Provision and management of greenspaces and routes that generate additional use and enjoyment

Rapid Evidence Review

March 2024

Natural England Evidence Review NEER027

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NATURAL ENGLAND

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Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

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Images

Figure 1: Green space – key interventions graphical summary:
Diagram by Emma White & Grant Waters, using vector graphics from Adobe Stock.

Figure 2: Street greening – key interventions graphical summary:
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Foreword

Natural England's purpose is to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development and it includes promoting nature conservation and protecting biodiversity securing the provision and improvement of facilities for the enjoyment of the natural environment and promoting access to the countryside and open spaces and encouraging open-air recreation. Sustainable Development requires management of the impacts of growth and housing development on the natural environment as well as delivering green infrastructure for the benefit of people.

Currently one of the ways Natural England addresses potential impacts from recreation on protected sites for nature conservation is by requiring local authorities to meet their statutory obligations by use of Strategic Solutions. Each solution is bespoke but largely provide a mix of Suitable Alternative Natural Greenspace (SANG) and Strategic Access Management and Monitoring (SAMM). Natural England is seeking to improve our understanding of the evidence about the provision and management of greenspace and green routes so that we, and others, can better understand how changes to such sites could support more use by the public that is enjoyable for everyone.

This report is one in a series of three reports that were commissioned at similar times, these reports are:

NEER026 Density and displacement of users of urban greenspaces and routes**.**

NEER027 Provision and management of greenspaces and routes that generate additional use and enjoyment**.**

RP04518 Compilation and review of evidence leading to SANG and SAMM provision**.**

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Executive summary

Background

This Rapid Evidence Review relates to the use and enjoyment of green spaces and green routes in, and close to, urban areas. This review forms part of a wider review of the literature in relation to the role and impact of Suitable Alternative Natural Greenspace (SANG) and Strategic Access Management and Monitoring (SAMM) areas in urban areas, either as green spaces or as green routes. The specific aim of this review is to understand the design and features of such spaces that promote use and enjoyment, thereby increasing the numbers of people accessing greener areas and the benefits they provide, whilst avoiding heavy demand on designated ecological sites that may negatively affect wildlife and biodiversity. The main research question is answered by considering three secondary research questions.

Method

The approach to deliver this review follows Defra guidance on Rapid Evidence Assessment (REA). Searches were conducted using key search terms in academic literature databases, as well as relevant stakeholder calls for evidence. A narrative synthesis of the evidence is presented for each secondary research question, along with limitations of the evidence base and recommendations to further increase use and enjoyment of green spaces in practice.

Review findings

Which key landscape features and facilities make a green space attractive to people?

- Attractiveness can be supported by a balance between natural and landscaped areas, such as open landscapes, presence of greater greenery (such as trees and vegetation), plant and wildlife biodiversity, water elements and good maintenance.
- It was found in five papers that biodiversity and attractiveness were linked.
- Only two papers showed the links between lawns and landscaped areas and attractiveness. However, spaces that were ‘overgrown’ or ‘unkept’ were found to not be attractive, especially where safety was a concern; this related particularly to women. It is recommended that a common vocabulary is defined to distinguish between natural/wild areas and that of unkept, unmanaged areas in relation to safety.
- General maintenance was found to be strongly linked to attractiveness, especially the maintenance of walking path quality. Factors that detract from attractiveness include spaces that are dirty, littered, messy, or with visible unused/empty ground.

- Proximity and accessibility of green space is important to promote attractiveness.
- Attractiveness of the presence of greenery extended to green routes, such as walking and cycling paths. It is important to provide a range of access options for green spaces, such as nearby transport options.
- Attractiveness is dependent on the specific needs of different users, and therefore facilities should be provided that enable green spaces to support a variety of uses and functions. Presence and appropriate design/maintenance of recreational equipment, seating, shaded areas, catering, and toilets are important elements in ensuring attractiveness across a range of users.
- Good access to facilities within the greenspace is important for attraction. This includes the presence of footpaths, cycle paths and trails. Evidence was inconclusive as to whether paved or more rough/natural paths in green spaces were preferred. Elevation was attractive in some cases yet raised issues regarding accessibility for those with mobility concerns.
- Safety provisions are important, especially for female adolescents, despite the evidence suggesting it was not a strong contributor to attractiveness. Park wardens, lighting and fences were found to support perceptions of safety.
- Organised activities and events that promote interest were found to increase attractiveness, and such programming should consider activities that promote interest from under-served groups, such as ethnic minorities, LGBTQIA+ community, people with health conditions, migrants, and people on low incomes.
- The evidence base is subject to limitations in relation to methodological approaches, generalisation of the findings to wider contexts and populations, as well as some studies disrupted due to the COVID-19 pandemic.

Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the carrying capacity of such places?

- Greenspace and green routes are used more the closer they are to residential areas and local amenities. Multiple entrance points can lead to more use by moderating distance to households or points of interest.
- Diversity of green routes and trails in terms of design, features, range of nearby facilities and use cases (i.e., waterways, cycle routes, nature trails, linear parks) is suggested to increase use across the population and cater for various activities.
- Connectivity of green spaces and routes was important for increasing use; this included connectivity to the street network and to urban centres with amenities, and between green spaces and routes themselves.
- Street greening was noted to provide opportunities for active travel and activity outside of green spaces, where safety concerns or lack of facilities were present, whilst still offering benefits of exposure to natural elements.
- Informal green spaces can be utilised to increase provision to underserved areas and interventions by local community groups can provide cost effective ways to revitalise such spaces, when combined with local authority support. In one study,

biodiversity and user participation in green space management were found to be mutually beneficial, and therefore public participation activities in maintenance and management of these spaces could be encouraged with the support of local authorities.

- Increased use can be stimulated by increasing the range of facilities a green space or route provides, ensuring they appeal to different needs and motivations for visits.
- The provision of facilities in greenspaces and green routes can increase use by increasing appeal and reducing barriers of access, especially for non-disabled older people and the mobility impaired. Such facilities include seating, shaded areas, light refreshment facilities, water features and toilets.
- Facilities such as sporting areas, playgrounds, water features can encourage use by adolescents, people of ethnic groups and people on low incomes. Specific cultural/social facilities, such as barbecues and picnic areas, can encourage use by under-served groups.
- Landscaped areas can increase use by reducing safety concerns compared to poorly maintained natural areas.
- Defined walking paths can promote feelings of safety and increase visits, especially by women, adolescents and people of ethnic groups.
- Fenced-off urban green spaces with restricted opening hours are linked to higher levels of environmental volunteering compared to those without fencing and unrestricted opening hours.
- Involvement of the community in green space management and improvements can increase use, and initiatives for mentoring and training are important to ensure that such engagement is inclusive to under-served user groups. Local authority support for public participation is critical for ensuring long-term community engagement.
- Park programming and organised events are of high importance in relation to increasing use to a range of demographic groups, especially for women, adolescents, older people, ethnic minorities, and people on low incomes. Programming can include exercise classes, sporting events, competitions and other events that encourage social use of green spaces. Group activities can promote feelings of safety and increase visits, especially by women and adolescents. Promotional material to support park programmed events and activities, such as informational signs, posters, and brochures, can potentially increase use.
- The evidence base is subject to some limitations. Most of the evidence was based on user accounts and interviews, as opposed to longer term before and after studies. Studies also noted limitations in timescale, seasonal variation, study of non-users and the granularity of interventions, i.e., lighting, vegetation design, etc.

Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the enjoyment/experience of such places?

- Street greening and active travel routes can enhance enjoyment and experience, especially the inclusion of trees. Specific type and positioning of greening measures

are important considerations for design, as mixed perceptions were found in relation to wild street vegetation and the preference for greenery barriers between traffic types on streets.

- Provision of seating, catering, recreational and sporting equipment, toilets, and path/trails were found to increase enjoyment/experience, where well maintained and designed with users' needs in mind.
- Good management in relation to maintenance and upkeep are important to not detract from enjoyment and experience, avoiding litter, vandalism, noise, anti-social behaviour. Despite the limited evidence in relation to how greenspace management can increase enjoyment/experience, it was noted that community involvement and agency is important.
- Perceptions of safety are important to increase enjoyment/experience, especially for those already sensitised to safety concerns in a space. Steps to improve such perceptions include reducing visual obstructions, multiple seating options, reducing dense vegetation, and considering spatial layout.
- The evidence has some limitations regarding the validity of conclusions in relation to other factors affecting enjoyment/experience and generalisability across wider populations and geographical areas, as well as a lack of studies on seasonal variations.

Green space – key interventions graphical summary

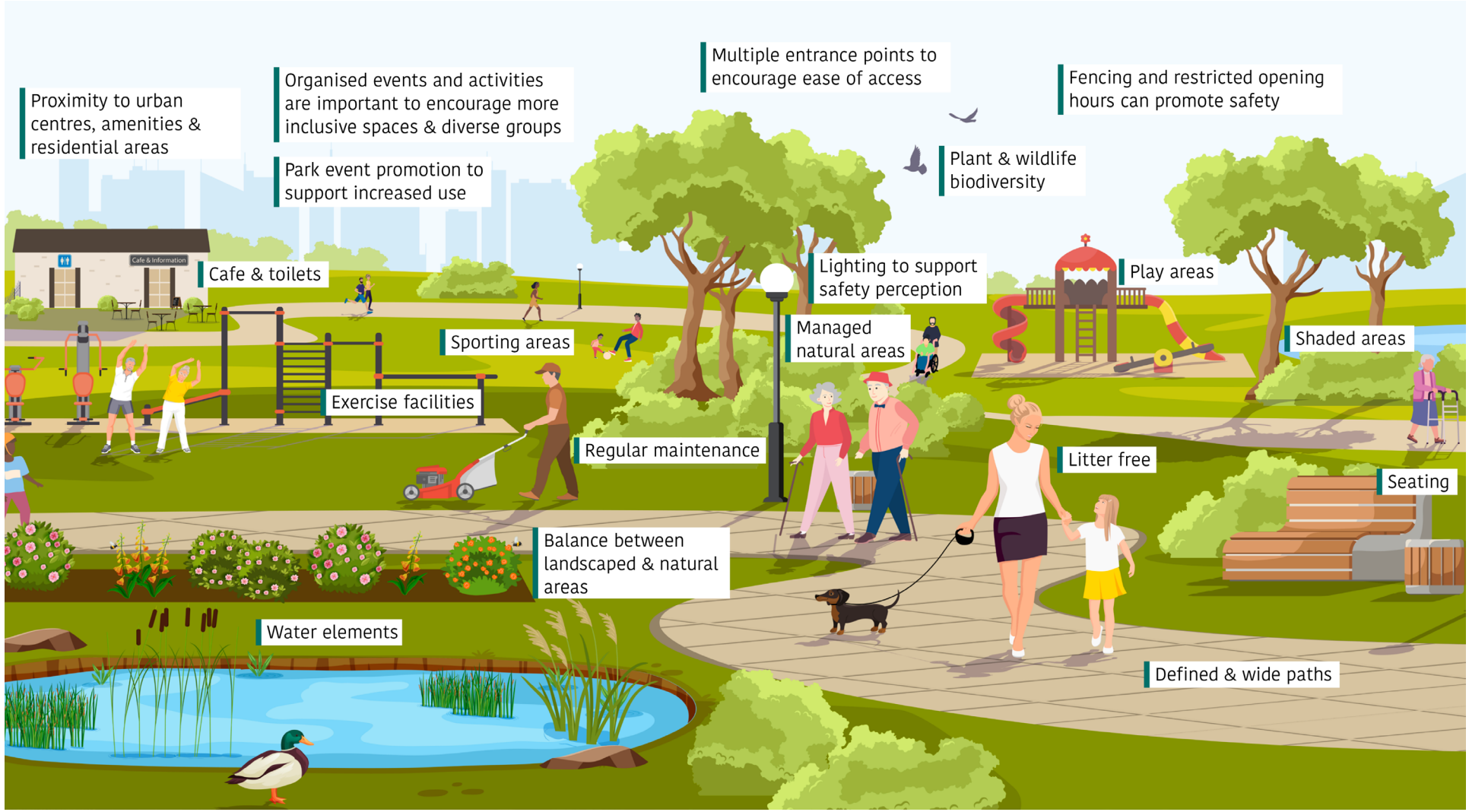

Figure 1. Illustration of key findings for promoting enjoyment and use in urban green spaces. Diagram by Emma White & Grant Waters using vectors from Adobe Stock.

Street greening – key interventions graphical summary

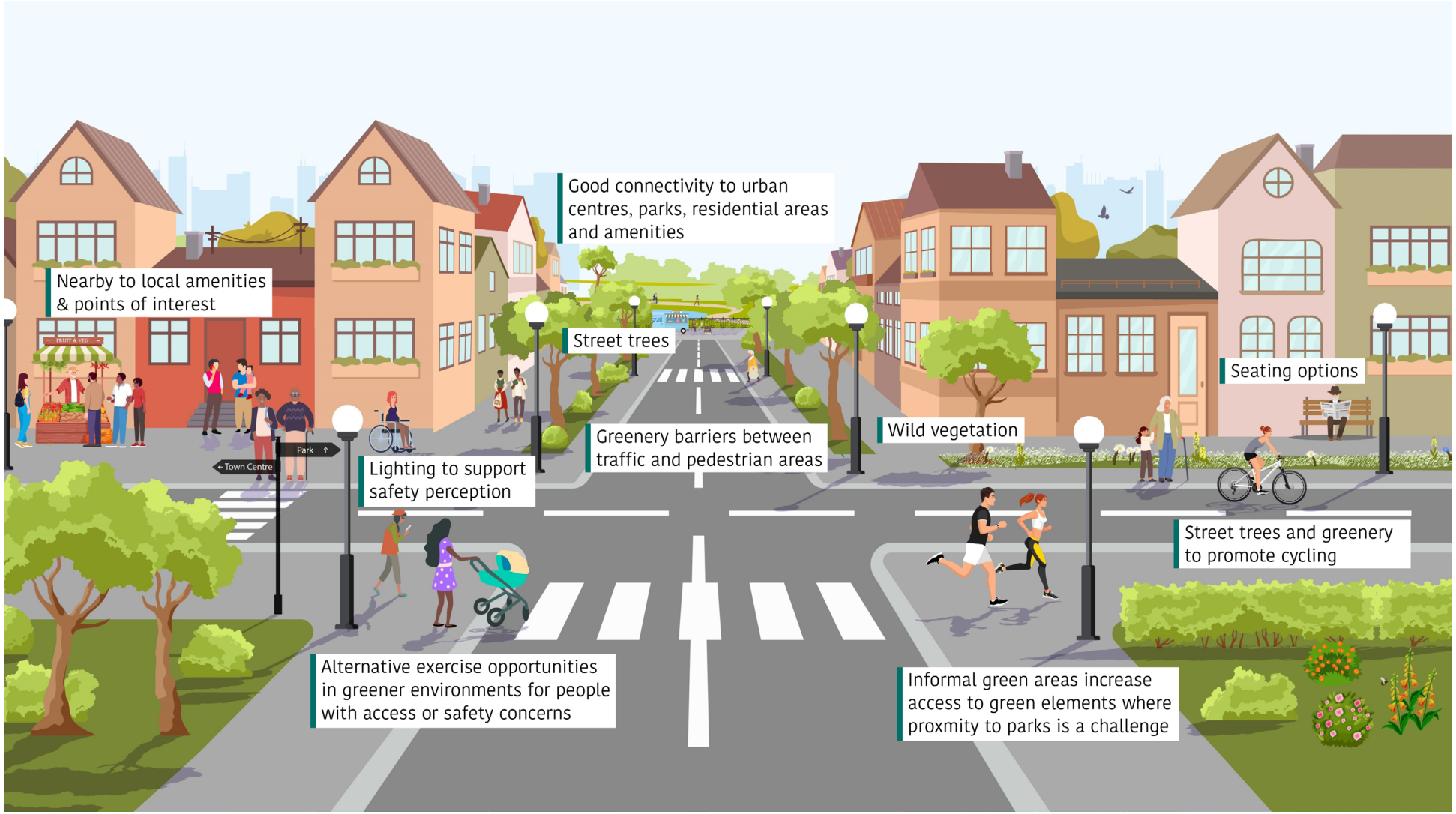

Figure 2. Illustration of key findings for promoting enjoyment and use in street environments through green interventions. Diagram by Emma White & Grant Waters using vectors from Adobe Stock.

Green active travel routes – key interventions graphical summary

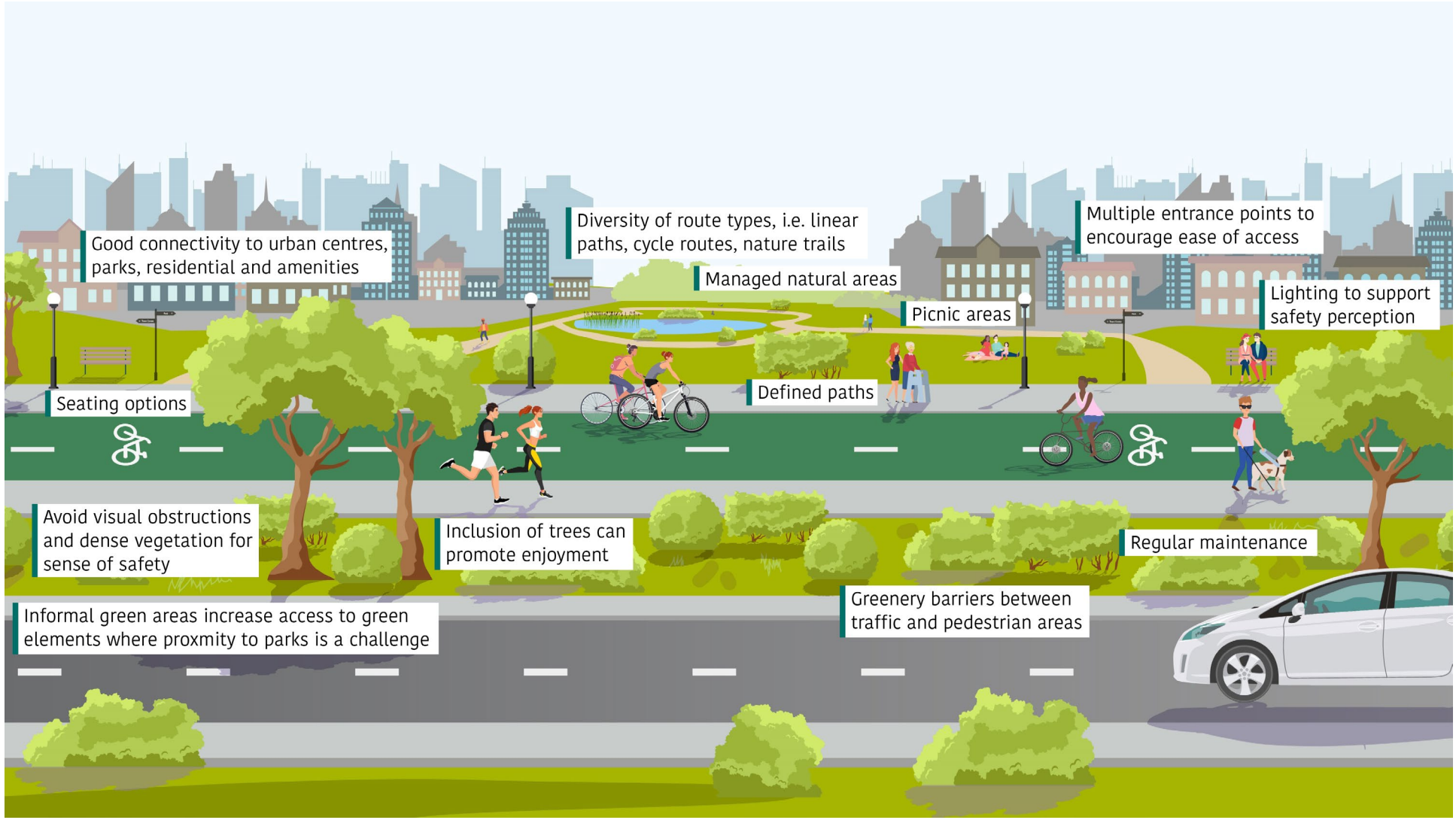

Figure 3. Illustration of key findings for promoting enjoyment and use in green active travel routes. Diagram by Emma White & Grant Waters using vectors from Adobe Stock.

Contents

Introduction and Background

Introduction

This Rapid Evidence Review relates to the use and enjoyment of green spaces and green routes in and close to urban. The review concerns the implementation of green infrastructure in urban areas and peri-urban areas. Therefore, it is aimed at national government departments and local government departments in urban areas. The review may also be relevant to various organisations and non-governmental organisations involved in implementing and promoting use of green spaces and green routes to improve health, wellbeing, and connection to nature.

Policy Context

The UK Government's 25-Year Environment Plan includes support for the greening of towns and cities and the multiple benefits it provides to people and nature (HM Government, 2018). Natural England was established following the successful passage of the Natural Environment and Rural Communities (NERC) Act 2006 through Parliament (HM Government, 2006). Natural England is an independent statutory Non-Departmental Public Body.

The NERC Act sets out Natural England's purpose: "to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development". (HM Government, 2006)

Natural England has two programmes that are relevant to this project:

- Connecting People with Nature (Natural England, 2020)
- Sustainable Development (Natural England, 2020)

The **Connecting People with Nature Programme** includes themes on local communities, a sense of place and enjoyment of nature, and social inclusion and health. Achieving these outcomes will likely require there to be more places where people can be active outdoors in green places, and social interventions to support those who have not previously participated in these activities to be active in the natural environment more often (Natural England, 2020).

Sustainable Development focuses on the impacts of growth and housing development on the natural environment, as well as opportunities for enhancement including the need for development to deliver green infrastructure for the benefit of people and the natural environment. Natural England is keen to adopt proactive approaches to meet these ongoing demands, whilst simultaneously increasing the opportunities for people to be active and connected to nature and considering the potential impacts of recreation on sites designated for nature conservation (Natural England, 2020).

Natural England addresses these objectives through the requirement of Local Authorities (LAs) to have suitable strategies that mitigate potential impacts and provide further opportunities for nature connection. This includes the provision of Suitable Alternative Natural Greenspace (SANG) and Strategic Access Management and Monitoring (SAMM) measures. Where the requirement of a SANG is identified, LAs must usually provide SANG land at a minimum of 8 hectares per 1000-person population (Woking Borough Council, 2021; Rushmoor Borough Council, 2020). Some LAs may have undeveloped land to provide suitable SANG areas in this order, but in other areas with greater levels of development (such as urban areas), alternative measures may need to be applied to meet this demand (Woking Borough Council, 2021). Alternative proposals could include boosting the carrying capacity (see definitions section) of existing greenspaces or providing green active travel routes and street greening, which relieve protected natural conservation areas from the impacts of recreation.

The provision of such alternatives may in fact result in increased accessibility and use of natural areas and the health and wellbeing benefits they can provide, whilst also ensuring protection of Special Areas of Conservation (SAC) and Special Protection Areas (SPA) (Joint Nature Conservation Committee (JNCC), 2022a; Joint Nature Conservation Committee (JNCC), 2022b).

Project Background

The provision and enhancement of green spaces and green routes are being discussed and undertaken to address the policy aims stated above for the provision of SANG and SAMM measures. It is therefore necessary to understand the evidence for the effectiveness of improvement options, especially in regard to increasing the access and quality of access to more natural elements and alternative green infrastructure that mitigates potential impacts from recreation on SACs and SPAs.

This project forms part of a wider review (carried out by others) of the literature and case studies regarding three topic areas:

1. Density of use of green spaces and green routes (by others)
2. Provision and management of green spaces and green routes and their enjoyment (This project)
3. The role of SANGs and SAMM (by others)

The ‘density of use of green spaces and green routes’ review aims to establish an understanding of how often green spaces and green routes in urban areas are currently used. This shall include understanding how the density of use ranges between the various types of green spaces, routes, and the presence of various green infrastructure elements (tree cover, green verges, wildflower meadows, recreational parks, nature reserves, etc.).

The ‘provision and management of green spaces and green routes and their enjoyment’ review aims to establish an understanding of how the creation, composition and maintenance approach of green spaces and green routes affects both the “willingness to

access” and the overall enjoyment and benefits gained by the visitor/s. The predominant context of this question is how such approaches can increase the carrying capacity and overall enjoyment/benefits gained by visitors of such green spaces and green routes.

The ‘role of Suitable Alternative Natural Green Spaces (SANGs) and Strategic Access Management and Monitoring (SAMM)’ review aims to establish an understanding of which approaches are most effective in mitigating negative impacts on SACs and SPAs and increasing the capacity of health and wellbeing benefits in combination with the knowledge gained from the reviews on ‘density of use’ and ‘provision, management and enjoyment’.

The combination of these three reviews shall result in a robust knowledge basis of the potential for SANGs and SAMM to be addressed in urban areas and ultimately achieve the following objectives.

- Protect SACs and SPAs from recreational impacts by controlling access and providing meaningful alternatives that provide similar or enhanced benefits.
- Increase opportunities for accessing more natural areas and for nature contact in urban areas to wider populations and demographics by providing a diverse range of area types, management approaches and activities that increase the carrying capacity of a neighbourhood.
- Implement improvements to existing green spaces and green routes that are proven to provide significant health, wellbeing, and enjoyment benefits.
- Strategically plan for new green spaces and green route types and features that are proven to provide significant health, wellbeing, and enjoyment benefits.

Project Objectives

This review aims to understand the impact of various types of green infrastructure in urban environments that could encourage increased use and access, diversity of activities, and the resulting benefits to people and nature. This review shall specifically address the following overarching question:

‘How does the provision and management approach of green spaces and green routes affect the carrying capacity of more natural environments in urban areas and the resulting health, wellbeing and enjoyment benefits?’

The purpose is to enable an informed view of what measures can increase the ability for people to connect meaningfully with nature on a regular basis, to allow for alternative spaces that alleviate pressure on spaces specifically for nature conversation, wildlife, and biodiversity.

Methodology

Research Questions

The Primary Research Question (i.e., the overriding aim of the research) is as follows:

'How does the provision and management approach of green spaces and green routes affect the carrying capacity of more natural environments in urban areas and the resulting health, wellbeing and enjoyment benefits?'

Three secondary questions have been defined to answer the Primary Research Question.

1. Which key landscape features and facilities make a green space attractive to people?
2. Can street greening, provision of green active travel routes, changes to publicly accessible greenspace management, safety interventions and provision of facilities increase the carrying capacity of such places?
3. Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the enjoyment/experience of such places?

The intervention/exposure and outcome variables related to these three secondary questions, as well as key policy implications, are summarised in Figure 4.

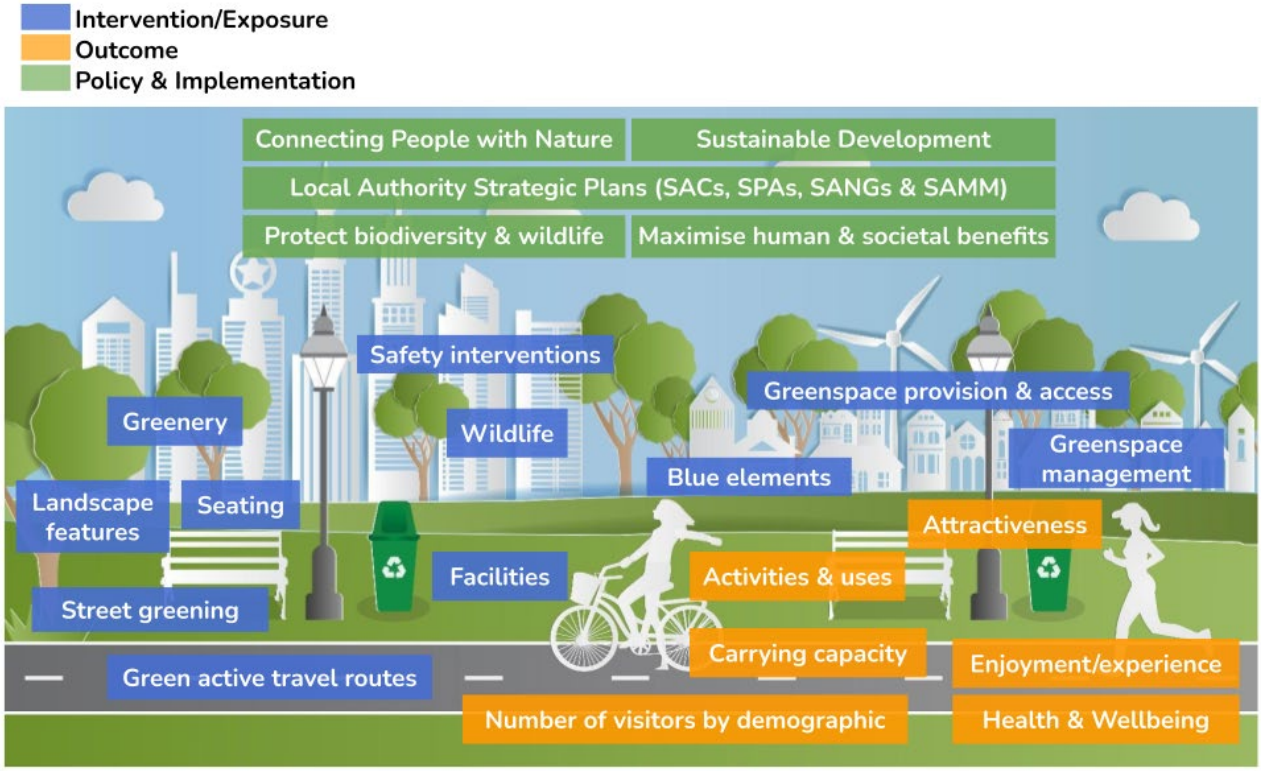

Figure 4. Project conceptual model addressing the primary research question. Diagram by Emma White & Grant Waters using vectors from Adobe Stock.

Rapid Evidence Review

The approach to this literature review follows Defra guidance on Rapid Evidence Assessment (REA) (Defra, 2015). Evidence was identified using key search terms in academic literature databases, reviewing relevant citations and stakeholder calls for evidence. An iterative search process was followed to group certain topic areas, to provide more comprehensive results and reduce the number of duplicates. The search terms used are outlined in Appendix A. Figure 5 overleaf provides a flow chart of the search results for each of the secondary questions and outlines the number of records included and excluded.

The quality of the evidence was considered in relation to the study methodology, study group and quality of analysis and conclusions. The review approach was informed by Defra guidance on Rapid Evidence Reviews (Defra, 2015) and is considered a fair interpretation of the evidence base, but it should be noted that the review is not fully systematic.

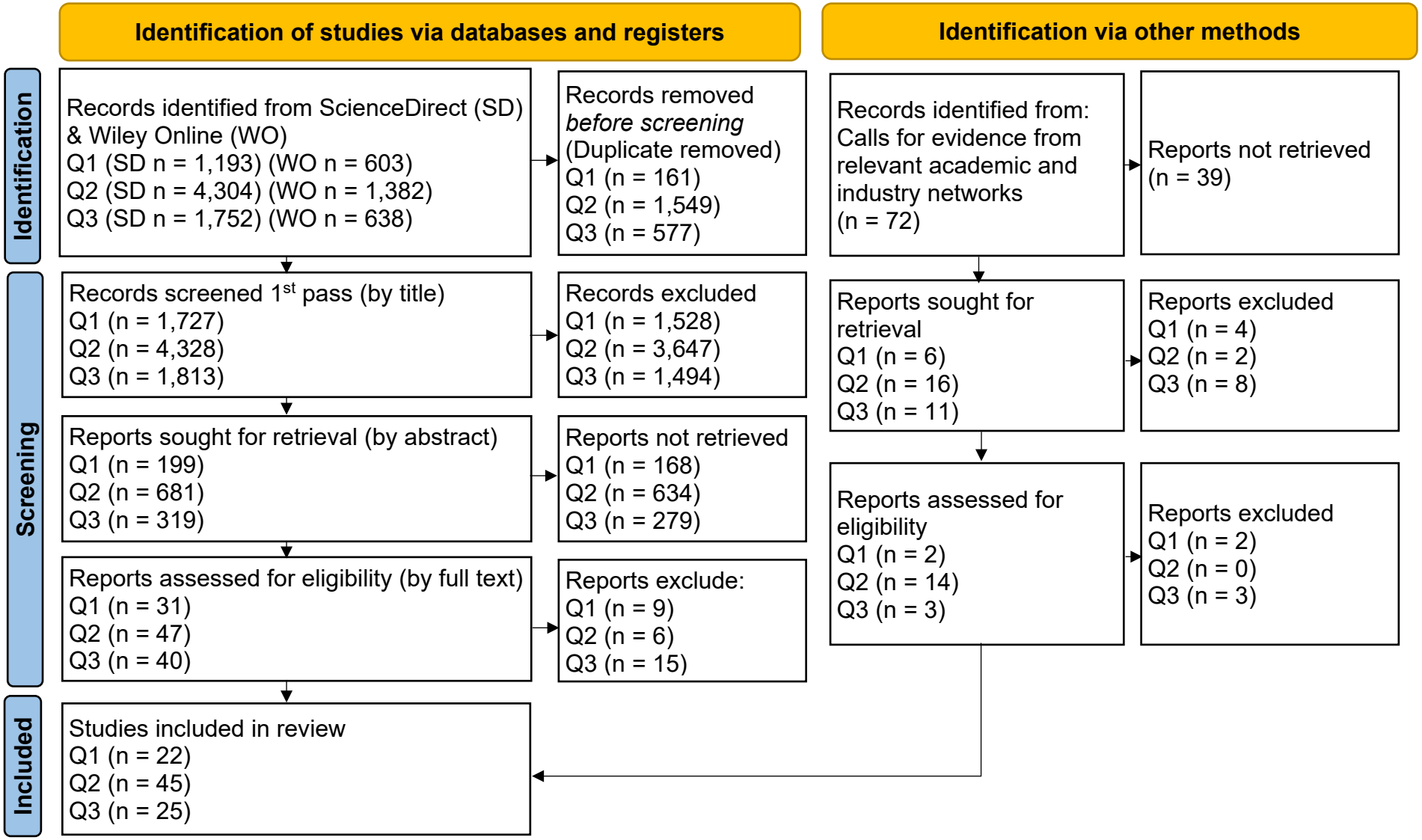

Figure 5. Flow diagram showing the process for identifying and screening sources of information for inclusion within the review. Adapted from Page, McKenzie, Bossuyt, Boutron, Hoffmann and Mulrow (2021).

Evidence Review

Which key landscape features and facilities make a green space attractive to people?

Evidence summary

Landscape features

Spaces perceived as being natural or semi-natural were considered to be more attractive than those that have been extensively landscaped (Phillips et al., 2022; Sonti et al., 2020; Žlender & Ward Thompson, 2017), and this was defined as a key 'pull factor' or driver of attractiveness in many (although not all) green spaces (Phillips et al., 2022). The presence of greater greenery (trees and vegetation) formed an important part of this perception of the space being natural and therefore attractive (Grilli et al., 2020; Jakstis et al., 2022; Refshauge et al., 2012). Among children, Veitch et al. (2021) reported that girls are more attracted to nature and greenery than boys. The general preference for greater greenery extended to alongside cycling/walking paths (Žlender & Ward Thompson, 2017). Isolation from surrounding urban areas was noted as important by Pueffel et al. (2018) but contradicted by Fontán-Vela et al. (2021) who reported that the integration of green space with the built environment is important for attractiveness and use.

Visibility over the landscape was related to attractiveness, in terms of the landscape being perceived as open or flat/low (Jakstis et al., 2022; Rivera et al., 2021; Unt & Bell, 2014). One paper reported that larger and more linear or irregularly shaped parks were more attractive (Dade et al., 2020), but Grilli et al. (2020) did not report size as a significant factor in attractiveness.

Maintained aspects of green space such as lawns (Phillips et al., 2022) and landscaped areas (Sonti et al., 2020) were related to attractiveness. However, there were more papers that reported associations between biodiversity and attractiveness, including diverse plants and wildlife (Jakstis et al., 2022; Mäntymaa et al., 2021; Pueffel et al., 2018; Sonti et al., 2020) and foliage of different heights (Dade et al., 2020). General maintenance of the space was related to attractiveness (Kou et al., 2021; Rivera et al., 2021; Sonti et al., 2020), especially maintenance of path surface quality (Unt & Bell, 2014; Žlender & Ward Thompson, 2017).

Within the green space, the presence of water was reported as important in multiple papers (Grilli et al., 2020; Jakstis et al., 2022; Phillips et al., 2022; Sonti et al., 2020). This was in the form of lakes, ponds, and flowing water. Jakstis et al. (2022) report that lakes/ponds are more preferred than flowing water in Northern, but not Central or Southern, Europe. Blue space that is further away from one's home may be more attractive (Wang et al., 2021). Veitch et al. (2021) reported that among children, girls are

more attracted to water than boys, echoing the similar finding reported for the presence of nature and greenery.

Negative landscape features

Several factors were identified as 'push factors' that make green spaces unpleasant, aesthetically unappealing, and/or unattractive e.g., one that was dirty, messy, or ugly (Akpınar, 2020; Misiune et al., 2021; Phillips et al., 2022; Unt & Bell, 2014), lacked greenery (Akpınar, 2020), or had visible unused/empty ground (Unt & Bell, 2014).

However, spaces that were perceived to be too natural can also be considered unattractive (Phillips et al., 2022), especially if the wildness of the green space exacerbated safety concerns (Sonti et al., 2020). That undesirable naturalness might be characterised by dense vegetation (Unt & Bell, 2014) and high tree and grass cover, especially if this impedes social interaction (Dade et al., 2020).

Inconclusive landscape features

One paper reported that increased elevation and rugged terrain was positively related to attractiveness (Norman & Pickering, 2019). However, Kou et al. (2021) also noted that for some individuals, especially those with mobility concerns, increased elevation may decrease attractiveness.

Path surface was not consistently related to attractiveness, which may be due to differences in user demographics/needs (Kou et al., 2021). Some users prefer paved paths (Phillips et al., 2022), while some prefer rough/natural paths (Kou et al., 2021).

Location and access

Proximity of the green space to home or daily route was noted as important by multiple papers (Grilli et al., 2020; Kou et al., 2021; Norman & Pickering, 2019; Refshauge et al., 2012; Rivera et al., 2021; Sonti et al., 2020; Talal & Santelmann, 2021; Žlender & Ward Thompson, 2017). However, this may interact with user characteristics, e.g., desired activity in the green space (Norman & Pickering, 2019), or gender and cultural background (Refshauge et al., 2012). Green space that is further away may also be more attractive for some because it offers a sense of escape, although only one paper reported this (Pueffel et al., 2018). Facilities to access the green space via a range of transport options, including public transport, are important (Huang et al., 2020; Kou et al., 2021; Mantymaa et al., 2021).

Facilities

Good access to facilities within green spaces is important for attraction. This comprises the presence and maintenance of footpaths, cycle paths and trails (Dade et al., 2020; Rivera et al., 2021; Sonti et al., 2020; Žlender & Ward Thompson, 2017), which should also support the range of activities that users want to do (e.g., walking vs biking; Norman & Pickering, 2019). Paths should also support separation of users such as pedestrians and

cyclists (Kou et al., 2021), and offer expansive, varied routes throughout the space (Grilli et al., 2020).

The presence of equipment for users within the green space, primarily children, was commonly reported as important. For children, adolescents, and parents/families, this centred on the availability of play equipment, playgrounds and/or sports facilities (Dade et al., 2020; Huang et al., 2020; Kou et al., 2021; Refshauge et al., 2012; Rivera et al., 2021; Sonti et al., 2020; Veitch et al., 2021). However, the equipment should be age-appropriate or age-inclusive for target users (Akpınar, 2020; Rivera et al., 2021). Exercise equipment for adults was also noted as a driver of attractiveness, but to a lesser extent (Dade et al., 2020).

The presence of a range of amenities was noted as an important aspect of attractiveness; this included seating, shade, catering facilities, and toilets (Dade et al., 2020; Grilli et al., 2020; Huang et al., 2020; Kou et al., 2021; Mäntymaa et al., 2021; Phillips et al., 2022; Pueffel et al., 2018; Refshauge et al., 2012; Sonti et al., 2020). Presence of dog facilities (i.e., dog park) was also reported as important by Talal and Santelmann (2021). For children, presence of seating, Wi-Fi, and signage may not be important (Veitch et al., 2021)

Good design of equipment and space was important for attractiveness (Refshauge et al., 2012) and this also included making facilities (equipment, space, amenities) accessible for those with disabilities or additional needs (Talal & Santelman, 2021).

Safety was noted as a driver of attractiveness by some authors (Kou et al., 2021; Refshauge et al., 2012; Žlender & Ward Thompson, 2017), especially for female adolescents (Akpınar, 2020). However, Phillips et al. (2022) reported that safety may not be a strong contributor to attractiveness. Park wardens, lighting, and fences are specific facilities that can support perceptions of safety (Kou et al., 2021) and thereby attractiveness.

Organised activities or events in green spaces supported attractiveness for general users (Fontán-Vela et al., 2021; Mäntymaa et al., 2021), adolescents (Rivera et al., 2021), and children (Huang et al., 2020). Art, sculptures, or features of interest were also attractive for both adults and children (Kou et al., 2021; Veitch et al., 2021).

Facilities factors negatively related to attractiveness

Generally, negative attributes tended to be the opposite of those that were considered important for attractiveness and were sometimes defined as ‘push factors’ (in contrast to ‘pull factors’ or drivers of attractiveness; Misiune et al., 2021; Phillips et al., 2022). Evidence relating to negative factors includes:

- poor maintenance (Christoforidi et al., 2022; Veitch et al., 2021), which includes dirtiness (Phillips et al., 2022; Sonti et al., 2020) and vandalism or anti-social behaviour (Kou et al., 2021; Fontán-Vela et al., 2021);

- lack of or inappropriate recreational infrastructure (Misiune et al., 2021), including play equipment (Veitch et al., 2021);
- crowding within the space (Phillips et al., 2022; Veitch et al.; 2021);
- barriers to accessing or circulating within the space, which included:
    - distance from home or everyday routine (Christoforidi et al., 2022; Misiune et al., 2021), especially for girls (Akpınar, 2020);
    - for parents with children, having to cross busy streets to access the space (French et al., 2017), and for cyclists, having to cycle on the road with traffic (Žlender & Ward Thompson, 2017);
    - lack of signage regarding paths (Žlender & Ward Thompson, 2017).

Limitations of the evidence base and additional research needs

Limitations of the research can be summarised in three categories: internal validity concerns; ecological validity and generalisability concerns; and impact of the COVID-19 pandemic.

1. Internal validity

There were limitations associated with small sample sizes (Refshauge et al., 2012; Žlender & Ward Thompson, 2017): technical challenges in data processing/analysis (Fontan-Vela et al., 2020; Jakstis et al., 2022; Kou et al., 2021; Mäntymaa et al., 2021; Wang et al., 2021); biases inherent to the types of data collected (e.g., self-report, observations, and social media reports; Grilli et al., 2020; Huang et al., 2020; Norman & Pickering, 2019; Talal & Santelmann, 2021; Unt & Bell, 2014; Wang et al., 2021); and order effects deriving from how measures were administered (Veitch et al., 2021).

Methodological inconsistencies within studies were reported by a minority of papers (Talal & Santelmann, 2021; Žlender & Ward Thompson, 2017). Considering all studies together, the heterogeneity of measures (and of operationalisation of landscape features and facilities variables) is also a limitation.

Overall, the majority of studies analysed were cross-sectional in design which limits causal interpretations of associations between features/facilities and attractiveness. This was only explicitly commented on by three studies (French et al., 2017; Grilli et al., 2020; Wang et al., 2021) but is a wider criticism of the body of evidence, which could be addressed by greater use of pre-/post-intervention studies and longitudinal data collection.

Unmeasured contextual variables may have affected internal validity by confounding relationships between green space features/facilities and attractiveness. This could include sociocultural factors such as available recreation time (Refshauge et al., 2012), gender, health and (dis)ability, ethnicity, socio-economic status, and education (Grilli et al., 2020; Huang et al., 2020; Jakstis et al., 2022; Kou et al., 2021), and environmental attitudes (Mäntymaa et al., 2021).

2. Ecological validity and generalisability

Not all studies offered extensive representation of how people interact with green space; e.g., inclusion of all available features and facilities (Veitch et al., 2021); use patterns (Norman & Pickering, 2019; Phillips et al., 2021); and surrounding neighbourhood characteristics (Christoforidi et al., 2022; Huang et al., 2020; Phillips et al., 2021). Studies identified a need to better reflect participants' individual, lived experiences in green space through qualitative methods, e.g., interviews (Phillips et al., 2021), focus groups (Žlender & Ward Thompson, 2017) and photovoice (Kou et al., 2021), and co-development of data collection tools (Pueffel et al., 2018).

Authors also commented on how study methods and sampling may affect generalisability of findings to diverse user groups, including: people who do not use green space (Dade et al., 2020; Mäntymaa et al., 2021; Phillips et al., 2021; Refshauge et al., 2012; Rivera et al., 2021) or do not have an intrinsic interest in the topic (Christoforidi et al., 2022; Norman & Pickering, 2019); the wider population (Jakstis et al., 2022; Phillips et al., 2021; Talal & Santelmann, 2021; Žlender & Ward Thompson, 2017), including particular age groups (Fontan-Vela et al., 2020), ethnic minorities (Fontan-Vela et al., 2020; Huang et al., 2020; Kou et al., 2021); and populations who are hard to reach, e.g., those without internet access (Jakstis et al., 2022).

Generalisability concerns also related to wider geographical contexts (Christoforidi et al., 2022; Fontan-Vela et al., 2020; Mäntymaa et al., 2021; Wang et al., 2021), especially rural areas (Rivera et al., 2021), varied types of green space (Phillips et al., 2021; Pueffel et al., 2018; Refshauge et al., 2012), and urban areas with safety concerns (French et al., 2017).

Finally, authors noted that findings may not be generalisable across time of day or year (Christoforidi et al., 2022; Huang et al., 2020; Kou et al., 2021; Pueffel et al., 2018; Rivera et al., 2021; Talal & Santelmann, 2021), and that longitudinal data collection may be important to address this (Norman & Pickering, 2019).

3. COVID-19 pandemic

Three studies (published between 2021 and 2022) reported that the pandemic may have influenced their findings via, e.g., changes in green space usage unrelated to landscape features/facilities (Christoforidi et al., 2022; Talal & Santelmann, 2021), disruption to planned data collection methods (Talal & Santelmann, 2021), and asking people to reflect on behaviours pre-pandemic after the fact, which may be inaccurate (Jakstis et al., 2022).

Conclusions and implications

Regarding landscape features, attractiveness of green space can be supported by: a balance between natural and landscaped areas; open landscapes; presence of greenery, plant and animal biodiversity, and water; and good maintenance. Regarding facilities, attractiveness is related to: proximity to and accessibility of green space; accessibility within the space that supports different user needs; presence and appropriate

design/maintenance of recreational equipment, seating, shading, catering, and toilets; safety provision; and activities or features that promote interest and engagement.

This evidence base is subject to some limitations, namely: methodological factors that limit causal inferences between landscape features/facilities and attractiveness outcomes; generalisability of the findings to wider contexts and populations; and disruption to some study methodologies due to the COVID-19 pandemic.

The literature presents recommendations to increase the attractiveness of green spaces via provision of landscape features and facilities. These recommendations focus on: centring the user; tackling inequalities; enhancing safety, accessibility, and awareness; and land use maintenance/management.

In order to centre the user in the design, planning, and management of green space, it is recommended to:

- develop understanding of the needs and aims of different users of a green space (Dade et al., 2020; Norman & Pickering, 2019; Pueffel et al., 2018; Rivera et al., 2021) and enable choice based on those needs and aims (Rivera et al., 2021);
- prioritise variation of features and facilities (e.g., walking paths, equipment) that promotes user choice (Refshauge et al., 2012; Rivera et al., 2021; Žlender & Ward Thompson, 2017);
    - Some specific recommendations for playgrounds were observed: condensed, rather than spread, playgrounds should be prioritised (Refshauge et al., 2012), as should large playground equipment that promotes adventure (Veitch et al., 2021);
- situate green space management in an emplaced context that reflects regional or cultural preferences/behaviours (Jakstis et al., 2022);
- consult and actively involve users in the design, planning, management, and maintenance strategies of green space (Grilli et al., 2020; Kou et al., 2021; Phillips et al., 2022; Unt & Bell, 2014; Žlender & Ward Thompson, 2017). This may be achieved through, e.g., participatory planning (Sonti et al., 2020) and user evaluations (Phillips et al., 2022);
- use evidence-based (Kou et al., 2021) and/or co-production design techniques involving users, land managers and researchers (Sonti et al., 2020; Huang et al., 2021).

In order to tackle inequalities, it is recommended to:

- focus on improvement of green space in urban and/or low socio-economic areas where ‘push factors’ discouraging use of green space are higher, access to recreation opportunities are lower, and impacts will be greater (Christoforidi et al., 2022; Fontan-Vela et al., 2021; Mäntymaa et al., 2021; Phillips et al., 2022);
- prioritise safety and inclusivity for diverse groups of people: all ages, gender expressions, ethnicities, and abilities or disabilities (Akpınar, 2020; Christoforidi et al., 2022; Sonti et al., 2020; Fontán-Vela et al., 2021; Kou et al., 2021; Veitch et al.,

2021). Green space management should especially focus on widening inclusion towards visitors who are in under-represented groups, e.g., ethnic minorities, members of the LGBTQIA+ community, people with health conditions, migrants, and people on low incomes (Talal & Santelmann, 2021);

In order to enhance safety, accessibility, and awareness, it is recommended to:

- amplify user voices regarding safety or related issues, and respond accordingly (Sonti et al., 2020);
- develop strategies to increase safety through environmental design, careful planning of facilities, and walkability (French et al., 2017; Huang et al., 2021; Refshauge et al., 2012);
- maximise green spaces in residential areas (Akpınar, 2020; Refshauge et al., 2012) close to a range of transports (Žlender & Ward Thompson, 2017). This includes infrastructure that can facilitate active travel (e.g., cycling; Mantymaa et al) while also enabling travel by private car for older users or those with mobility needs (e.g., Kou et al., 2021);
- develop information campaigns to inform users about facilities at green spaces (Mäntymaa et al., 2021), and education campaigns to raise awareness of the benefits of visiting green space Refshauge et al. (2012);
- develop or increase availability of organised activities (Fontán-Vela et al., 2021), especially those targeted at specific user groups (e.g., women, children, families) to reduce barriers to green space use (Akpinar, 2020; French et al., 2017; Huang et al., 2021; Sonti et al., 2020).

To support attractiveness via land use management strategies, it is recommended to:

- carefully maintain landscape features and facilities (e.g., via planting, pruning, cleaning; Akpinar, 2020; Fontán-Vela et al., 2021; Rivera et al., 2021);
- identify and prioritise ‘push’ and ‘pull’ factors during green space planning processes (Misiune et al., 2021; Phillips et al., 2022), which may include factors relating the space itself and its social context (Akpinar, 2020);
- conduct valuation of the ecosystem services provided by informal or ‘unofficial’ green spaces (Unt & Bell, 2014), and connect green spaces at different scales to form ‘green networks’ (Phillips et al., 2022);
- position facilities together so that natural parts of a green space can be preserved (Mäntymaa et al., 2021).

Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the carrying capacity of such places?

Evidence summary

Street greening

There is some evidence that street greening can increase carrying capacity, providing alternative areas to experience the benefits associated with exposure to natural elements.

Street greening may provide important, safe alternatives for people to conduct physical activity outside of green spaces where sufficient access or provision of activities is not available, especially for older people (He et al., 2020). The presence of greenery along streets can increase the likelihood of cycling (Lu et al., 2019) and traffic calming measures can further promote the use of streets (Robertson et al., 2012).

Good street connectivity and connections to local amenities (such as residential areas, urban centres, and places of interest) is important to encourage use where street greening is applied (He et al., 2020). Urban planners and designers should use eye-level street greening assessments to ensure that city-dwellers' true exposure to nature is the primary focus (He et al., 2020; Lu et al., 2019).

Limitations of the evidence base and additional research needs

The two relevant studies identified on this topic were conducted in Asia; no papers were found in geographically relevant areas to this study (UK, Europe, Canada, Australia, New Zealand, and northern states of the USA), and the results from Asia may not be generalisable to other geographical contexts.

The two papers reviewed used heterogeneous methods to assess street greenness, including streetscape photos taken by researchers (He et al., 2020), Google Street View, and a Normalised Vegetation Difference Index (Lu et al., 2019). These different methods each have strengths and weaknesses. He et al. (2020) found that streetscape photos realistically captured pedestrian perspectives and can be done alongside questionnaire data capture. The researcher however must be proficient and the process of taking streetscape photos can be time and cost intensive. Lu et al. (2019) noted that Google Street View images are easily accessible online and have a vast geographical range but may sometimes have locational errors. Comparing this alongside Google Street View images, Lu et al. (2019) registered that Normalised Vegetation Difference Index provides an objective estimation of greenery in cities, but from an aerial view.

Green Active Travel Routes

Two papers were identified in relation to green active travel routes, which specifically looked at use of urban greenways (Keith et al., 2018; Xie et al., 2023). The studies echoed the recommendations in relation to street greenery, regarding importance of good connectivity with the street network, proximity to residential areas and amenities, and entrance points:

Good connectivity to other route networks and connections to local amenities (such as residential areas, urban centres, and places of interest) is important to encourage use of green active travel routes (Keith et al., 2018; Xie et al., 2023). The provision of multiple entrance points to green active travel routes or greenways can moderate the association between proximity, built environment characteristics and promote visits (Xie et al., 2023).

Safety concerns can deter use of green active travel routes due to lack of visibility and natural surveillance by members of the public, especially for racial and ethnic minorities (Keith et al., 2018). Local building density was negatively correlated to use of greenways, but this was suggested to be due to more modern, dense housing developments incorporating greenspaces within them, reducing the presence/need for urban greenways (Xie et al., 2023)

Keith et al. (2018) called for urban planners and designers to consider location, catchment areas and populations served by new green active travel routes. The expectations and needs of neighbourhoods are diverse and therefore, one greenway trail design form may not be effective at increasing use across a wide population.

Limitations of the evidence base and additional research needs

The two papers identified used different methods to examine the relationship between green active travel routes and use. Keith et al. (2018) (USA) adopted intercept surveys and systematic observation approach to understand visitor activity, while Xie et al. (2023) used longitudinal surveys to understand frequency, time, and duration of intensity of visitors on the greenway and health benefits. These methods have different strengths but are both influenced by recall and/or social desirability bias.

Other key limitations include short research time frames that do not account for seasonal variations in visitor activity (Keith et al., 2018), insufficient representation of non-users (Keith et al., 2018), and lack of granular assessments, i.e., the impact of individual features (such as toilets and lighting) on greenway use and possible behavioural differences amongst joggers, cyclists, and walkers (Xie et al., 2023).

Greenspace management

Community-based engagement and support with greenspace management was found to increase use of such spaces in urban areas (Delrose et al., 2014; Rupp et al., 2022; Mattijssen et al., 2017; Fongar et al., 2019). Active engagement by, and support from, local authorities is important to provide security and stability to such community groups

(Mattijssen et al., 2017). Support included helping community groups formalise their activities within legal frameworks, develop adaptive resource capacity, and to help create stable policies and frameworks that ensure participation is long-term and sustainable (Mattijssen et al., 2017; Mathers et al., 2015).

Engaging refugees and asylum seekers in green space management, through the introduction of mentoring programmes, can increase their use of parks and greening projects (Risbeth, Blacknicka-Ciacek and Darling, 2019) and may be applied more broadly to encourage greater participation and use for underserved communities.

Both in relation to formal (Risbeth, Blacknicka-Ciacek and Darling, 2019) and informal greenspaces (Farahani & Maller, 2019) it was emphasised that urban planners and designers should consider thoughts, aspirations and concerns of residents whilst forming designs and management plans. Small scale landscape modifications informed by rigorous community consultation can greatly enhance quality and accessibility, hence visitation of such spaces. Additional support and funding for training on greening initiatives and citizen engagement is encouraged to foster support for community groups by local governments (Rupp et al., 2022; Mattijssen et al., 2017).

Interventions such as guerrilla gardening activities may provide cost effective ways to revitalise informal greenspace, increasing provision to underserved areas, whilst fostering community engagement in the provision of green destinations (Hardman et al., 2018) but again, this was found to benefit from local authority support to ensure legitimacy and reduce concerns of land contaminants. Post-occupancy evaluation processes are also fundamental, highlighting the long-term value of informal green spaces to communities (Dempsey & Burton, 2012). In one study it was found that biodiversity and user participation in greenspace management were mutually beneficial; this is suggested to lead to a positive socio-ecological feedback loop, further increasing use and biodiversity richness (Dennis & James, 2016).

Limitations of the evidence base and additional research needs

Predominantly, behavioural observations, semi-structured interviews and surveys were used to examine the impact of changes to publicly accessible green space management. Advantages and disadvantages of these methods have already been discussed.

Regarding novel methodologies, there was one instance of community based participatory research. Community based participatory research is practical for streamlining the focus of research and bolstering community impact and sustainability (Derose et al., 2014). It should be considered that stakeholders may have divergent interests, i.e., park directors and park advisory boards may feel a need to safeguard urban green spaces from overcrowding. Effectiveness of community based participatory research is also impacted by the regularity of meetings (Derose et al., 2014).

Limitations of the findings were that direct causation between participation and increased use is not certain, due to variabilities in the regularity and intensity of activities (Rupp et al.,

2022), limitations of geographic contexts (Mattijssen et al., 2017) and variations in the size of greenspaces and levels of volunteerism (Dennis & James, 2016).

Acknowledging the increasing heterogeneity of green space in cities, broader classification is needed by governments and urban planners, to also incorporate informal green spaces into data for quality monitoring (Feltynowski et al., 2018).

Location and Access

Greenspace proximity to residential areas and neighbourhood greenery was found to be positively related to increased use and activity (Dunton et al., 2014; Rigolon, 2017; Veitch et al. 2020; Rivera et al., 2021; Huang et al., 2020; Public Health England, 2020), but this varies across traditionally well-served (predominantly white) and under-served (predominantly racial and ethnic minority) groups (Rushing et al., 2019).

Fenced-off urban green spaces with restricted opening hours are linked to higher levels of environmental volunteering compared to those without fencing and unrestricted opening hours (Dennis & James, 2016).

Limitations of the evidence base and additional research needs

A strength of the evidence reviewed was that it included a mix of cross-sectional objective studies (Dunton et al., 2014; Rigolon, 2017; Huang et al., 2020) and qualitative walk-along observational studies (Rivera, 2021; Veitch, 2020). However, cross-sectional studies were noted to insufficiently account for neighbourhood selection bias (Dunton et al., 2014) and qualitative studies may not fully allow for the identification of characteristics most important for visits (Rivera, 2021). Objective studies of park distance using GIS techniques may underestimate the true distance (Dunton et al., 2014) and there was not study of the reasons why such inequities of access exist (Rigolon, 2017). It is suggested that further research should be conducted on the impact of park features on specific populations and demographics, as well as considering health status or conditions (Veitch, 2020).

A few of the studies noted small sample sizes, which causes limitations in terms of ruling out neighbourhood selection bias, measuring cultural and social differences between groups (Huang et al., 2020; Dunton et al., 2014). A common limitation across the studies was that participants were predominantly regular park users (Veitch, 2020; Rivera, 2021) and it is suggested that further studies should be conducted with a greater proportion of participants who are irregular visitors to parks (Veitch, 2020).

Studies were conducted in either spring or summer periods only (Rivera, 2021; Huang et al., 2020). Further work should be carried out to investigate use during autumn and winter seasons (Huang et al., 2020; Rivera, 2021).

Provision of facilities and safety interventions

The provision of landscaped and well-maintained areas (Sonti et al., 2020; Rivera et al., 2021; Huang et al., 2020; Farahani & Maller, 2019) and defined walking paths and trails (Derose et al., 2019) can increase use by reducing concerns of safety, particularly among

certain demographics such as women, women with children, and adolescents (e.g., Sonti et al., 2020). Poor maintenance of natural spaces can increase safety concerns (Farahani & Maller, 2019). However, two studies did not find strong relationships between park upkeep, walking trails availability and visual aesthetics and increased visits among older adults (Kou et al., 2021; Veitch et al., 2020).

The provision of facilities was related to increased use in several studies with different demographic groups. Benches, seating, cafés, shaded areas, toilets, and water features were found to encourage use (Sugiyama & Ward Thompson, 2008; Vetch et al., 2020; Kou et al., 2021; Rivera et al., 2021; Marquet et al., 2019a). These elements were particularly necessary for encouraging use by non-disabled older people (Sugiyama & Ward Thompson 2008; Veitch et al., 2020; Kou et al., 2021), as well as the availability of car parking spaces to increase accessibility (Kou et al., 2021). Regarding use by older people with functional and/or cognitive impairments, everyday objects in the physical environment in some instances can support or complicate use (Aspinall et al., 2010; Brookfield et al., 2017). Availability of bike storage units was also found to impact park visitation levels by children in low-income neighbourhoods in New York City, USA (Huang et al., 2020). The presence of sporting facilities and playgrounds was found to encourage use (Roberts et al., 2016), especially by adolescents and ethnic groups (Marquet et al., 2019a; Rivera et al., 2021). Use of greenspaces among adolescents (13-18 years) was positively correlated with provision of picnic areas, shaded areas, and park upkeep (Rivera et al., 2021). Insufficient social/cultural facilities, such as barbecues and picnic areas impeded the number of visits by ethnic minorities (Rushing et al., 2019). Also, two studies investigating both full off-leash park access and designated off-leash areas found that introducing off-leash dog areas into multi-use parks could potentially diversify visitor profiles (Lee, Shepley & Huang, 2009; McCormack et al., 2016), though evidence is inconclusive.

Park programming of events and group activities was found to increase use across a broad range of groups and reduce concerns of safety and foster social interaction (Cohen et al., 2013; Hunter et al., 2015; Roberts et al., 2016; Hunter et al., 2019; Derose et al., 2020; Veitch et al., 2020). These include women and children, ethnic groups, low-income groups, and older people. Activities may include yoga, dance and exercise classes, sporting events, competitions, and other social activities. Such organised activities can in turn increase visits by friends, relatives of park users as well as onlookers (Cohen et al., 2013), which can also encourage use by adolescents (Rivera et al., 2021). Park programming supplemented by promotional materials, for example informational signs, posters and brochures can potentially increase use, though evidence remains inconclusive (Roberts et al., 2016; Hunter et al., 2019; Public Health England, 2020; Elliott et al., 2021).

Limitations of the evidence base and additional research needs

Various methods were used to examine the influence of facilities and safety provisions on carrying capacity of urban green spaces. In the context of this, physical intervention, behavioural observations, walk along interviews, natural experiment designs and objective statistics (i.e., crime rates) were commonly cited as research methods. The advantages and disadvantages of behavioural observations and objective statistics have been

previously discussed. Regarding walk along interviews, Rivera et al. (2021) praised this method for offering detailed, novel, and immersive and real time insights into visitor perspectives of park facilities. This method also minimised recall bias. Regarding natural experiments, such methods enable the comparison of park activity pre and post built environment interventions (McCormack et al., 2016). Reflecting on weaknesses, the degree to which certain individuals visited before and after park modifications cannot be deduced (Veitch et al., 2012). Holistically a few other limitations were expressed across papers: distinctly the limited time scale of research (Cohen et al., 2010), the lack of account of seasonal and meteorological variation in use (Rivera et al., 2021), insufficient sample size (Dunton et al., 2014), insufficient representation of non-users (Veitch et al., 2020) and/or certain socio-demographic groups (Huang et al., 2020; Misiune, Julian, & Veteikis, 2021).

Limitations of the evidence base and additional research needs

Overarching limitations of the literature to answer this research question include limited period of study, therefore not considering seasonal and meteorological variations, limited sample sizes and insufficient representation of non-park users and certain socio-demographic groups. It is also noted that studies typically lacked granularity in relation to the impact of specific modifications, such as toilets, lighting, landscaping designs and changes, behavioural differences, etc. This therefore suggests that further research is required to appropriately inform designers, planners, and park maintenance teams as to the specific designs that can promote use.

The relevant studies available for street greening and green active travel routes were found to be limited. The studies tended to be of observational design, which can be useful to reduce recall bias, but were noted to be weak in relation to the collection of representative objective data that can be assessed over longer periods and scales.

Conclusions and implications

To increase the use of greenspaces and green routes, consideration is needed for the placement and landscape design of spaces, to provide access in proximity to residential areas, but also to provide a range of facilities that appeal to different needs and user types. Park facilities such as seating, shading, catering, and toilets can help increase use by older people, sporting areas can encourage people of ethnic minorities and people on low incomes, and consideration should be made for culturally specific facilities to increase use by traditionally underserved communities, such as barbecues and picnic areas.

Greenspace management should seek to involve local users to help inform the designs, maintenance, and activities, as these have been found to increase use across broad demographic groups. Long-term participation in greenspace management is heavily dependent on support from local government, to aid the groups establishing their own governance arrangements, frameworks, and capacity. The introduction of mentoring programmes in relation to greenspace management have been found to increase use by

traditionally underserved communities and funding to support such initiatives is important to encourage greenspace use for these groups.

Landscaped areas can increase use by reducing safety concerns compared to “natural”, more unkept areas. Defined walking paths can enhance use by further promoting feelings of safety. Park programming can encourage use, both by interest but also in relation to safety concerns, and is particularly important for increasing visits by women, adolescents, older people, ethnic minorities, and people on low incomes. Such programming can include exercise classes, sporting events, competitions and other events that encourage social use of greenspaces.

The connectivity of greenspaces and green routes to both street networks, urban centres with amenities but also between themselves, was of importance across several demographics. Interestingly, green routes may provide significant opportunities for active travel and activity outside of greenspaces, due to safety and/or reduced facilities, but still with the benefits of exposure to natural elements. This is particularly relevant to increasing proximity of greenery to residential areas within urban centres, but provision should be made for multiple entrance points and good connectivity to nearby amenities. Diversity in the type of green route trails could encourage use by a wider range of the population.

This evidence base was subject to some limitations. Most of the evidence was based on user accounts and interviews, as opposed to longer term before and after studies. Studies also noted limitations in timescale, seasonal variation, the study of non-users, the granularity of specific interventions, such as lighting, vegetation design, etc.

The literature above presents recommendations to increase the use of greenspaces and green routes in urban areas, through interventions such as: changes to greenspace management, the provision of facilities, safety interventions, as well as the provision of street greening and urban greenways. It is highlighted that studies investigating the impact of street greening and urban greenways on use were found to be limited.

In order to encourage use via the design, planning, and management of greenspaces and routes, it is recommended to:

- increase greenspace proximity to mixed use (i.e., town centres) and residential areas (Dunton et al., 2014; Rigolon 2017; Huang et al., 2020; Veitch et al., 2020);
- acknowledging the increasing heterogeneity of green space in cities, broader classification is needed by governments and urban planners, also incorporating informal green spaces into remote sensing data (Feltynowski et al., 2018);
- increase the proximity and connectivity of greenways to residential areas, ensuring that several entrances are provided (Zie et al., 2023; Tie et al., 2023; Keith et al., 2018). Consider opening times, fencing and entrances in relation to how they might affect use and participation in volunteering activities (Dennis & James, 2016);
- ensure that park design includes a range of park elements to encourage diversity of users, especially concerning age. This particularly relates to increasing adolescent visits by increasing presence of family members and peers (Rivera et al., 2021);

- encourage community participation in the design and management of greenspaces (Derose et al., 2014; Mattijssen et al., 2017; Farahani & Maller, 2019; Risbeth, Blacknicka-Ciacek and Darling, 2019). Support should be provided by local government to foster relationships between community groups and help such groups to establish long-term participation and capacity for involvement (Mattijssen et al., 2017);
- provide seating, shaded areas, light refreshment facilities (such as a café) and toilets (Sugiyama & Ward Thompson, 2008; Roberts et al., 2016; Kou et al., 2020; Veitch et al., 2020). These can be especially important to increase numbers of senior visitors. For older people with physical and/or cognitive impairments, everyday objects in the physical environment can potentially nurture or complicate park use (Aspinall et al., 2010; Brookfield et al., 2017);
- consider the provision of sporting facilities and playgrounds (Rivera et al., 2021; Marquet et al., 2019a). These can be important to increase adolescent visitors.
- Consider the provision of park programming, such as events, exercise classes, sporting competitions and other activities to encourage social use of the greenspaces (Veitch et al., 2020; Cohen et al., 2013);
- post-occupancy evaluation processes are also fundamental, highlighting the long-term value of informal green spaces to communities (Dempsey & Burton, 2012);
- provide support and funding for training on green initiatives and citizen engagement to provide support for fostering positive relationships between local government and community groups (Rupp et al., 2022; Mattijssen et al., 2017);
- promotional materials for park events and activities tailored to different user groups (Public Health England, 2020; Elliot et al., 2021).

In order to tackle inequalities of use in green spaces and routes, it is recommended to:

- consider the provision of areas for sports and play, such as basketball courts, swings, or water features (Marquet et al., 2019a; Rivera et al., 2021);
- consider the provision of greenspace facilities that are specific to underserved socio-cultural groups, such as barbecues and picnic areas (Rushing et al., 2019);
- consider the provision of park programming of events to encourage underserved socio-economic groups, such as sporting events, classes, competitions, and other activities (Cohen et al., 2013) and encourage visiting of family members, relatives, peers and onlookers (Cohen et al., 2013);
- provision of mentoring programmes to support inclusive participation in greenspace management activities (Risbeth, Blacknicka-Ciacek and Darling, 2019);
- plan for a diversity of greenway trails and routes that are well connected to neighbourhoods and residential areas (Keith et al., 2018; Tie et al., 2023).

In order to reduce barriers of safety, accessibility, and awareness on use of greenspaces and green routes, it is recommended to:

- increase street greening in residential areas to encourage walking and active travel outside of greenspaces, especially where safety and access to facilities are barriers

of access (He et al., 2020; Lu et al., 2019). This should be paired with improvements in street connectivity to amenities and transport (He et al., 2020; Keith et al., 2018);

- carefully consider landscaping design and upkeep of greenspaces and routes planned for increased use and avoid natural, unkept areas (Sonti et al., 2020) and include designated walking paths (Derose et al., 2019);
- consider programming of activities, such as yoga, dance, and exercise classes to encourage physical activity levels in greenspaces by women and children (Derose et al., 2020).

Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the enjoyment/experience of such places?

Evidence summary

Street greening

The presence of street greenery (trees and vegetation) enhances enjoyment or experience of these spaces, relative to streets without greenery. This relates specifically to increased preference and aesthetic appraisals (Bonthoux et al., 2019; Dobbie & Farrelly, 2022; Nawrath et al., 2019; Newton et al., 2010; Weber et al., 2014) and self-reported psychological wellbeing (Lindal & Hartig, 2015; Newton et al., 2010; Weber et al., 2014). However, one study reported that street trees are more valued for their environmental benefits than their role in enhancing enjoyment, although this may be less true for women (Graça et al., 2018).

The extent and design of greenery can affect how streets are experienced. There is evidence of a dose-response relationship in that street preference increases with greater levels of greenery, especially trees or mixed types of vegetation (Dobbie & Farrelly, 2022; Lindal & Hartig, 2015; Nawrath et al., 2019). Designated areas for vegetation are highly preferred (Bonthoux et al., 2019), especially if this means it is less likely to be subject to vandalism (Newton et al., 2010). There is a lack of consensus regarding experiences of wild street vegetation, which can be perceived as interesting or beautiful, but also unmaintained or weed-like if in high-visibility locations (Bonthoux et al., 2019; Sikorski et al., 2017; Weber et al., 2014).

Limitations and further work

The findings above are subject to limitations regarding studies' internal validity; e.g., order effects arising from presentation of environmental stimuli (Dobbie & Farrelly, 2022), and un-measured or poorly measured contextual variables, such as socio-demographic factors (Weber et al., 2014), childhood experiences and education (Bonthoux et al., 2019), and local cultural/urban characteristics (Graça et al., 2018). These variables could be included in future studies.

Ecological validity and generalisability of the studies may also be limited due to:

- the use of photographs rather than in situ evaluations (Sikorski et al., 2017) which participants may not be very familiar with, and/or may not accurately represent their experiences in such settings (Lindal & Hartig, 2015; Nawrath et al., 2019). Efforts to make stimuli more immersive and realistic in future studies may address this;

- the low response rate and over-representation of women participants in sampling (Lindal & Hartig, 2015);
- the place-specific nature of some findings that may not generalise to other locations, which can be addressed by studies that are broader in geographical scope (Weber et al., 2014; Graça et al., 2018);
- seasonal variations in greenery appearance that may affect preference at other times of year (Bonthoux et al., 2019).

Green active travel routes

There is some evidence that green active travel routes are related to greater enjoyment or experience. In a study of greenways for walking and cycling, 98% reported experiential benefits (recreation and enjoyment) as being important or very important, and 44% indicated that the natural scenery along the route was very important to them (Keith et al., 2018). Cycle tracks with trees and bushes are preferred to those without, especially when the greenery forms a barrier between the track and the pavement/road, although these preferences may vary between demographic groups (Lusk et al., 2020).

There is evidence that enjoyment or experience of green active travel routes varies depending on the user. Perceptions of, and preference for, high levels of greenery on walking routes to parks is related to perceiving the benefits of the vegetation (e.g., visual stimulation, interest), while those who do not prefer this type of scene tend to perceive the route as poorly maintained and/or unsafe (Tilt, 2010).

Limitations and further work

The evidence is subject to limitations regarding internal validity, including: cross-sectional design limiting causal inferences (Tilt, 2010); small sample size (Lusk et al., 2010) and possible non-response bias (Tilt, 2010); use of self-report measures (Keith et al., 2018; Tilt, 2010), although that is unavoidable given the subjective nature of 'enjoyment/experience' variables; order effects deriving from stimuli presentation methods (Lusk et al., 2020); and unaccounted-for variables such as park proximity (Tilt, 2010) that could be addressed in future studies.

There are also limitations to ecological validity of the studies. The study by Lusk et al. (2020) involved photomontages that may have lacked realism; this could be addressed in future studies through use of more immersive stimuli. Current findings may not be generalisable to other active travel routes or geographical regions (Keith et al., 2018; Tilt, 2010), or to other times of year that were not studied (Keith et al., 2018; Lusk et al., 2020).

Site management

One paper was identified in relation to site management (Jansson et al., 2016), and this focused on children aged 10-11 years. Children reported positive, but different, experiences related to play in managed and unmanaged areas in their urban village. Managed areas such as playgrounds supported positive social dimensions of play, while unmanaged/abandoned areas supported a sense of freedom and varied, creative types of

enjoyment. Children also reported mixed evaluations of the management provision; maintenance of managed greenspace was positively regarded, while governance and planning, loss of green space, and lack of consultation with children were negatively regarded.

Limitations and further work

Only one paper was identified in relation to this topic. It is limited in terms of its small sample size, and the fact that the research was conducted in a village which, although classed as urban in Sweden, may be considered rural in a UK context. This paper also focuses on children and may not be generalisable to adult experiences. Further work is needed to examine connections between experience/enjoyment of green space and site management.

Provision of facilities

Open green space (Arnberger & Eder, 2015) and the presence of natural elements (e.g., established trees, gardens and birdlife, water features; Veitch et al., 2020; Wood et al., 2017) is positively related to enjoyment.

Provision of facilities (seating, catering, toilets, etc.) is related to enjoyment and positive experience of green space (Bertram & Rehdanz, 2015). Much of this evidence relates to seating. Availability of high-quality (ideally wooden) seating is consistently found to support positive experience (Bertram & Rehdanz, 2015; Campagnaro et al., 2020; Newton et al., 2010; Nordh & Østby, 2013; Veitch et al., 2020; Wood et al., 2017). For relaxation or psychological restoration, seating should support the possibility of sitting alone (Arnberger & Eder, 2015; Nordh & Østby, 2013). For feelings of safety, seating need not facilitate sitting alone (Campagnaro et al., 2020), but for socialisation seating should actively facilitate sitting with others in small gatherings (e.g., via provision of picnic benches and gazebos enclosed by greenery; Hadavi et al., 2015; Nordh & Østby, 2013). Limited seating reduced enjoyment and psychological restoration (Nordh & Østby, 2013), as did hard-surface seating, e.g., metal/concrete benches (Hadavi et al., 2015; Nordh & Østby, 2013).

Availability of recreation spaces and amenities is related to positive experience. This includes playgrounds, catering, toilets (Wood et al., 2017; Newton et al., 2010), shade, activities/events (Veitch et al., 2020) and drinking fountains (Campagnaro et al., 2020). The aesthetic value of space is also important for enjoyment and wellbeing outcomes (Baumeister et al., 2020; Veitch et al., 2020). Sports facilities (e.g., fitness equipment, trails, and courts/tracks/pitches) support wellbeing (Baumeister et al., 2020), especially via the cultural ecosystem services of recreation and stress reduction (Campagnaro et al., 2020; Wood et al., 2017).

Paths support positive experiences in green space (Veitch et al., 2020), especially wide gravel trails (Arnberger & Eder, 2015). Historic buildings and squares can also support recreation and ecotourism outcomes by providing a sense of place (Baumeister et al., 2020).

Good management of facilities is important for enjoyment (Veitch et al., 2020; Newton et al., 2010) and psychological restoration (Nordh & Østby, 2013). For some green space users this may include limiting dog access (Arnberger & Eder, 2015). Factors that limited enjoyment and experience were poor maintenance of spaces and facilities (Nordh & Østby, 2013) and/or anti-social behaviour (e.g., litter, vandalism, noise; Arnberger & Eder, 2015). The presence of litter bins may negatively impact on stress reduction (Campagnaro, et al., 2020).

Limitations and further work

Limitations in sample size and characteristics may mean data are not representative of the wider population, especially with over-representation of regular green space users (Veitch et al., 2020), women (Nordh & Østby, 2013), students, and/or participants with higher levels of education (Baumeister et al., 2020; Nordh & Østby, 2013; Veitch et al., 2020) or a higher socioeconomic status (Wood et al., 2017; Veitch et al., 2020). Future research could prioritise representative sampling and inclusion of participants with a lower education level, those from different cultural backgrounds, and those with/without children (Baumeister et al., 2020). Data collection should also encompass demographic, socioeconomic, and environmental variables in order to control for their confounding effects on enjoyment and experience (Campagnaro et al., 2020; Wood et al., 2017).

Methodological limitations may have compromised the internal validity of some studies; e.g., via possible inaccuracies in data collection techniques (Baumeister et al., 2020), priming of participants' awareness of negative environmental factors (i.e., litter; Arnberger & Eder, 2015), and researcher estimation of participant age when screening for recruitment (Veitch et al., 2020). Cross-sectional study design (Wood et al., 2017) and a lack of qualitative data (Hadavi et al., 2015) also limited the ability of some studies to make causal inferences about their findings.

One study also commented on limits to its ecological validity, in that – outside of a research context – green space characteristics are a product of trade-offs between human enjoyment and environmental needs (Bertram & Rehdanz, 2015).

Safety

Safety interventions in the reviewed literature related to the layout of green space and the type/extent of vegetation within the space. Visual obstructions or unclear spatial layout reduced perceptions of safety within green spaces (Lis & Iwankowski, 2021a; Lis et al., 2022) and therefore reduced preference/liking for the space. The reductions in perceived safety arising from visual obstructions in turn reduced perceptions of privacy (Lis & Iwankowski, 2021a), which is a limiting factor if users are visiting a space to find solitude and psychological restoration.

High-density vegetation was also related to reduced perceptions of safety and thereby reduced enjoyment (Pardela et al., 2022) especially when the overall space did not have a clear layout (Lis et al., 2022) or was highly enclosed (Tabrizian et al., 2018). Interestingly, density of planting may not in itself negatively affect preference; this effect seems to arise

when people associate dense vegetation with threat (Lis & Iwankowski, 2021b). Tabrizian et al. (2018) suggest that such environments might make it harder to identify possible threats and therefore be less restorative.

In an intervention study (Ward Thompson et al., 2013), perceptions of safety increased following improvement of vegetation, trees, visibility, and views. The perceived quality of the physical neighbourhood, which the researchers used to indicate quality of life, also increased amongst residents.

Limitations and further work

The above studies have limitations relating to:

- internal validity, arising from: cross-sectional study design (Ward Thompson et al., 2013); measures that were not validated (Ward Thompson, Roe, & Aspinall, 2013) or did not capture all aspects of a dependent variable (Lis, A. & Iwankowski, P. (2021a); demand characteristics that may have biased participant response (Tabrizian et al., 2018; Ward Thompson et al., 2013); and limited inclusion of individual, demographic, or sociocultural covariates (Lis et al., 2022; Pardela et al., 2022; Tabrizian et al., 2018) or matching of pre- and post-intervention samples on these variables (Ward Thompson et al., 2013);
- ecological validity, arising from: use of photographs that do not capture immersion in in-situ settings (Lis & Iwankowski, 2021a, 2021b; Lis et al., 2022);
- generalisability, arising from: unrepresentative sampling (Pardela et al., 2022); location-specific findings (Tabrizian et al., 2018); and seasonal or weather-dependent effects (Lis & Iwankowski, 2021b; Lis et al., 2022).

Limitations of the evidence base and additional research needs

There are three main limitations in the literature used to answer this research question.

1) Internal validity - Due to cross-sectional designs, small sample sizes, demand characteristics, limited inclusion of individual, demographic, or sociocultural covariates, order effects in the presentation of stimuli, non-response bias, the use of self-report measures, and poorly measured contextual variables. Future research should better account for the influence of socio-demographic factors, childhood experiences and education, local cultural/urban characteristics, and the proximity to greenspace.

2) Ecological validity - A few studies used photo-elicitation methods, which are unable to capture the experiences of more immersive stimuli. One study did, however, utilise immersive virtual environments, which enabled researchers to present photo-realistic scenes. But researchers should consider conducting in-situ research for more ecologically valid findings.

3) Low generalisability - Due to seasonal and weather-dependent effects (such as using photographs taken in summer), unrepresentative sampling (e.g., the overrepresentation of

women and high socio-economic status groups in some studies), and location-specific findings.

In addition, only one paper was identified in relation to greenspace management, suggesting a gap in the literature from which further research would be of benefit, and/or a limitation in the search terms used to generate papers for the purposes of the present review.

Conclusions and implications

Enjoyment/experience of streets and active travel routes can be supported by the presence and greater extent of greenery, especially trees. However, these positive perceptions depend on the type and positioning of greenery (e.g., in relation to mixed perceptions of wild street vegetation, and preference for greenery on active travel routes to be used as barriers between traffic types) and on individual differences between users.

Evidence regarding connections between site management and enjoyment/experience of green space is inconclusive due to limited literature on the topic. The role of site management may depend on what users aim to do in the space; however, user involvement and agency in site management is noted as important.

There was extensive evidence that facilities such as seating, catering, recreational equipment, toilets, and paths/trails support enjoyment/experience, as long as they are well-maintained and appropriate for users' needs/preferences.

Steps to increase perceptions of safety, such as improved visibility in green space, support enjoyment/experience. Conversely, visual obstructions, poor spatial layout, and dense vegetation can negatively affect enjoyment/experience, especially if users are already sensitised to safety concerns in a space.

This evidence base is subject to limitations regarding internal validity of studies (e.g., limited understanding of contextual variables), external validity (e.g., use of photos rather than in-situ experience) and generalisability (e.g., to wider populations, geographical areas, and seasons).

The literature presents recommendations to increase enjoyment/experience (of greenspace) via street greening, green active travel routes, changes to site management, safety interventions and provision of facilities. These recommendations focus on: understanding the space and centring its users; using types of materials known to support human and environmental wellbeing; maintaining the space/intervention appropriately; and making design choices that prioritise a sense of safety.

To understand the space and centre users, it is recommended to:

- understand the local physical and societal context, and existing use patterns of the street, in order to select/design appropriate interventions (Dobbie & Farrelly, 2022);

- focus on design choices that support user needs and preferences (Arnberger & Eder, 2015; Keith et al., 2018; Lusk et al., 2010; Tilt, 2010). It is important to provide a range of facilities that suit different user groups, bearing in mind their heterogeneous needs and motivations when visiting green space (Campagnaro et al., 2020; Wood et al., 2017; Veitch et al., 2020);
- urban greenspace managers should consult with users of these spaces and provide them with a say in management strategies (Jansson et al., 2016).

To use types of materials known to support human and environmental wellbeing, it is recommended to:

- prioritise gravel over asphalt paths (Campagnaro et al., 2020);
- add seating to green space that uses wooden, unfinished materials and is arranged in ways that can support socialisation (Hadavi et al., 2015; Newton et al., 2010; Nordh & Østby, 2013);
- regarding street greening, exploit the benefits of wild vegetation where appropriate, as it has lower management needs (Bonthoux et al., 2019; Sikorski, et al., 2017), although higher-maintenance vegetation may be preferable in more visible areas (Sikorski, et al., 2017);
- use wild vegetation and street trees to support outcomes beyond experience/enjoyment, e.g., biodiversity (Bonthoux et al., 2019; Nawrath et al., 2019; Weber et al., 2014) and urban resilience to climate change (Graça et al., 2018).

To appropriately maintain the space or the greening intervention:

- maintain all facilities, including infrastructure, historic/heritage sites, and sports facilities (Arnberger & Eder, 2015; Baumeister et al., 2020);
- beyond individual facilities, maintenance of the wider space is important, e.g., maintaining cleanliness and low crime (Bertram & Rehdanz, 2015);
- develop strategies to ensure adequate maintenance of street greening where needed (Dobbie & Farrelly, 2022).

To prioritise users' sense of safety, it is recommended to:

- create porous, low-enclosure spaces that allow people to leave easily (Tabrizian et al., 2018);
- avoid visual barriers between activity and leisure zones (Lis & Iwankowski, 2021a);
- prioritise visibility and spatial legibility by cultivating open landscapes and visible sky (Lis & Iwankowski, 2021b). This can be achieved by shaping dense and wild-looking planting in such a way that it helps people orientate and find their way around (Lis et al., 2022);
- prioritise visibility and spatial legibility over dense vegetation in areas that are away from people (Lis & Iwankowski, 2021a) or are at risk of crime or anti-social behaviour (Lis & Iwankowski, 2021b; Pardela et al., 2022);

- less spatially legible areas, which are perceived as unsafe, could be monitored to improve the sense of safety (Lis et al., 2022).

Overall Conclusions and Implications

Which key landscape features and facilities make a green space attractive to people?

- Attractiveness can be enhanced by providing a balance between natural and landscaped areas, open landscapes, the presence of greenery, plant and animal biodiversity, water elements, litter free and good maintenance. It is recommended that a common vocabulary is defined to distinguish between natural/wild areas and that of unkept, unmanaged areas in relation to safety concerns and littering.
- Proximity of greenspace is a key determinant of attractiveness, as well as accessibility. Situating greenspaces within residential areas that are close to a range of transports can facilitate active travel, while also enabling travel by private car for older users or those with mobility needs. It is recommended that 'unofficial' greenspaces (e.g., small areas of green space, disused areas, trees belts) are included and connected to the wider network to provide different scales of spaces that improve accessibility and proximity.
- Presence of facilities is particularly important to support different user needs, such as recreational equipment, seating, shading, catering, barbecue/picnic areas, and toilets. Appropriate design and maintenance of facilities is also considered to be important in supporting attractiveness. It is suggested that facilities are positioned together so that natural parts of a green space can be preserved.
- Provision of a variety of features to meet the needs and aims of different users and reduce concerns of safety and lack of inclusivity, such as walking and cycling paths, playgrounds that promote adventure, sporting equipment, etc. These can promote user choice and be appealing to wider demographics.
- The programming of activities or features that promote engagement can increase attractiveness and reduce barriers to greenspace use for specific targeted user groups and increase inclusion, especially for under-represented groups. This can also include educational campaigns to promote the benefits of greenspace use to these groups.
- Community consultation that actively involves users in the design, planning, management, and maintenance strategies can further improve the attractiveness of greenspaces. Greenspace planning processes should account for landscape and social 'push' and 'pull' factors, in relation to varying needs and preferences. Co-design practices can also be effective at ensuring that designs cater for the local context.

Can street greening, provision of green active travel routes, changes to publicly accessible greenspace management, safety interventions and provision of facilities increase the carrying capacity of such places?

- Greenspace and green routes are used more the closer they are to residential areas and local amenities. Multiple entrance points can lead to more use by moderating distance to households or points of interest.
- Diversity of green routes and trails in terms of design, features, range of nearby facilities and use cases (i.e., waterways, cycle routes, nature trails, linear parks) is suggested to increase use across the population and cater for various activities.
- Greenspace management should seek to involve local users to help inform the designs, maintenance, and activities, as these have been found to increase use across broad demographic groups. Long-term participation in greenspace management is heavily dependent on support from local government, to aid the groups establishing their own governance arrangements, frameworks and capacity.
- Greenspace and route design should include facilities that reduce barriers of access, especially for older people and the mobility impaired. Such facilities include parking, seating, shaded areas, light refreshment facilities and toilets.
- Street greening and green routes can provide important alternative opportunities for active travel and activity outside of designated greenspaces, which may be avoided due to safety concerns or reduced access to facilities (such as older people), but still with the benefits of exposure to natural elements. Sufficient environmental conditions, such as noise, air quality and lighting, should be considered of such routes to not deter their use.
- Facilities such as sporting areas, playgrounds, water features can encourage use by adolescents, and specific cultural facilities, such as barbecues and picnic areas can encourage use by traditionally under-served groups.
- Landscaped areas with walking paths can increase use by reducing safety concerns compared to unmaintained natural areas.
- Connectivity of greenspaces and routes is important to encourage use, in relation to accessibility, but also for safety. Connectivity to the street network, urban centres with amenities but also between other greenspaces and routes is important to encourage use across several demographics. Additionally, a variety of entrance points should be provided to increase access proximity to local areas.
- Park programming of activities, such as yoga, dance and exercise classes, sporting events and social activities can encourage use, both by interest and in relation to reducing safety and inclusivity concerns. Such activities are particularly important for increasing visits by women, adolescents, older people, ethnic minorities, and people on low incomes.
- The introduction of mentoring programmes in relation to greenspace management have been found to increase use by traditionally underserved communities and

funding to support such initiatives is important to encourage greenspace use for these groups.

Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the enjoyment/experience of such places?

- Street greening and active travel routes can enhance enjoyment and experience, especially through the inclusion of trees. The specific type and positioning of greening measures are important considerations for design, as mixed perceptions were found in relation to wild street vegetation and the preference for greenery barriers between traffic types on streets.
- Provision of seating, catering, recreational and sporting equipment, toilets, and path/trails were found to increase enjoyment/experience, where well maintained and are designed with user's needs in mind.
- Good management in relation to maintenance and upkeep are important to avoid detracting from enjoyment and experience, such as litter, vandalism, noise, anti-social behaviour.
- Despite the limited evidence in relation to how greenspace management can increase enjoyment/experience, it was noted that community involvement and agency is important.
- Perceptions of safety are important in order to increase enjoyment/experience, especially for those already sensitised to safety concerns in a space. Steps to improve such perceptions include reducing visual obstructions and reducing dense vegetation, as well as considering spatial layout.

Glossary

Attractiveness is a measure of the extent of use of a place, including the number of visitors using the place and the duration of their stay there, and the intention and motivation to visit that place.

Carrying Capacity is a measure of the potential number of individuals that a natural resource can support, without resulting in the degradation of the resource for present and future generations. It is a term used to describe the potential for green infrastructure to serve the population but also to consider a limit on this to protect key habitats and wildlife.

Enjoyment has been defined in psychological research (Smith, Harrison and Bryant, 2014) as “a positive affective state that occurs when a person engages in an experience or activity that satisfies a desire, goal, or need, including but not limited to the need for pleasure, meaning, security, safety, sustenance, esteem, belongingness, or love.” (Smith, Harrison and Bryant, 2014).

Experience refers to the psychological outcomes/benefits of well-being and restoration, as well as preference, as relating to the liking of a place, or the finding of a place aesthetically pleasing (Wilkie and Clements, 2018).

Facilities are defined for the purposes of this review as elements that provide utility, such as seating, toilets, children’s play areas, cafes, community hub, bins, transport and parking, etc.

Green Infrastructure is defined in the National Planning Policy Framework (NPPF) as “a network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity” (*National Planning Policy Framework*, 2021). Natural England furthers this expansive view of Green Infrastructure (GI) and breaks it into ‘GI Network’ and ‘Linear GI’. “A GI network can include street trees, green roofs/walls, parks, private gardens, allotments, sustainable drainage systems, through to wildlife areas, woodlands, wetlands and natural flood management functioning at local and landscape scale. Linear GI includes roadside verges, green bridges, field margins, rights of way, access routes, and canals and rivers” (Natural England, 2022).

Green Route or **Green Active Travel Route** is a piece of transport or mobility infrastructure that includes green infrastructure and/or natural elements, specifically for the purposes of active travel (walking, cycling and wheeling). This is a wide-ranging term to allow for a variety of green elements and density of these elements that may occur as part of general mobility infrastructure, such as street trees, green verges, wildflower verges, hedgerows, green wall or vertical wall systems, water features on pedestrian footways or streets, etc.

Greenspace or green space is defined as a designated green and/or natural area, including both green and blue areas such as park, woodland, wetland, river, canal, nature reserve, allotment, green corridors, etc.

Greenspace or site management is the approach to planning, care and maintenance programming of a designated green space or green infrastructure element and may be defined as “a strategic, inclusive and long-sighted approach of continued re-planning, re-design, re-construction and maintenance of green spaces” (Jansson *et al.*, 2020). This can take many forms ranging from National Park or Area of Outstanding National Beauty (AONB) status, local authority park maintenance contracts, Non-Governmental Organisation (NGO) support, community participation and friends of parks groups, local activism, etc. Residents and communities have long been interested in managing their local green spaces. As local authority budgets become increasingly restricted, communities are under pressure to take an active role in green space management in partnerships with the public, and where applicable, private sector. Support for such partnerships has been made manifest at the highest level of government through the UK's 2011 Localism Act (Mathers, Dempsey and Frøik Molin, 2015).

Guerrilla Gardening is the method of gardening to enhance abandoned sites through planting and maintenance, often without the approval of the landowners.

Landscape Features are defined for the purposes of this review as geographical, topographical, historical, and natural elements within the environment, such as hills and views, woodland, ponds, avenues, heritage buildings and/or structures, landmarks, etc.

Neighbourhood Floor Area Ratio (FAR) is a factor of the total built area to net site area (Prior and Partners, Maccreanor Lavington, 2019).

Restoration has been defined in psychological research (Scopelliti, Carrus and Bonaiuto, 2018) as “the capacity for natural environments to replenish cognitive resources depleted by everyday activities and to reduce stress levels” (Scopelliti, Carrus and Bonaiuto, 2018).

Safety interventions are practical upgrades (predominantly) undergone by greenspaces to improve perceptions of safety (Hunter, Cleary and Braubach, 2019).

Suitable Alternative Natural Greenspace or SANG is the name given to greenspace that is of a quality and type suitable to be used to mitigate potential impact of residential development on SACs or SPAs by preventing an increase in visitor pressure. Its role is to provide alternative green space to divert visitors yet providing equivalent or enhanced health, wellbeing and social benefits. The effectiveness of SANG as mitigation will depend upon the location and design. These must be such that the SANG is more attractive than the SPA to users of the kind that currently visit the SPA (Woking Borough Council, 2021).

Strategic Access Management and Monitoring or SAMM aims to protect a SPA from recreational pressures arising from new housing development through education (both on and off site), guidance, promoting the use of SANG sites, and monitoring the effectiveness of the avoidance strategy (Rushmoor Borough Council, 2020).

Special Areas of Conservation or SACs are protected areas in the UK designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters) (Joint Nature Conservation Committee (JNCC), 2022a).

Special Area of Conservation or SPAs are protected areas for birds in the UK classified under the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters) (Joint Nature Conservation Committee (JNCC), 2022b).

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Appendix A – Search strategy

Research questions:

How does the provision and management approach of green spaces and green routes affect the carrying capacity of more natural environments in urban areas and the resulting health, wellbeing and enjoyment benefits?

Secondary research questions:

1. Which key landscape features and facilities make a green space attractive to people?
2. Can street greening, provision of green active travel routes, changes to publicly accessible greenspace management, safety interventions and provision of facilities increase the carrying capacity of such places?
3. Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the enjoyment/experience of such places?

Search strategy:

Iterative and strategic searches were conducted using a wide number of search terms and these were systematically filtered based on the uniqueness and relevancy of the results. Boolean search operators were used to create search strings that combined population/environment, intervention/exposure and outcomes as per the PICO method.

Population limitations:

Study setting shall include: urban, suburban, peri-urban & urban fringe

Country of study shall include: UK, Europe, Canada, Australia, New Zealand & northern states of the United States of America.

Academic databases searched:

ScienceDirect; Wiley Online;

Taylor & Francis, Director of Open Access Journals, EBSCO and MDPI were also considered during the initial search iteration, but results were deemed either not of sufficient quality or significant duplicates records were identified.

Search terms:

Q1: Which key landscape features and facilities make a green space attractive to people?

Urban; city; neighbourhood; green; nature; natural; park; visit; duration; motivation

Q2: Can street greening, provision of green active travel routes, changes to publicly accessible greenspace management, safety interventions and provision of facilities increase the carrying capacity of such places?

Urban; city; neighbourhood; green; nature; natural; park; walk; exercise; provision; management; participation; safety; fear; crime; characteristic; activity; play; visit; number; frequency; capacity; access

Q3: Can street greening, green active travel routes, changes to site management, safety interventions and provision of facilities increase the enjoyment/experience of such places?

Urban; city; neighbourhood; green; nature; natural; park; exercise; walk; management; provision; maintenance; safety; activity; characteristic; preference; wellbeing; restoration

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