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Designing for Wild Life: Enabling City Dwellers to Cohabit with Nature

Moxon, Siân
London Metropolitan University, London, UK
s.moxon@londonmet.ac.uk

People benefit from living alongside nature. Yet we face a troubling scenario of alarming global biodiversity decline, vast loss of greenspace to urbanisation, and harmful disconnection of city dwellers with nature. This is a particular problem in existing residential streets, which make up a significant proportion of UK cities and could offer substantial greenspace and wildlife habitat.

Living with increased contact with nature, people would benefit from better health and wellbeing. Moreover, greening the city would improve air quality, and reduce overheating and flood risk. But policy to increase greenspace and its biodiversity focuses on the easy target of new developments and public spaces; and guidance for the public lacks urban emphasis, street-scale thinking and design oversight. Meanwhile, management of greenspace in domestic gardens is largely unregulated and residents underestimate its importance for environmental functions, including providing wildlife habitat.

Design research could enable city residents to change how they live, with designers using their skills to communicate a better way to live alongside nature in cities. A practice-based case study, 'Rewild My Street', seeks to inspire and empower London residents to adapt their own homes, gardens and streets for wildlife. Through architectural drawings, product specification and a spatial manifesto, the project shows a vision of a residential city street adapted for living in harmony with nature. This offers a design-led template for creating a global network of biodiverse, sustainable cities.

Keywords: living; biodiversity; greenspace; architecture; urban rewilding; residential; National Park cities

1 Research Focus: Designing Nature into the City

People benefit from living alongside nature, especially in cities. Spending time in a natural environment lowers our pulse rate, blood pressure and cortisol levels (Park, Tsunetsugu, Kasetani, Kagawa & Miyazaki, 2010), and makes us feel mentally restored (White, Phal, Ashbullby, Herbert & Depledge, 2013). This perhaps explains why people living in urban areas with more green space report better general health (Maas, Verheij, Groenewegen, de Vries & Spreeuwenberg, 2006). Greenery can help tackle environmental and social problems associated with cities: improving air quality by blocking and dispersing pollutants

(Air Quality Expert Group 2018); reducing overheating and surface flooding through shading, evapotranspiration and infiltration (Blanusa & Page, 2011); and even reducing crime (Kuo & Sullivan, 2001). Further, places that are good for wildlife tend to be good for people. The more biodiverse an urban greenspace the more it benefits our psychological wellbeing (Fuller, Irvine, Devine-Wright, Warren & Gaston, 2007). Greening cities for biodiversity therefore benefits human inhabitants by enhancing their health and wellbeing, and improving their living environment.

Despite the benefits of nature to humankind, we are causing alarming global biodiversity decline, vast loss of greenspace to urbanisation, and harmful disconnection of city dwellers with nature. Global wildlife populations have suffered a 60% decline since 1970, due to human activity (Grooten & Almond, 2018). City greenspace, with value for wildlife and people, is being lost through the parallel phenomena of urban sprawl (WWF, 2017) and densification (Haaland & Konijnendijk van den Bosch, 2015). Reducing our access to greenspace in this way is akin to self-harm, when a correlation has been shown between contact with nature and human life expectancy (Poudyal, Hodges, Tonn & Cho, 2009).

Loss of vegetation is a particular problem in existing residential gardens, which make up one quarter of a typical UK city (Thompson, 2019) and could offer substantial wildlife habitat (Blanusa & Page, 2011). A quarter of UK front gardens are entirely paved, reflecting a threefold increase in the past decade (RHS, 2019).

London is a case in point, losing greenspace at a rate of 2.5 Hyde Parks annually as a result of changes in domestic gardens (Smith, 2010). These changes concern the replacement of trees, lawns and flowerbeds with hard surfaces and outbuildings, dramatically reducing the biodiversity value of the individual gardens and, moreover, their cumulative value to the neighbourhood and overall city (Smith, 2010). The London Wildlife Trust therefore identifies a need for urban versions of rural rewilding projects to restore greenery and biodiversity (Frith, 2016; Rewilding Britain, 2014). This will be difficult when residents underestimate the importance of their gardens for environmental functions, such as providing wildlife habitat (Smith, 2010).

The paper explores whether design could take on this challenge by influencing city dwellers to rewild their own residential streets. This is analysed through a case study that seeks to provide a model for the redevelopment of London, and, ultimately, a global network of biodiverse cities.

The study therefore tackles the research question, ‘Could a vision of a rewilded urban street engage residents to adapt their homes for wildlife?’ This raises the sub-questions:

- How should a vision of living with nature be communicated to inspire the public?
- How can the vision be informative to enable residents to carry out the adaptations shown?
- How should wildlife features be sensitively integrated within an existing urban context?
- How can the vision allow for diversity in its interpretation?
- How can vision drawings be used to organise expert external guidance and make it relevant to urban contexts?

This research addresses the Living track by aiming to use design to shape how people live in relation to nature, and to make cities better for both the people who live in them and the

diverse wildlife that could live in them. It explores how design can enhance our lives by improving the environment, at both the local and global scales: locally, by making city streets more liveable, increasing city residents' access to greenspace and contact with nature; and globally, by mitigating biodiversity loss and the effects of climate change. It seeks to use design to influence the way people think about their street's potential for urban wildlife, and the actions people take or products people buy to make their homes more biodiverse.

2 Research Context: Other Research, Policy and Guidance

The current context sees biodiversity research focused on new-build housing; guidance for the public lacking urban emphasis, street-scale thinking and design oversight; and policy to increase greenspace and its biodiversity focused on new developments and public spaces.

2.1 Biodiversity and Housing Research

Other research aims to address biodiversity decline through housing design. Barratt Homes and the Royal Society for the Protection of Birds (RSPB) are jointly studying biodiversity in new-build housing with integral wildlife features (Thomas, 2018). This study is on a greenfield site and aimed at changing how people live by influencing new-build developers, rather than residents of existing, urban housing stock.

2.2 Biodiversity Guidance

Several organisations offer expert online advice to encourage the public to manage their gardens for greenery and wildlife. These include RSPB's 'Give Nature a Home' (RSPB, 2019) and the Royal Horticultural Society's (RHS's) 'Greening Grey Britain' (RHS, 2019) campaigns. Conservation bodies, such as RSPB and the Wildlife Trusts, have information about particular species and habitats on their websites. This guidance is not design-based and tends to focus on adaptations to individual gardens, with limited consideration of buildings or streets; it is nationwide, therefore not specific to urban contexts.

Some conservation organisations recommend wildlife products for particular species. However, there is a lack of design-based advice on selecting products for integration in urban settings.

A number of community-based demonstration projects are helping city residents implement changes to their environment for wildlife. These include the Wildlife Trusts' 'My Wild City' in Bristol (Avon Wildlife Trust, 2019), and wildlife garden award scheme in Exeter (Devon Wildlife Trust, 2019); and Earthwatch Institute's 'Naturehoods' in Oxford and Swindon (2019). These are on-the-ground projects without a design agenda of creating a masterplan for sensitively integrating wildlife provision within streets.

2.3 Biodiversity and Green Infrastructure Policy

UK targets are in place to protect biodiversity (HM Government, 2011). Biodiversity policy in the UK includes a chapter of the national 'Strategy for Sustainable Construction' (HM Government, 2008), the Mayor of London's regional 'Environment Strategy' (2018), and biodiversity planning guidance for some local authorities (Hackney Council, 2011). These all focus on new developments or public spaces, rather than existing, residential streets.

Regulation can do little to change the impact of private garden management when existing gardens are largely beyond the remit of local government (Gaston, Smith, Thompson & Warren, 2005). Policies that do exist restrict the area of front gardens that can be paved over without planning permission (Communities and Local Government & Environment Agency,

2008), removal of trees with significant amenity value to a neighbourhood (Communities and Local Government, 2012) and unacceptable housing development within back gardens (Smith, 2010). These were not implemented for the direct benefit of biodiversity and do not therefore stipulate protecting vegetation, hedges and shrubs, or controlling the construction of garden outbuildings.

The study aims to address gaps in the above research and guidance by tackling existing urban housing at street scale and taking a new perspective centred on design research. It intends to reframe the existing guidance for urban residents and signpost it with design oversight. It seeks to circumnavigate the shortcomings in policy by using design models to enable community action.

3 Methods: Architectural Design Process

3.1 London Setting

The context of London was chosen for the study, as the capital has aspirations to celebrate and increase its greenspace, yet is particularly affected by loss of garden wildlife habitat.

The capital already boasts 47% green and blue space (Mayor of London, 2018), despite being the UK's most populous conurbation (Office for National Statistics, 2018). Its greenness has been acknowledged by official recognition as the world's first National Park City (London National Park City, 2019). This is bolstered by targets from the National Park City Foundation to make the city 'greener, healthier and wilder' (London National Park City, 2019), and from the Mayor of London to add 12% tree cover and raise greenspace to 50% by 2050 (Mayor of London, 2018).

Private gardens will be important in achieving this, as they constitute nearly a quarter of the capital's land area and connect other habitats (Mayor of London, 2018), but a ten-year study found hard surfaces in the city's domestic gardens had increased by 26%, while vegetation decreased by 12%, having a notable adverse impact on their value as wildlife habitat (Smith, 2010).

In light of the limitations of regulation in gardens, there is a need to educate Londoners on the contribution their gardens make to the city's overall greenspace and biodiversity, and on how to adapt and manage their own gardens with this in mind. This could in turn encourage communities to lobby their borough councils to make changes to their streetscape. A new model for implementing policy by empowering communities is therefore needed.

The case study project, Rewild My Street, was set up to provide this model by creating a design vision and guidance to inspire and empower Londoners to adapt their homes for wildlife.

3.2 Architectural Design Process

The project used practice-based design research methods to interrogate the aforementioned research questions. Specifically, it followed the architectural practice research methods promoted by the Royal Institute of British Architects (RIBA, Research in Practice, 2013). An expert design team followed an iterative design and drawing process to test ideas, using architecture, landscape and urban design thinking. The process consisted of activities mapped to project Work Stages 0 to 3, as set out in the RIBA's Plan of Work (2013), which are routinely followed by practicing architects in the UK.

3.2.1 Stage 0: Strategic Definition

The first stage involved identifying the strategic brief and assembling the design team.

The strategic brief derived from the primary research question, ‘Could a vision of a rewilded urban street engage residents to adapt their homes for wildlife?’, which set the strategy to develop a vision of a rewilded urban residential street. The design was applied to the baseline of a notional typical London residential street, defined in the study by the Victorian (1837-1901) terraced housing typology, due to its prevalence in most London boroughs. Given the urban context, the definition of ‘rewilding’ as ‘returning areas of land to a wild state, including the reintroduction of animal species that are no longer naturally found there’ (Harper Collins, 2019) was reinterpreted to mean that the proposed design should return a street to a greener, more biodiverse state by adapting it to accommodate a wide variety of plant and animal life. In terms of the scope of the design, ‘homes’ were taken to mean all parts of the private domain, including the house, front and rear garden, and outbuildings; the definition also extends to the street, while acknowledging that this would usually be in public ownership and that residents would therefore need to petition their local council to make interventions here.

The project was carried out by a design team with relevant expertise, led by an architect. The team consists of architects and ecologists. Design is inextricably linked to the designer’s personal perspective, so it was necessary that the architects could draw on years of experience in practice, including expertise in existing and residential buildings in London; as well as specialist knowledge in sustainable design, including design for biodiversity. Similarly, the ecologists, who were consulted for feedback on the proposals at key stages of the project, needed to be proficient in providing consultancy for biodiverse London developments. These personal perspectives enabled the design team to understand the subject and make considered design decisions.

3.2.2 Stage 1: Preparation and Brief

This stage required the architects to develop project objectives, including project outcomes; develop the project brief; and review site information.

The research sub-questions determined the project objectives: to communicate a vision of living with nature in a way that should inspire the public; to make that vision informative, so that residents could carry out adaptations to their homes; to sensitively integrate wildlife features within an existing urban context; to allow diversity of implementation options; and to use drawings to organise expert external guidance and make it relevant to urban contexts.

To achieve these objectives, the project outcome was decided as a set of architectural drawings accompanied by a spatial manifesto and compiled in an online resource. These would show how the notional typical residential street could be adapted to increase its biodiversity. The drawings would consist of a concept collage; and street-scale plan, elevation, sectional perspective and isometric projections at 1:1250. The project brief was developed to work towards this outcome.

Information was gathered on a notional site by visiting and researching photographs of Victorian homes and streets, then surveying a typical Victorian house and street to create an accurate drawing using Computer Aided Design (CAD) software.

3.2.3 Stage 2: Concept Design

In this stage, activities included preparing concept designs and finalising the brief.

Concept designs were made using hand-drawn, annotated sketches. These went through many iterations to arrive at a template for what information would be included on each drawing.

Figure 1. Sketch for sectional perspective drawing. Source: Siân Moxon

The design concept of a rewilded urban street was consolidated by producing a concept collage, using image-editing software. This depicted a grey existing street overlaid with planting and recolonised by diverse species of wildlife that could be found in an urban setting.

Figure 2. Concept Collage showing project vision. Source: Siân and Jon Moxon (with altered photographs courtesy of Daniel Case, Super.lukas, Didier Descouens, Ninjatacoshell, Peter Mulligan, Claus Rebler, Karen Arnold, Potapov Alexander/Shutterstock).

The concept was developed by writing the following spatial manifesto, which describes the project vision in words:

> Take a typical London residential street. Adapt its terraces, gardens and streetscape to transform it into a haven for wildlife. The street will come back to life: the bees will be buzzing, the birds will be singing, the frogs will be hopping and the owls will be hooting. The changing seasons and the pattern of day and night will be seen from every living room - while children growing up on the street will have nature on their doorsteps.
>
> No more paved over front gardens, no more felled street trees, no more synthetic lawns. Bring back real greenery and real life. Every small change will add up to make a big difference.
>
> Just add wildflower meadows, patio ponds, bird boxes and feeders, and insect hotels. Puncture the fences to link up back gardens, forming mammal corridors. And watch the wildlife return in droves.
>
> While addressing the alarming decline in biodiversity, the newly green streets will improve air quality, and lessen urban overheating and flood risk associated with climate change. Londoners will benefit from improved health and wellbeing through better access to nature.
>
> Gardens cover a quarter of London and existing buildings will remain with us for years to come. For a lasting legacy, we must enable these spaces to accommodate nature, turning the whole city into a National Park to make future generations proud. Rewild My Street will do exactly this.

The brief was developed by analysing precedents that were judged to present design information in an engaging and informative way. These included visual communication techniques, such as infographics, and other design-research projects, such as ‘A Pattern Language’ (Alexander, Ishikawa, Silverstein, Jacobson, Fiksdahl-King & Shlomo, 1977) and the ‘101 Rules of Thumb’ series (Heywood, 2013 & 2015). These make engaging use of drawings and diagrams as templates for architecture and sustainable design, respectively, which could be applied to illustrate design for biodiversity for a lay audience. Qualities contributing to their effectiveness were identified as simplicity, use of hand drawing and colour, and use of focused annotation.

This research helped to establish effective presentation methods that would be used to produce the final drawings. It was decided to use hand-drawn line drawings, rendered using image-editing software for most of the drawings. The aerial view was produced using image-editing software alone, as the designers felt this three-dimensional view would benefit from a different character to set it apart from the other, two-dimensional projections. The drawings would be cross-referenced through simple keys to external guidance on associated species, habitats, products and DIY activities to help people implement the depicted adaptations.

3.2.4 Stage 3: Detailed Design

This stage concerned preparing a developed design, including outline specifications.

The concept sketches were redrawn to scale on CAD to a basic level, then printed and overlaid to set up detailed drawings in pencil to form the basis of the hand drawings. At this stage, the drawing process was used to test ideas for how to successfully integrate wildlife measures into existing properties, targeting adaptations to encourage species likely to colonise urban settings. Once the design team was content with the proposals, the hand

drawings were traced over these as black line drawings, using two pen thicknesses to achieve the desired appearance of simplicity. These were scanned and embellished in image-editing software to show textures, colour, shadows, and inhabitation by people and animals.

Outline specification was informed by extensive product research, taking into consideration the recommendations of conservation organisations. Most of the products were either tested by the architects on a London residential property or inspected as samples. The ecologists were consulted to advise from their experience of testing products on built schemes. Preference was given to products manufactured by environmentally conscious companies, local to London or the UK.

3.2.5 Stages 4 to 7

The project is set up to empower residents to carry out Stages 4 to 7 of the RIBA Plan of Work (representing Technical Design, Construction, Handover and In Use) themselves, by giving practical guidance on implementation in the preceding stages, as described above. Nevertheless, these phases are crucial to the project's success, as they are when the effects on people's lives will happen. Construction, when people install a purchased product or make a home for wildlife by following an activity, is when residents will become most active in the project process and feel they are doing something worthwhile. During use is when residents will benefit from their adaptations, enjoying additional greenery and wildlife on their street, and carry out any recommended maintenance. During these stages, there is the facility for residents to ask questions about installation or give feedback on the effectiveness of their installations through the website.

It was important for the design team to evaluate the impact and potential of the drawings and web resource following the detailed design stage. This was done both through internal critical review and external feedback, particularly from audiences outside the architectural profession. Feedback was sought by entering competitions and awards, monitoring social and mainstream media interest in the project, encouraging people to sign up to the website, and conducting a survey by questionnaire.

4 Findings: Vision Drawings and Web Resource

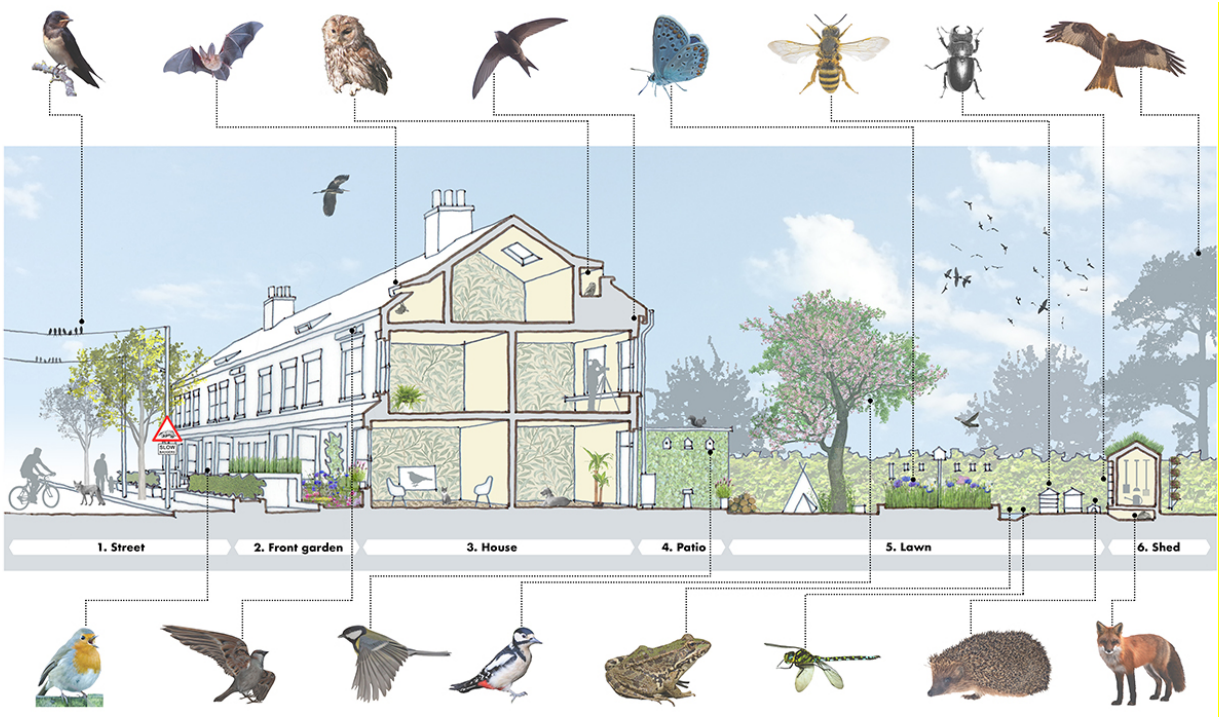
The design process described above has resulted in a vision for living in harmony with nature in our cities, shown through the concept collage, spatial manifesto and set of vision drawings of a rewilded London street.

The nature of the vision is one of streets full of greenery where people live surrounded by wildlife. Yet it remains a street with urban character, where wildlife habitat is neatly and appropriately incorporated within the architecture, garden design and streetscape. It is also a vision of community spirit and cooperation, where residents take responsibility for their environment, individual actions contribute to a greater whole, and people play and socialise in the street. Further, it is a vision of a healthier place for people to live, where residents will enjoy better physical health and emotional wellbeing, along with better air quality, temperature control and flood protection.

This vision has been encapsulated in and used as the basis of a design toolkit through the rewildmystreet.org website. Here, the concept collage and manifesto are used to introduce the project and its mission.

Each vision drawing is employed for a different purpose on the website, using a key to cross-reference the drawing to relevant expert external guidance. Although the drawings form a comprehensive set, showing the same adaptations to the street, this allows individual drawings to be used to organise information on wildlife species, wildlife habitat, products for wildlife, and activities to attract wildlife. This guidance takes the form of external links to expert organisations or manufacturers identified by the literature review, and has been carefully selected and compiled to be relevant to urban contexts. In this way, the resource collates diverse external guidance, combining educational information on the importance of managing streets for wildlife with practical advice on how to achieve this.

Most of the keys are organised by the street, front garden, house, patio, lawn and shed zones identified on the drawings to help people locate a particular wildlife feature and find out more information about it.



Species	Guide
Mammal	The Mammal Society
Badger	The Mammal Society
Bats	Bat Conservation Trust
Deer (Muntjac)	The Mammal Society
Fox	The Mammal Society
Hedgehog	Hedgehog Street
Mole	The Mammal Society
Mouse (Wood)	The Mammal Society
Otter	The Mammal Society
Rabbit	The Mammal Society
Rat (Brown)	The Mammal Society
Shrew (Common)	The Mammal Society
Squirrel (Grey)	The Mammal Society
Vole (Field)	The Mammal Society
Water Vole	The Mammal Society

Species	Guide
Bird of prey	Hawk & Owl Trust
Hobby	Hawk & Owl Trust
Kestrel	Hawk & Owl Trust
Owl (Tawny)	Hawk & Owl Trust
Peregrine	Hawk & Owl Trust
Red Kite	Hawk & Owl Trust
Sparrowhawk	Hawk & Owl Trust

Species	Guide
Bird (other)	RSPB
Blackbird	RSPB
Black Cap	RSPB
Black Redstart	RSPB
Crows	RSPB
Ducks/geese/swans	RSPB
Dunnock	RSPB
Finches	RSPB
Goldcrest	RSPB
Gulls/terns	RSPB
Heron (Grey)	RSPB
Nuthatch	RSPB
Parakeet (Ring-necked)	RSPB
Pigeons/doves	RSPB
Robin	RSPB
Sparrows	RSPB
Starling	RSPB
Swallow/martins	RSPB
Swift	Swift Conservation
Tits	RSPB
Thrushes	RSPB
Wagtails	RSPB
Warblers	RSPB
Woodpeckers	RSPB
Wren	RSPB

Species	Guide
Amphibian/reptile	Froglife
Adder	Froglife
Frog (Common)	Froglife
Grass Snake	Froglife
Lizard (Common)	Froglife
Newt (Great Crested)	Froglife
Newt (Smooth)	Froglife
Slow Worm	Froglife
Toad (Common)	Froglife

Species	Guide
Invertebrate	Buglife
Ants	Buglife
Bees/wasps	Buglife
Beetles	Buglife
Bumblebees	Bumblebee Cons. Trust
Butterflies	Butterfly Conservation
Flies	Buglife
Grasshoppers/crickets	Buglife
Lacewings	Buglife
Mayflies	Buglife
Millipedes/centipedes	Buglife
Moths	Butterfly Conservation
Slugs/snails	Buglife
Spiders	Buglife
True bugs	Buglife
Woodlice	Buglife

Species	Guide
Plant/fungus	Plantlife
Fungi	Woodland Trust
Trees/hedges	Woodland Trust
Wildflowers	Plantlife

Figure 3: Sectional perspective showing proposed typical house and street with adaptations for biodiversity, focusing on species. Source: Siân and Jon Moxon (with altered photos courtesy of Charles J Sharp, Pau.artigas, Super.lukas, Didier Descouens, Ninjatacoshell, George Hodan, Piotr Siedlecki, Peter Mulligan, Potapov Alexander/Shutterstock).

The sectional perspective is used to highlight species of wildlife that might be attracted to an urban street. The drawing uses images of key species with leader lines indicating where they

might be found: for example, a swift is shown with a leader line pointing to a swift box on the rear wall of the house. Some of the larger animal species are also shown populating the house and garden to give the image a sense of animation. The key contains links to information on prospective species, in this case categorised by mammal, bird of prey, other bird, amphibian or reptile, invertebrate, and plant or fungus.

This drawing was deemed successful by the design team in enabling residents to envision how they could live in greater harmony with a diverse range of species.

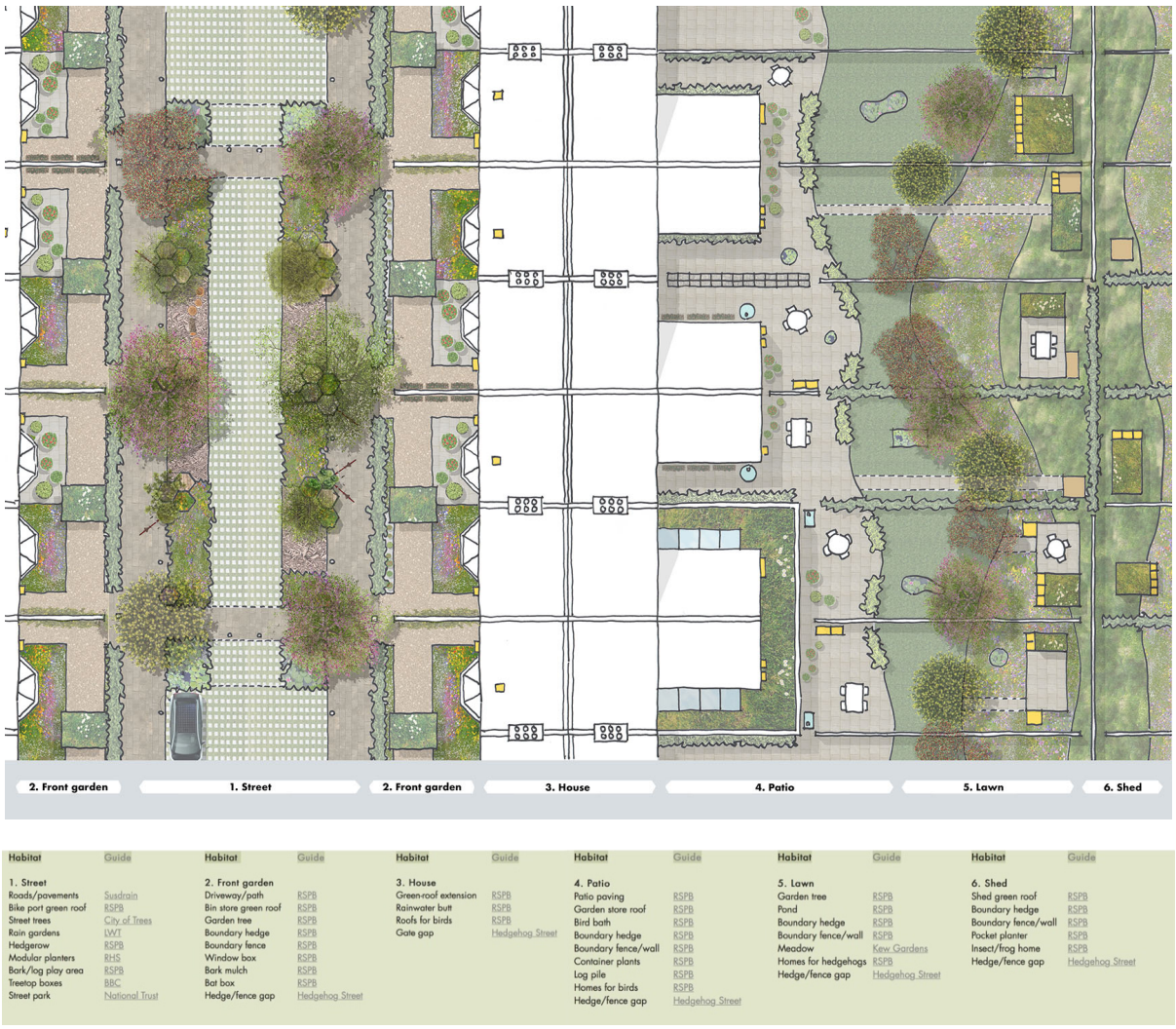


Figure 4: Street plan showing proposed typical street with adaptations for biodiversity, focusing on habitat. Source: Siân & Jon Moxon, Viktoria Fenyes.

The street plan in used to show types of natural habitat that could be created in an urban environment, categorised as green roof, trees, water, hedgerow, green wall, wildflowers, dead wood, habitat box and wildlife corridor. Its key compiles links to information about such habitats, organised according to the zones to help residents identify where in the street this habitat might be best suited. For example, the wildflower habitat is suggested as a meadow in the lawn zone; and the green roof is proposed on the bin store and shed, in the front garden and shed zones, respectively. The plan emphasises the potential for continuity of habitats across garden boundaries - depicting a continuous hedge in the front gardens and a stylised wave of meadows in the back gardens - facilitated by wildlife gaps shown in the

boundary fences. This uniformity is balanced by a sense of individuality, with some houses indicating nest boxes and others preferring ponds, but all contributing something to the overall mosaic of habitats offered by the street. These simple adaptations are juxtaposed with more radical interventions in the street, not least the car-free street park. Although this feature would require local authority investment and implementation, it is designed to be wholly viable, being based on modular components that fit within the existing street layout and leave clearance for emergency and maintenance vehicles.

The design team considered this drawing effective at conveying to residents that they could live in a much greener environment that provides a patchwork of connected habitats.

The street and back garden elevations are employed to highlight off-the-shelf products that can be purchased to benefit wildlife. The key for the elevations includes suggested products with links to retailers, again organised by the zone the product is depicted in. Products have been selected for their suitability for an urban setting, for instance using contemporary design or modern materials, and being suited to retrofit in small spaces or on vertical surfaces. Products have also been chosen to suit wildlife species that are known to thrive in cities.

The design team was confident these drawings could influence the products people buy, making it easy for city dwellers to source products that suit an urban setting and attract urban wildlife species.

Product	Shop	Product	Shop	Product	Shop	Product	Shop	Product	Shop	Product	Shop
1. Street		2. Front garden		3. House		4. Patio		5. Lawn		6. Shed	
Outdoor lighting	Woodscape	Green roof bin store	Front Yard Company	Nestbox camera	RSPB	Green wall	Treebox	Mini meadow	Meadowmat	Insect hotel	Crocus
Planted bike port	Cyclehoop	Raised bed	Woodblocx	Tawny owl nest box	RSPB	Nest boxes	Habi Sabi	Bird table/feeders	RSPB	Green roof	Posh Shed Company
Tree	Habitat Aid	Window boxes	Crocus	Anti-hunt cat collar	Hi-Craft	Bird bath	RSPB	Container pond	Waterside Nursery	Frog house	RSPB
Treetop beehive	Bee Kind Hives	Sparrow terrace	NHBS	Swift box	Swift Conservation	Container plants	Crocus	Compost bin	Primrose	Wildlife fence gap	Jacksons Fencing
Hedgerow	Habitat Aid	Bat box/roof tile	NHBS	Rainwater butt	Hugo	Log pile bench	Holmes & Gardens	Hedgehog house	Ark Wildlife	Pocket planter	WallyGro

Figure 5: Street elevation showing proposed typical street with adaptations for biodiversity, focusing on products. Source: Siân & Jon Moxon, Viktoria Fenyes.

Product	Shop	Product	Shop	Product	Shop	Product	Shop	Product	Shop	Product	Shop
1. Street		2. Front garden		3. House		4. Patio		5. Lawn		6. Shed	
Outdoor lighting	Woodscape	Green roof bin store	Front Yard Company	Nestbox camera	RSPB	Green wall	Treebox	Mini meadow	Meadowmat	Insect hotel	Crocus
Planted bike port	Cyclehoop	Raised bed	Woodblocx	Tawny owl nest box	RSPB	Nest boxes	Habi Sabi	Bird table/feeders	RSPB	Green roof	Posh Shed Company
Tree	Habitat Aid	Window boxes	Crocus	Anti-hunt cat collar	Hi-Craft	Bird bath	RSPB	Container pond	Waterside Nursery	Frog house	RSPB
Treetop beehive	Bee Kind Hives	Sparrow terrace	NHBS	Swift box	Swift Conservation	Container plants	Crocus	Compost bin	Primrose	Wildlife fence gap	Jacksons Fencing
Hedgerow	Habitat Aid	Bat box/roof tile	NHBS	Rainwater butt	Hugo	Log pile bench	Holmes & Gardens	Hedgehog house	Ark Wildlife	Pocket planter	WallyGro

Figure 6: Back garden elevation showing proposed typical street with adaptations for biodiversity, focusing on products. Source: Siân & Jon Moxon, Viktoria Fenyes.

Finally, the aerial view illustrates home-improvement activities that can be carried out to help wildlife. It shows people participating in some of the activities, such as putting up a bat box or digging a pond, and enjoying the streetscape to give a sense of community. The key references links to step-by-step guides by conservation bodies, which explain how to carry out each activity and which typically list tools, materials, time and budget required.

The design team concluded this drawing portrayed how London's streets could foster a much greater sense of community for those who live there and promote outdoor living for all ages.

The design team was satisfied that the proposals were well considered, the drawings were engaging and the website provided a valuable resource. This has been corroborated by positive reactions to the project from public, professional and academic audiences. The project has been recognised as a winner of the Imagine London as a National Park City competition and finalist of London Metropolitan University's Big Idea Challenge, and has been shortlisted for the Corporation of the City of London's Sustainable City Awards. It is continuing to attract mainstream media coverage, a steady growth in social media followers, mailing list subscribers and support from related organisations. The drawings have been published by the UK's leading architectural trade journal, conservation organisations, and several influential London magazines; and presented at academic conferences and the UK's foremost sustainability trade show.

Activity	Step-by-step	Activity	Step-by-step	Activity	Step-by-step	Activity	Step-by-step	Activity	Step-by-step	Activity	Step-by-step
1. Street		**2. Front garden**		**3. House**		**4. Patio**		**5. Lawn**		**6. Shed**	
Limit outdoor lighting	RHS	Green your bin store	LWT	Make a nestbox cam	Gardeners' World	Grow a green wall	RSPB	Plant a mini meadow	Buglife	Make an insect hotel	Buglife
Plant your bike port	Front Yard Co	Build a raised bed	RHS	Build an owl nest box	Barn Owl Trust	Build a bird box	RSPB	Feed the birds	RSPB	Add a green roof	LWT
Plant a tree	RSPB	Plant window boxes	RSPB	Limit cat kills	RSPB	Make a bird bath	RSPB	Make a mini pond	RSPB	Make a frog house	RSPB
Make a bee hotel	Buglife	Make a sparrow box	RSPB	Build a swift box	Action for Swifts	Grow container plants	RSPB	Make compost	RSPB	Make a wildlife gap	RSPB
Plant a hedgerow	LWT	Build a bat box	Bat Conservation Trust	Install a rainwater butt	RSPB	Make a log pile	Buglife	Make a hog house	Hedgehog Street	Make a pocket planter	Birds & Blooms

Figure 7: Aerial view showing proposed typical street with adaptations for biodiversity, focusing on activities. Source: Viktoria Fenyes.

A study by Imperial College London MSc students used Rewild My Street as a case study to determine whether people would be prepared to pay for the street improvements shown in the drawings. The study concluded that a significant proportion of the 500 respondents from across Greater London supported paying towards the proposals, highly valuing their potential for wildlife habitat, along with the health benefits of air quality and recreation. Although 82% of those surveyed reported already often seeing wildlife on their streets, over half thought their street needed more greenery; 87% supported implementing some of the proposals.

Reflecting on the primary research question, the above findings suggest that a vision of a rewilded urban street could, in theory, engage residents to adapt their homes for wildlife. In later stages of the project it will be important to assess whether residents are implementing the suggested adaptations in practice.

Considering the research sub-questions, the design process has determined that this vision of living with nature should be communicated through rendered architectural drawings at street scale, a concept collage and a spatial manifesto to inspire the public. Giving the drawings an infographic quality and cross-referencing them to external guidance has helped ensure the vision is also informative to enable residents to carry out the adaptations shown.

Showing the proposals at street scale was essential to help residents appreciate how even small changes they make can contribute to make their overall street a better place for both wildlife and people to live. The plan and aerial view clearly illustrate the sizable habitat area that connected back and front gardens can create. Similarly, the plan, elevations and aerial view show the cumulative greening effect of making changes over the extent of a street.

The literature review and design process revealed that wildlife features should be suitable for small spaces or vertical surfaces, targeted at urban species, and generally of contemporary design and materials to be sensitively integrated within an existing urban context.

Diversity was suggested by showing a large portion of the street, so that a single drawing can at once capture large and small gestures, and a balance between variety and uniformity. This is particularly apparent on the street plan, which shows radical interventions to the streetscape alongside minor changes to the houses and gardens. In addition, indicating stylised habitat zones on this drawing helped show individuality in measures adopted across the street, within a framework of continuity to the street as a whole. Showing off-the-shelf products and DIY activities through separate drawings was judged to be a good way to offer different implementation options in terms of cost and time.

Associating different drawing projections with different topics, and reflecting these in the drawing keys organised by plot zones, was found to be an effective way of organising external guidance and editing it for its relevance to urban contexts.

In summary, the case study has successfully created an inspiring vision of a typical London residential street adapted for biodiversity by applying an architectural design process to produce a set of aspirational drawings embedded in a practical resource. This highlights the potential for design research to promote the ideal of a biodiverse, sustainable city and generate design-led resources to achieve it.

5 Contribution to Field: A Model for Biodiverse Cities

The project makes an important contribution to the field of green infrastructure and biodiversity by addressing gaps in current literature, providing new insights through practice-based design research, and creating a scalable model for future development.

Gaps in existing literature are addressed by focusing on urban rewilding; tackling existing residential contexts; working at street scale; and presenting design guidance for public use.

The use of design research offers particular insights by capturing an inspiring vision of living with nature; creating image-based guidance; efficiently organising information; and ensuring considered integration of wildlife features into a street. There is scope for the project to develop further by the design team being more active in the later project work stages identified in the research methodology. This could include production of technical drawings to further assist with implementation of the proposals; involvement in live prototype projects during construction; and in-use surveys to assess the impact of the measures on biodiversity levels and resident quality of life.

The project resources present a new model, founded on empowering communities to change their living environments by taking more responsibility for their own role in solving environmental problems, both in their immediate environment and globally, in contexts that

are difficult for government to intervene. As such, it shows the way for city dwellers to cultivate and take care of nature on their doorsteps.

The project shows the potential for design research to inspire and empower city residents to change how they live, with designers using their skills to communicate a way to live alongside nature in cities, promoting the potential of urban areas as green, wild and healthy places to live. The resulting output offers a design-led model for encouraging biodiverse redevelopment of London and other cities worldwide for the benefit of wildlife and people alike.

6 References

Air Quality Expert Group (2018). Impacts of vegetation on urban air pollution. DEFRA. https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1807251306_180509_Effects_of_vegetation_on_urban_air_pollution_v12_final.pdf

Alexander, C., Ishikawa S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., Shlomo, A. (1977). *A pattern language: Towns, buildings, construction.* New York, USA. Oxford University Press.

Avon Wildlife Trust, My Wild City. (Accessed 19 February 2019). https://www.avonwildlifetrust.org.uk/mywildcity

Blanusa, T., & Page, A. (2011). Gardening matters: Urban gardens. *RHS*. https://www.rhs.org.uk/getmedia/6ae44cfe-8e50-4d7b-bd9d-88ffa0eaaeaa/urban-greening.pdf

Communities and Local Government (2012). Protected trees: A guide to tree preservation procedures. Communities and Local Government Publications. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/244528/2127793.pdf

Communities and Local Government, Environment Agency (2008). Guidance on the permeable surfacing of front gardens. Communities and Local Government Publications. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7728/pavingfrontgardens.pdf

Devon Wildlife Trust, Exeter Wildlife Gardening Award. (Accessed 19 February 2019). https://www.devonwildlifetrust.org/exeter-wildlife-gardening-award

Earthwatch Institute, Naturehood. (Accessed 26 March 2019). https://earthwatch.org.uk/get-involved/projects-activities/naturehood

Frith, M. (2016). Will London get wilder: Are we ready for real wildness? *Wild London*. London Wildlife Trust. Winter:12-13.

Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). psychological benefits of greenspace increase with biodiversity. *Biology Letters, 3*(4). doi:10.1098/rsbl.2007.0149

Gaston, K. J., Smith, R. M., Thompson, K., & Warren, P. H. (2005). Urban domestic gardens (II): Experimental tests of methods for increasing biodiversity. *Biodiversity and Conservation*, *14*:395-413. doi:10.1007/s10531-004-6066-x

Grooten, M., & Almond, R. E. A. (Eds), (2018). Living planet report 2018: Aiming higher. WWF. https://www.wwf.org.uk/sites/default/files/2018-10/wwfintl_livingplanet_full.pdf

WWF (2017). Urban solutions for a living planet: Cities sharing leadership for sustainability. http://awsassets.panda.org/downloads/URBAN_SOLUTIONS_HANDBOOK_2017_lowres_spreads.pdf

Haaland, C., & Konijnendijk van den Bosch, C. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban Forestry and Urban Greening, 14*(4):760-771. doi:10.1016/j.ufug.2015.07.009

Hackney Council (2011). Hackney advice note: Biodiversity and the built environment. https://hackney.gov.uk/biodiversity#advice

Harper Collins, Collins English dictionary (Accessed 12 July 2019). https://www.collinsdictionary.com/dictionary/english

Heywood, H. (2013). *101 rules of thumb for low-energy architecture*. London, England. RIBA Publishing

Heywood, H. (2015). *101 rules of thumb for sustainable buildings and cities*. London: RIBA Publishing

HM Government (2008). Strategy for sustainable construction. https://webarchive.nationalarchives.gov.uk/+/http:/www.bis.gov.uk/files/file46535.pdf

HM Government (2011). The natural choice: Securing the value of nature. UK: TSO. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/228842/8082.pdf
Kuo, F. E., & Sullivan, W. C. (2001). Environment and crime in the inner city: Does vegetation reduce crime? *Environment and Behavior, 33*(3):343-367. doi:10.1177/0013916501333002
London National Park City. (Accessed 15 February 2019). http://www.nationalparkcity.london/
Maas, J., Verheij, R. A., Groenewegen, P. P., de Vries, S., & Spreeuwenberg, P. (2006). Greenspace, urbanity and health: How strong is the relation? *Journal of Epidemiol and Community Health, 60*(7):587–592. doi:10.1136/jech.2005.043125
Mayor of London (2018). London environment strategy. Greater London Authority. https://www.london.gov.uk/sites/default/files/london_environment_strategy.pdf
Office for National Statistics (2018). Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2017.
Park, B. J., Tsunetsugu, Y., Kasetani, T., Kagawa, T., & Miyazaki, Y. (2010). The physiological effects of shinrin-yoku (taking in the forest atmosphere or forest bathing): Evidence from field experiments in 24 forests across Japan. *Environmental Health and Preventative Medicine, 15*(1):18-26. doi:10.1007/s12199-009-0086-9
Poudyal, N. C., Hodges, D. G., Tonn, B., & Cho, S-H. (2009*).* Valuing Diversity and Spatial Pattern of Open Space Plots in Urban Neighborhoods. *Forest Policy and Economics, 11*(3):194-201.doi:10.1016/j.forpol.2009.02.007
Rewilding Britain (2014) Rewilding Britain: a proposal to make Britain a wilder place.
RIBA, Plan of work (2013). RIBA Publishing. https://www.ribaplanofwork.com/
RIBA, Research in practice (2013). RIBA Publishing. https://www.architecture.com/-/media/gathercontent/home-improvements-housing-research-in-practice/additional-documents/ribaresearchinpracticeguidepdf.pdf
RHS, Greening Grey Britain. (Accessed 01 February 2019). https://www.rhs.org.uk/get-involved/greening-grey-britain/why
RSPB, Give Nature a Home in Your Garden. (Accessed 19 February 2019). https://www.rspb.org.uk/get-involved/activities/give-nature-a-home-in-your-garden
Smith, C. (2010). London: Garden city?: Investigating the changing anatomy of London's private gardens, and the scale of their loss. London Wildlife Trust, Greenspace Information Greater London, Greater London Authority. https://www.gigl.org.uk/partnershipcasestudy/garden-research/
Thomas, A. (2018). Neighbourhoods for nature. *Nature's Home.* Summer:28-34. https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/nature-home-kingsbrook.pdf
Thompson, K., & Head, S. Gardens as a resource for wildlife. (Accessed 26 March 2019). http://www.wlgf.org/The%20garden%20Resource.pdf
White, M. P., Phal, S., Ashbullby, K., Herbert, S., & Depledge, M. H. (2013). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology 35*:40–51. doi:10.1016/j.jenvp.2013.04.002

About the Authors:

Siân Moxon: BSc BArch ARB BREEAM-AP FHEA is a senior lecturer in sustainable design, researcher in urban biodiversity and the founder of www.rewildmystreet.org. She is an architect, BREEAM accredited professional, HEA Fellow and the author of 'Sustainability in Interior Design'.

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