroofs.org/ (visited on 21st July 2019).

Longo, A. and Campbell, D. (2017). 'The determinants of brownfields redevelopment in England'. *Environmental and Resource Economics* 67 (2), pp. 261–283. https://doi.org/10.1007/s10640-015-9985-y.

Lorimer, J. (2008). 'Living roofs and brownfield wildlife: towards a fluid biogeography of UK nature conservation'. *Environment and Planning A: Economy and Space* 40 (9), pp. 2042–2060. https://doi.org/10.1068/a39261.

Mahmoudi Farahani, L. and Maller, C. (2019). 'Investigating the benefits of 'leftover' places: residents' use and perceptions of an informal greenspace in Melbourne'. *Urban Forestry & Urban Greening* 41, pp. 292–302. https://doi.org/10.1016/j.ufug.2019.04.017.

Mathey, J., Arndt, T., Banse, J. and Rink, D. (2018). 'Public perception of spontaneous vegetation on brownfields in urban areas — Results from surveys in Dresden and Leipzig (Germany)'. *Urban Forestry & Urban Greening* 29, pp. 384–392. https://doi.org/10.1016/j.ufug.2016.10.007.

Milder, J. C. and Clark, S. (2011). 'Conservation development practices, extent, and land-use effects in the United States'. *Conservation Biology* 25 (4), pp. 697–707. https://doi.org/10.1111/j.1523-1739.2011.01688.x.

Milder, J. C., Lassoie, J. P. and Bedford, B. L. (2008). 'Conserving biodiversity and ecosystem function through limited development: an empirical evaluation'. *Conservation Biology* 22 (1), pp. 70–79. https://doi.org/10.1111/j.1523-1739.2007.00812.x.

Miller, J. R. (2005). 'Biodiversity conservation and the extinction of experience'. *Trends in Ecology & Evolution* 20 (8), pp. 430–434. https://doi.org/10.1016/j.tree.2005.05.013.

Mullin, K., Mitchell, G., Nawaz, N. R. and Waters, R. D. (2018). 'Natural capital and the poor in England: towards an environmental justice analysis of ecosystem services in a high income country'. *Landscape and Urban Planning* 176, pp. 10–21. https://doi.org/10.1016/j.landurbplan.2018.03.022.

Natural England (1998). *Brownfield: red data — The values artificial habitats have for uncommon invertebrates (ENRR273)*. URL: http://publications.naturalengland.org.uk/publication/127046.

— (2015). *Monitor engagement with the natural environment: annual report from the 2013–2014 survey*. URL: http://publications.naturalengland.org.uk/publication/6579788732956672 (visited on 28th February 2021).

Noy, C. (2008). 'Sampling knowledge: the hermeneutics of snowball sampling in qualitative research'. *International Journal of Social Research Methodology* 11 (4), pp. 327–344. https://doi.org/10.1080/13645570701401305.

Oxford, M. (2013). Ecological capacity and competence in local planning authorities: what is needed to deliver statutory obligations for biodiversity? Association of Local Government Ecologists.

Pandya, R. E. (2012). 'A framework for engaging diverse communities in citizen science in the US'. *Frontiers in Ecology and the Environment* 10 (6), pp. 314–317. https://doi.org/10.1890/120007.

Parliament of the United Kingdom (2006). *Natural Environment and Rural Communities Act 2006*. Chapter 16. URL: https://www.legislation.gov.uk/ukpga/2006/16/pdfs/ukpga_20060016_en.pdf (visited on 21st July 2019).

Pyle, R. M. (1978). 'The extinction of experience'. *Horticulture* 56 (1), pp. 64–67.

Robins, J., Henshall, S. and Farr, A. (2013). The state of brownfields in the Thames Gateway. Buglife. URL: https://cdn.buglife.org.uk/2019/07/The-State-of-Brownfields-in-the-Thames-Gateway.pdf.

Roque de Pinho, J., Grilo, C., Boone, R. B., Galvin, K. A. and Snodgrass, J. G. (2014). 'Influence of aesthetic appreciation of wildlife species on attitudes towards their conservation in Kenyan agropastoralist communities'. *PLoS ONE* 9 (2), e88842. https://doi.org/10.1371/journal.pone.0088842.

Rupprecht, C. D. D., Byrne, J. A. and Lo, A. Y. (2016). 'Memories of vacant lots: how and why residents used informal urban green space as children and teenagers in Brisbane, Australia, and Sapporo, Japan'. *Children's Geographies* 14 (3), pp. 340–355. https://doi.org/10.1080/14733285.2015.1048427.

Sanderson, M. A., Skinner, R. H., Barker, D. J., Edwards, G. R., Tracy, B. F. and Wedin, D. A. (2004). 'Plant species diversity and management of temperate forage and grazing land ecosystems'. *Crop Science* 44 (4), pp. 1132–1144. https://doi.org/10.2135/cropsci2004.1132.

Schadek, U., Strauss, B., Biedermann, R. and Kleyer, M. (2009). 'Plant species richness, vegetation structure and soil resources of urban brownfield sites linked to successional age'. *Urban Ecosystems* 12 (2), pp. 115–126. https://doi.org/10.1007/s11252-008-0072-9.

Schäfer, T. and Kieslinger, B. (2016). 'Supporting emerging forms of citizen science: a plea for diversity, creativity and social innovation'. *JCOM* 15 (02), Y02. https://doi.org/10.22323/2.15020402.

Schultz, P. W. (2000). 'New environmental theories: empathizing with nature: the effects of perspective taking on concern for environmental issues'. *Journal of Social Issues* 56 (3), pp. 391–406. https://doi.org/10.1111/0022-4537.00174.

Small, E. C., Sadler, J. P. and Telfer, M. G. (2002). 'Carabid beetle assemblages on urban derelict sites in Birmingham, UK'. *Journal of Insect Conservation* 6 (4), pp. 233–246. https://doi.org/10.1023/A:1024491111572.

Smith, R. M., Warren, P. H., Thompson, K. and Gaston, K. J. (2006). 'Urban domestic gardens (VI): environmental correlates of invertebrate species richness'. *Biodiversity & Conservation* 15 (8), pp. 2415–2438. https://doi.org/10.1007/s10531-004-5014-0.

The Guardian (2016). *Percentage of global population living in cities, by continent*. URL: https://www.theguardian.com/news/datablog/2009/aug/18/percentage-population-living-cities (visited on 21st July 2019).

The Royal Society (2014). A picture of the UK scientific workforce. Diversity data analysis for the Royal Society. Summary report. London, U.K.: The Royal Society. URL: https://royalsociety.org/-/media/Royal_Society_Content/policy/projects/leading-way-diversity/picture-uk-scientific-workforce/070314-diversity-report.pdf.

The Royal Society for the Protection of Birds (2018). *Canvey Wick Nature Reserve*. URL: https://www.rspb.org.uk/reserves-and-events/reserves-a-z/canvey-wick/ (visited on 21st July 2019).

The Wildlife Trusts (2019). *Brownfield*. URL: https://www.wildlifetrusts.org/habitats/towns-and-gardens/brownfield (visited on 21st July 2019).

Tong, A., Sainsbury, P. and Craig, J. (2007). 'Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups'. *International Journal for Quality in Health Care* 19 (6), pp. 349–357. https://doi.org/10.1093/intqhc/mzm042.

Weitkamp, E. and Longhurst, J. (2012). 'Mediating consultation: insights from private sector consultants involved in air quality consultations'. *Journal of Environmental Planning and Management* 55 (1), pp. 113–125. https://doi.org/10.1080/09640568.2011.583064.

White, C., Costello, C., Kendall, B. E. and Brown, C. J. (2012). 'The value of coordinated management of interacting ecosystem services'. *Ecology Letters* 15 (6), pp. 509–519. https://doi.org/10.1111/j.1461-0248.2012.01773.x.

Wilkinson, C. and Weitkamp, E. (2016). Creative research communication: theory and practice. Manchester, U.K.: Manchester University Press.

Wong, C. and Schulze Bäing, A. (2010). Brownfield residential redevelopment in England. What happens to the most deprived neighbourhoods? York, U.K.: Joseph Rowntree Foundation.
URL: https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/brownfield-residential-redevelopment-full.pdf.

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