

Health Benefits from Biodiversity and Green Infrastructure

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ENVIRONMENTAL PROTECTION AGENCY

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- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiological Protection
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet regularly to discuss issues of concern and provide advice to the Board.

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Synthesis Report

Prepared for the Environmental Protection Agency

by

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The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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Contents

Acknowledgements	ii
Disclaimer	ii
Project Partners	iii
List of Figures	vii
List of Tables	viii
Executive Summary	ix
1 Introduction	1
1.1 Overview	1
1.2 Objectives	1
2 Literature Review	2
2.1 Overview	2
2.2 Objective	2
2.3 Methods	2
2.4 Review of the Literature	2
2.5 Accessibility: Proximity and Duration of Time Spent in Green Spaces	5
2.6 Features of Green Space that Benefit Health and Wellbeing	6
2.7 History of Green Spaces in Ireland	6
3 Perceptions of the Value of Green Spaces	10
3.1 Overview	10
3.2 Objective	10
3.3 Methodology	10
3.4 Results	12
3.5 Discussion	17
3.6 Conclusion	22
4 Potential for the Use of Geocoded Data in Further Research	25
4.1 Overview	25
4.2 Objective	25
4.3 Methods	25

4.4	Outcomes	25
4.5	Discussion	27
5	Monitoring Engagement with Natural Environment and Wellbeing	28
5.1	Overview	28
5.2	Objective	29
5.3	Methods	29
5.4	Outcomes	29
5.5	The Current Situation in Ireland	33
5.6	Summary	34
6	Recommendations	35
6.1	Overview	35
6.2	Objective	35
6.3	Methods	35
6.4	SWOT Analysis	35
7	Implications for Policymakers, Researchers and Practitioners	37
7.1	Implications for Health Promotion and Healthy Ireland Goals	37
7.2	Implications for Healthy Cities, Public Participation Networks and Community Groups	40
7.3	Implications Regarding Features of Accessible Green Urban Space for Relevant Stakeholders	40
7.4	Implications for Future Research	41
8	Conclusion	42
	References	44
	Abbreviations	56
	Appendix 1	57

List of Figures

Figure 2.1.	Percentage of green urban areas in core cities in EU-27 countries	9
Figure 3.1.	Score plot of statements for PC1 and PC2	13
Figure 5.1.	Word cloud highlighting issues or barriers that stakeholders perceived as preventing people from connecting to nature	30

List of Tables

Table 3.1.	Summary of stakeholders interviewed and who undertook the Q-sorts (statement ranking) for this research	11
Table 3.2.	Initial analysis of components and their corresponding eigenvalues	12
Table 3.3.	Variance in stakeholder responses in relation to first two extracted components	12
Table 3.4.	Principal component values and themes and shared variance (or communalities) for the Q-sorts analysis (showing median stakeholder response to each statement)	14
Table 4.1.	Research utilising health/socio-economic data and extent of greenness	26
Table 5.1.	Number of stakeholders who referred to specific issues or barriers that they perceived as preventing people from connecting to nature	28
Table 5.2.	Transition framework of actions, as perceived by stakeholders, to overcome barriers preventing people from connecting with nature and to support a salutogenic society	29
Table 5.3.	Range and extent of strategies to engage people with nature and wellbeing	31
Table 5.4.	American programmes available at different scales (local and national schemes)	31
Table 5.5.	Schemes or practices available locally or regionally in UK or Ireland	32
Table 6.1.	Strengths and weaknesses, opportunities and threats of the recommendations relating to each work package.	35
Table 7.1.	Selected actions outlined within Healthy Ireland Framework that are relevant to this study and relevant contributions arising from this project	37
Table 7.2.	Healthy Ireland in the Health Services – Implementation Plan 2015–2017 actions that are relevant to this study, and relevant contributions arising from this project	39
Table 7.3.	Benefits of Green spaces in relation to Health and Wellbeing components	40
Table 7.4.	Percentage green space per capita as detailed by the literature and the European Environmental Agency	40
Table 8.1.	Synthesis of research findings from this study in relation to the Healthy Ireland Ipsos MRBI survey of health in Ireland in 2015 and Natural England Access to Evidence Information	42

Executive Summary

Healthy environments promote human health and wellbeing. The connections between a high-quality environment, a healthy society and the economy are emphasised by the Environmental Protection Agency (EPA) strategy and the Healthy Ireland Framework for action. Public expenditure on health in Ireland faces increasing challenges posed by the ageing demographic and the potential burden of chronic disease as a result of people living longer, but not necessarily healthier, lives. There is an urgent need to reconnect an increasingly urbanised society with nature, in terms of both health and sustainability. The aim of this research was to evaluate the literature, legislation, policy and practice to assess the evidence for and perceptions of the benefits to health from connecting with nature.

This research comprised five work packages designed to elicit evidence of benefits to health and wellbeing from contact with nature: (1) a review of the literature to evaluate the evidence and identify key themes and research gaps; (2) an assessment of the perceptions of key decision-makers involved in planning, designing, managing and promoting the use of Ireland's green spaces to compare and contrast the values of, and the barriers to, using green spaces; (3) an assessment of the use of measurements of greenness in studies examining geocoded health data, as there is currently no universally accepted terminology relating to units of green space; (4) mapping of public engagement with nature and health initiatives at international, global and European levels to identify best-practice case studies; and (5) recommendations for future policy and strategies. The strengths, weaknesses, opportunities and threats associated with their potential implementation in Ireland were summarised.

Outcomes

This emerging area is currently informed by multiple, differing approaches, for example health promotion, eco-psychology, conservation, landscape planning, sports, medicine and recreation disciplines. Evaluating the evidence is difficult given the evolving landscape of knowledge. Nonetheless, there is evidence of mental and physical health-related benefits from connections

with nature, although there are knowledge gaps and more robust studies are needed.

This is the first study to connect the perceptions and values of key decision-makers in Ireland regarding green spaces, nature and health. In this study, engineers, planners, local authority biodiversity decision-makers, conservationists and health promotion officers strongly agreed with the perception that contact with nature benefits health and wellbeing. Decision-makers differed in how they viewed the design and appearance of multi-functional green spaces. Four of the five decision-making groups recognised that biodiversity was an important function of green spaces. Engineers' perceptions were less positive than other decision-makers' regarding the potential to integrate biodiversity into playgrounds, sports grounds and amenity areas.

While decision-makers agreed that connecting with nature should be free and available to everyone, they felt that funding for integrated nature and health projects was less important than infrastructure or waste management, from a public expenditure and political lobbying perspective. Furthermore, they identified access, lack of awareness and attitudinal blocks as barriers that prevented people from connecting with nature.

Lessons can be learned from the case studies on engaging people with nature, for example:

- applying an ecosystems approach to wellbeing and environment legislation (Wales);
- developing an integrated health–nature action plan (as proposed in Scotland);
- engaging people in nature-based activities, such as the Green Prescriptions Programme pilot (Donegal), Healthy Parks, Healthy People (international programme), and
- monitoring such engagement (England).

This project is relevant to 18 of 64 actions outlined within the Healthy Ireland Framework. It addresses a further 11 Health Service Executive initiatives; these are associated with other national cross-sectoral strategies such as Get Ireland Active! The National Physical

Activity Plan for Ireland (Healthy Ireland, Department of Health & Department of Transport, Tourism and Sport), Better Outcomes Brighter Futures, The National Policy Framework for Children and Young People 2014–2020 (Department of Children and Youth Affairs) and the Positive Ageing Strategy (Department of Health).

Recommendations

The Health Service Executive and local authorities could work more closely together to ensure that access to attractive biodiverse space is secured at strategic planning levels (as part of a Strategic Environmental Assessment). This collaboration could also entail carrying out baseline assessments, providing training and delivering pilot programmes such as those delivered in

Ontario. Communities could work together to enhance the use of nearby spaces for people and nature.

Conclusion

Biodiversity is essential to a health-sustaining environment, but quantifying the evidence for this is a major challenge. Multifaceted arguments are needed to involve people in co-creating biodiverse spaces that suit preferences and life stages. This research shows that connecting with nature makes people feel happy, more restored and motivated to be more active, which is in keeping with Healthy Ireland and EPA goals. Devising and implementing a health–nature strategy could optimise cross-sectoral working to create a healthy environment and society.

1 Introduction

1.1 Overview

Human health and wellbeing depends on a healthy environment; therefore, management of such a key natural resource has (1) strategic importance for human health (Wolch *et al.*, 2014) and (2) the potential to contribute to the Irish economy (Bullock *et al.*, 2008; EPA, 2012a; EPA, 2016). Research to date has focused on improving environmental factors that can adversely affect human health, such as air and water pollution (e.g. Cormican *et al.*, 2012). However, a previous Science, Technology, Research and Innovation for the Environment (STRIVE) report (Garavan *et al.*, 2010) recommended that there should be interdisciplinary research on the positive benefits to human health and wellbeing from engagement with the natural environment. A functioning natural environment can sustain healthy human populations (Sandifer *et al.*, 2015), but the ecosystem–health relationship is complex (Tzoulas *et al.*, 2007; Keune *et al.*, 2013; Romanelli *et al.*, 2014; Oosterbroek *et al.*, 2016) and knowledge gaps can pose challenges to policymakers and practitioners (Keune *et al.*, 2013; Mantler and Logan, 2015). This project [modified by the project steering committee and the National University of Ireland (NUI) Galway’s ethics committee] reviewed (1) evidence of wellbeing and health benefits from biodiversity, (2) views of health benefits from nature held by people who make decisions regarding green space

and (3) practices to engage the public with the natural environment as a sustainable health strategy, to inform policymakers and practitioners of the health benefits from the natural environment and to recommend implementation strategies in Ireland.

1.2 Objectives

The objectives of this study are to:

1. provide a comprehensive report evaluating current international best practice in promoting integrated biodiversity and sustainable health and wellbeing practices;
2. assess the perceived value of green spaces to health in an Irish context;
3. review use of geocoded health, biodiversity, socio-economic and spatial data to inform planning for sustainable health and biodiversity;
4. assess best practice on public engagement with health, wellbeing and biodiversity;
5. provide recommendations for future policy and strategies and the potential strengths, weaknesses, opportunities and threats (SWOT) associated with their implementation in Ireland.

2 Literature Review

2.1 Overview

The growing recognition of the importance of ecosystem services and the connections between sustainable use of natural resources and a salutogenic society among policymakers, economists and practitioners has resulted in the publication of a body of literature in recent years. The evidence underpinning the relationship between ecosystems and human health is complex and comprises multi and interdisciplinary research.

2.2 Objective

The objective was to provide a detailed and comprehensive report evaluating current international best practice in promoting integrated biodiversity and sustainable health and wellbeing practices.

2.3 Methods

Simultaneous computerised searches of online databases were undertaken to identify key publications in English. Databases included ScienceDirect V.4, Scopus (Elsevier), Web of Science (Thomson Reuters), JSTOR, Academic Search Premier, Academic Search Complete, Psychology and Behavioral Sciences Collection, GreenFILE, PsycINFO (EBSCO), Encyclopedia of Life Sciences, Wiley Interscience Journals, Wiley Online Library, BioMed Central (Springer), PubMed, Cochrane Library and Geobase (Online Computer Library Center). Searches were also undertaken using SCIRUS and Google Scholar. Each hit or website returned was checked for relevant literature. European Union (EU) funded projects [PHENOTYPE (www.phenotype.eu), BREATHE (<http://www.creal.cat/projectebreathe/resultats.html>), OPENNESS (<http://www.openness-project.eu/>) and BESAFE (<http://www.besafe-project.net/index.php>)] were examined. Searches used relevant terms associated with the constituent elements of health and wellbeing benefits from biodiversity and green spaces, combined with any of the following terms: effectiveness, evidence-base, review, analysis, methodology, intervention, outcome, practice, planning, policy, green infrastructure, landscape, ecosystem services, natural capital, nature conservation, wildlife, life-course events (birth, pregnancy, childhood, adolescence, adults,

elderly, inter alia). Wildcards were also used, such as effective*, analys*, wood*, natur*, park* and child*. References cited in relevant publications were checked (backward citation searches) and papers citing relevant publications were studied (forward citation searches). Attention was paid to research undertaken in Europe, Australia and America. More than 170 publications from over 90 peer-reviewed journals, spanning multiple disciplines, in addition to 12 systematic reviews and conference abstracts, were examined to collate the evidence for benefits to health and wellbeing from biodiversity and green spaces.

2.4 Review of the Literature

2.4.1 *Direct benefits from green spaces*

Edward O. Wilson defined biophilia in 1984 as “the urge to affiliate with other forms of life” (Wilson, 1984). The natural environment benefits human health and wellbeing directly, as healthy ecosystems provide human society with products such as crops, fruit, medicines, and services such as pollination, water purification and carbon storage (TEEB, 2013). The presence of trees and vegetation promotes a sense of place (Mantler and Logan, 2015), while the extent of trees and vegetation in Wisconsin has been shown to reduce the incidence of depression (Beyer *et al.*, 2014). Urban forests can remove air pollution [as described by Nowak *et al.* (2006) for 55 US cities], manage storm water run off (Djordjevic *et al.*, 2011) and keep people and buildings cool (Lafortezza *et al.*, 2009; Lee *et al.*, 2015). In Scotland, it has been predicted that “a green cover increase of approximately 20% over the present level could eliminate a third to half of the expected extra urban heat island effect in 2050” (Emmanuel and Loconsole, 2015). Increased levels of residential greenness have been linked to better birth outcomes (Laurent *et al.*, 2013; Dadvand *et al.*, 2014a; Ebisu *et al.*, 2016) (see Chapter 4).

2.4.2 *Indirect ecosystem benefits change throughout the life course*

Ecosystems can support human society indirectly, through contact with nature and green spaces (Capaldi

et al., 2014; Romanelli *et al.*, 2015). Different types and features of green space may benefit health and wellbeing differently as people move through the course of their lifetime from birth to old age (White *et al.*, 2013; Dzhambov *et al.*, 2014; Wheeler *et al.*, 2015). Academics at the interface of environmental psychology and health promotion have theorised that contact with nature and therapeutic spaces reduces stress (Stress Reduction Theory) (Ulrich, 1999) and restores attention (Attention Restoration Theory) (Kaplan and Berman, 2010). Restorativeness is a term embedded in the literature (White *et al.*, 2013b; Akpinar, 2016; Collado *et al.*, 2016).

The extent of urban greenness has influenced reproductive condition in Connecticut and California (USA) and cities in Lithuania and England (Laurent *et al.*, 2013; Grazuleviciene *et al.*, 2015; Ebisu *et al.*, 2016). More pregnancies went to full term in areas with increased levels of urban greenness in Kaunas, Lithuania (Grazuleviciene *et al.*, 2015). Urban greenness was also associated with increased birth weight in Israel (Agay Shay *et al.*, 2014), Bradford (Dadvand *et al.*, 2014a), California (Laurent *et al.*, 2013), Bavaria (Markevych *et al.*, 2014) and Vancouver (Hystad *et al.*, 2014). In Bradford, England, better foetal growth was observed with increasing levels of greenness when more than 10,000 births were analysed in terms of (1) proximity to areas of green space larger than a small football pitch and (2) the levels of greenness surrounding their residence (Dadvand *et al.*, 2014a). Better birth outcomes were observed when there was a 10% increase in tree cover within 50m of residences in Portland, Oregon (Donovan *et al.*, 2011). While these studies confirm modest, but better, birth outcomes, the distance at which the “green benefit” applies differs: 50m for Laurent *et al.* (2013), 100m for Dadvand *et al.* (2012a,b), 250m for Ebisu *et al.* (2016) and 500m for Dadvand *et al.* (2012c) and Markevych *et al.* (2014), although a meta-analysis of eight studies confirmed that greenness within 100m of the residence is the most important (Dzhambov *et al.*, 2014). Confounding factors (e.g. maternal smoking) (Laurent *et al.*, 2013) were highlighted in one study. Further research was recommended (Markevych *et al.*, 2014) to ensure that this weak benefit was more than might be expected by chance (Laurent *et al.*, 2013). Modest results aside, the extent of greenness was linked to improved air quality, quieter surroundings and a more appealing neighbourhood (Laurent *et al.*, 2013) and had the greatest impact on birth weight of babies born into lower socio-economic groups in Barcelona

(Dadvand *et al.*, 2012c), Bavaria (Markevych *et al.*, 2014) and Tel Aviv (Agay-Shay *et al.*, 2014). The measures of greenness are further discussed in Chapter 4, but several authors recommended that future research should include vegetation types (Laurent *et al.*, 2013). This may help to explain the inconsistency in the distances over which green benefits extend, as the uptake of air pollution might vary with vegetation type (Laurent *et al.*, 2013) and people may differ in their response to the appeal of vegetation (Dzhambov, 2014).

The presence of trees and green infrastructure can buffer children from stressful events and improve cognition in rural areas (Wells and Evans, 2003) and in urban areas such as Rome, Italy (Carrus *et al.*, 2015b) or Houston, Texas (Kim *et al.*, 2016). In a study of children aged 4–6 and their parents in Kaunas, Lithuania, increasing greenness reduced parental stress and promoted social behaviour in children from families with less education (Balseviciene *et al.*, 2014). Walking in parks rather than along urban streets resulted in better spatial working memory in children aged 3–5 and older children were more attentive (Schutte *et al.*, 2015). Increased exposure to green space surrounding schools improved children's cognitive skills and academic performance in Spain (Dadvand *et al.*, 2015).

How children engage with nature is influenced by how they use green spaces (Skar *et al.*, 2016a); increased use of green space in children aged 8–11 in Edinburgh was linked to better health and wellbeing (McCracken *et al.*, 2016). Children's positive and negative attitudes towards engaging with nature have received less attention than parental attitudes (Beyer *et al.*, 2015). In South Africa, fear of anti-social behaviour and perceptions of danger deterred children from using green spaces (Alexander *et al.*, 2015), but children in Wisconsin linked some fears regarding nature to self-preservation and being able to learn new skills or make new discoveries, which were not necessarily obstacles to engaging with nature (Beyer *et al.*, 2015). Children interpreted unstructured play as a benefit of being in nature (Beyer *et al.*, 2015) and children in Norway were more engaged with nature when they played spontaneously in nature than when they participated in adult-organised events (Skar *et al.*, 2016a,b). The authors recommended setting time aside for children to decide for themselves how to play or enjoy nature (Skar *et al.*, 2016a). Playing and enjoying nature as a child exposes children to a wider range of microbial diversity, which reduces allergies in teenagers (Hanski, 2014)

and motivates them to develop knowledge about nature (Mustapa *et al.*, 2015). Enjoying nature was highlighted as the first of a four-step pathway to inculcating a lifelong connection with nature in 9- to 10-year-olds in Florida (where the other three steps included care for wildlife, togetherness, and stewardship) (Cheng and Monroe, 2012) and increasing the likelihood of future adult use of green spaces (Thompson *et al.*, 2008). Children from immigrant families in Montreal feel nurtured and restored when they spend time in nature and value it as a free and accessible resource (Hordyk *et al.*, 2015a,b). The ability to feel restored from being in the natural environment was a key factor in a recent evaluation of children's school playgrounds in Victoria, Australia (Bagot *et al.*, 2015), although children from farming backgrounds did not respond in the same way, possibly because they undertook farm practices and did not associate being outdoors with being restored or relaxed (Collado *et al.*, 2016). While the level of vegetation did predict how restored the children felt, the study revealed that, in addition to increasing greenness, how children spent their time in the playground also contributed to their wellbeing, causing the authors to recommend including children in co-designing spaces such as school playgrounds (Bagot *et al.*, 2015) and other public green spaces (Chawla, 2015).

Green spaces also benefited children's physical fitness, as observed in Bristol (Brockman *et al.*, 2011), Istanbul (Akpinar and Cankurt, 2016) and Houston, Texas (Kim *et al.*, 2016). Their level of activity outdoors is increased by positive parental attitudes to green spaces (McFarland *et al.*, 2014) and restricted by parental concerns regarding safety (Veitch *et al.*, 2006; Tappe *et al.*, 2013). The frequency of physical activity in children increased with residential proximity to urban green spaces (Tappe *et al.*, 2013; Akpinar and Cankurt, 2016) and, if parents were also active, this resulted in more time spent being active by both parents and children (Akpinar and Cankurt, 2016). In Houston, Texas, the wellbeing and physical activity of Hispanic students aged 10 and 11 was linked to the extent of open landscapes with old trees included in their urban environments (Kim *et al.*, 2016). Residential greenness and the presence of forests nearby were linked to physical activity and lower body mass index (BMI) for children in Spain, but an increased risk of asthma was observed when parks were nearby. The authors highlighted the need to consider the potential risk of increased allergic reactions

with increased exposure to grasses and plants that produce pollen (Dadvand *et al.*, 2014b).

As children progress through adolescence, nature and green spaces can provide a restorative function (Roe and Aspinall, 2012; Kelz *et al.*, 2013; Akpinar, 2016; Li and Sullivan, 2016). Students with window views of green spaces surrounding high schools in Illinois had better psychological wellbeing than those with no views of green spaces (Li and Sullivan, 2016). The extent of greenness surrounding the school restored high school students psychologically but did not have any impact on physical health (Akpinar, 2016). Teenagers in Austria reported better psycho-social wellbeing, but not increased cognition, when the level of vegetation in their school grounds was increased (Kelz *et al.*, 2013). Being out in nature (e.g. going away to the beach) was therapeutic for teenagers in Scotland (Roe and Aspinall, 2012) and for families in south-west England (Ashbullby *et al.*, 2013), Canada (Woodgate and Skarlato, 2015) and Buffalo, New York (Feda *et al.*, 2015) and restored teenagers in Northern Finland (Wiens *et al.*, 2016). These teenagers, aware of the influence of seasonal changes on their wellbeing, acknowledged they had better mental health and wellbeing in summer than in winter (Wiens *et al.*, 2016). Park size was a good predictor of stress relief (Feda *et al.*, 2015) and being in a safe, green environment gave them a sense of place (Woodgate and Skarlato, 2015). Place was also important to teenagers in Edinburgh, but further work is needed to examine how nearby spaces can be designed to provide teenagers with greater relief from the stresses of daily life (Roe and Aspinall, 2012).

Older people lived longer in areas with increased opportunities to walk in green streets near their homes (Takano *et al.*, 2002). In mega-cities, such as Tokyo, senior citizens who could stroll in green streets and parks, with access to sunlight and reduced noise pollution, showed increased survival over the following 5 years, irrespective of age, sex and socio-economic factors (Takano *et al.*, 2002). A recent review indicated that reduced mortality levels (e.g. from cardiovascular disease) were associated with increased greenness (Gascon *et al.*, 2016), although this finding is not universal (Richardson *et al.*, 2012). Comparisons between the few studies evaluating green space and mortality are difficult, due to the variation in (1) experimental design, (2) the population under investigation, (3) how green space was assessed and (4) the influence of other

factors such as age, income etc. (Gascon *et al.*, 2016). The loss of biodiversity features can also impact health and wellbeing; for example, the removal of 100 million ash trees in America because of the invasive emerald ash borer was linked to increased human mortality (e.g. from cardiovascular and respiratory disease) (Donovan *et al.*, 2013).

2.5 Accessibility: Proximity and Duration of Time Spent in Green Spaces

Sustainable cities worldwide value the proximity of nature; the merit of nearby nature is reflected in strategies, policies and manifestos, for example Healthy Parks, Healthy People (Australia), NICE guidelines and Natural England manifesto (UK), Policy and Advocacy Statement 20137 and American Public Health Association (USA). Accessibility and proximity can influence the use of green spaces, particularly in urban settings (Adinolfi *et al.*, 2014; Finlay *et al.*, 2015). This need to have nature nearby may be perceived to be less critical in Ireland where 10–20% of selected urban areas are green spaces (SOER, 2015). One-fifth of the area of Galway city is made up of green spaces and designated areas (Galway City Draft Development Plan, 2017–2023) and town and city sizes in Ireland are relatively small in a European context [the National Spatial Strategy 2002–2020 (DELG, 2002)]. In larger, more sprawling cities, for example Beijing and Los Angeles, where car dependency is higher (Richardson *et al.*, 2012), satisfaction, use and exercise levels in green spaces were increased when they were close to residences (Cohen *et al.*, 2007; Zhang *et al.*, 2015).

Several studies (encompassing varied social, population and location characteristics) reported self-proclaimed positive impacts of green spaces on respondent's health and wellbeing, as a result of living in close proximity to green spaces (Lange *et al.*, 2008; Alcock *et al.*, 2015; Finlay *et al.*, 2015; Madureira *et al.*, 2015; Triguero-Mas *et al.*, 2015). These studies cross a variety of different social, population and location characteristics. Triguero-Mas *et al.* (2015) state that "green spaces are associated with better self-perceived general and mental health across different degrees of urbanisation and socio-economic status, and with gender". In the Growing Up in Scotland project, mothers of 6-year-olds who lived within 5 minutes' walking distance of parks reported that their children spent

less time watching television, undertook more weekly visits to green spaces and displayed better health than those whose mothers felt that the park was further away than it was in reality (Aggio *et al.*, 2015). Accessibility and walkability were of particular importance to elderly green space users in Canada, with some residents concerned over heavy traffic flows, although issues were slowly being addressed with longer-timed traffic lights for ease of crossing (Finlay *et al.*, 2015). Research from Norway has found that recreational areas over 500m away from the residents' homes related to a decrease in visits by 56% to green areas (Koppen *et al.*, 2014). Schipperijn *et al.* (2013) point out that "green spaces can facilitate a wide range of free or low cost activities and the availability of urban green space is one of the environmental factors that is frequently linked to increased levels of physical activity, particularly recreational physical activity".

Finnish and Canadian research suggests that when green spaces were available close to home, visits were made more frequently (Neuvonen *et al.*, 2007; McCormack *et al.*, 2014). Opportunities to encounter nature nearby allow people to relax and the presence of vegetation creates a calm setting which has been shown to alleviate mental fatigue and restore the mind (Wolf and Flora, 2010). Within built environments, parks and green spaces are calm settings that encourage social interaction and de-stressing through opportunities for conversation or exercise, which in turn provides cognitive respite (Wolf and Flora, 2010). Spending time in green spaces promotes social cohesions and social behaviour (Zelenski *et al.*, 2015), such as acts of helpfulness (Guéguen and Stefan, 2016).

There are wider issues that are important in terms of the significance of this study, for example the mental and physical connections to green spaces. This study has focused on the provision of green space, but recent research has highlighted the need to integrate informal green infrastructure (Rupprecht *et al.*, 2015) with the paths and roads people take to work, to college, to school and to the shop (Sarkar *et al.*, 2015). This has two key benefits: first, the presence of tree-lined streets attracted people to walk and to walk for longer distances. Second, tree-lined streets and grassy verges constitute informal green networks that connect green spaces and facilitate dispersal by wildlife and sustain metapopulations, for example butterflies (Rupprecht *et al.*, 2015). Rather than there being separate green spaces, connecting routes and corridors also need to

be green, from the viewpoints of climate change mitigation, green infrastructure, biodiversity and aesthetics.

While managing informal green space for biodiversity and aesthetic purposes can attract people to access green spaces (Sarkar *et al.*, 2015), other research has highlighted that some people have a capacity and inclination to engage with nature (Bell *et al.*, 2014; Lin *et al.*, 2014; Shanahan *et al.*, 2015). People demonstrating this trait were more likely to spend time outdoors in their own neighbourhood, to travel to places to connect with nature and to stay longer in those sites (Lin *et al.*, 2014). There is debate as to how innate this trait is, or whether it is a feature that can be influenced by external events such as environment, education, childhood experiences, etc. (Arbuthnott *et al.*, 2014). Botanic Gardens (BGCI, 2006), natural history museums and parks are often urban settings that, in addition to fulfilling an educational role (BGCI, 2006), can connect people to nature (Arbuthnott *et al.*, 2014) and increase their motivation to undertake conservation or pro-environmental actions (Arbuthnott *et al.*, 2014; Beery *et al.*, 2015; Zelenski *et al.*, 2015). Increasing people's desire to be connected to nature could increase their visits to green spaces (Lin *et al.*, 2014). Feeding birds is an accessible way to engage with "everyday wildlife" and to nurture a desire to be connected with nature (Brock *et al.*, 2015; Cox and Gaston 2016). Bird feeding fosters care for wildlife (Brock *et al.*, 2015) and awareness of different visiting birds has increased species recognition skills (Cox and Gaston, 2015). Knowledge concerning people's changing capacity for contact with nature throughout their lifetime was highlighted as a gap in the current literature (Bell *et al.*, 2014). Another question that has not received much attention is, for people who seek contact with nature, whether this began in childhood or not, and how this affinity was developed (Bell *et al.*, 2014). The role of "place" in providing contact with nature requires further investigation (Beery and Wolf-Watz, 2014).

2.6 Features of Green Space that Benefit Health and Wellbeing

Recent studies suggest that people accrue greater benefits to their health and wellbeing from areas that are more diverse and perceived to be more natural, regardless of the setting (urban, peri-urban, rural) and, in particular, that living near the coast was associated with greater overall health, regardless of wealth (Wheeler *et al.*, 2012; White *et al.*, 2013a,c; Wheeler *et al.*, 2015). In evaluating a range of illnesses, some associated

with income deprivation and lower socio-economic status, access and proximity to green space has been demonstrated to show clear benefits in relation to circulatory disease, obesity and wellbeing, although other studies have been equivocal in demonstrating that green spaces could mitigate socio-economic inequalities (Sugiyama *et al.*, 2016). Other research has demonstrated the restorative value of landscapes and biodiversity in terms of stress management. The length of visit and perceived quality of biodiversity resulted in increased restorativeness and was shown to be a good predictor of increased wellbeing (Carrus *et al.*, 2015). Green spaces offer opportunities for the public to undertake physical activities and for the alleviation of the stress and pressures that are encountered in daily life (Tzoulas *et al.*, 2007). This is important, as the Healthy Ireland Framework states: "health is much more than an absence of disease or disability and individual health, and that of the country, because it affects the quality of everyone's lived experience" (DoH, 2013). However, some studies on health benefits from nature and wellbeing are subjective and sometimes contradictory as interviewees' personal perceptions form the main basis for results with weak statistical associations, bias and poor study design, so further appraisal and critique of the research is necessary (Lee and Maheswaran, 2010; Kabisch *et al.*, 2015a; Sandifer *et al.*, 2015).

2.7 History of Green Spaces in Ireland

In Ireland, towns and villages have traditionally had areas known as "the green" (or some variation thereof). Some Irish urban green spaces are linked to an agricultural past. "Fair-greens", which were used for livestock trading in the past, are present in many towns today. Examples include Ennis, Co. Clare, and Ballinasloe, Co. Galway (Clare County Library, 2015; Ballinasloe Area Community Development Ltd., 2016). Fairs still occur on Ballinasloe "fair-green" every year (Ballinasloe Area Community Development Ltd., 2016) while the fair-green in Ennis has been developed into a recreation facility called Tim Smythe Park, with facilities such as a children's playground, an outdoor gym, three pitches, a 400 m running track and walking paths (Active Ennis, 2013). In larger Irish cities such as Dublin, green spaces have been present as specialised recreational green spaces for much longer. In the 19th century, the provision of parklands was used as a response to Irish social and political conditions and to concerns over

clean air and recreational opportunities in towns and cities (Brück and Tierney, 2009). As towns grew, issues associated with urbanisation were recognised.

2.7.1 Urbanisation

Urbanisation is the process by which a rural area becomes an urban one; the application of the term “urban” varies greatly between different countries, referring to cities, towns, villages, conurbations or localities (Gaston, 2010; OECD, 2015). The Irish Central Statistics Office (CSO) defines urban as “persons living in population clusters of 1500 or more inhabitants” (CSO, 2011). Miller *et al.* (2015) point out that human history has been characterised as a slow yet accelerating shift from rural to urban areas with both positive and negative consequences; urban areas now hold 54% of the global population and are projected to grow to 66% by 2050 (2.5 billion extra people) (United Nations Department of Economic and Social Affairs, Population Division, 2014). Urban population growth will not be evenly dispersed throughout the cities of the world (James *et al.*, 2009). The attractiveness of large cities, with their sense of greater freedom and quality of life, aligned with the projected urban population growth means that some perceive “that urban areas are increasingly conflictive, unhealthy, unmanageable, and, above all, an enormous pressure on the environment” (Gómez *et al.*, 2011). Opportunities exist for cities to redesign spaces and find innovative solutions for increased liveability and provision of green spaces (James *et al.*, 2009).

2.7.2 Planning policy and the role of planning authorities

With increasing development, urbanisation and changes in living patterns, planning authorities play an important role in sustaining development and providing services. The Planning and Development Act 2000 sets the framework for Ireland’s planning system and guides planning authorities, An Bord Pleanála and the Courts of Ireland in determining planning and development matters. It encompasses all the planning regulations and provisions passed in Ireland since 1963 and aims to create a more efficient, sustainable, development-focused and strategic approach to the Irish land planning system (Irish Statute Book, 2000, Act 28). The Planning and Development Act (Amendment) 2010 (Irish Statute Book 2010, Act 30) requires county

and local development plans to take into account and comply with regional and national strategies when they are drawn up. County development plans cover land zoning for every activity within the county boundary, including agriculture, housing, industry and recreation, along with services such as waste, conserving the environment and landscape, while promoting integration of planning and sustainable development (Clare County Council, 2011).

The Local Government Act (Regional Assemblies) (Establishment) Order 2014 changed regional governance when it came into effect at the end of 2014 (Irish Statute Book 2014, S.I. No. 573). The existing regional planning guidelines will remain active until these new strategies are in place. The aims of the new assemblies are to co-ordinate, promote and support strategic planning and sustainable development and promote effectiveness in local government and public services. Their main function will be to draw up regional spatial and economic strategies (RSES). These will replace the current regional planning guidelines and will be drawn up in conjunction with the various enterprise and economic development agencies. The regional spatial and economic strategies will inform subregional planning area plans and must also feed into the new National Planning Framework (DECLG, 2015a). This three-tier approach outlines the “integrated top-down and bottom-up approach” of the proposed framework. In 2015, 50 years after the first national planning legislation was implemented, a new Planning Policy Statement was published (DECLG, 2015b). Ten strategic principles inform the planning policy. A key issue here is the recognition that biodiversity and the landscape contribute to the quality of life of sustainable communities. Additional principles include the need to safeguard environmental quality, to sustain communities, to provide them with a good quality of life and to make walking and cycling more attractive, which could be secured through green space and green infrastructure.

2.7.3 Planning guidelines and green space policy

Planning guidelines for sustainable residential developments in urban areas were drawn up and published by the Department of Environment, Heritage and Local Government in 2009 (DEHLG, 2009). This is the main document in which national policy specifies the requirements for green space, describing advantages of public open space as “apart from the direct provision of active

and passive recreation, it adds to the sense of identity of a neighbourhood, helps create a community spirit, and can improve the image of an area (especially a regeneration area)” (DEHLG, 2009). This document points to a number of important factors that will help to improve the quality of public open spaces, including design, accessibility, variety, shared-use, biodiversity, sustainable urban drainage and provision of allotments and community gardens, and recommended that 2–2.5 hectares of open spaces should be provided per 1000 population (DEHLG, 2009). Further recommendations included that a total of 15% of the land area for green-field residential development plans, 10% of brownfield developments or infill site plans and 20% of areas in industrial or institutional sites should be open spaces (DEHLG, 2009). The policy guidelines for green space as set out by the guidelines for sustainable residential developments were subsequently incorporated into local or county development plans.

2.7.4 Role of development plans in providing green space

Development plans “set out an overall strategy for the proper planning and sustainable development of the area of the development plan”. Sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland *et al.*, 1987). It has been described as an aggregate of characteristics, including economic growth and security, environmental quality, social cohesion and quality of life, which can help to achieve a more stable form of community that meets the diverse needs of existing and future residents by the effective use of resources, both human and natural, to strengthen prosperity (Egan, 2004; Turcu, 2013). Green infrastructure is an important part of sustainable development, as it connects the natural world with the human world. It is defined as a strategically planned and managed network featuring high quality biodiversity (uplands, wetlands, peatlands, rivers and coast), farmed and wooded lands and other green spaces that conserve ecosystem values thus providing essential services to society (Comhar CDC, 2010). The role of green infrastructure and its importance in terms of benefits to humans has been set out in Our Sustainable Future, a Framework for Sustainable Development for Ireland (DECLG, 2012) as a “network of green spaces that help conserve natural ecosystems and provide benefit to human populations through, for

example, water purification, flood control, food production and recreation”. Our Sustainable Future contains commitments to implement green infrastructure in the planning system (DECLG, 2012).

2.7.5 Mechanisms within the planning process that deliver green space

The planning process in Ireland is complex and different mechanisms can be used to deliver green spaces. Section 10 of the Planning and Development Act states that environment and landscape should be conserved and protected [subsections (c), (e) and (p)], while promoting sustainable development that mitigates climate change [subsection (n)] and maintains access to the natural environment [subsection (o)]. National policy guides the requirements for green space, which are subsequently incorporated into the local and county development plans drafted by all local authority departments. Development plans identify tracts of land that are zoned for recreational use. Developers and their consultants may propose green space as part of a development. The developer and consultants are responsible for the siting, size, and design of the features they incorporate. Once planning permission is applied for, it is the responsibility of the local authority to seek submissions or reports on the application and make a judgement as to whether to grant permission or not. At this stage, the application is either granted or is judged to require amendment. In addition, national projects with associated green space delivery may be lead by Transport Infrastructure Ireland with involvement from local authorities. Once a green space has been created, it needs to be maintained and promoted.

2.7.6 Extent of green space in cities

The extent of green space can be expressed in terms of a percentage area of the total city space or as the percentage of green space per capita (see Table 7.4). It varies markedly across the world (see Figure 2.1). This may be due to geographic variations in the extent of accessible green space, to the methods used to calculate the number of people (taken either as the number when people are at work or the number of inhabitants), to the size of the city or to where boundaries are drawn. Most of the selected EU cities contained up to 40% green space. Very few cities contained more than 50% green space. Data on Cork, Galway, Limerick and Waterford showed that green space composed

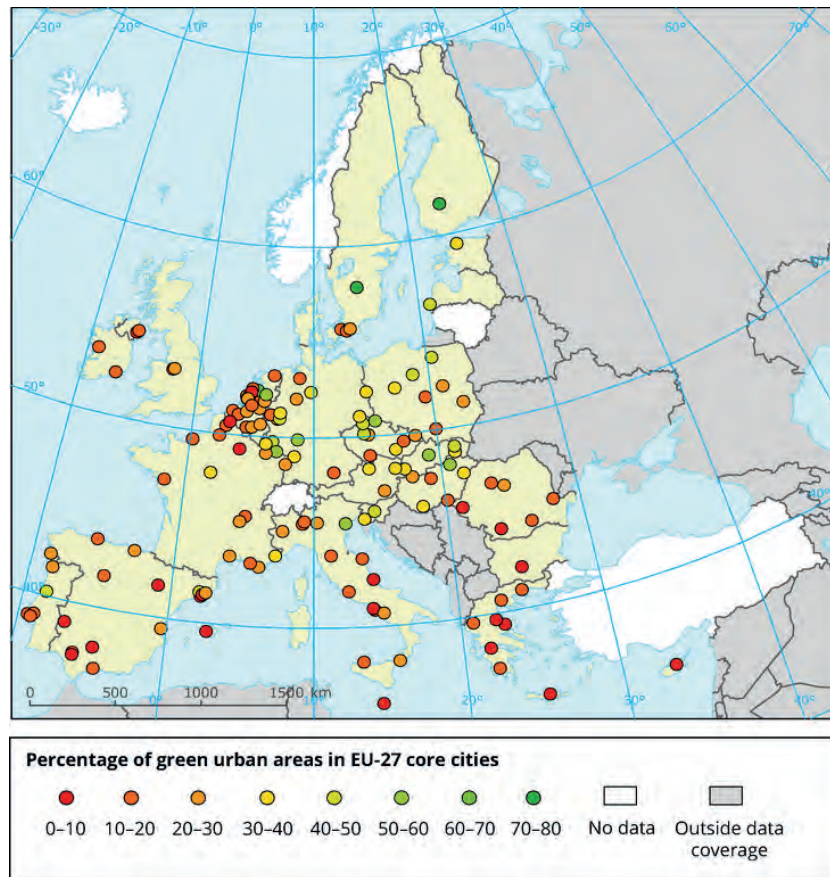


Figure 2.1. Percentage of green urban areas in core cities in EU-27 countries. The coloured dots indicate the percentage of city area occupied by green space. Source: EEA (2015).

10–20% of the total area (EEA, 2013). Records for Dublin show that this varies from 0.7 m²/person in The Liberties (Kearns and Ruimy, 2014), to 0.65 m²/person in south-east quadrant of the Dublin Canal Ring region, 3.3 m²/person in the North Central Area, 1.63 m²/person in the North West Area, 3.4 m²/person in Central Area and 2.5 m²/person in the South Central Area, giving an average of 1.9 m²/person for the area covered by Dublin City Council (Anurag, 2014; Kearns and Ruimy, 2014).

2.7.7 Management and use of green space

Managing green spaces was traditionally carried out by local authorities; however, in recent years, especially with a growing interest in green infrastructure (Comhar,

2010), multigovernance and public participation has meant that different stakeholder groups participate in the decision-making process. Interdisciplinary collaboration and careful planning is essential to make space for wildlife and to ensure that communities can connect with nature and green space. As green space policies need wide-scale social acceptance to be successful, understanding the range of viewpoints and values held on this topic can help in (1) the decision-making process and (2) the effective implementation of such policies. Professionals from different backgrounds who make green spaces available, accessible and attractive to the community may hold differing attitudes relating to the health benefits that can come from green spaces and nature.

3 Perceptions of the Value of Green Spaces

3.1 Overview

Green space policies and strategies are implemented by a number of key decision-makers. As the decision-makers come from a number of different professions, they are likely to hold a range of viewpoints and values. The aim of this work package is to elicit the values and viewpoints held by key stakeholders responsible for providing and promoting use of green space. Additionally, this work package will determine how their perceptions could influence the process of implementing a green space strategy and the overall quality of green spaces in relation to space for people and nature.

3.2 Objective

The objective was to assess the value to health of green spaces as perceived by key professional stakeholders in an Irish context.

3.3 Methodology

3.3.1 Rationale for approach taken

Environmental policies need wide-scale social acceptance to be effective (Barry and Proops, 1999). Given that perceptions influence the decision-making process, a systematic study to fully explore the range of viewpoints and values held on a particular topic (Brown, 1996) can inform the feasibility of implementing a policy effectively (Barry and Proops, 1999). Q-methodology provides the ideal platform to quantify results subjectivity by combining qualitative data (collating the attitudes of many) and quantitative data (statistically analysing the range of attitudes) to provide a robust insight into how decisions are shaped by personal attitudes. The range of attitudes is referred to as the “concourse” (Kindermann and Gormally, 2013) which should comprise a finite number of ways of thinking about the issue (discourses) (van Exel and de Graaf, 2005; Doody *et al.*, 2009). Examples of this include perceptions of (1) meanings (definitive), (2) fact (designative), (3) inquiry (questioning), (4) worth (evaluative) and (5) predictions (advocative) (Barry and Proops, 1999; Ellis *et al.*, 2007; Doody *et al.*, 2009).

The stages involved in Q-methods are (1) conflict/theme identification, (2) statement collection, (3) statement selection, (4) Q-sorts and (5) Q-sort analysis (Doody *et al.*, 2009; Kindermann and Gormally, 2013). This study applied a recognised modification of the Q-sort process, which meant that it was managed by email rather than using the conventional method of permitting stakeholders to sort the statements into agreement and disagreement categories (van Exel and de Graaf, 2005; Matinga *et al.*, 2014).

3.3.2 Q-stages

Conflict/theme identification

In the context of this study, the concourse is the spectrum of attitudes relating to health benefits from green spaces and nature, held by professionals who make green spaces available, accessible and attractive to the community. To ensure that different categories of discourse were represented in relation to the type, design, function and use of green space, the concourse was subdivided into themes, including the meaning of terms (definitive), the state of the environment (predictive), the use people make of green spaces (designative) and the values and benefits attributed to green spaces (evaluative) (Dryzek and Berejikian, 1993; Ellis *et al.*, 2007; Doody *et al.*, 2009). The themes were used to inform a questionnaire (see Appendix 1) and subsequent steps within the Q process.

Statement collection using open-ended questionnaires

Stakeholders in this study were restricted to professionals who contributed to the decision-making process regarding the availability, type and use of green spaces, but who may vary in their valuation of green spaces, nature, and health and wellbeing benefits. In practice, they worked as public service engineers, planners, health promotion officers, nature conservationists or others with a role in biodiversity promotion or decision-making in relation to green space. All these stakeholders were invited to complete an open-ended questionnaire from which statements were collected. Based on their availability, the stakeholders were also

Table 3.1. Summary of stakeholders interviewed and who undertook the Q-sorts (statement ranking) for this research

Sector	Planners	Engineers	Health promotion officers	Conservation officials	Local authority staff with biodiversity-related roles ^a	Total
Interviews	3	5	4	3	4	19
Q-sorts (statement ranking)	10	10	8	7	8	43

^aLocal authority staff with biodiversity-related roles included heritage officers, biodiversity officers, environmental officers, landscape architects and other local authority decision-makers. Health promotion officers are a small national team located throughout Ireland; all remaining stakeholders were based in the west of Ireland.

selected to take part in the Q-sort stage (Table 3.1). Interviews were carried out both face-to-face and over the telephone. In most cases, the questions and an information sheet were sent by email to the interviewee prior to the interview taking place. All interviews were recorded using an Olympus digital voice recorder (model W5–750M). A total of 19 interviews with stakeholders (Table 3.1) were conducted over a 2-week timeframe in early August 2015.

Statement selection

All interviews were transcribed, with 130 statements initially extracted for Q-sorts analysis. Between 21 and 60 statements have been used in previous Q-method studies (Ryan *et al.*, 2006; Ellis *et al.*, 2007; Visser *et al.*, 2007; Doody *et al.*, 2009; Killam *et al.*, 2012; Kindermann and Gormally, 2013; Matinga *et al.*, 2014), with one study concluding that 36 statements were sufficient, from the perspective of the respondents and the researchers (Barry and Proops, 1999). The number of statements was first reduced to approximately 50 usable statements, which were deemed to be representative of the interviews. These were complemented by four statements taken from the literature to ensure that the statements reflected the discourse categories (Ellis *et al.*, 2007; Doody *et al.*, 2009) and the full range of opinions on the topic of health and wellbeing benefits from green spaces (van Exel and de Graaf, 2005). Based on a trial administered to a pilot group who did not participate in the rest of the study (van Exel and de Graaf, 2005), a final list of 39 statements, known as the “Q-set”, was selected. Comprising a wide range of opinions, this was not too large a number to deter respondents from completion (Barry and Proops, 1999).

Q-sorts

The original interviewees were contacted to rank the 39 statements, with additional stakeholders selected to ensure that sufficient numbers (43 in total) completed the Q-sort procedure (Table 3.1). The number of respondents in this study is within the range of other published Q-sort studies in which the number ranged from 25 to 59 (Barry and Proops, 1999; Ellis *et al.*, 2007; Visser *et al.*, 2007; Doody *et al.*, 2009; Killam *et al.*, 2012; Kindermann and Gormally, 2013; Matinga *et al.*, 2014). Respondents ranked the statements, according to their level of agreement with each one, by choosing a response ranging from “strongly agree” (+3) to “do not know/neutral” (0) to “strongly disagree” (–3), giving a reason for their choice where possible. This unforced ranking system was applied to the statements to allow participants a free choice of how many statements they were allowed to strongly agree/disagree with, thus allowing respondents a greater freedom of choice without restricting their responses to a quasi-normal distribution.

Q-sort analyses

Principal component analysis (PCA) was undertaken to synthesise the Q-sort statements from the body of stakeholder responses into a number of compound elements, thereby reducing the data to its most important elements (Dytham, 2011). Eigenvalues were first calculated to determine how many components were influencing variation within the data and should, therefore, be extracted. The data were then rotated obliquely (using a Direct Oblimin rotation) to aid interpretation (Field, 2005). Missing data (stakeholders skipped scoring some statements) were excluded on a list-wise basis. A correlation matrix revealed the

patterns in ranks assigned by the stakeholder groups to the statements. These clusters of correlations were examined to determine common or uncommon viewpoints across stakeholder groups. The table of communalities that outlines the shared variance of each statement was calculated. The pattern matrix was then investigated to determine the extent to which the new components were responsible for the course of views expressed.

3.4 Results

3.4.1 Principal component analysis

Principal component analysis was undertaken on 34 statements (after unscored statements had been removed) to identify those components that best explained stakeholders' perceptions. Initial components analysis revealed eight components with eigenvalues over 1.0, which is typically taken as the cut-off point for further investigation in PCA (Field, 2005). While this accounted for approximately 88% of all variance within the dataset, most of the variance (approximately 47%)

is explained by the first components (Tables 3.2 and 3.3). For this reason, only the first two components (PC1 and PC2) were extracted (Field, 2005) (Table 3.2). Although the third component (PC3) accounts for 13% of the variance, further analysis revealed it did not contribute any additional information in terms of reflecting the stakeholder's views on the key components.

The first (PC1) and second (PC2) components contributed approximately 33% and 13.8%, respectively, of all variance in stakeholder responses (Table 3.3). The responses to the statements were subsequently grouped according to the two main principal components (Figure 3.1).

3.4.2 PCA and the strength of responses to statements

Figure 3.1 outlines the agreement levels (positive, negative and neutral) of all stakeholder groups with the statements analysed (Table 3.4). PC1 (x-axis) divided statements with which stakeholder groups either all agreed or disagreed to the positive and negative sides of the x-axis.

Table 3.2. Initial analysis of components and their corresponding eigenvalues

Component	Initial eigenvalues (not rounded up)		
	Total	Variance (%)	Cumulative variance (%)
1	11.205	32.957	32.957
2	4.696	13.810	46.767
3	4.404	12.953	59.721
4	2.681	7.887	67.607
5	2.496	7.343	74.950
6	1.866	5.488	80.438
7	1.443	4.245	84.682
8	1.242	3.652	88.334

Table 3.3. Variance in stakeholder responses in relation to first two extracted components

Extracted variance explained in stakeholder response (PCA)							
Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings ^a
	Total	Variance (%)	Cumulative variance (%)	Total	Variance (%)	Cumulative variance (%)	Total
1	11.205	32.957	32.957	11.205	32.957	32.957	10.951
2	4.696	13.810	46.767	4.696	13.810	46.767	5.186

^aThe values here represent the distribution of the variance after the Direct Oblimin rotation.

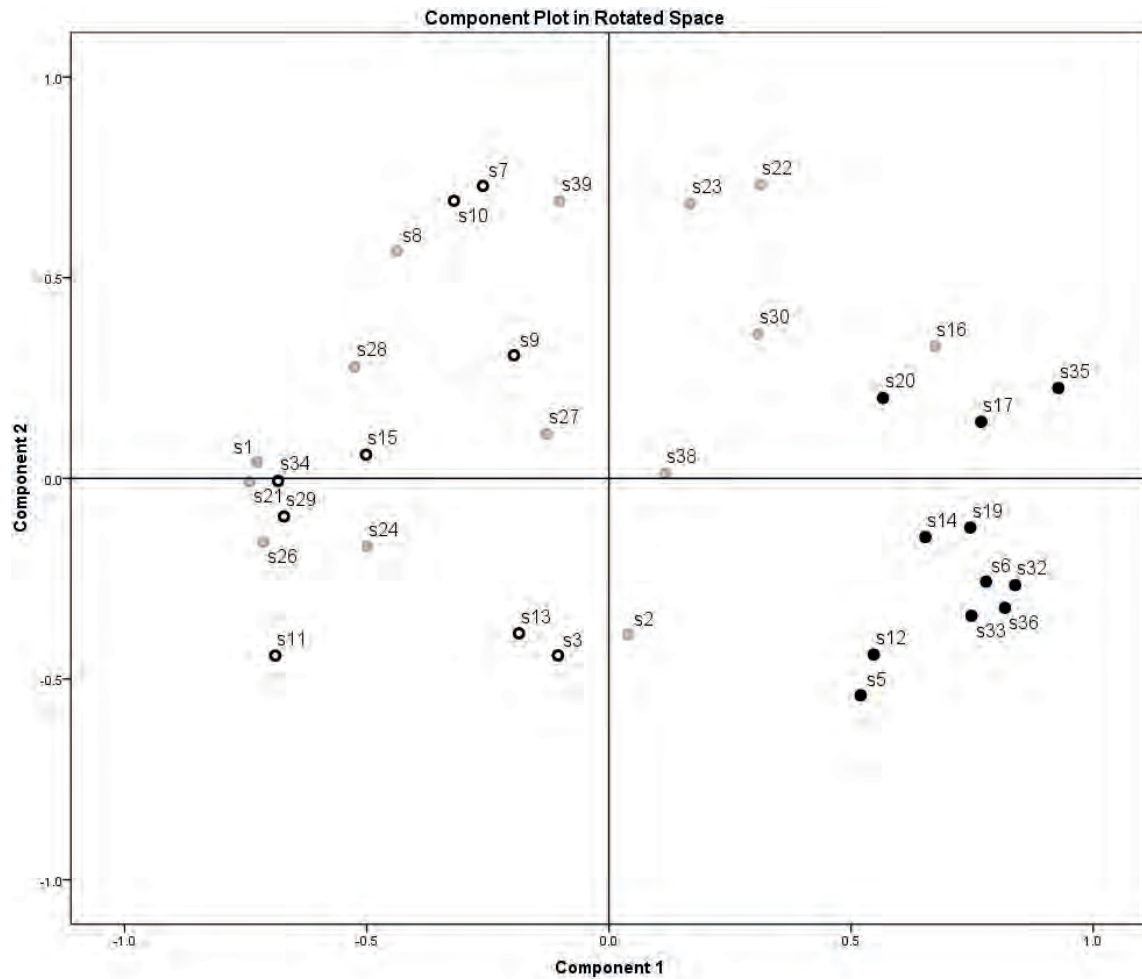


Figure 3.1. Score plot of statements for PC1 and PC2. Black circles represent agreement responses to the statements, clear circles represent disagreement responses and grey circles indicate agreement, disagreement and neutral responses to the statements, classified as “mixed responses”.

The statements with which stakeholder groups all agreed were clustered together, with high component loadings for PC1 ranging from 0.5 to 0.9 (Figure 3.1). Large co-ordinate values on the x-axis suggest that these statements represent different aspects of the same underlying component (Field, 2005), indicating the importance of PC1 in terms of explaining the stakeholders’ intensely held views. However, where all stakeholder groups similarly disagreed with the statements, the component loadings (ranging from -0.75 to -0.02) were not clustered together (Figure 3.1), suggesting that these views were not as intensely held (Table 3.4).

The relationship with PC2 (y-axis) is less clear, as the responses to statements across the entire scatterplot were more varied. The component loadings in PC2 ranged from 0.02 to 0.79 and -0.01 to -0.56 . Mixed responses to statements loaded onto both principal

components (PC1 and PC2) and were not clustered closely to either axis. These responses were classed as complex (Field, 2005) and did not fully explain the variance in mixed responses to statements (Table 3.4). To explore this further, the proportion of shared variance in the statements or communality was examined.

3.4.3 *Principal component analysis: shared variance and extracted elements*

The concourse of views can be summarised by examining how much of the shared variance in stakeholder views was accounted for by the extracted components (communalities) (see Table 3.4). High communality data (>0.3) (Field, 2005) indicate that the extracted components explain most of the variation in the range of views held by the stakeholders. Low communality data (<0.3) represent a small proportion of the shared variance and, therefore, do not contribute much to the

Table 3.4. Principal component values and themes and shared variance (or communalities) for the Q-sorts analysis (showing median stakeholder response to each statement)

Number and statement	Stakeholder responses	Median	Shared variance	PC1	PC2
				Nature	Access
35	Spending time in nature allows you to de-stress and problem-solve	3	0.879	0.848	0.400
36	I feel fitter because being out in nature motivates me to walk more	3	0.815	0.890	-0.148
32	When people have the opportunity to recognise plants and understand animal behaviour, it's a positive experience	2	0.810	0.895	-0.090
33	When I connect with nature I am motivated to look after it and protect it	3	0.718	0.828	-0.181
6	I go into nature as much as possible to exercise	3	0.704	0.834	-0.093
7	I don't exercise outside, I go to the gym instead	-3	0.628	-0.455	0.649
11	Enjoyment of nature is only for those who can afford the resources to do so	-3	0.622	-0.554	-0.561
10	Nature is not accessible unless you have a car	-3	0.616	-0.504	0.602
5	I relax by seeking contact with nature, from walks to the beach or the woods and having picnics	3	0.607	0.658	-0.417
22	Open green areas are better than woodlands in urban settings	-2	0.597	0.106	0.765
17	In urban settings, too much concrete is bad for our mental health	3	0.594	0.715	0.288
19	Green spaces in urban areas give us an opportunity to watch/experience wildlife	2	0.586	0.765	0.030
8	If you have young children, playgrounds and amenity areas become more important than wild areas	-2	0.552	-0.585	0.458
21	Areas designed for biodiversity in urban spaces are unsightly as they may contain dog faeces, litter and needles	-2	0.549	-0.725	-0.155

Table 3.4. Continued

Number and statement	Stakeholder responses	Median	Shared variance	PC1 Nature	PC2 Access
1 Urban green spaces are more for playing, relaxing and exercising than for wildlife		2	0.534	-0.723	-0.104
12 I walk to places where I find nature		2	0.530	0.657	-0.314
16 There aren't enough green spaces in cities and towns to engage with nature		2	0.527	0.570	0.449
26 A big green area where people can play sports is much more important than creating areas of biodiversity		-2	0.516	-0.656	-0.294
39 Nature can be really stressful when you're being bitten by insects		-2	0.499	-0.290	0.644
23 I avoid densely planted urban woodlands as they promote anti-social behaviour		-2	0.479	-0.024	0.692
34 For me, I don't think contact with nature benefits health and wellbeing		-3	0.466	-0.668	-0.141
14 In an urban setting, it makes me happy just knowing that I may come across nature around the corner		2	0.464	0.681	-0.011
29 Contact with nature is only for people who can afford to spend time outdoors		-2	0.0449	-0.632	-0.224
28 Most adults do not appreciate nature		-2	0.376	-0.591	0.163
20 Green spaces in urban areas make exercise accessible		2	0.342	0.500	0.304

Key to stakeholders: ◆, engineer; ■, planner; □, conservationist; ✕, health promotion officer; ●, local authority staff with biodiversity-related roles.

The nature theme represents a personal value for nature and the access theme represents accessibility (physical barriers and mental blocks).

patterns in the data (Field, 2005). Since 9 of the 34 statements in this study had communality values below 0.3, these were not considered further. In total, 25 statements shared between 34% and 88% of the variation within the principal components (Table 3.4). Of the 25 statements, 11 represented stakeholder agreement

(with the statements and with each other) and 6 represented stakeholders who responded similarly in disagreeing with the statements. Eight represented mixed responses to the statements (stakeholders did not all agree or all disagree with the statements).

Principal components: themes of agreement and disagreement

Key themes of agreement (+1 to +3) and disagreement (−1 to −3) were revealed by PCA. The first principal component concerned nature and, in particular, the personal values of nature and combined definitive and evaluative discourses (Barry and Proops, 1999). This component was represented by associated positive and negative high-correlation values (Figure 3.1; Table 3.4). All stakeholders strongly disagreed that there were no personal health and wellbeing benefits from connecting with nature [statement (s) 34], linking the presence of too much concrete to impaired mental health (s17), and were happy with encountering nature in urban settings (s14). Stakeholders who agreed with statements referring to feeling fitter (s36) and more motivated (s36 and s33), feeling positive (s32), being able to problem-solve and de-stress (s35) and to relax (s5), because they were connected to nature when doing so (s36 and s6), disagreed with statements referring to the need to exercise in a gym (s7), because green spaces can make exercise accessible to them (s20). Stakeholders who strongly disagreed that resources, such as time and finances, were needed to access (s10) or enjoy nature (s11) all agreed that nature was within workable distance (s12). Stakeholders who enjoyed seeking contact with nature in a variety of ways (s5) emphasised the opportunity to watch urban wildlife (s19) and recognise plants (s32), and were motivated to conserve nature (s33).

The second principal component concerns access, in terms of physical barriers and perceived mental blocks, and reflects designative and questioning discourses regarding the multifunctionality of green spaces (Barry and Proops, 1999). While this principal component (PC2) explained almost all the remaining variation, the relationships are not as strong as for PC1 (Figure 3.1; Table 3.4). Statements relating to the appearance and design of green spaces drew mixed opinions. Some stakeholders valued playgrounds and open areas (s8 and s26) and some were more concerned with barriers, such as being bitten by insects (s39) or being afraid of experiencing anti-social behaviour in enclosed areas such as woodlands (s23). Planners and health promotion officers preferred open green areas to urban woodlands while engineers, other local authority decision-makers and conservationists disagreed, but for different reasons. Engineers, uniquely, prioritised sports pitches (s26) over creating spaces for nature.

Of all the stakeholders, only engineers agreed that most adults did not value nature (s28). While engineers thought there were sufficient places to connect with urban nature, local authority decision-makers held neutral views and conservationists, health promotion officers and planners agreed that there should be more places to engage with nature in cities and towns (s16). Of all the stakeholders, planners most strongly associated urban woodlands with anti-social behaviour (s22 and s23), leading to their preference for open areas for nature.

Mixed responses revealed that stakeholders differ in the strength of their views regarding access and appearance or design. Agreement and disagreement responses revealed that stakeholders share strongly-held views regarding the importance of green space for health and wellbeing, though all stakeholders do not apply this view consistently in terms of recreation with the family (playgrounds) and formal team games (sports pitches). In giving reasons for their views, three of five stakeholder groups cited cost or insufficient funding for green space events as an issue. This was illustrated by stakeholder comments such as:

... limited funding, compared to how we spend on other areas like transport, waste management – there's more spent in this local authority picking up litter than there is on conserving sites. There is no one the local authority must report to, like roads and transport report to Transport Ireland and central government.

We've produced a biodiversity strategy but we've no resources to drive it! So central government is pretty good at ratifying new strategies and legislation for local authorities but it doesn't resource them for it.

Another respondent highlighted the issues with prioritising strategic, long-term investment from a local point of view:

There is no central authority giving out funding for recreation and conservation, other than one-off grants and ... the reality is that the local authority has to fund strategic things like waste. I guess a councillor is more likely to be lobbied for the condition of the roads than for funding for green space.

Another comment acknowledged benefits to health and acknowledged that a joined-up approach in which different bodies sharing funding to address this issue might be a way forward in the future.

... just being outdoors walking its massive. What's the figure that one in ten people in Ireland suffer from depression, you would think that alone would get us funds to develop more walkways and provide information. It's again because of national policy and joined up thinking. If you combined it up you could reduce health costs and justice problems. ... there is also the fact that different bodies do not want to share funding. Until such time as Europe advocate the joined-up thinking and shows that the linkages and what should be done that way.

The implications of the relationships between the stakeholder responses to statements and the underlying components will be evaluated in the discussion.

3.5 Discussion

3.5.1 Overarching findings

This is the first study (in an Irish and European context) to demonstrate that local authority staff, conservationists and health promotion officers (n = 43) strongly agree that there are health and wellbeing benefits from contact with nature and green space, and that this has personal relevance to them (s34). In an international context, the perceptions of key stakeholders who design, plan, provide, manage and promote use of green space have not received adequate attention. A Swedish study examined attitudes of planners in relation to biodiversity (Sandström *et al.*, 2006) but it did not apply Q-methods. Stakeholder workshops elicited views and values to prioritise implementation of green infrastructure in east England (Roe and Mell, 2013), but this did not use Q-methods and did not address the issues at the heart of this study. Recently, BESAFE, an EU project involving nine countries did use Q-methods to examine the perceptions of biodiversity and ecosystem services by conservation practitioners and researchers (Termansen *et al.*, 2014). Notwithstanding similarities between the BESAFE project and that presented here, the BESAFE project focused on biodiversity and ecosystem services, whereas the focus of this study was on green

spaces and health and wellbeing benefits (Termansen *et al.*, 2014).

Key themes of strong agreement and disagreement

In this study, Q-methods identified that stakeholders strongly agreed that connecting with nature benefits health and wellbeing and that resources, such as a car or money, were not needed to connect with nature.

Engineers strongly disagreed with planners and health promotion officers (and disagreed with conservationists and local authority staff with biodiversity-related roles) over the multifunctional nature of green space. Engineers strongly agreed that large open spaces where people could play sports are more important than creating areas of biodiversity (s26), whereas the other stakeholders did not agree with this statement.

Key components underpinning areas of agreement and disagreement

Overall, most of the stakeholder groups agreed that a biodiversity function is important for urban green spaces. All groups recognised that contact with nature encouraged them to walk more, feel fitter, helped them de-stress and problem-solve, and to relax with family. When they identified and recognised biodiversity, stakeholders felt positively connected to nature, which motivated them to conserve it (Figure 3.1; Table 3.4).

No stakeholders shared neutral views on any issue, but they agreed and disagreed to varying degrees (sometimes strongly) on a number of issues:

- While health promotion officers/conservationists agreed and planners strongly agreed that there are not enough urban green spaces to engage with nature, public service engineers disagreed with this (s16).
- Engineers strongly agreed, and conservationists/local authority staff with biodiversity-related roles (LABRs) agreed and health promotion officers slightly agreed, that urban green spaces are more for playing, relaxing and exercising than for wildlife, whereas planners disagreed (s1).
- Engineers strongly agreed that most adults do not appreciate nature, but planners strongly disagreed and all the other stakeholders disagreed with this statement (s28).

- Planners agreed that they avoided densely planted urban woodlands as they promote anti-social behaviour, while conservationists strongly disagreed, LABRs disagreed and engineers slightly disagreed (s23).
- Engineers agreed that if you have young children, playgrounds and amenity areas become more important than wild areas, while LABRs and conservationists disagreed and health promotion officers held views were between disagreeing and strongly disagreeing (s8).
- Although conservationists strongly agreed that nature can be stressful when being bitten by insects, engineers slightly disagreed and LABRs/health promotion officers disagreed (s39).

3.5.2 Principal components

The Q-sort analysis reduced the variation in stakeholder views to two principal components (Table 3.3; Figure 3.1). Component 1 represents a personal value of nature and component 2 describes accessibility in terms of physical barriers and mental blocks.

Component 1: Perceptions regarding a personal value of nature

The first component concerns health and wellbeing benefits from nature and the multifunctionality of green spaces. The extent of multifunctional land in urban spaces is limited and under high development pressures from infrastructure, housing and commercial use (Haaland and van den Bosch, 2015; McMorris *et al.*, 2015; Madureira *et al.*, 2015). While multifunctional urban green spaces (MUGS) (and their ecosystems) are often small (Derkzen *et al.*, 2015), they provide services such as improving air quality, urban cooling and protection from urban noise (Hansen and Pauleit, 2014; Martinez-Juarez *et al.*, 2015). The densification of urban areas means that the ecosystem services delivered by MUGS are of great importance to urban populations (Derkzen *et al.*, 2015) and are under increasing pressure (Haase *et al.*, 2014). Urban ecosystems have, until recently, been overlooked in the literature (Davies *et al.*, 2011; Haase *et al.*, 2014) and there are gaps in our knowledge regarding their management to benefit both nature and human society (Standish *et al.*, 2013; Derkzen *et al.*, 2015) despite human health and wellbeing representing the “ultimate ecosystem service” (Sandifer *et al.*, 2015). The promotion of urban

ecosystem services (Kabisch, 2015a) could raise awareness of the health benefits from green spaces.

Stakeholders in this study perceive a value to human health and wellbeing from multifunctional spaces. Current research in England (Alcock *et al.*, 2015), Catalonia (Triguero-Mas *et al.*, 2015), Italy (Carrus *et al.*, 2015a), France and Portugal (Madureira *et al.*, 2015), Canada (Finlay *et al.*, 2015; Hordyk *et al.*, 2015a,b), Bogota, Colombia (Scopelliti *et al.*, 2016), the USA (Richardson *et al.*, 2012) and Australia (Astell-Burt *et al.*, 2013; Carter and Horwitz, 2014) demonstrates that contact with nature results in positive health and wellbeing effects and supports the views of the stakeholders in this study. There is a growing awareness that healthy urban environments are those that make space for people and nature and offer people the chance to connect with nature on their doorstep (Standish *et al.*, 2013). This is exemplified by one of the health promotion officers in this study who stated that “nature – flora and fauna – is an important component of urban green spaces; this contributes to healthier urban living spaces for local populations and biodiversity.”

Respondents in this study valued the opportunity to watch wildlife in urban green spaces (s19). Similarly, in Sheffield, urban green spaces that had been designed as wildlife corridors to counteract habitat fragmentation provided opportunities for human–wildlife interactions (Fuller *et al.*, 2007). A conservation official in this study observed that “even the sound of the gulls are great, and in a city it is even more precious to see some small plots with trees and shrubs that might attract a blackbird, wren or blue tit.” Stakeholders acknowledged that the opportunity to recognise plants and understand animal behaviour was a positive experience (s32) which motivated them to conserve nature (s33) (Kollmuss and Agyemen, 2002). People who connect with nature in this way may get involved in citizen science (Meyer, 2015). Citizen science projects to monitor wildlife or remove invasive species (Kobori *et al.*, 2016) are relatively cost-effective and have the potential to engage more people in the practice of science (Meyer, 2015; Kobori *et al.*, 2016). As David Attenborough points out: “no one will protect what they don’t care about; and no one will care about what they have never experienced” (Bristol Natural History Consortium, 2010). This awareness is demonstrated by a health promotion officer stating that “we need more biodiversity and green spaces in urban areas, but these should be well planned, designed and managed by local authorities” and by a conservation

official observing that “in Ireland there is a paucity of green spaces and potential habitats in our towns and cities”. Such comments reflect the need for more green spaces in which to experience nature (s16).

When people walk to places to experience nature (s12), they are motivated to walk more (s36). This gives stakeholders a feeling of increased fitness (s36) and the respondents acknowledged that accessibility of green spaces makes exercise easier (s20). The influence of social relationships on behaviour was noted by a health promotion officer who said “all my activities were indoor before I met my wife ... she is very into nature and she has imbued [me with] a sense of a respect for nature.” He described what connecting with nature meant to him: “even the sense of being outdoors ... the bird life and wildlife is hugely important in an urban area, it’s fabulous, you are in better form”. Comments by another health promotion officer in this study revealed other reasons to exercise outdoors, stating that “I find gyms are very crowded, cramped, unhygienic environments.” However, exercising in a gym was an important practice for an engineer, who differentiated between fast-paced cardiovascular exercise indoors and use of natural environments to work through a problem commenting that “I would set out on a walk to think about an issue and by the time I finished (the walk), I had resolved it.”

The relationship between undertaking regular outdoor activities and residential proximity to green spaces is borne out by research in Sweden (Ezebilo *et al.*, 2015), Beijing (Zhang *et al.*, 2015), Finland (Neuvonen *et al.*, 2007) and Lithuania, where use of green space was linked to better cardiovascular health (Tamosiunas *et al.*, 2014). Swedish and Finnish people spend more time undertaking physical activities in natural areas than indoors (Ezebilo *et al.*, 2015; Pietilä *et al.*, 2015) and, as a desire to be in more natural surroundings was what prompted people to return to parks in a Canadian city, this should be taken into account in the design of parks (McCormack *et al.*, 2014). In this study, the proximity of green spaces to the respondents’ location makes exercise part of their everyday experience; however, respondents also identified health benefits from a perception of surrounding greenness or nearby nature.

Knowing that green space is nearby in an urban environment (s14) also made stakeholders feel happier, while too much concrete or “hard-paved” surfaces (s17) was associated with impaired mental health. One engineer viewed green spaces as “an oasis in

the desert”. Triguero-Mas (2015) posited that views of tree-lined streets acted as micro-restorative settings for urban dwellers and that direct access to these spaces was not necessary to provide the restorative benefits. Stakeholders connect with nature to de-stress and problem-solve (s35). Several studies concur that time spent in nature provided people with opportunities for psychological wellbeing, stress reduction, recuperation, experiencing solitude and rejuvenation and can provides a sense of peace and tranquillity (Wolch *et al.*, 2014; Finlay *et al.*, 2015; Triguero-Mas *et al.*, 2015).

Stakeholders relaxed in green spaces by having picnics (s5) and playing, with a senior LABR commenting that “outdoor play is essential” and a health promotion officer observing that “children enjoy being outdoors in all sorts of weather and conditions – (it is) a part of healthy child development.” Children in Bristol and in Warrington reported that they were motivated to spend time outdoors, to bond with friends, to prevent boredom, to benefit health and wellbeing and to feel free (Brockman *et al.*, 2011; Ridgers *et al.*, 2012). A recent review of the literature highlighted that safety was a key issue for parents and children (Lee *et al.*, 2015b). In a study in America, parents recognised the benefits of outdoor play for their children and were prepared to tolerate the drawbacks such as dirty clothes and hands (Bohling *et al.*, 2012). Two conservationists reflected differing views, with one commenting that “attitudes to muck, insects, getting clothes dirty, etc. are ... barriers” and, to counteract that, another commented that “I take my nieces and nephew outside all the time to explore nature and they love it. Germs are not all bad!” Contact with dirt helps to develop a child’s immune system (Haahtela *et al.*, 2013) and regulates asthma and allergies (Ruokolainen *et al.*, 2015), while time spent in nature gives children and teenagers a greater affinity to these spaces (Lin *et al.*, 2014).

While health and wellbeing benefits arise from multifunctional green space, stakeholders value this in different ways. Planners alone agreed that urban green spaces are equally for playing, relaxing, exercising and for wildlife (s1). When it comes to play, most stakeholders, apart from engineers, acknowledged the equal importance of wild areas and playgrounds for children (s8) with one health promotion officer observing that “children’s playgrounds and amenities should have green spaces with lots of biodiversity” as a means of increasing knowledge and connection with biodiversity and the environment in children at a young age.

Engineers were unique in placing more value on sports grounds than biodiverse areas (s26). This difference in engineers' views may be linked to the second component, which is concerned with access and barriers associated with the design, appearance and integration of biodiversity in green spaces.

Component 2: Perceptions regarding accessibility – physical barriers and mental blocks

The second component is concerned with access and barriers that arise by integrating biodiversity into green spaces and how this influences views on their design and appearance.

Accessibility

In this study, there was an awareness that public transport in the west of Ireland did not readily facilitate some types of nature experiences. Comments suggested that public transport was mostly available to remove people from green spaces into an urban area, rather than increasing access to rural nature places. This has implications for tourism, as well as maintaining urban–rural connectivity. While getting to natural places was one barrier, stakeholders' responses suggest that there are other barriers to accessing nature, including fear of antisocial behaviour and biting arthropods such as ticks, midges, mosquitos and horseflies.

Research has highlighted a growing disconnect between people and nature known as “extinction of experience” (Soga *et al.*, 2015). For example, students from an urban area, on a field trip to a rural landscape, expressed fears of biting insects (Bixler *et al.*, 1994). In this study, only conservation officials agreed that being bitten by insects was stressful. Conservationists tend to spend more time in the natural environment. As they may have to spend time undertaking conservation management activities on site or completing surveys, they cannot choose to leave a place immediately, unlike people who can choose to abandon recreational activities should they encounter biting insects. While it seems a little surprising that more stakeholders did not respond similarly regarding insects, those who disagreed with this statement may also have less experience of nature. Nevertheless, animal pests are an important consideration in the design and location of urban green spaces to ensure that pest or biting arthropods do not pose an obstacle to people connecting with nature. Barriers

could also be created by the appearance and design of green spaces.

Perceptions regarding design of green spaces

While the presence of green spaces made people happy (s14), attitudes to design features were more nuanced. Despite the acknowledged value of trees (Neuvonen *et al.*, 2007; Finlay *et al.*, 2015), with people incentivised to walk more by the presence of tree-lined streets in London (Sarkar *et al.*, 2015), planners and health promotion officers in this study avoided dense woodland (s22), as they associated them with antisocial behaviour (s23). People feel safer in amenity-managed green spaces than in biodiverse green spaces (Özgüner and Kendle, 2006; Adinolfi *et al.*, 2014), although obscured views and an untidy appearance were reasons why people preferred open spaces over densely wooded areas (Tzoulas and James, 2010). Appearance may not be the sole factor, as people's preferences for relatively open areas may be influenced by the fact that these are the places in which they spend most time or associate with a particular activity (Qiu *et al.*, 2013; Lee *et al.*, 2015a).

3.5.3 Implications of this research for the stakeholders

In this study, stakeholders strongly agreed on the value of nature and green spaces for health and wellbeing. There are, however, a number of fundamental areas where the mixed responses indicated that stakeholders hold differing views. Furthermore, within stakeholder groups, a range of opinions was held, with opinions of varying intensities. The implication of this is that perceived values and viewpoints cannot be consistently allocated to specific roles within the community. This means that there needs to be ongoing engagement and discussion within and between stakeholders to elicit and take account of the full range of views.

A similar complexity of views held by nature conservation officials, non-governmental organisation (NGO) workers and biodiversity researchers in nine EU countries emerged from a recent survey (BESAFE) (Termansen *et al.*, 2014). Delivery of agreed targets and governmental commitments could be impacted by the different viewpoints held by researchers and practitioners. The BESAFE project's aim was to determine what drives the opinions underpinning biodiversity conservation and ecosystem services, and the linkages between biodiversity and ecosystem services. Using Q-methods, the

views of the BESAFE stakeholder groups were reduced to four main components: scientific, ethical, economic and emotional, though different aspects of each component were prioritised by the individual stakeholder groups (Termansen *et al.*, 2014). All groups recognised the ethical and economic dimensions of biodiversity conservation, with nature conservation practitioners relating this to the provision of ecosystem services. Scientific researchers prioritised the functional role of biodiversity, but social science researchers valued an emotional connection to nature and were more likely to question the role of biodiversity in ecosystem services. Overall, conservation practitioners were more supportive of emotional arguments for biodiversity than the scientific researchers.

Similarly, this study demonstrates that complex values cannot be consistently categorised solely on the basis of roles. While stakeholders agree on the health and wellbeing benefits from nature and green spaces, views differ between stakeholders on issues regarding access, design and function. The relative weakness of the evidence base relating to biodiversity and health may contribute to the lack of consensus, because differences in personal opinion are difficult to resolve by an appeal to evidence where evidence is lacking. A key recommendation would be to start by bringing the various stakeholders together to hear and share views on green space, nature and health and wellbeing. One option might be to focus initially on the issues where there is most agreement, for example some of the mixed but opposing responses to statements had only one stakeholder group espousing a different viewpoint to the other stakeholders. Some of the key statements regarding the value of biodiverse spaces in urban areas were supported by all stakeholders except the engineers. Engineers, while at one level recognising the importance of nature and green spaces for health and wellbeing, appeared to struggle more with the concept of integrating biodiversity into non-natural green spaces such as playgrounds and sports pitches.

Nature can be integrated or retrofitted into created spaces at a variety of different scales within urban areas. This includes strategically planned green infrastructure, sustainable urban drainage schemes, green cycle paths or walkways and community projects incorporating features to benefit wildlife, such as green walls, green roofs, planting trees and butterfly borders, making bug hotels or bird and bat boxes (Curtin and Fox, 2014). Such features can sustain communities and

the environment, though care is needed to ensure that their introduction is conducted with environmental and social/community values at its heart to entice people to relax or be active outdoors, while not driving property values beyond the means of the local community (Wolch *et al.*, 2014).

This evidence suggests that there is a need for a multi-disciplinary learning on the part of ecologists, planners, engineers, landscape architects, health promotion officers and social scientists, which could be met through site visits in the short term and training courses in the long term. University and continuous professional development courses must offer more on ways to integrate nature into created spaces to increase physical activity (Lovell *et al.*, 2014) and wellbeing (Shanahan *et al.*, 2015), to provide opportunities to relax (Gonzalez and Kirkevold, 2016), develop ecotourism potential (Wolch *et al.*, 2014) and benefit the environment and community (Sandifer *et al.*, 2015). Such a course could be modelled on a Canadian training module (Ontario Public Health Association, 2016) aimed at local authority, environmental health and public health professionals. On completing the Ontario-based course, all professionals are able to describe the legislative drivers and mandates that govern the work of each profession and to take account of the connections between land use planning decisions, community design and the environment as determinants of health in their day-to-day profession. Such a course could contribute to transforming practice through research-informed policy in Ireland [e.g. the National Planning Framework (DECLG, 2015b)] or by cross-sectoral decision-making [e.g. Objective 1 of the National Biodiversity Plan (NPWS, 2011) and actions from Theme 2, “Partnerships and Cross-Sectoral Work”, of Healthy Ireland]. In addition, Action 35 of The National Physical Activity Plan (DoH, 2016) prioritises the need to develop a programme of continuous professional development regarding the role of physical activity for those working in developing the built environment.

In the short term, site visits could be organised to places that provide a range of opportunities for people to engage with nature at different times throughout their lifetime. These site visits should include representatives from all key stakeholder groups and should allow them to meet the other people involved in planning, providing, promoting and managing such spaces for people and for nature. Examples of this type of work is that undertaken by ECO-UNESCO in Dublin City and the visits organised by the Native Woodland Trust. Such

site visits could be themed to focus on the attitudinal and physical barriers identified in this study to ensure that key stakeholders can make space for people and nature in different ways as their needs change through their lifetime (Soga *et al.*, 2015).

Site visits could be followed up with workshops to highlight learning points from all stakeholders and to reach agreement on a desired green space that connects with all stakeholders. Examples of this have occurred in Denmark and in the UK, where all members of the community were involved in designing an urban green space. From this, stakeholders could identify actions needed to achieve the desired future and who would be likely to fulfil those actions. With clearly allocated roles, responsibilities and targets, this action plan should be in operation for a set period of time and reviewed to ensure that progress is made.

3.5.4 Limitations

While it is feasible to administer the Q-method by email, with clear, simple instructions and an open line of communication (Matinga *et al.*, 2014), an unforeseen limitation arose. In this study, some stakeholders completed the survey, but did not always explain each decision. With more support and prompting, it is possible they may have provided more information. Several respondents were concerned with the length of the Q-sorts (39 statements). As other studies have used 40–50 statements, this had been discounted as a limitation (van Exel and de Graaf, 2005). Nevertheless, fewer statements might elicit more detailed explanations for responses.

3.5.5 Further research

The stakeholders who participated in this research were mostly situated in the west of Ireland (as health promotion officers are located throughout Ireland, all health promotion officers nationwide were invited to participate). Based on this research, an all-Ireland study involving a number of core urban areas, with the involvement of all relevant stakeholders in conservation, health and local authority roles would be beneficial for comparative purposes. Extending the stakeholders to include teachers, social workers and police would also add relevant views concerning the values and use of green spaces.

Planning and conservation policies and legislation are important for determining design, use and management of green spaces. Further research on how stakeholders perceive policy and legislation around green spaces in Ireland would be beneficial. Furthermore, research on the demographics of which individuals and communities use urban green spaces and how they use them would be very helpful in the planning and design processes for future green space provision.

3.6 Conclusion

Contact with nature benefits health and wellbeing, and is a universal value across all stakeholder groups that fulfil roles in delivering, managing and promoting uses of green space in Ireland today. Stakeholders' perceptions differed in how they viewed the design and appearance of multifunctional green spaces.

Four of the five stakeholder groups agreed that biodiversity was an important function of urban green spaces. Planners and health promotion officers (and to a lesser extent, conservationists and other local authority staff with biodiversity-related roles) were more positive than engineers regarding the potential to integrate biodiversity into playgrounds, sports grounds and amenity areas. Given the differences in stakeholder roles, such differences, while apparent, were not as extreme as might have been anticipated prior to this research.

3.6.1 Outcomes of the research

The stakeholders in this study contribute to delivering green spaces for people and nature in different ways. Their perceptions may influence how they contribute to the decision-making and implementation of green space policies and practices. In particular, their ideal green spaces are quite varied.

Engineers

Local authority engineers play a lead role in the provision of green space in Ireland. In city councils, where parks departments deliver and manage green spaces that may impact on infrastructure (especially traffic or drainage), engineers may provide advice. They contribute to drafting proposals at the development plan stage (local/county) and provide reports to councils on planning applications. Area engineers are responsible for the delivery of new green areas in towns or

villages and will deliver local aspects that feed into national projects; for example, the Roads Section of Galway County Council led the proposed Connemara Greenway project.

Engineers in this study went against prevailing stakeholder perceptions on a number of issues. In considering families and other people, they prioritised playgrounds and amenity areas, such as sports pitches, over wild and biodiverse areas, and believed that there were sufficient places to encounter nature in urban areas. While they agreed that contact with nature was a benefit to human health, they agreed that most adults did not appreciate nature. Based on this research, an engineer's ideal green space would be open, tidy and well structured, with flowers in neat borders, amenity shrubs and short grass. They would contain sport pitches and playgrounds and would be unlikely to contain wild areas.

Planners

Local authority planners play a key role in the provision of green space in Ireland. Planners may provide advice to parks departments in city councils, where delivery of green spaces interacts with planning functions. They contribute proactively to the Strategic Environmental Assessment (SEA) process (<http://www.epa.ie/monitoringassessment/assessment/sea/>) (EPA, 2012b), to the drafting of proposals at the development plan stage (local/county), and reactively by providing reports to Councils on planning applications. Planners may advise on green spaces in relation to other aspects of their role, for example through studies on outdoor recreation (Border Midland and Western Regional Assembly, 2014) or amenity and recreation needs assessments (Galway City Council, 2008).

In this study, planners' views followed the general prevailing attitudes in agreeing or disagreeing with statements. Planners uniquely believed that urban spaces were for people and nature. They desired more biodiversity/nature in urban areas. Planners thought that adults appreciated nature and recognised the value of multifunctional green spaces. Based on this research, a planner's ideal green space would be open, with no dense woodland. They would have wild areas for biodiversity close to playgrounds and sports pitches. They do not feel that biodiverse areas are unsightly. While they are not concerned that natural areas with long grass might contain litter, needles or dog faeces,

they avoid dense woodlands in urban areas, as they associate them with antisocial behaviour.

Local authority staff with biodiversity-related roles

These decision-makers can include biodiversity officers, heritage officers, environmental awareness officers, environmental assessment officers, environmental education officers, landscape architects and parks staff. They play important roles in the local biodiversity policies and provision of green space in Ireland. Biodiversity officers protect, manage and enhance the local environment by promoting awareness and understanding of nature to the public. In addition, they play a role in integrating biodiversity with planning, development and management. They often work with community groups to develop and implement action plans to maintain or restore biodiversity. They may, in the case of parks departments in city councils, be responsible for providing, delivering and managing green spaces. They also contribute proactively to the SEA process, to drafting proposals at the development plan stage (local/county) and may compile and review reports to councils on planning applications. They may participate in wider sustainable initiatives, such as the Healthy Cities Project. They may advocate green spaces through Studies on Outdoor Recreation (Border Midland and Western Regional Assembly, 2014) or Amenity and Recreation Needs Assessments (Galway City Council, 2008).

In this study, the views of local authority staff with biodiversity-related roles followed the general prevailing attitudes concerning whether stakeholders agreed or disagreed with statements. Based on this study, the ideal green space that local authority staff with biodiversity-related roles would design is not neat and tidy. It would contain some open grassy areas and some woodland, as well as areas for biodiversity, playgrounds and sports pitches.

Conservationists

Conservationists may be involved in the provision of green space if and when they are consulted by local authorities or asked to make a submission in relation to draft plans or projects that require SEA or Appropriate Assessment (AA). They may also participate in public participation networks, which are used for consultations on local authority activities.

Conservationists' perceptions followed the general prevailing attitudes concerning whether stakeholders agreed or disagreed with the statement. With the exception of the response regarding insect bites and the attitude to woodlands, a similar pattern was seen in the statements with mixed responses. Based on this research, a conservationist's ideal green space contains woodland, as they do not associate this with antisocial behaviour. Conservationists would have wild areas for biodiversity close to playgrounds and sports pitches, but they hold neutral views in relation to the appearance of biodiverse areas with long grass that might contain litter, needles or dog faeces. They were also more likely to recommend that green spaces contain some dog-free zones.

Health promotion officers

The Health Service Executive (HSE) can respond to planning applications and is a prescribed body where development may have health impacts. The HSE is a partner in the Healthy Cities Forum and may belong to the Public Participation Network. Health promotion officers can make submissions in response to local authority plans. Health promotion officers work with local authorities to devise strategies to create more green spaces and more sustainable environments, and to raise awareness of areas of naturalness in urban environments, for example Parkrun events. They work with local authorities and recreation and health organisations to create outdoor gyms, Slí na Sláinte routes, walkways and cycleways and to develop trails. They can influence green space use through organising events such as Parkrun.

In this study, the perceptions of health promotion officers followed the prevailing trend. They expressed a weak preference for open over closed areas, and they slightly agree that they avoid urban woodlands due to unsociable behaviour. They valued multifunctional space, slightly agreeing that urban green spaces are more for playing, relaxing and exercising than for wildlife, but strongly disagreed that a big green area where people can play sports is much more important than creating areas of biodiversity, even though they strongly agreed that green areas made exercise accessible. Based on this research, a health promotion officer's ideal green space is not neat and tidy, with amenity planting. It is probably more open than closed, and is not very likely to contain densely wooded areas. Some parts of it have long grass, and health promotion officers did not worry

that this would contain needles, litter or dog faeces. Some parts of it contain areas for wildlife, as well as play and exercise areas.

3.6.2 *Implications for the planning process*

In Ireland, the planning process can provide green spaces at a number of levels, including national, county and local, ranging from a strategic approach to provision as part of a development project. The consultation process is complex and stakeholder groups have opportunities to contribute to different stages of the process.

If each of the stakeholders had sole responsibility for green space design and provision and if the extent to which their perceptions was known to influence their decision-making process, three key potential issues emerge: (1) planners, health promotion officers and conservationists may be more likely to provide and promote more spaces for people to connect with nature than engineers; (2) the appearance and design might be very different, as stakeholders do not share the same views with regard to the design of their ideal green space; and (3) engineers may be least likely to create spaces for nature or to have some areas managed more naturally.

Based on this research, recommendations regarding green space are provided in Chapter 7. Stakeholders identified two overarching issues: (1) the lack of an integrated environment and wellbeing policy and (2) the low level of funding available to initiate green space and wellbeing programmes for people and nature.

Within an international context, the gap between scientific researchers and planners was highlighted at a workshop entitled "Green Cities, Healthy People" (Phenotype, 2013b) which articulated the cross-sectoral need to work together to incorporate health and wellbeing needs into how green space is managed (Phenotype, 2013a,b). Good practices of collaborative working are underway, for example Regional Open Space Strategy (Central Puget Sound, 2012) and, in Ontario, public health organisations, planning, parks and environmental sectors work together to implement public policy, projects and planning decisions (Ontario Public Health Convention, 2015). Opportunities need to be provided to facilitate greater collaboration between stakeholders. Implementation of a green-space, nature and wellbeing policy, with community engagement, would make this possible. Urban environments could truly make space for people and nature.

4 Potential for the Use of Geocoded Data in Further Research

4.1 Overview

The international literature includes geocoded spatial, environmental, health-related and socio-economic data. This work package outlines the potential benefits of geocoded environmental, socio-economic and health and wellbeing data. This may be possible from 2015 onwards, with the introduction of unique residence-based postcodes.

4.2 Objective

The objective was to learn from the use of biodiversity data and socio-economic and health statistics in international reports to assess how this could be applied to future planning for sustainable health and biodiversity in Ireland.

4.3 Methods

Information relating to types of assessments and datasets used in evaluating the benefits to health and wellbeing conferred by biodiversity and wellbeing was extracted from relevant original literature selected in WP2 (see WP2, with the exceptions of systematic reviews). Datasets were categorised depending on whether they represented population, health, biodiversity or spatially related information and statistics. The uses of such information in the literature is highlighted in Table 4.1. Recommendations for future research areas are provided in Chapter 6.

4.4 Outcomes

Of the 182 peer-reviewed papers assessed, 24 provided useful information for this work package. Throughout the literature, different measurements and types of green exposure were used (Donovan *et al.*, 2011; Beyer *et al.*, 2014; Jiang *et al.*, 2014).

4.4.1 Assessment of greenness

“Greenness” denotes the type, extent and condition of vegetation in a particular location (USGS, 2013). It is

measured as the percentage of green space available (Mitchell and Popham, 2008), or as percentage tree cover (Beyer *et al.*, 2014), or expressed as a measure of vegetation cover (US Geological Survey, 2013), for example using the Normalised Difference Vegetation Index (NDVI) (Almanza *et al.*, 2012; Laurent *et al.*, 2013; Beyer *et al.*, 2014; Cohen-Cline *et al.*, 2015). Other measures included park attractiveness (Sugiyama *et al.*, 2016) and land use (Mitchell and Popham, 2008; Ebisu *et al.*, 2016). Land use scales were not comparable, as the Generalised Land Use Database (Mitchell and Popham, 2008), which allocated parcels of land at a 10 m² scale to parks, agricultural land, and other open spaces, would not have had the precision to classify green space as forest, shrub, herbaceous or cultivated land (Ebisu *et al.*, 2016).

4.4.2 Percentage cover

The percentage of cover, calculated from land cover maps, refers to vegetation or trees (Mitchell and Popham, 2008; Donovan *et al.*, 2011; Beyer *et al.*, 2014; Jiang *et al.*, 2014; Richardson *et al.*, 2012). Trees were used in a few studies, as it is easier to persuade authorities to plant trees than to create new green spaces (Donovan *et al.*, 2011).

4.4.3 Park attractiveness

Attractiveness was based on the size and presence of features. Parks greater than 1 ha and in proximity to the participants’ home were used for the study (Sugiyama *et al.*, 2010).

4.4.4 Normalised Difference Vegetation Index

Vegetation cover surrounding a specific location, for example home (Laurent *et al.*, 2013) or school (Akpınar, 2016), can be assessed, as plants, shrubs and trees reflect light (specifically visible and near-infra-red light) that can be measured by remote satellite sensors (USGS, 2013). NDVI values have been broadly interpreted as the following: 0.1 or less: barren rock, sand or snow; 0.2–0.5: sparse vegetation (shrubs,

Table 4.1. Research utilising health/socio-economic data and extent of greenness

Measure of greenness	Health/socio-economic-related measures/surveys		Purpose	Reference
Park area and distance from park	Socio-economic factors	Western Australian Health and Wellbeing Surveillance System (HWSS) survey	Mental health	Sugiyama <i>et al.</i> (2016)
Land cover and proximity	Health, Alcohol, and Psychosocial Factors in Eastern Europe (HAPIEE)	Questions given to HAPIEE participants; baseline data included self-reported socio-demographic and health data measurements	Cardiovascular health	Tamosiunas <i>et al.</i> (2014)
Land cover	English index of multiple deprivation (EIMD) 2004	National statistics office provided geocoded mortality data on age, sex, cause of death	Health inequalities	Mitchell and Popham (2008)
Percentage land cover	2nd Dutch National Survey of General Practice (DNSGP-2)	(1) Number of health complaints in the last 14 days; (2) perceived mental health (GHQ-12); and (3) single measure of perceived health in the range “excellent” to “poor”	Mitigate stress of life events on health	van den Berg <i>et al.</i> (2010)
Percentage cover	Tax records and birth certificates informed the socio-economic status and saleability of residence	Regional Land Information System database: housing population density, street connectivity, proximity to parks, infrastructure, geocoded police crime records	Birth outcomes	Donovan <i>et al.</i> (2011)
Tree cover	N/A	Stress levels measured as salivary cortisol and skin conductance levels (gender)	Impact of green space on stress	Jiang <i>et al.</i> (2014)
Tree cover, NDVI and percentage tree cover	Survey of the Health of Wisconsin (SHOW) (3 years of data)	Geocoded data from interviews, physical exams and biospecimens from a representative sample of residents controlled for age, socio-economic factors etc.	Impact on depression	Beyer <i>et al.</i> (2014)
NDVI	German Infant Study on the Influence of Nutrition Intervention plus Environmental and Genetic Influences on Allergy Development (GINIplus)	Influence of Life-Style Factors on the Development of the Immune System and Allergies in East and West Germany plus the influence of traffic emissions and genetics (LISApplus)	Impact on birth weight in Munich	Markevych <i>et al.</i> (2014)
NDVI	Part of existing PHENOTYPE study (three different survey phases)	Age, socio-economic and demographic measures, smoking preferences, BMI, women's residential history, occupation during pregnancy, health behaviour and education	Impact on behavioural and emotional problems	Balseviciene <i>et al.</i> (2014)
NDVI	Born in Bradford: longitudinal multi-ethnic community birth cohort study aiming to examine the impact of environmental, psychological and genetic factors on maternal and child health and wellbeing	Participants were pregnant women at 26–28 weeks' gestation who completed a baseline questionnaire detailing information on socio-economic characteristics, ethnicity and family trees, lifestyle factors, environmental risk factors and physical and mental health	Birth outcomes and social inequality	Dadvand <i>et al.</i> (2014a)
NDVI	Synergistic Theory and Research on Obesity and Nutrition Group (STRONG) kids project	Parents filled out a questionnaire on demographic characteristics, gender, race, education, diet, physical activity, parent–child relationships that moderate behaviours related to obesity risk	Physical activity	Grigsby-Toussaint <i>et al.</i> (2011)

N/A, not applicable.

grassland); 0.6–0.9: dense vegetation, such as temperate and tropical rainforests and crops (at peak growth stage) (USGS, 2013). This record spans from 1981 to 2013 and utilises data from six polar orbiting satellites (USGS, 2013). The NDVI has been used to determine the relationship (if any) between greenness and physical activity (Grigsby-Toussaint *et al.*, 2011; Almanza *et al.*, 2012), cardiovascular disease (Pereira *et al.*, 2012),

pregnancy outcomes in Barcelona (Dadvand *et al.*, 2012c), California (Laurent *et al.*, 2013), Tel Aviv (Agay-Shay *et al.*, 2014) and Munich (Markevych *et al.*, 2014), and mortality (Mitchell and Popham, 2008; Villeneuve *et al.*, 2012). Most papers specified the area around the geocoded residence that was assessed (Villeneuve *et al.*, 2012; Laurent *et al.*, 2013; Markevych *et al.*, 2014; Cohen-Cline *et al.*, 2015). A range of distances have

been used: 1 km (Cohen-Cline *et al.*, 2015), 50 m, 100 m and 150 m (Laurent *et al.*, 2013), 100 m, 250 m, 500 m and 800 m (Markevych *et al.*, 2014) and 500 m (Villeneuve *et al.*, 2012).

The assessment of greenness and the distance or proximity of greenness to a fixed location were most used in the literature (see Table 4.1).

4.5 Discussion

Greenness is a measurable feature that does influence health and wellbeing; however, care is needed in deciding when and how to measure it (Richardson *et al.*, 2012). None of the studies, regardless of the type of measurement used, assessed greenness over a

number of years; they all represented a snapshot in time (Dadvand *et al.*, 2012b,c; Gascon *et al.*, 2016). Although most studies used coarse assessments of greenness (NDVI or percentage cover) which may be a limitation (Dzhambov *et al.*, 2014), some studies recommended providing more detail on green features (Almanza *et al.*, 2012; Richardson *et al.*, 2012), though this may be restricted to specialists or require investment and training in ecological field skills (Dallimer *et al.*, 2012; Muratet *et al.*, 2015). A future national research study could evaluate socio-economic and other inequalities to assess the relationship between nature and health, but the over-riding limitation will be the difficulty in interpreting cross-sectional studies and evaluating more precise measures of greenness.

5 Monitoring Engagement with Natural Environment and Wellbeing

5.1 Overview

There is evidence of benefits to health and wellbeing from engaging with the environment. However, to promote health and positive attitudes to the environment, benefits need to be attained by most people in most communities in Ireland. An important first step in developing a strategy to engage communities and individuals with nature is to know the audience and to assess what they know (Novacek, 2008). The next step is to identify existing and perceived barriers (section 5.4.1). When issues that prevent contact with nature have been identified (Table 5.1), the next step is to identify mechanisms to overcome those barriers (Table 5.2). Such mechanisms can be grouped to suggest the

level of change needed, which may be a policy, education or investment level (Fahy and Rau, 2013) and to determine the timeframe within which such changes can be implemented (Fahy and Rau, 2013). These mechanisms can form the basis of an action plan to enable people to transition towards a more sustainable, salutogenic society [e.g. Scotland's action plan to implement nature-health strategy (Scottish Natural Heritage, 2015)]. Case studies detailing effective strategies (Canada, US and worldwide, see sections 5.4.2 and 5.4.3), legislation (Wales and Scotland, see section 5.4.4) and monitoring health and wellbeing benefits from connecting with nature (England, see section 5.4.5) demonstrate successful ways to engage people with nature. An overview of the current situation

Table 5.1. Number of stakeholders who referred to specific issues or barriers that they perceived as preventing people from connecting to nature

Stakeholder group	Number of stakeholders in each group					Total	Percentage
	Engineers	Planners	Health promotion officers	Conservationists	Other LABR		
Number in each group	4	4	4	3	3	18	100
<i>Barriers identified by stakeholders</i>							
Accessibility	2	2	2	3	2	11	61
Attitudinal block	2	2	1	1	2	8	44
Awareness gap	–	2	2	2	2	8	44
Lack of appreciation	1	1	2	3	–	7	39
Lack of public transport	2	1	1	2	–	6	33
Time	1	1	1	2	–	5	28
Perceived distance	1		1	2	1	5	28
Lifestyle	1	1	1	–	1	4	22
Weather	–	1	2	1	–	4	22
Design	–	1	1	–	1	3	17
Few or no facilities	1	2	–	–	–	3	17
Cost	1	1	–	–	–	2	11
Too small	–	1	–	–	–	1	6
Antisocial behaviour/fear	1	–	–	–	–	1	6
Not enough nature	–	–	–	1	–	1	6
Terrain	1	–	–	–	–	1	6
Traffic safety/fear	–	–	1	–	–	1	6
Choice of facilities	–	1	–	–	–	1	6
No barriers	1	–	–	–	–	1	6

Table 5.2. Transition framework of actions, as perceived by stakeholders, to overcome barriers preventing people from connecting with nature and to support a salutogenic society

Type of action required	Short term	Medium term	Long term
Policy/practice	Refine how to integrate green space and nature upfront in strategic planning	Be more imaginative in design/connectivity	Increase the amount of soft landscaping and connect to nature/green space
Education/engagement	More leadership/information in relation to places to go and choice of facilities available	Greater public dialogue between academics, government and communities	
	Organise and publicise short walks to hear sounds of nature	Motivate and incentivise people to engage with nature	
	Communicate how to dress for weather	Awareness programme to develop understanding and using nature spaces	
Stimulus (economic investment)	More parking, and other facilities; increased presence of community wardens	Inclusive transport, more connected cycle lanes	Better public transport system

in Ireland (section 5.5) is presented. This summarises the evaluation of the pilot Green Prescriptions initiative in Donegal, as there are important learning outcomes to apply in any similar initiative in the future.

5.2 Objective

The objective was to assess the best practice on public engagement with the issues of health and wellbeing and biodiversity.

5.3 Methods

Mixed methods were used to examine the policies and practices which could be used to integrate health, wellbeing and environment. Stakeholders (n=18, see Table 5.1 for a breakdown of roles) were consulted in one-to-one interviews on their views in relation to barriers to engaging with the natural environment. In this work package, however, a distinction was made between conservationists working for National Parks and Wildlife Services and local authority staff whose remit included biodiversity among other responsibilities, heritage officers and biodiversity officers. Phrases used by stakeholders (including nouns, verbs, and adjectives) were used to generate a word cloud (pronouns and prepositions were excluded). The word cloud is a visual representation generated by an algorithm that counted the number of times words were used by stakeholders to indicate barriers or issues that prevent people from engaging with the natural environment. In addition, strategies and schemes were collated (section 5.4.2)

and case studies (section 5.4.3) were summarised. Legislation and policy measures throughout the EU, Australia and America were consulted. Health, education, conservation and local authority organisations in the EU, Australia and America were examined to identify programmes that engaged the public with nature in relation to health and wellbeing. Peer-reviewed publications were consulted to assess the effectiveness of these programmes and practices. Lessons learned from such assessments can inform recommendations and ensure adaptive and responsive practice.

5.4 Outcomes

5.4.1 *Barriers to engaging with nature and mechanisms to overcome them*

Stakeholders highlighted a number of barriers to engaging with the natural environment (Figure 5.1; Table 5.1).

Larger and more intensely coloured words were used more frequently in the interviews, suggesting that stakeholders perceived that internal (attitude, lack of awareness, lack of appreciation) and external factors (access, distance, design, weather, facilities) were barriers preventing people from engaging with the natural environment. Of these, all stakeholders perceived that attitudinal blocks and access were important issues (see also Table 5.1).

Within stakeholder groups, conservationists were the only group that identified accessibility and a lack of

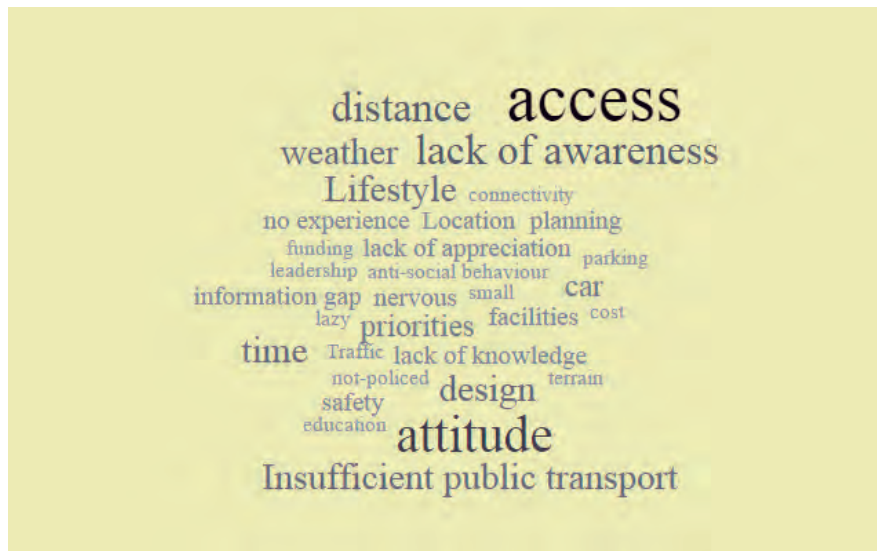


Figure 5.1. Word cloud highlighting issues or barriers that stakeholders perceived as preventing people from connecting to nature.

appreciation as perceived barriers; no other stakeholder groups all agreed on the same barriers (see Table 5.1). Some issues were perceived as barriers by only one stakeholder group: planners referred to the lack of facilities and size as barriers, while health promotion officers referred to concerns over road safety and fear of traffic as an issue. One conservationist felt that there was not enough nature to engage people's interest. Engineers referred to fear of anti-social behaviour and mentioned that the terrain might be a barrier to people using walking sticks, buggies or wheelchairs. Only one engineer did not perceive any barriers. No perceived barriers were uniquely identified by local authority staff with a biodiversity-related role. While it is hard to draw conclusions from the low numbers of participants, the results of this work package suggest that barriers highlighted by all stakeholder groups warrant further attention, such as accessibility, attitudinal blocks and awareness gaps.

Stakeholders recommended a number of solutions to overcome barriers that can prevent people from engaging with the natural environment. Some solutions already exist, which means that they may need only minor tweaking to be successful (strategic planning) (Table 5.2).

While the low number of participants meant that it was hard to draw conclusions from these results, the suggestions highlighted by the stakeholders could be considered as warranting further attention. Some

actions are already underway and may simply require more publicity.

5.4.2 Global strategies to engage people with nature and wellbeing

Good practice, at global, European and regional levels exists (Table 5.3). Local strategies have been implemented in America (Table 5.4), and in the UK and Ireland (Table 5.5).

5.4.3 Developing strategies of engagement with natural environment: case studies

While diverse programmes appear to be available (and the lists in the tables are not exhaustive), they reflect a short-term and dispersed patchwork of programmes that are available only while funding lasts. Two case studies indicated the potential to integrate health, wellbeing and biodiversity policy measures and practices (Romagosa *et al.*, 2015). The first case study highlights the development of strategies, action plans and the evidence base to engage people with nature at global, national and local scales (Healthy Parks, Healthy People programme, <http://www.hphpcentral.com/articles-research>). The second case study examines a review of visitor perceptions of benefits from being in Alberta's protected areas (Healthy Outside, Healthy Inside, Canada) (Lemieux *et al.*, 2015).

Table 5.3. Range and extent of strategies to engage people with nature and wellbeing

Location delivered	Initiative				
	Healthy Parks, Healthy People	EUROPARC Federation	Healthy Naturally	Green Gyms/Park Prescriptions ^a	Local area programmes
IUCN	X				
Canada	X		X		
UK	X	X	X	X	X
Spain		X			
Finland	X	X			
USA	X			X	X
Australia	X			Due to be launched 2016	Beyond Blue ^b
Korea	X				
New Zealand	X			X	
Ireland				X	X

X indicates that the initiative is delivered in this location.

^aGreen Gyms/Park Prescriptions are grouped together, as they typically involve doctors prescribing a physical activity to be undertaken outdoors regularly.

^bTownsend and Weerasuriya (2010).

IUCN, International Union for Conservation of Nature.

Table 5.4. American programmes available at different scales (local and national schemes)

Scheme	Website	Local/national scale
Stay Healthy In Nature Every day (SHINE)	http://www.ebparks.org/activities/hphp/shine	East Bay/Oakland
Prescription Trails	https://prescriptiontrails.org/about/	New Mexico
Park Prescriptions: Prescribing Parks for Better Health: Success Stories	http://www.nrpa.org/Grants-and-Partners/Recreation-and-Health/Park-Prescriptions	National Recreation and Park Association
Every Kid in a Park	https://everykidinapark.gov/about/	National
DC Park Rx	http://aapdc.org/chapter-initiatives/dc-park-rx/	American Academy of Pediatrics District of Columbia Chapter and partners
Greater Williamsburg Area Park Prescriptions	http://www.gwaparkrx.com/uploads/5/5/1/3/55136505/*nrpa_prescribing_parks_for_better_health_success_stories.pdf	Parks Research Lab, College of William and Mary

Case study: Healthy Parks, Healthy People

The Healthy Parks, Healthy People programme began in Victoria, Australia in 2000 (<http://parkweb.vic.gov.au/about-us/healthy-parks-healthy-people>), and is now a global programme which connects people with nature to benefit health and wellbeing and to conserve the environment. In America, it is run by the National Parks Service (https://www.nps.gov/public_health/hp/hphp.htm) who launched their Science Plan in 2013 (Healthy Parks, Healthy People US, 2013). This plan sets out a future research agenda and outlines a framework to engage people in nature. The first action is to assess the services and resources available outdoors. The next step will be to evaluate the barriers/motivations that

hinder or help people in their use of the natural environment. Dissemination and monitoring are outlined. This framework is also evident in the Guide to the Healthy Parks, Healthy People Approach and Current Practices report, produced following the World Congress conference in 2014 (Healthy Parks, Healthy People, 2014). This report highlighted the need to consider social justice and indigenous communities, as well as the need for diversity in engaging people with nature throughout their lifetime. In particular, the importance of meaningful places for children and young people was emphasised. The World Congress highlighted international obligations in relation to health, sustainability and biodiversity and called for a new agenda for nature and for human

Table 5.5. Schemes or practices available locally or regionally in UK or Ireland

Scheme	Region	Details
Naturally Healthy	Devon	DLNP (2014)
Stepping Stones to Nature (SS2N) 2012	Plymouth	
Green Gym (Yerrell, 2008)	England and Scotland	Conservation Volunteers (CV)
	Northern Ireland	Conservation Volunteers in Northern Ireland (CVNI)
Green Prescriptions	Ireland	Donegal pilot (Stirrat <i>et al.</i> , 2013); Dun Laoghaire-Rathdown trial February 2016 (http://www.naturehealthandwellbeing.ie/projects/)
Healthy Choices/ LiveWell Dorset	Dorset	https://www.livewell-dorset.co.uk/content/dam/ouk-dorsetco/Docs/Content/Natural-Choices.pdf ; http://www.dorsetlnp.org.uk/Natural_Choices_in_Dorset.html
Natural Choices for Health and Wellbeing	Northwest England, Merseyside, Manchester	http://www.merseyforest.org.uk/files/documents/1267/Natural+choices+for+health+and+well-being+report+Final+Report+August+2013.pdf
Nature4Health	Mersey Forest	http://www.merseyforest.org.uk/our-work/nature4health/
Branching Out	Nine locations in Scotland	http://newcaledonianwoodlands.org/wp/wp-content/uploads/2015/01/Branching_Out_Report.pdf
Woodlands for Health	Wicklow pilot scheme in Ireland	Coillte/Independent Mental Health Advocacy
Come Outside!	Twelve areas in Wales	Natural Resources Wales (https://naturalresources.wales/media/4949/come-outside-interim-evaluation-report-july-2015-external-final.pdf)
EcoMind 2013	Worthing	
Learning through Landscapes	England and Wales	
	Scotland	Grounds for Learning
Paths for All	Scotland	Scottish organisation dedicated to walking (http://www.pathsforall.org.uk/pfa-home)
Let's Talk and Walk	Ireland	http://www.ifa.ie/get-walking-get-talking-ifa-announces-series-of-forest-walks-for-green-ribbon-campaign-this-may/#.V3a1BPkrK71 ; events organised as part of the See Change Green Ribbon Campaign (http://www.greenribbon.ie/about-the-green-ribbon)
Green Passport	Ireland	Dun Laoghaire-Rathdown schools

health. The state of the evidence underpinning Healthy Parks, Healthy People measures to benefit physical, mental, social and spiritual and environmental health was appraised in 2015 (Healthy Parks, Healthy People, 2015).

Case study: Healthy Outside, Healthy Inside programme, Alberta, Canada

Visitors to three national parks in Alberta were asked about the perceived benefits they had accrued from being in nature. The results indicated strong components for health and wellbeing benefits (Lemieux *et al.*, 2015). Visitors were personally motivated to visit the national parks because they recognised substantial personal benefits to their health and wellbeing. Their wellbeing was improved psychologically, emotionally, socially and physically. Women perceived greater benefits than men, in terms of their spiritual, social, psychological and emotional wellbeing (Lemieux *et al.*, 2015). Lemieux *et al.* (2015) suggest that urban parks and green spaces

could also be perceived by people as playing an important role in delivering health and wellbeing outcomes. Planners, ecologists, health promoters, policymakers and researchers could consider co-developing short and medium-term monitored programmes, for example Woodlands for Health, that engage people with nature to maximise health and wellbeing outcomes (Iwata *et al.*, 2016).

5.4.4 Implementing legislation and practice to engage with the natural environment in the UK

Legislation and policy have the potential to be powerful drivers of change if they are reasonable, evidence-based and targeted (McDaid *et al.*, 2014). Any potential Irish policy or practice could learn from exemplars in Wales (<http://thewaleswewant.co.uk/about>, see below) and Scotland (the integrated health–nature proposed action plan, next page).

Case study: Well-being of Future Generations (Wales) Act 2015 and Environment (Wales) Act 2016

Policymakers and decision-takers in Wales enacted wellbeing legislation (<http://thewaleswewant.co.uk/about/well-being-future-generations-wales-act-2015>) which sets out seven goals and a cross-sectoral public duty to address the social, economic, environmental and cultural wellbeing of people in Wales (Welsh Government, 2015a). It legally confirms that delivering for biodiversity is part of sustainable development and is a key health and wellbeing goal. Linked to this is the Environment (Wales) Bill 2016 which also confers duties on public and private bodies to take action for natural resources (Welsh Government, 2015b). Indicators to the achievement of the goals related to this act will be published in 2016 and all public bodies named in the legislation must report annually on their work. This is the first time an ecosystems approach has been applied in UK-based legislation (Wales Biodiversity Partnership, 2016).

Case study: a natural health service for Scotland

In Scotland, a robust framework is driving cross-sectoral partnership projects (e.g. partnership working through Good Places, Better Health and the Green Exercise Partnership 2015) to deliver challenging policies, for example “Scotland’s Biodiversity – a Route Map to 2020” (Scottish Government, 2015) and indicates a sustained recognition of the value of the environment for health across the Scottish Government (Scottish Government 2008, 2015). Green Exercise and the Healthy Parks, Healthy People programmes have been in existence for a number of years, run by Scottish Natural heritage (SNH) with NHS Scotland and Forestry Commission Scotland. After meetings with other environmental sector groups in May 2015, they developed an action plan to launch an integrated nature–health programme, which was proposed to the Rural Affairs, Food and Environment Delivery Board in September 2015 (Scottish Natural Heritage, 2015). The action plan sets out how to integrate Green Infrastructure and Green Exercise and outlines the lead organisation, time-frame, detail of 10 actions and indicative costs. In early 2016, the Scottish Government consulted on a natural health service for Scotland. Contact with nature to promote health and wellbeing is embedded in Scotland’s Biodiversity: a Route Map to 2020 as one of the “Six Big Steps for Nature” in Scotland so it benefits the nation’s

wellbeing and prosperity. Big Step 3 focuses on nature close to where people live and work (greenspace, nature and landscapes). It highlights how investing in nearby nature will benefit the health and quality of life for the people of Scotland, through partnership projects, for example by developing the Natural Health Service in collaboration with the NHS.

5.4.5 Case Study: monitoring wellbeing through engagement with the natural environment

The Monitor of Engagement with the Natural Environment (MENE) survey, funded by Natural England, the Department for the Environment, Food and Rural Affairs (Defra) and the Forestry Commission, has been analysing information relating to how people in England visit the countryside, enjoy urban green spaces, observe nature and undertake voluntary conservation work. Data are representative of the English population and take account of age, gender, residence region (rural/urban), social-economic status, the presence of children and/or dogs in the household. Between 46,000 and 49,000 people are interviewed annually in their homes or over the phone. Data have been used to influence policy and practice, to underpin decision-making at local and national levels, for research and peer-reviewed publications and to support projects and reports. Data from the MENE survey are included to indicate the percentage of people using green spaces for health/exercise purposes in the Public Health Outcomes Framework (Public Health England, 2015). Further information regarding the use of the survey is contained in a review (Natural England, 2014).

5.5 The Current Situation in Ireland

Ongoing cross-sectoral working in Ireland is in evidence in delivering Objective 1 of the National Biodiversity Plan (NPWS, 2014) and in implementing Healthy Ireland goals (DoH, 2013) but there is no overarching health and wellbeing legislation which integrates health, community, sustainability and environment, or confers a duty on public and private bodies, as was enacted in Wales in 2015.

A Green Prescription pilot (see section 5.5.1), which is similar to programmes in New Zealand and America, ran in Donegal in 2011–2013 (see case study details); this is noteworthy as it applied an ecosystems approach

(Crosse, 2011). A similar pilot is due to begin in June or July 2016 in the South Dublin and Wicklow area. Collaborative woodland walk schemes were delivered by Mental Health Ireland, The Friends of Newcastle Hospital Mental Health Association (MHA), the local HSE Mental Health Services and Coillte (Iwata *et al.*, 2016). However, effective partnership projects need to be undertaken nationally and supported by local authorities, conservation organisations and communities.

Ways to increase activity in the environment have been identified by Healthy Ireland (Action 3.10), recommending that facilities such as “cycle lanes, playgrounds, well-lit paths, etc.” should be planned by local authorities in collaboration with local communities, schools and other stakeholders to ensure that they “are appropriate to the needs of the community”. Furthermore, the National Physical Activity Plan (DoH, 2016) includes actions (action numbers 31–37) to promote the use of the natural and built environments to increase activity. These actions include training, production of guidelines, development of walking and cycling strategies, collaboration with planners and designers to create cycle paths and walkways and other actions to utilise any opportunity to “maximise physical activity and recreation amenities in the natural environment”. However, neither document explicitly outlines that in urban areas, naturalness may facilitate exercise (Barton and Pretty, 2010; Keniger *et al.*, 2013; Sugiyama *et al.*, 2016) and that connecting with nature motivates people to spend more time outdoors and lead healthier lives (Pretty *et al.*, 2005; Bowler *et al.*, 2010; Lee and Maheswaran, 2010; Sugiyama *et al.*, 2010; van den Berg *et al.*, 2010; Gladwell *et al.*, 2013. Collaboration between conservationists and health promotion staff to implement a programme of Healthy Parks, Healthy People would engage people to connect with nature which would benefit health and wellbeing. This means that landscape architects, ecologists, health promotion officers and other people involved in designing, managing and promoting use of parks need to work together to create nature-based spaces to benefit wellbeing and promote physical activity.

There is no national monitoring of engagement with the natural environment, such as MENE in England (2008 to the present). As in the case of England, such a national survey could also be linked with delivery of the National Physical Activity Plan in terms of the

percentage of people using outdoor places for health or exercise reasons.

There is no national nature and wellbeing policy, although there are people working as ecotherapists in Ireland. There is a translational gap in applying the evidence to inform policy and practice. An overarching, research-informed national nature and wellbeing policy or a strategy would allow many of the actions highlighted by the stakeholders to be implemented (section 5.3.1).

5.5.1 Case study evaluation of Green Prescription pilot

The Green Prescription pilot was a community-based initiative that took place in a number of urban and rural environments in Donegal between 2011 and 2012, and involved health promotion staff, the HSE, GPs, community organisations and members of the public. People were empowered to take part in physical activity in nature (green exercise) with others to benefit their health and wellbeing and, in doing so, to improve community health and wellbeing. The Donegal pilot was assessed in terms of physical activity and mental wellbeing. It did not address the use of specific “green” areas, though participants reported perceptions that increases in their wellbeing were due to, *inter alia*, contact with nature. More information is contained within the evaluation report (Stirrat *et al.*, 2013).

5.6 Summary

The Healthy Parks, Healthy People programme is a global programme and could be used as a mechanism to coalesce interested parties in Ireland into a movement to connect people with nature and being physically active outdoors. In the short term, a variety of measures may be needed to get inactive people active and to offer a diverse range of opportunities to engage people and meet their specific needs. Green Prescriptions could be used by more healthcare practitioners and linked to community groups and other initiatives, such as Parkrun and Get Ireland Walking, and monitored in conjunction with Healthy Ireland and SportIreland. Lessons can be learned from the implementation of the Wellbeing Act in Wales and the launch of the Natural Health Service in Scotland to develop a long-term sustainable strategy (and possible legislation) in Ireland.

6 Recommendations

6.1 Overview

This study focused on evidence-based literature and perceptions of key decision-makers regarding the benefits of nature contact to human health and wellbeing. This study identified that there are benefits and, although further research is needed in this area, these results informed the development of recommendations for policymakers.

6.2 Objective

The objective is to provide recommendations for future policy and strategies, and the potential SWOT associated with their implementation in Ireland.

6.3 Methods

The recommendations arising from the work packages associated with this study were reviewed. Strengths and weaknesses of the recommendations were identified. External opportunities and threats were identified and assessed with respect to the recommendations.

6.4 SWOT Analysis

Table 6.1 outlines the SWOT analysis for each of the work packages (WP2–5).

Table 6.1. Strengths, weaknesses, opportunities and threats of the recommendations relating to each work package

WP2	Recommendations in relation to evidence of health benefits from biodiversity and green spaces
Strength	Evidence that biodiversity benefits different components of health and wellbeing at different life stages (e.g. birth weight, cognitive functioning in children, stress mediation in teenagers and adults) helps to overcome socio-economic restrictions (section 2.4.2) and helps cognitive and physiological functioning in elderly. The strongest level of evidence supports benefits to physical health, but a good level of evidence for mental health and wellbeing has recently emerged
Weakness	Lack of detail regarding habitat composition (Chapter 4; section 2.4.2) or quality (Chapter 4). Many studies are cross-sectional in design and so cannot indicate causation. There are weaker levels of evidence for emotional, spiritual benefits and there should be research into this area
Opportunity	Strategic plan for accessible green space throughout life-course. Consider design location and layout of schools, playgrounds, residential homes, hospitals and strategic involvement in the planning process
Threat	Costs and benefits to health from Irish biodiversity warrants further investigation, but study design/implementation is challenging due to the intrinsic complexity of the interactions and cross-sectoral relationships involved
WP3	Recommendations in relation to stakeholders' perceptions of health benefits from biodiversity and green spaces
Strength	All stakeholders agreed on health benefits from nature
Weakness	All stakeholders did not value biodiversity equally; stakeholders disagreed over design and accessibility of green spaces
Opportunity	All stakeholders could work together with communities to design salutogenic sustainable environments. Some sections for biodiversity can be integrated into playgrounds and sports pitches
Threat	If all stakeholders do not work together to design green spaces, the spaces may not function for biodiversity or people. Avoid planting too many pollen-producing plants close to paths (evidence from review)
WP4	Recommendations in relation to future research strategies
Strength	Geocoding of environmental and socio-economic data has some potential
Weakness	Datasets are usually only from a single point in time. Measures of greenness are broad-scale and lack fine detail. No national dataset of quality of green space to which the population has access
Opportunity	There is the opportunity to include more detailed measures of vegetation to habitat classification/species identification, for example potential to assess greenness over a period of time
Threat	Several studies show that members of the public perceive that they can recognise more diversity than is present (Fuller <i>et al.</i> , 2007; Dallimer <i>et al.</i> , 2012), and identify fewer species correctly when compared with a specialist (Muretat <i>et al.</i> , 2015).

Table 6.1. Continued

WP5	Recommendations relating to engaging with nature and wellbeing
Strength	There is potential to reconnect people with nature, to make them more engaged with others and with living, to reduce stress, to make the public more likely to conserve natural places of importance
Weakness	Funding needs, attitude shifts, re-education
Opportunity	There is potential to develop schemes to engage people with outdoors
Threat	Potential to over-medicalise nature, nature seen only as a medical tool/medicine

7 Implications for Policymakers, Researchers and Practitioners

This section is subdivided into implications for specific stakeholders.

7.1 Implications for Health Promotion and Healthy Ireland Goals

Healthy Ireland articulated its goals for improved health and wellbeing across Irish society when the framework for action was published in 2013. The framework comprised 64 actions, grouped into six themes: governance and policy, partnerships and cross-sectoral work, empowering people and communities, health and health reform, research and evidence, and monitoring, reporting and evaluation. In implementing the Healthy Ireland Framework throughout the HSE (including

the workforce, the services and the people who are cared for within the healthcare system), the National Implementation Plan within the health services has specifically focused on creating an environment that promotes health and wellbeing (DoH, 2015a).

This section highlights outcomes of this study in relation to selected actions outlined within the Healthy Ireland Framework (Table 7.1) and specific sections of the Healthy Ireland in the Health Services National Implementation Plan 2015–2017 (Table 7.2). Not all of the actions of the Healthy Ireland Framework (Table 7.1) or Healthy Ireland in the Health Services National Implementation Plan (7.2) were selected; actions were chosen on the basis that they were relevant to health and wellbeing.

Table 7.1. Selected actions outlined within Healthy Ireland Framework that are relevant to this study and relevant contributions arising from this project

Healthy Ireland Framework		Contribution from this study
Reference	Action	
<i>Theme 1: governance and policy</i>		
1.4	Policy units in Government Departments and partner organisations will work with the Health and Wellbeing Programme to produce integrated, co-ordinated inter-sectoral plans to address risk factors and social determinants of health	Good practice case studies of integrated nature and health policies (Wales), programmes and strategies (Scotland, England, Australia and USA). More gains if integrated health and nature action plan, this hits targets for both HI and NPWS
1.7	Establish formal multisectoral committees to provide national co-ordinated mechanisms to address and respond to issues that affect human, environmental and animal health, in line with EU Council requirements	Environmental scientists, policymakers and practitioners can play an important role in multisectoral committees
1.9	Draw up specific proposals in relation to the potential role of local authorities in the area of health and wellbeing, having regard to the principles set out in paragraph 2.5 of the Action Programme for Effective Local Government	LPA, health professionals, landscape architects and ecologists play a key role in planning sustainable communities, providing nature spaces for people to exercise, destress and be restored
<i>Theme 2: partnerships and cross-sectoral work</i>		
2.2	Local health partners will engage with local authorities in their work to address local and community development, with the aim of co-ordinating actions and improving information sharing for improved health and wellbeing	Actions could be informed by the programmes detailed in this report and walking and conservation actions, e.g. Healthy Parks, Healthy People etc.
2.6	Analyse existing community support infrastructure to promote and enable active citizenship and volunteering across the lifespan. Where possible, these supports will be consolidated and strengthened, to increase the proportion of children and adults of all ages involved in these activities. The work of the former Taskforce on Active Citizenship is relevant in this regard	Evidence of several reports (Forestry Commission Scotland, Conservation Volunteers) showing how volunteerism helps conservation as well as dementia and depression, and promotes feeling restored and calm

Table 7.1. Continued

Healthy Ireland Framework		Contribution from this study
Reference	Action	
2.8	Implement evidence-based prevention and early intervention initiatives aimed at children and families, initially focusing on areas of disadvantage, drawing evidence emerging from the Prevention and Early Intervention Programme	Evidence of benefits for children's wellbeing and education, especially in lower socio-economic backgrounds
2.11	Develop a plan to promote increased physical activity levels across the population, as an exemplar of how Healthy Ireland will work. The Healthy Ireland Council will be key in developing linkages with and between partners and advising on priorities	Literature and stakeholders confirmed that being close to nature made them feel fitter and being out in nature motivated them to exercise more
2.12	Work with the Environmental Protection Agency (EPA) on its Health Advisory Committee to further integrate and improve consideration of human health and environmental protection activities across EPA functions and functions of related agencies and sectors	Outlined research questions that could be addressed. Need to have multidisciplinary projects to help apply integrated programmes
2.13	Combine mental health promotion programmes with interventions that address broader determinants and social problems as part of a multi-agency approach, particularly in areas with high levels of socio-economic deprivation and fragmentation	See earlier comment in theme section 2.8. This applies to very young children. Some evidence that benefits accrue even if there is no direct contact with nature
<i>Theme 3: empowering people and communities</i>		
3.5	Support, link with and further improve existing partnerships, strategies and initiatives that aim to support older people to maintain, improve or manage their physical and mental wellbeing	Evidence that contact with nature benefited older people to maintain and restore health
3.6	Support, link with and further improve existing partnerships, strategies and initiatives that aim to remove barriers to participation and to provide more opportunities for the involvement of older people in all aspects of cultural, economic and social life in their communities	Community garden scheme in Louth, Ireland "growing through the ages" which engaged older people and school children in a garden project (see http://www.groundswell.ie/portfolio.html). A similar project was initiated in Fermanagh, Northern Ireland (Northern Ireland Wildlife Trust, Growing Together)
3.10	By creating "activity friendly" environments, cycle lanes, playgrounds, well-lit paths, etc., local authorities will engage with local communities, schools and other stakeholders to plan facilities that are appropriate to the needs of the community	Such spaces could tie in with green infrastructure, greenways and include spaces for biodiversity. For example, Men's Shed, refugees and Terryland conservation volunteers planted cowslips and devil's-bit scabious. The area is better for butterflies than when it was amenity grassland and is now used as an outdoor classroom for all ages
3.11	Develop strategies to enhance social connectedness across the life course and to connect people most in need to resources, services, education and healthcare	See above and theme section 3.6
<i>Theme 4: health and health reform</i>		
4.9	Promote a skilled, diverse, cross-trained prevention workforce through training and continual professional development for primary care workers, health improvement and promotion staff, public health, educationalists (including those working in the early years sector) environmental health, health protection and staff in other sectors	Report includes examples of existing training, highlights training needs and site visit suggestions
<i>Theme 5: research and evidence</i>		
5.2	Work with the HRB to implement a plan designed to build research capacity in the area of health and wellbeing and develop specific strategies and platforms for dissemination, knowledge transfer and implementation of research informed policy, practice and service development	This project shows that multiple disciplines are engaged in the use of nature to benefit health and wellbeing
5.3	Support actions to standardise, expand and mainstream existing work programmes designed to deliver health and social community profiling data at the local level	Pilot programmes could be trialled and monitored, in a similar way to some of the successful programmes in place in Scotland and Canada

Table 7.1. Continued

Healthy Ireland Framework		Contribution from this study
Reference	Action	
<i>Theme 6: monitoring, reporting and evaluation</i>		
6.1	Develop an Outcomes Framework that will specify baseline indicators and targets, where appropriate	Need baseline assessments on what communities want from nature and how it could be used to identify health and wellbeing outcomes and targets
6.4	In developing an Outcomes Framework, research networks, academic collaborations and data and research groups will be identified, strengthened and developed (where gaps exist)	Need to have collaboration between social scientists and ecologists; collaboration between engineers, planners, health professionals, community groups and academics; links to training

HI, Healthy Ireland; HRB, Health Research Board; LPA, local planning area; NPWS, National Parks and Wildlife Service.

Table 7.2. Healthy Ireland in the Health Services – Implementation Plan 2015–2017 actions that are relevant to this study, and relevant contributions arising from this project

Healthy Ireland actions		Outcomes/potential contribution from this study
<i>Addressing modifiable risk factors and life course perspective actions</i>		
37	Develop a series of special reports in relation to various elements of health and wellbeing improvement, from determinants to interventions to outcomes, with priority given to health protection, health inequalities and the environment and health	Summary of evidence could be presented in relation to environment, health and wellbeing
<i>Research and evidence actions</i>		
50	Establish research prioritisation, commissioning, management and dissemination processes with key partners	Disseminate research as and when required
51	Develop and disseminate health and wellbeing profiles at county level	Contribute information on how features and functions of green space could benefit health and wellbeing to profiles
<i>Healthy eating and active living action plan actions</i>		
87	Support, promote and implement evidence-based programmes to increase physical activity among key risk groups	Green spaces made exercise accessible to stakeholders
88	Engage and collaborate with local authorities in their work to promote active living among key population groups in the community	Recommendations for local authorities will link with recommendations for Healthy Ireland
<i>Wellbeing and mental health action plan</i>		
98	Collaborate with health and wellbeing teams and programmes to accelerate development of programmes for early intervention/prevention	Contribute evidence to help inform programmes
100	Develop an increased focus on the health and wellbeing of our population in the delivery of recovery-oriented services	Provide information as required on recovery services and health and wellbeing benefits from nature
104	Further develop psychology services within primary care to support and empower clients and service users to manage their mental health and promote wellbeing	Provide information as required to empower service users to manage their mental health and promote wellbeing
<i>Healthy childhood action plan</i>		
108	Identify those groups requiring additional support and services and ensure programmes developed encompass the wider determinants of health	Provide material to inform programmes
118	Promote physical activity to increase the proportion of children taking regular physical activity	Children and teenagers were more active when green spaces were close by
<i>Positive ageing strategy</i>		
126	Support the development of Age Friendly Cities and Counties in conjunction with the local authorities and other community and voluntary organisations	Provide Healthy Cities and Age Action etc. with advice in relation to green space and health and wellbeing

7.2 Implications for Healthy Cities, Public Participation Networks and Community Groups

Local communities, Healthy Cities and community groups need to consider the nearby environment and what natural spaces can offer society in the development and maintenance of sustainable communities (Table 7.3).

7.3 Implications Regarding Features of Accessible Green Urban Space for Relevant Stakeholders

This section is based on the interviews undertaken with stakeholders, in which they were asked about design and accessibility of their ideal space, and on the review of the literature. Studies have highlighted the benefits of nature on the doorstep [e.g. people living less than 300 m from their nearest green space were less stressed than those whose nearest green space was more than 1 km away (Stigsdotter *et al.*, 2010)]. Accessible green space

was described by Natural England (2010) as “available free of cost for the general public and mainly utilised by target users living in the catchment area”. Public Health England defined it as “that which is located close to residents’ homes, easy to walk to, physically accessible, safe to use, and provides well maintained facilities.” Safety, quality, size and accessibility were key features that influenced people’s levels of use of open green spaces (EEA, 2013).

At least 9 m²/person of accessible open green space are recommended by the World Health Organization, but this may vary depending on the size of the city, the number of inhabitants and where boundaries are drawn (Dzhambov *et al.*, 2014). Despite these caveats, a measurement of accessible open green space per capita can be a useful potential comparison (see Table 7.4). According to the Green Cities Index report (Siemens, 2012), Latin American Index cities have more green space per capita than the African and Asian Index cities, with averages of 255 m²/person in Latin American cities versus 74 m²/person in Africa [notable exceptions are

Table 7.3. Benefits of Green spaces in relation to health and wellbeing components

Health and wellbeing	Green spaces, nature and extent of green infrastructure encountered in daily life, going to work, school or to the shops
Physical components	Contact with nature motivated people to exercise more; people can exercise and be active with their families in green spaces
Mental components	Time in green spaces and green surroundings improved cognitive functioning in some studies, provided places for people to relax and acted as a buffer from the stresses of daily life
Social components	Diverse green spaces and greenness near homes and communities can help to mitigate socio-economic factors and health inequalities
Environmental components	People are more motivated to conserve nature if they have experience of it and value it, e.g. for its restorative function

Table 7.4. Percentage green space per capita as detailed by the literature and the European Environmental Agency

Country	City	Percentage green space per capita	Source
Spain	Cadiz	3–4 m ² /person	Fuller and Gaston (2009)
	Fuenlabrada	3–4 m ² /person	
	Almería	3–4 m ² /person	
Italy	Reggio di Calabria	3–4 m ² /person	Fuller and Gaston (2009)
	Florence	5.5 m ² /person	Fratini and Marone (2011)
Romania	Timișoara	16 m ² /person	Morar <i>et al.</i> (2014)
France	Nantes	57 m ² /person	http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2011/05/EGCNantesUKChap3-F.pdf
Austria	Vienna	120 m ² /person	https://www.wien.info/en/sightseeing/green-vienna/green-spaces-and-recreation-areas

Cape Town (290 m²/person) and Johannesburg (231 m²/person)] and 39 m²/person in Asia (average of 22 cities) [notable exception is Singapore (66 m²/person)]. In Europe, accessible green space varies (Fuller and Gaston, 2009) (see Table 7.4); in Berlin, Germany, the aim is to provide at least 6 m² urban green per person (Kabisch *et al.*, 2015b).

The term “easy to walk to” has been interpreted in relation to time [e.g. within 5 minutes’ walk (Vancouver) (Hunter *et al.*, 2015); less than 15 minutes’ walk (Chillón *et al.*, 2009)], but this term can also refer to distance [0.25 mile (Hur *et al.*, 2010); 0.75 miles for female adolescents in Carolina (Colabianchi *et al.*, 2007); up to 1.5–2.5 miles for Irish adolescents (Nelson *et al.*, 2008)]. In a guide to create walkable communities for local governments (Mid America Regional Council), prepared by the Bicycle Federation of America Campaign to Make America Walkable, the authors recommended officials consult the community to determine an appropriate walking distance.

- Green biodiverse spaces should be designed so that there is at least one within walkable distance from people’s homes, as it made people happy that nature was close by (Zelenski and Nisbet, 2014).
- Green spaces should be co-designed with communities and reflect local needs.
- Areas should be as large as possible (stakeholders), with connections through flowery verges or linear habitats alongside paths and roads (literature).
- Areas should be relatively open, but grass does not all have to be the same length. This design could suggest careful, rather than a lack of, management. Interpretative signage can explain the practice and highlight signs of nature to look out for.

- A few scattered trees or clumps of trees are preferable to dense planting of trees.
- Paths, recreational areas and places to relax and engage with nature should be incorporated from the start, to promote use and maintain a feeling of safety.
- Exercise areas, trails and paths need to provide maximum contact with green space, as this made exercise accessible and nature contact motivated people to walk more.
- Not all areas should be managed to the same intensity. Some parts near paths could be managed more to look tidy, whereas stakeholders recognised the value of incorporating wild areas, which could be further away from paths.
- Biodiversity areas can be designed to accommodate playgrounds and other amenity areas. Most stakeholders recognised the value of being able to spot wildlife.

7.4 Implications for Future Research

- National study of stakeholder perceptions involving people in conservation, health and local authority roles. This could be extended to teachers, police and social workers.
- Determining how stakeholders perceive policy and legislation around green infrastructure in Ireland would be beneficial.
- Demographic data on what and how individuals and communities perceive and use urban green spaces could help in the planning and design processes for future green space provision.

8 Conclusion

There is evidence that contact with nature benefits health and wellbeing, but many studies lack rigor (Capaldi *et al.*, 2015). Most studies are cross-sectional, not longitudinal (Capaldi *et al.*, 2015), and causation cannot be inferred in most cases (Mitchell and Popham, 2008). Nevertheless, throughout their lifetime, people gain physical, mental, cognitive, physiological, emotional, tangible and aesthetic benefits from nature and green spaces (Table 8.1).

There seems to be evidence that surrounding greenness removes pollution, acts as a noise barrier, and keeps people cool in the summer, and also acts as a buffer to allow people to destress and feel restored. It

also has a motivational function, as there is evidence from the literature review and the perceptions of the stakeholders that they were happy knowing nature was nearby and this motivated them to walk or exercise more. While much of the existing research tended to focus on physical health or the restorativeness of nature, Lemieux *et al.* (2015) took the more holistic and integrated approach, recommended by Maller *et al.* (2006), which evaluated benefits in terms of the physical, mental, spiritual, social and environmental components of health and wellbeing.

The World Health Organization recommended 9m² green open space per city dweller, though there was

Table 8.1. Synthesis of research findings from this study in relation to the Healthy Ireland Ipsos MRBI survey of health in Ireland in 2015 (DoH, 2015b) and Natural England Access to Evidence Information (Natural England, 2016a,b)

Health issue and Healthy Ireland survey outcomes	Literature review evidence findings	Research need (informed by Natural England evidence notes and literature review)	Findings from this study regarding decision-makers' perceptions of health benefits from contact with nature
<i>Physical activity</i>			
More than two-thirds (68%) of Irish adults are not active enough. Inactivity is linked to weight gain, higher risks of cardiovascular disease, high blood pressure, diabetes, colon and breast cancer, as well as falling and of hip and vertebral fractures and depression. "Being more physically active" is one of two changes most frequently selected (38%) towards improving health and wellbeing	Some evidence that people enjoy being active in nature and gain benefits from it. Some evidence of socio-economic benefits associated with more activity in nature places. Cycling, walking or habitat management practices have been prescribed as part of a medical toolkit and undertaken on an individual or group basis. Participants reported better mood and feelings of self-worth	Future greenspace interventions need better definitions and methodological, reporting and evaluation rigour to help clarify the effectiveness of such interventions. The UK Medical Research Council's "Complex Intervention Guidance" is a useful aid as interventions are seldom undertaken in isolation. They are usually part of wider programmes of activity	Engineers, planners, local authority biodiversity decision-makers and health promotion officers strongly agreed that they "go into nature as much as possible to exercise". Health promotion officers strongly agreed that green spaces in urban areas "make exercise accessible". Health promotion officers, conservationists and planners feel fitter because being out in nature motivates them to walk more
<i>Psychological wellbeing</i>			
About 1 in 10 adults report a probable mental health problem (PMHP). This includes 9% of the Irish population aged 15 and over; it is more prevalent among women (13%) than men (6%), and also among those aged 65+ (12%)	Positive mental health outcomes have been reported at individual and population levels. Therapeutic interventions using nature demonstrate positive, if weak outcomes. Being active in natural environments had positive outcomes for children's mental health (and cognitive, emotional and behavioural wellbeing)	Socio-economics, gender and age may confound results. Bias may be an issue in some studies. To be translational at a population level, future studies need to consider effectiveness in relation to developing and trialling evidence-based interventions suitable for commissioning. Key features are health condition, population size, intervention and outcome (see above)	Decision-makers agreed or strongly agreed with the following: spending time in nature allows them to de-stress and problem-solve; they relax by seeking contact with nature, from walks to the beach or the woods and having picnics; in an urban setting, they felt happy just knowing that they may come across nature around the corner

little reference in the literature to this being secured for city populations (Dzhambov *et al.*, 2014), and, as seen in sections 2.7.7 and 7.3, figures vary considerably. Recommendations have been made in each work package, and are summarised in Chapter 7. Health promotion officers and planners need to ensure access to high quality and attractive green space is secured at strategic planning levels (e.g. at SEA level) to benefit health and wellbeing and provide people with the opportunity to engage with nature on a daily basis.

In Chapter 3, the potential for an integrated health, wellbeing and nature strategy was highlighted as the

overriding outcome of assessing views of stakeholders who plan, design, manage and promote green spaces. This was further developed in Chapters 5 and 6, with reference to the integrated strategies employed by the Healthy Parks, Healthy People programme, the integrated health and nature service proposed recently in Scotland and the legislation in Wales that obliges public and private organisations to take account of the seven health and wellbeing goals, including the goal of a resilient ecosystem that supports sustainable development and a salutogenic society. The overwhelming conclusion of this study is that policies and practices regarding health and nature need to be better integrated.

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Abbreviations

BMI	Body mass index
EU	European Union
HSE	Health Service Executive
LABR	Local authority staff with biodiversity-related roles
MENE	Monitor of Engagement with the Natural Environment
MUGS	Multifunctional urban green spaces
NDVI	Normalised Difference Vegetation Index
PCA	Principal component analysis
SEA	Strategic Environmental Assessment
SWOT	Strengths, weaknesses, opportunities and threats

Appendix 1

Health Benefits from Biodiversity and Green Infrastructure Survey

Questionnaire to gather information on stakeholders' perceptions and opinions regarding benefits to health and wellbeing from biodiversity and green spaces.

The objective of this study is to assess stakeholders' perceptions and opinions regarding the value to health from nature. Specifically we aim to describe the breadth of opinions and perceptions of key groups in relation to a number of initiatives to engage people more with nature and spend time outdoors and link this with the steps needed to gain a baseline understanding of people's engagement with the natural environment. This study could increase awareness of the links between health, engaging with the natural environment and undertaking outdoor activity in green spaces, and encourage participants to reflect on how to sustain or enhance their participation in such activities.

1. Thinking about definitions, when we talk about the natural environment, nature and green spaces, what do those terms mean to you? (definitions)
2. Focussing specifically on the natural environment, how healthy do you think it is and how would you rate the state of the natural environment? (condition)
3. Looking now at how you use the natural environment, how do you spend time in the natural environment and green spaces? Please include frequency and duration where possible. (use)
4. Thinking about where you spend time in the natural environment and green spaces, how do you get there? (access/means/time/sustainability)
5. What, in your opinion, is the importance of nature in the built environment to you? (attitude evaluation 1)
6. Thinking now about other people, what do you think is the value of green spaces in an urban setting? (value)
7. Still with a focus on members of the public, but also considering your own needs, if you were to design a green space you would use, what would it include? (future)
8. What do you think are the issues or barriers that prevent people connecting to nature? (attitude evaluation 2)
9. What do you think are the benefits of connecting people with nature? (attitude evaluation 3)
10. What do you think are the benefits to health and wellbeing from nature? (attitude evaluation 4)

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL

Tá an Gníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaoil a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaoil a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: Déanaimid córais éifeachtacha rialaithe agus comhlionta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcleonn leis na córais sin.

Eolas: Soláthraimid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírthe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.

Tacaíocht: Bimid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaoil atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaoil inbhuanaithe.

Ár bhFreagrachtaí

Ceadúnú

Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaoil:

- saoráidí dramhaíola (*m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola*);
- gníomhaíochtaí tionsclaíocha ar scála mór (*m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta*);
- an diantalmhaíocht (*m.sh. muca, éanlaith*);
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géimhódhnaíthe (OGM);
- foinsí radaíochta ianúcháin (*m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha*);
- áiseanna móra stórála peitрил;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil

- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíríú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a idíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaoil.

Bainistíocht Uisce

- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uisce idirchriosacha agus cósta na hÉireann, agus screamhuisceí, leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaoil

- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil (*m.sh. tuairisciú tréimhsiúil ar staid Chomhshaoil na hÉireann agus Tuarascálacha ar Tháscairí*).

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn

- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil

- Taighde comhshaoil a chistiú chun brúnna a shainathint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta

- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaoil in Éirinn (*m.sh. mórfhleananna forbartha*).

Cosaint Raideolaíoch

- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas

- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaoil ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaoil (*m.sh. Timpeall an Tí, léarscáileanna radóin*).
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhail ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta

- Feasacht comhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil

Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:

- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- An Oifig um Cosaint Raideolaíoch
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

Authors: Caitriona Carlin, Martin Cormican
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This project reviewed (1) evidence of wellbeing and health benefits from biodiversity, (2) views of health benefits from nature held by people who make decisions regarding green space and (3) practices to engage the public with the natural environment as a sustainable health strategy, to inform policymakers and practitioners of the health benefits from the natural environment and to recommend implementation strategies in Ireland

Identify Pressures

Public expenditure on health in Ireland faces increasing challenges posed by an aging population with 60% of adults diagnosed as obese. Irish adults are not active enough (68%), and 1 in 10 Irish people aged 15 and older report a probable mental health problem. As they age, future populations are likely to face increasing chronic illnesses linked to obesity and depression. Healthy environments promote human health and wellbeing. This research shows that connecting with nature makes people feel happy, more restored and motivated to be more active, which is in keeping with Healthy Ireland and EPA goals.

Inform Policy

This is the first study to connect the perceptions and values of key decision-makers in Ireland regarding green spaces, nature and health. In this study, engineers, planners, local authority biodiversity decision-makers, conservationists and health promotion officers strongly agreed with the perception that contact with nature benefits health and wellbeing. Decision-makers differed in how they viewed the design and appearance of multifunctional green spaces. Four of the five decision-making groups recognised that biodiversity was an important function of green spaces. Engineers' perceptions were less positive than other decision-makers' regarding the potential to integrate biodiversity into playgrounds, sports grounds and amenity areas. This project is relevant to the EPA Corporate Strategy 'Strategic Plan 2016-2020 – Our Environment, Our Wellbeing'. The project is relevant to 18 of the 64 actions outlined within the Healthy Ireland Framework and addresses a further 11 Health Service Executive initiatives.

Develop Solutions

The overwhelming conclusion of this study is that policies and practices regarding health and nature need to be better integrated. In particular, the research recommends that Health Service Executive and local authorities should work more closely together to ensure that access to attractive biodiverse space is secured at strategic planning levels. This collaboration should also entail carrying out baseline assessments, providing training and delivering pilot programmes such as those delivered in other jurisdictions.

Devising and implementing a cross sectoral health–nature strategy would embed nature at the heart of everyday decisions and support a healthy environment and society.