3. Designing for green space sustainability

This is the third in a series of four evidence report cards summarising what we know about: (a) natural environments and human health; and (b) opportunities for promoting human health and wellbeing through sensitive ‘green’ and ‘blue’ public open space management. This card focuses on how to enhance the economic, social and ecological sustainability of green spaces in ways deemed acceptable to local communities, including existing and future users.

Identifying economically sustainable management and maintenance approaches

With publicly owned green spaces under increasing pressure from diminished local authority budgets and competing budgetary demands, the need to find more sustainable approaches to park management and maintenance has become ever more apparent. NESTA’s ‘Rethinking Parks’ programme was established to explore and pilot the feasibility of alternative management approaches in collaboration with the Heritage Lottery Fund and the Big Lottery Fund. A range of valuable resources are now available online sharing the learning from this programme, including:

- Piloting the feasibility of an endowment fund to support long-term park maintenance efforts in Sheffield, establishing an independent charitable trust to look after public green spaces, using both the return on the endowment fund and social enterprise models. Although still in its early stages, emerging insights are available online.
- Exploring options for novel partnerships between specific community groups, businesses and educational organisations to provide opportunities for volunteers to gain horticultural skills and work experience whilst maintaining the parks. This is being piloted in Bristol, and reflects similar initiatives established in alternative community green spaces, such as the Hill Holt Wood social enterprise in Lincoln. Ensuring volunteers feel supported and equipped to engage in such initiatives is important to maintain engagement over time.
- Working with communities to encourage less intensive but more biodiversity-friendly management and maintenance regimes. For example, Burnley Borough Council have phased in several changes to their green space asset base, including: replacing more labour intensive annual bedding schemes with perennial planting; converting 11ha of former heritage parkland into managed meadows (saving over £41k); and engaging volunteers in the management of local coppice woodland, which is producing woodchip for local playgrounds and wood fuel.

There are increasing efforts to understand how urban grassland can be managed to enhance public wellbeing and urban biodiversity, including opportunities to replace close-mown amenity grass with designed urban meadows, requiring less mowing (Garbuzov et al., 2015). Urban meadows prioritise visible wildlife and pollinators alongside public satisfaction and aesthetic appreciation. They can include annual meadows consisting of self-seeding flower species, or perennial meadows comprising grasses and flower species that flower each year (sequential flowering during a season is achieved by cutting meadows after the first flowering). Non-invasive exotic species may be planted alongside native species to enhance the colour range of the meadow (‘pictorial meadows’) and extend the flowering season, thereby supporting late-flying pollinators (Dunnett, 2011). Although urban meadows are less labour intensive to manage than mown grass, they do require intensive preparation or maintenance at specific times of the year, and locational context is crucial to their establishment and public acceptability (as detailed by LWEC, 2016).
Identifying socially sustainable management and maintenance approaches

Engaging local communities in green space design, management and maintenance decisions is thought to promote public acceptability, stewardship and the long-term social sustainability of these settings (Dempsey et al., 2016). This may be particularly important in the face of shifts to less intensive maintenance regimes intended to promote biodiversity since ecological quality can conflict with aesthetic preference (Filibeck et al., 2016). Studies have called for an ‘ecological aesthetic’, with opportunities to gain pleasure from both the physical features of a setting and an understanding of its ecological function (Ives and Kelly, 2016). A better understanding of residents’ mental constructs of biodiversity, and associated attitudes to biodiversity management, can facilitate the design of biodiversity-related policies that are better supported by the public (Fischer and Young, 2007).

Public participation will not necessarily generate consensus amongst all individuals but can help to understand the root causes of conflict (e.g. conflicting values, interests, personalities, concerns about fairness and social justice etc.) and to find more acceptable solutions (Ives and Kelly, 2016; Young et al., 2010). In part, this will require a detailed understanding of how people currently perceive, use, value and experience a space (Ward Thompson, 2013). A range of approaches could be drawn upon, including:

- **Web-based public participation Geographical Information System (PPGIS) surveys**, allowing residents to map how they perceive and routinely engage with different aspects of their local environments (Kyttä et al., 2013; Brown and Kyttä, 2014). This type of software is now available online (‘Maptionnaire’), along with other community mapping tools. This could be complemented with postal mapping questionnaires, producing social value maps linked to respondent demographics/life circumstances (Tyrväinen et al., 2007).

- **Mobile applications**, such as the ‘Ramblr’ app, enabling smart phone users to record and geo-tag audio-visual data about their perceptions and use of different local green and blue spaces. When mapped with GIS, this data can provide contextualised insights into the relative contributions of varied public open spaces to residents’ sense of wellbeing.

- **PhotoVoice approaches**, using participatory photography and storytelling methods to enable diverse individuals to represent their priorities and values; although more resource-intensive, the opportunity to photograph and then discuss places of personal importance (and places invoking negative reactions) can provide valuable insights into more subtle aspects of experience that may be missed through text-based surveys or traditional forms of consultation. Variations of this type of approach are increasingly used as research tools to understand people’s green space experiences and perceptions (e.g. Finney and Rishbeth, 2006; Hansen-Ketchum et al., 2011; Plane and Klodawsky, 2013; Bell et al., 2015).

- **Participatory workshops** with current and/or potential users, using activities such as the CABE Spaceshaper approach; a practical, participatory process used in situ to measure collaboratively the quality of public space before investing time and money in improving it.

Additional effort may be needed to engage marginalised individuals in these processes, particularly those living within ‘poverty traps’ but with shared access to small, underused green spaces (Dennis and James, 2016; Dennis et al., 2016). The ‘Connected Communities’ programme, initiated by the Royal Society of Arts, recommends the use of social network mapping to identify typically overlooked community members (Rowson et al., 2010). The ‘Neighbourhoods Green’ initiative has produced a range of online resources to support engagement of social housing residents in the design and management of shared green spaces within their living environments.
Importantly, the drivers underpinning green space management and maintenance changes need to be recognised by communities as more than economic. Engaging the public in green space decision-making at an early stage is central to achieving this, with long-term dialogue deemed more effective than discreet stand-alone engagement events (Emery et al., 2015). Approaches are needed that emphasise participation as a process with clear objectives and committed to empowerment, equity, trust and learning (Reed, 2008).

Identifying ecologically sustainable management and maintenance approaches

A functional network of green space is important for the maintenance of the ecological dimension of a sustainable urban landscape (Sandström et al., 2006). In many towns, urban green space can provide considerable biodiversity benefits. Surveys of 15 urban and suburban parks in Flanders (Belgium), for example, revealed that the 15 parks contained about 30%, 50%, 40%, and 60% of the total number of wild plant species, breeding birds, butterflies, and amphibians still occurring in Flanders, respectively (Cornelis & Hermy, 2004). However, urban green spaces form interconnected networks and it is therefore necessary to understand both the characteristics of individual spaces for biodiversity and their spatial configuration in the wider landscape. A scale-dependent tension is often apparent in urban green space management, whereby individual spaces are typically smaller than the unit of management needed to retain viable populations of species or functioning ecosystems (Goddard et al., 2010). In short, quality, quantity and connectivity are all important for maintaining biodiversity and ensuring the sustainable provision of ecosystem services.

Quantity and connectivity. While few would argue that having more urban green space enhances biodiversity and ecosystem service provision, the issue of connectivity is far more contentious. Often improving connectivity between habitats is seen as integral to maintaining genetic fitness between separate populations and preventing the fragmentation and isolation of urban wildlife (Magle et al., 2012). Similarly, enhancing connectivity is the single most repeated suggestion for adapting nature conservation to climate change (Heller & Zavaleta, 2009). In practice, however, urban landscapes vary from sprawling suburbs to high-rise cities with large public parks. Increasing connectivity without also increasing the overall area of green space (and hence overall costs) can only be achieved by having fewer large parks. A growing body of evidence suggests that urban ecosystems do not function as well as they could in the absence of large parks. In a review of existing evidence, Stott et al., (2015) show that carbon storage, water infiltration, pollination and temperature regulation are all enhanced by the presence of larger green spaces as opposed to connectivity, and only wellbeing and air purification are enhanced by connectivity as opposed to increased availability of larger spaces. Similarly, Hodgson et al., (2009) show that the importance of connectivity has been over emphasised when adapting nature conservation to climate change, and conservation efforts would be better focused on improving habitat area and habitat quality (see also Greenwood et al., 2016). In the face of climate change, populations of species are likely to persist in larger green spaces; such sites act as pools from which individuals disperse to neighbouring sites, and are more likely to be species newly colonising parts of their range (Lawson et al., 2014, Thomas et al., 2012). In the absence of climate change, maintaining connectivity at the expense of larger and higher quality green space is even less beneficial (Donaldson et al., 2016, Hodgson et al., 2011).

Improving quality. Several measures have been proposed to enhance the biodiversity value and ecosystem service provision of urban green spaces. These include: (i) tree planting, and the preservation of mature trees within and around urban green spaces; (ii) creating artificial nest sites for bees and wasps; (iii) the creation of sustainable drainage systems (SuDS), such as small ponds; (iv) ensuring high
availability of dead wood for fungi and other saproxylic organisms (i.e. those that depend, during part of their life cycle, on dead or dying wood); and (v) creating patches of nettles for butterfly larvae. Overall, however, while some methods for increasing the biodiversity of urban green spaces are likely to be very effective, others have a much lower probability of success.

**Tree planting, and the preservation of mature trees** increases carbon capture, provides shade and urban cooling and improves air and water quality (Hale et al., 2015). It also enhances biodiversity, particularly when trees are native and a variety of species are present (Alvey, 2006). Appropriate management can also enhance biodiversity; artificial gap creation and the incorporation of topsoil from a nearby forest has been shown to increase the floral diversity of parks (Nakamura et al., 2005).

Of particular concern in the context of UK biodiversity is the rapid decline of many bee and wasp species (Biesmeijer et al., 2006). **The creation of artificial nest sites for solitary bees and wasps** has been shown to be highly effective in encouraging nesting of a variety of species (Gaston et al., 2005), though the design of the nest is important. Tin cans packed with paper straws, often recommended as an effective design (e.g. O’Toole, 1992), are generally less effective than using wooden blocks with holes drilled in them or placing sections of bamboo cane in plastic drainage pipes, both of which typically encourage bees and wasps to nest (Gaston et al., 2005). In contrast, however, the creation of artificial nest sites for bumble bees is very ineffective as artificial nest sites are rarely used (Gaston et al., 2005).

**The creation of sustainable drainage systems (SuDS)**, such as ponds and wetlands, swales and filter strips, filter drains, canals, rills and channel systems (Landscape Institute, 2013) can be highly effective at slowing, filtering or retaining surface water runoff, putting excess water to use near where it lands to prevent it from dispersing too quickly (Everett et al., 2016). SuDS can be implemented at various scales, and have been used successfully to enhance the biodiversity and amenity value of previously neglected public open spaces, as illustrated by the **Derbyshire Street Pocket Park** SuDS in Bethnal Green, London. However, in many instances small artificial ponds in urban green spaces are rather poor in more valued aquatic organisms such as dragonflies, mayflies and water beetles (Gaston et al., 2005).

**Placing piles of dead wood in urban green spaces** (where this is possible without encountering resistance from local residents) has been proposed as a measure to encourage fungi and other saproxylic organisms, and freshly cut logs of birch are often used. While such log piles will often take a number of years to decay, and in consequence are colonised by relatively few saproxylic species, except over longer timescales, they do provide havens for a variety of other species. Frogs and a variety of invertebrates will often make use of these habitats (Gaston et al., 2005).

**The creation of patches of nettles**, either in gardens or in urban green spaces is often advocated to encourage butterfly larvae in the popular non-scientific gardening literature (Vickery, 1995). In practice, however, such patches are usually colonised only by a small number of common butterfly species, though on occasion rarer moths and a variety of bug and spider species will also use this habitat (Gaston et al., 2005).