

Green infrastructure: concepts, perceptions and its use in spatial planning

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Abstract

Green infrastructure offers a contemporary approach to the conceptualisation and management of landscape resources. It has developed rapidly in the UK, Europe and North America as a result of the opportunities it has provided in meeting the ecological, economic and social challenges of spatial planning. The attention given to growth in green infrastructure has been supported by the development of a number of overarching principles – principles that provide green infrastructure research with a multi-layered understanding of the changing nature of landscape resources.

This thesis outlines the complex nature of green infrastructure development, its meanings, its perception and use as an approach to landscape planning. Three key themes are identified. Firstly, by exploring variations in the meanings of green infrastructure this thesis presents an examination of its conceptual development to date. The second explores the role of perceptions in the value and use of green infrastructure resources. It examines the role of ecological, psychological and social constructions of green infrastructure and assesses how these affect personal and communal landscape interpretations. The final theme discusses current green infrastructure use by practitioners. The varied nuances of green infrastructure are outlined and an assessment is given of how the principles of green infrastructure have been translated into appropriate landscape management. Each of these themes explores the relationships between green infrastructure principles, its perceptions (by users), and its use in practice (spatial planning).

The themes developed in this thesis identify a number of conceptual and implementation principles for green infrastructure. The roles of integrated planning policy, strategic thinking, multi-functionality, connectivity, and access are discussed in order to highlight the different forms that green infrastructure research has taken. Based on these discussions, this thesis proposes that a green infrastructure approach to planning can be used to meet the complex challenges of current landscape planning. With continued development of green infrastructure, some of the most pressing issues in planning, such as green space planning or sustainable urban development, can be discussed. These issues are discussed throughout the thesis and clear links are made between this exploratory green infrastructure research and planning practice.

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Ian Mell, Newcastle, January 2009.

¹ The views of the individuals noted in this thesis are their own interpretations of green infrastructure and do not necessarily represent the views of the organisations they represent.

Preface

In the winter of 2006, a family member asked me over dinner to explain what green infrastructure was and to describe what I was actually doing (or, in my words, researching). This was a normal conversation to have in my parents' home as my Mother has never fully understood what my PhD entailed apart from the fact that it involved grass, trees and 'green stuff'. I told her what green infrastructure could be and she replied 'Oh, so I have one in the back garden'. I replied simply, yes. Following this conversation, I was able to explain for the first time to her what green infrastructure is, how it differs in size, scale, appearance and meaning, and how its value differs according to different needs and influences. This conversation highlighted to my family the simplicity of what green infrastructure could be, but also suggested to them that there are a number of diverse meanings and differences between how different groups perceive them.

The juxtaposed simplicity and complexity of green infrastructure forms the main body of this thesis in which I will answer some of the questions posed by my Mother. I will attempt to answer what green infrastructure is, how it affects the environments we all live in, how people interact with it, and what it means for the future of our landscape. By outlining how green infrastructure is currently being debated within planning policy and practitioner spheres, this thesis highlights the role of ecological, economic, and socio-political agendas that combine to influence this continuing debate.

This thesis is the culmination of four years of discussions like the one outlined above. Hopefully, with this work I will have prepared a volume that will answer similar questions and contribute to the debates relating to green infrastructure, environmental perceptions and spatial planning.

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Acronyms and abbreviations

ANGSt	Accessible Natural Greenspace Standards (English Nature, 2003)
APA	American Planning Association
B&L	Bedfordshire & Luton
CA	Countryside Agency
CABE	Commission for Architecture and the Built Environment
CABE Space	Commission for Architecture and the Built Environment (green space)
CC	Climate change
CF	Community Forest
CIAT	Countryside in and Around Towns (Countryside Agency & Groundwork, 2005)
CIL	Community Infrastructure Levy
CUDEM	Centre for Urban Development and Environmental Management
DCLG	Department for Communities and Local Government
DCMS	Department for Culture, Media, and Sport
DCSF	Department for Children, Schools, and Families
DEFRA	Department for the Environment, Food, and Rural Affairs
DETR	Department for the Environment, Transport and the Regions
DoH	Department of Health
DoT	Department of Transport
DPD	Development Plan Document
EA	Environment Agency
EIP	Examination in Public
EMSS	East Midlands Scoping Study
EN	English Nature
ENGO	Environmental Non-Governmental Organisation
EPA	Environmental Protection Agency (USA)
ESRC	Economic and Social Research Council
GCV	Gateshead Conservation Volunteers
GI	Green infrastructure
GIS	Geographical Information Systems
GS	Green spaces
GU	Green Urbanism
GX	Green Exercise
HLF	Heritage Lottery Fund
ICT	Information and Communications Technology
IIS	Infrastructure Investment Strategy
IRF	Integrated Regional Framework
LA	Local Authority
LAA	Local Action Agreement
LDF	Local Development Framework
LSP	Local Strategic Partnerships
MAA	Multi-Area Agreement
Maryland DNR	Maryland Department of Natural Resources (USA)
MF	Multi-functional / Multi-functionality
MK & SM EQL	Milton Keynes & South Midlands Environment & Quality of Life Sub Group
NE	Natural England
NECF	North East Community Forests Partnership
NESE	North East Strategy for the Environment (Environment Forum North East)
NGO	Non-Governmental Organisations
NHS	National Health Service
NLUD	National Land Use Database
NW	North-West
ODPM	Office of the Deputy Prime Minister
PCSD	President's Council on Sustainable Development (USA)
PCT	Primary Care Trust
PPG	Planning Policy Guidance

PPG17	Planning Policy Guidance 17: Planning for Open Space, Sport and Recreation (ODPM, 2002)
PPS	Planning Policy Statement
PPS1	Planning Policy Statement 1: Planning and Climate Change (DCLG, 2007)
PPS2	Planning Policy Statement 2: Green Belts (ODPM, 2001)
PPS9	Planning Policy Statement 9: Biodiversity and Geological Conservation
PPS12	Planning Policy Statement 12: Local Spatial Planning
RCEP	Royal Commission for Environmental Pollution
RDAs	Regional Development Agencies
RDS	Regional Development Strategy
RES	Regional Economic Strategy
RSS	Regional Spatial Strategy
RTPI	Royal Town Planning Institute
Section 106	Section 106 Agreement for planning gain
SC	Sustainable Communities Agenda (ODPM, 2003)
SLA	Service Level Agreement
SPD	Supplementary Planning Document
SUDS	Sustainable Urban Drainage Systems
TCPA	Town and Country Planning Association
UMass	University of Massachusetts, Amherst (USA)
UNN	University of Northumbria
UR	Urban Renaissance (DETR, 2000)

Chapter 1.0. Green infrastructure, environmental perception, spatial planning

1.1 Can you tell a green field from a cold steel rail - What does Green Infrastructure mean to you? (Davies *et al.*, 2006:29)

If you were to sit and watch the people walking through Hyde Park (London) on a Monday morning at 8.30 am, what would you think they were doing? If you were to see the same people walking on a Sunday afternoon in the same park would your interpretation of their activities change? The chances are that your responses would be very different. The question, therefore, is *Why?* Green spaces or *green infrastructure* such as Hyde Park are spaces where it is possible for activities of a juxtaposed nature² to be conducted by the same people at different times of the day, week or year in the same place. People briskly walking through Hyde Park on a Monday morning could be using the park to aid their movement to work, school or the gym. Whereas, on a Sunday afternoon they could be using the same space to spend time with friends, take in the aesthetic quality of the park or simply to get away from it all and relax. What is apparent, though, is that Hyde Park fundamentally remains the same green infrastructure. Only the perceptions and use of it change. Although the actual space changes very little from day to day, it is the way in which it is perceived and used for different purposes that affects our perceptions of it.

Green infrastructure can, therefore, be viewed as a specific landscape resource, e.g. Hyde Park, a component of the wider resource such as London, being a wide green infrastructure network, or as a concept. Green infrastructure, has, however also been described as an overarching concept that incorporates a number of green spaces within one label. This thesis takes the former interpretation as the base interpretation of what green infrastructure is proposed to mean. Such variation in what green infrastructure is proposed to be supports the view that it can be a spatially diverse concept that meets a number of needs at local, regional and even national scales. Each of these interpretations will be discussed within this thesis to highlight how specific landscape elements, green infrastructure networks, and the principles that support the conceptual approach to green infrastructure, are currently being developed in landscape policy and management.

Green spaces such as Hyde Park provide human users and wildlife with a number of contrasting functions, opportunities or habitats depending on their design, facilities and characteristics. Moreover, each green space is perceived differently due to a number of factors, which include but are not limited to, size, aesthetic quality and function, but also include location within the urban, urban-fringe and rural landscapes (CABE Space, 2005a). One can question whether, for example, the Rising Sun Country Park in the urban-fringe of North Tyneside is used for the same reasons as Leazes Park with its urban location in Newcastle? Are the National Parks in Northumberland and the Lake District used by the same people or for the same purposes as the Riverside Country Park in Chester-le-Street? Does a localised integrated water or sustainable urban drainage system (SUDS) have the same

² Examples of juxtaposed activities would be recreation, e.g. intensive sports, and a conservation or wildlife habitat being used concurrently on the same site.

functions and uses as a larger, cross-boundary river? The answer to these questions is potentially 'no'. This is because different spaces are perceived as providing different functions for individual users because there is an almost unlimited variation in both landscape type and composition. This suggests that the different functions, forms and locations of a space or green infrastructure could be interpreted through a system of use and value attribution (Burgess *et al.*, 1988; Nohl, 1983).³ Using this view as a basis, this thesis proposes that the subtle variations in the distribution and function of *green infrastructure* provide a user with an individual experience of that place. This individual view may be influenced by a number of factors and no two users will view a landscape in exactly the same way. This dual process of understanding and engagement with the landscape will therefore link the conceptual development of green infrastructure with discussions of landscape policy and our use of these resources. The green infrastructure literature thus suggests that the diversity in form and function supports a dynamic system of landscape interpretations. An understanding of these processes is proposed within the green infrastructure literature as an important area that landscape managers need to take into account when developing a broader knowledge of what *green infrastructure* is, how it is used, and how it should be planned (Xu *et al.*, 2006).

Plate 1.1 Different types of Green Infrastructure



The anecdotal questions posed above provide a background to the question of what green infrastructure is, and the purpose it serves to economic, environmental and social spheres of society. Hyde Park can once again be used as an example of a functional green infrastructure, as the park can be said to offer a number of different opportunities or affordances for humans, i.e. exercising and relaxation concurrently. It is also a busy thoroughfare into west and central London and is an

³ Here, Burgess *et al.* discuss the view that spaces have a number of functions. Consequently, perceptions of these spaces are subject to a dynamic system of interpretations that review the form and function of a space, its location in terms of their neighbourhood, city, and region, and the ways in which these spaces can be used in their lives.

ecologically important habitat. Consequently, this space can be viewed as fulfilling a wide variety of economic and social needs, as well as providing important environmental functions (i.e. water management or habitats). Hyde Park can also be interpreted as providing a number of the main principles of green infrastructure, namely: strategic connectivity, access, and blocks of contiguous and linked resources within a strategic green network of supporting spaces.

The differences in green space composition and function are, therefore, central to the articulation of a green infrastructure approach to landscape planning. Thus, by utilising the idea that green spaces are elements of a wider green infrastructure network, this allows a range of practitioners and academics to bring their own understandings of green space planning or assessments into one coherent planning agenda. The diversity of landscape composition and the perceptions of these spaces are two of the main characteristics relating to the development of the green infrastructure concept (Plate 1.1 and 1.2 highlights this diversity). However, there are also questions that address its main conceptual foundations, and assess how it should be developed and implemented. Within this thesis, I address these questions as well as ask how green infrastructure has developed conceptually and as a landscape management process. This will explore the different meanings and interpretations of what green infrastructure is and examine whether there are differences in the concept's use in the UK, Europe, and North America. This lack of a uniform or inclusive use of green infrastructure may, therefore, hinder its integration into mainstream planning policy. This approach will enable a discussion of green infrastructure to be made that integrates a range of historic green space terminology and research in order to present a focussed and contemporary examination of landscape planning.

I support this examination with a review of academic, practitioner and user interpretations of green infrastructure and its proposed values. This will assess how different ecological, economic and social influences affect the interpretation and use of green infrastructure resources. The role of landscape interpretation is an important element in green infrastructure development as there is currently little research assessing the perceptions of landscape form and function using a green infrastructure approach to landscape planning practice. I will also contextualise the current use of green infrastructure within contemporary landscape planning research and ask what the future holds for this currently contested concept. Here, I argue that natural and human resources are in a constant state of change and that green infrastructure offers a process that can successfully address these changes.

I will also outline within the three main areas of empirical data how one of the major opportunities for future green infrastructure planning originates from its potential to aid the re-construction of existing (grey) infrastructure and the possibility this holds to develop new 'greener' infrastructure. Consequently, by reviewing how green infrastructure can be adapted or developed within changing landscapes, the planning policy responses can also be assessed to highlight how, or whether these challenges are, being met. Green infrastructure planning may therefore be viewed as bringing together a number of planning practices to aid the development of functional and sustainable spaces. This notion will be discussed in more depth in Chapters 2 and 3. Chapter 1, however, will present a brief examination of what green infrastructure is proposed to constitute, how these ideas vary between

different academic, practitioner, and policy sources, and will review the overall structure of this thesis. This chapter also outlines the research questions developed for this thesis and examines their relevance to green infrastructure development.

1.2 Green Infrastructure: concepts, perception and its use in spatial planning

The title of this thesis '*Green Infrastructure: concepts, perceptions and its use in spatial planning*' represents the three main areas of study for this research. The first area reviews the development of green infrastructure and explores its meanings and its uses in terms of landscape planning. This outlines a discussion assessing why different people (practitioners and academics) view the conceptual and practical development of green infrastructure as important and discuss its relevance in different landscape planning contexts. The second area examines the perceptions of different green infrastructure resources from a variety of user groups. The aim of this section is to discuss how perceptions of green infrastructure develop, differ from and impact on the use of resources. It also assesses whether interpretations can be grounded in theories of landscape perception that promote a normative view of green infrastructure. The final area presents a review of how different organisations utilise green infrastructure and examine how the concept is being implemented by governmental and non-governmental agencies. This section explores how the conceptual ideas relating to green infrastructure are being developed within planning policy and translated into practice.

These three areas, therefore, assess the development of green infrastructure, how green infrastructure is perceived and used and how it is being implemented and planned for by different practitioners. By developing research focussing on each of these three areas, the relationships between green infrastructure development and its use, it is possible to identify where the principles of green infrastructure have been successful. It can also suggest possible gaps for further research and debate. Outlining the links between these three areas, though, is not straightforward. There are logical lineages between the development of green infrastructure as a concept and its subsequent use in planning policy and practice. The links between *green infrastructure* and *spatial planning* and *environment perceptions* are, however, not as readily apparent.

By reviewing how or why people use and value spaces and the reasons behind these interpretations, it is possible to suggest a more appropriate definition or use of green infrastructure in landscape planning. Consequently, understanding the role of environmental interpretation can be to support or contest the appropriateness of the principles developed for green infrastructure and their utility in landscape development. The three main themes of this thesis - *green infrastructure*, *environmental perception* and *spatial planning* - will examine the relationship between how people view and interact with the landscape and how these views can be integrated into different strategic green infrastructure planning policy and implementation plans.

1.3 Green Infrastructure: setting the scene

This introductory chapter outlines a number of the broad questions relating to the development of green infrastructure. It sets out the main principles that have been attributed to, or underpin, the

concept, and reviews how the breadth of green infrastructure thinking provides scope to meet a number of ecological, economic and social challenges.

1.3.1 Development of a green infrastructure discourse

This thesis addresses the following questions: What is green infrastructure? Where can it be found? What is it for? How is it used? These questions form the body of this thesis, providing an insight into how different user groups, academics and practitioners address and interact with green infrastructure as a concept and as elements of a given landscape. According to the growing literature relating to green infrastructure, it can consist of playing fields, gardens, golf courses, riparian corridors or heathland (see National Land Use Classification, www.nlud.org). Consequently, the diversity in what constitutes green infrastructure provides a broad scope for its discussion and its use. The range of spaces (form and location) and resources (function) that green infrastructure is proposed to include has also enabled a number of authors (Ahern, 2007; Davies *et al.*, 2006; TCPA, 2004) to develop a series of typologies categorising the different elements of the concept. This debate has provided scope for a strategic interpretation of environmental resources to be made that underlies the connective and supportive nature of green infrastructure. This highlights two of the primary questions discussed in this thesis: what *actually* constitutes green infrastructure and how these ideas are articulated, and what is the subsequent value of these discussions in landscape planning practice?

Within the research literature, it has been suggested that green infrastructure can include gardens, local nature reserves or national parklands. They can be a place to eat your lunch, a place to exercise, or a place to escape. They can be stormwater systems, green roofs, or porous pavements. Consequently, this diversity highlights another fundamental green infrastructure debate: Is there a consensus as to what it is? If not, then how are these different interpretations integrated to aid its development? With such variation in green infrastructure thinking, this thesis addresses these issues and presents a discussion of the diverse opinions and background research relating to the concept. The thesis also comes at a time when environmental planning has once again been brought to the forefront of public debate. In terms of the economic climate of 2008-09 and the development of better places to live, work and recreate, this study examines how green infrastructure can be used to meet the challenges of a more appropriate form of landscape management, the development of functional and accessible spaces, and the building of more sustainable communities.

Green infrastructure thinking should therefore be thought of as a contemporary area of planning research and implementation. Although it utilises a number of conceptual ideas drawn from landscape ecology, planning, and geography, it brings these ideas together to develop a holistic and dynamic approach to landscape planning. These areas will be discussed in the theoretical framework proposed in Chapter 2 and will inform the discussions outlined in Chapters 6 and 8.

The contemporary nature of the concept can be assessed by examining both the diversity in interpretations of green infrastructure and the rise in academic and practitioner research relating to it. Various activities, e.g. landscape management projects, policy initiatives and academic research, have promoted a number of key principles of green infrastructure. Multi-functionality, connectivity

between different ecological elements, the notion of strategically important resources that hold the key values in promoting access and connectivity, and the integration of larger land parcels and supporting networks have all been discussed as central ideas in the development of green infrastructure. The dissemination of these values has also allowed a number of research platforms to be developed supporting green infrastructure publicly at a number of organised conferences and workshops.

Plate 1.2 Are these examples of Green Infrastructure principles, i.e. connectivity or multi-functionality?



The process of attributing principles to green infrastructure has been highlighted with the holding of focussed Green Infrastructure seminars during 2006 and 2007. On 3 April 2006, the *Green Infrastructure Planning: Sustainable Cities in the 21st Century* seminar was held in Newcastle-upon-Tyne. This event was organised as a forum to discuss the Green Infrastructure Planning Guide developed by a team from the North East Community Forests, Newcastle University and Northumbria University (hereafter Davies *et al.*, 2006). It opened up a debate on the use of green infrastructure as an appropriate green space planning strategy. Attendees at the seminar included members of regional and national bodies, English Nature and the Countryside Agency (now Natural England), but was also attended by landscape practitioners and consultancy groups including CEED and the Halcrow Group.⁴ The delegates attending the event all held an interest in the developing relevance of green infrastructure, an interest that addresses the role green infrastructure has as an application in developing multi-functional landscapes. The relevance of this event and the Countryside Agency-sponsored *Green Infrastructure Conference* in Leeds (29/03/2006) reveals that there is a growing focus on green infrastructure thinking in the landscape management sector.

The Countryside Agency event in Leeds was held to present work by CUDEM⁵ at Leeds Metropolitan University and outlined further conceptual and practical applications for future green infrastructure development. Both events become increasingly relevant when discussed in conjunction with the expanding literature and the development of a number of planning initiatives and policies. What these two events highlight is that there has been rapid development in green infrastructure thinking, promoting a view that considers green infrastructure as a concept that has far reaching benefits at a

⁴ CEED and the Halcrow group are environmental consultancy organisations.

⁵ CUDEM is the Centre for Urban Development and Environmental Management.

number of different scales (Ahern, 2007; Carter and Fowler, 2008). Moreover, the Countryside Agency stated that 'green infrastructure could describe more strategic, positive and dynamic ways to analyse and promote green spaces of various kinds' (2006:1). Green infrastructure is therefore being explained as a process that can be used to develop new areas of research and attract potential funding from government and environmental non-governmental organisations (ENGOS). This suggests that the focus of contemporary planning in developing sustainable places could benefit from the development of green infrastructure because of its ability to meet a number of contrasting development targets.

These events have been followed by other conferences and research seminars including the *Place Shaping, Spatial Planning and Liveability Conference* held at University College London (March 2008) which promoted the value of green infrastructure within academic-practitioner-policy debates. The development of green infrastructure events in the UK has been mirrored by similar events in North America. Examples include the 3rd *Fábos Landscape and Planning Symposium* (April 2007), which was used by a number of researchers to raise practitioner awareness and further the conceptual debates regarding green infrastructure, as was the 2008 Association of American Geographers (AAG) Annual Conference (Ahern, 2007; Mell and Roe, 2007; Rottle, 2007). These events provided a public forum where green infrastructure can be debated in terms of its value as a planning practice. They also show that debates are growing simultaneously in a number of geographical locations. Although the examples shown are drawn from the UK and North America, this process is also underway in the Middle East and China (Jim and Chen, 2003).

With the rise in public awareness and its assessment of the growing instability of local, regional and global environments, people are looking more than ever at ways to manage their surroundings in a sustainable way. The development of a forum discussing the potential value of green infrastructure as a way of meeting these challenges allows researchers and practitioners to engage with these debates. Green infrastructure has thus been proposed as a planning mechanism that offers a process whereby sustainability agendas can be discussed in a coherent, progressive and forward-looking context.⁶ However, although the sustainability agenda has consistently grown since the release of the Brundtland Report (WCED, 1987), sustainability is still not viewed by some as a necessity.⁷ Green infrastructure may, therefore, offer a process for developing better places to live through the creation of more appropriate environmental and social design incorporating a 'greener' or sustainable ethos.

The links between sustainability and green infrastructure, then, focus on the need to maintain the ecological, economic, and social functions of the landscape whilst also meeting the needs of the population. Fortunately, although there have been decreases in the actual level of ecological resources, green infrastructure potentially offers a process where the proportion of 'green' can be increased to meet these broader ecological, economic, and social needs (Kambites and Owen, 2007;

⁶ For examples of this process see Beatley's review of European and Australian cities using innovative planning to improve the sustainability of their landscapes (Beatley, 2000; 2009).

⁷ Some countries and politicians are still reluctant to acknowledge that human interactions with the natural environment have had a negative effect on global climate change. Recent examples include the reluctance of the United States of America and China to sign up to the proposals in the Kyoto Protocol.

Dapolito Dunn and Stoner, 2007). Furthermore, within this thesis, green infrastructure will be discussed as being able to act as both a natural resource 'sink' or as a defined space with a primary ecological function (i.e. a reservoir or forest), and as a broader-scale landscape management tool, placing the concept into the wider planning debates compared to other methods of green space or Greenway planning.

Green infrastructure will be reviewed as providing inputs into broader (i.e. global) environmental debates whilst also examining the value of its components, structures and connections at a regional and local level. By reviewing the principles of landscape ecology, the role of ecological network theory will be examined to outline a way of linking landscapes and creating 'greenseams' of infrastructure that perforate them (Dapolito Dunn and Stoner, 2007). System connectivity theory is drawn from a number of disciplines and promotes the functional role of a supporting system that allows the free flow of capitals, energy, and people within and across boundaries (Forman, 1995; Burgess *et al.*, 1988; Jongman and Pungetti, 2004). Gehl (1987) contextualises this role by stating that a successful and sustainable space is one that provides the infrastructure (the physical landscape) to allow people to interact, move, and live within a given (social) landscape. Green infrastructure may hold a key position here by enabling planners and developers to develop attractive and functional spaces that promote multi-functional use.

However, it is important to recognise that, although networks and systems approaches are central to green infrastructure thinking, they are elements of a wider matrix of spaces. This thesis therefore reviews how different interpretations of networks in landscape management practice have been developed in green space and urban planning. Thus, by comparing the historical work of Ebenezer Howard and Frederick Law Olmsted to current green infrastructure thinking, a series of transitions in landscape planning will be presented and reviewed (Howard, 1988; Fábos, 2004). The current research utilising green infrastructure (i.e. the Sustainable Communities programme – ODPM, 2005) can be examined as a continuation of the historical values described by Olmsted and Howard. These links will be developed in Chapters 2 and 8.

1.3.2 Perceptions and interpretations of green infrastructure

A further aim of this thesis is to present empirical data outlining how different academic, practitioner and user groups develop their perceptions and values of green infrastructure in order to assess how these interpretations are being translated into planning policy, practice and the use of these landscape resources. These are comparisons that will be explored to examine how, and why, landscapes are developed in different ways in different locations. This analysis will provide insights into how ecological, economic and social influences are viewed in terms of interpretations of, and use of, the landscape. It is, however, clear from an initial review of green infrastructure research that differences could occur between geographical areas (e.g. the UK and North America) which may influence the relationships between landscape planning and human behaviour as described by Olmsted (Fábos, 2004), Howard (Howard, 1988) and more recently Beatley (2000; 2009) This argument was also outlined by Davis (2006) who presented a review of Los Angeles as a metropolis developed by political and social interactions with a continually changing economic and social environment. Davis

suggests it is important to understand the relationship between people and landscape if the use and public perceptions of that space are to be fully understood.

An understanding of this relationship will be examined in Chapters 3 and 7 which will propose a more defined process of assessing the landscape and its potential meanings. As Davis states, with a working knowledge of how people interact with spaces they can be managed to support a range of ecological, economic and social activities. In terms of green infrastructure development, understanding the elements or influences on perceptions will potentially develop a more in-depth appreciation of what is deemed important in terms of a space's form, function and location. Knowledge of these ideas can then be reviewed in terms of green infrastructure management or design in order to assess how personal and communal needs are translated into planning policy and practice.

1.3.3 Green infrastructure application in practice

A final theme reviewed in this thesis examines how ecological, economic and social aspects of environmental management can be examined through a green infrastructure approach to landscape planning. Issues relating to the integration of policy and implementation practices will be discussed in terms of the geographical location in which green infrastructure is being developed. In essence, this thesis will present *green infrastructure* as a discussion of both the conceptual debates and its practical use as a landscape management process. Only through this joint discussion can the underlying values (i.e. ecological, economic and social) attributed to green infrastructure become clear.

This process reviews whether providing links between human behaviour, planning policies and social and ecological resources promotes sustainability in landscape planning and can actually increase use. The benefits attributed to green infrastructure therefore need to take into consideration how people, policy and place are influenced by the three main components of sustainable development: social, ecological and political equity. The role of policy and practice integration will be discussed as central components of green infrastructure development and use. To paraphrase Lindsey *et al.* (2001), if green space offers a framework for human interactions with the landscape, a green infrastructure approach to planning and policy may represent the conceptual framework promoting this process.

1.4 Green Infrastructure: the present situation

The current focus of green infrastructure research in the UK reviews the development of the concept whilst embedding it into different areas of planning policy. Within this process, a continued dialogue between researchers, planners, and decision-makers is occurring in order to engage the governance structures of planning policy. This process reflects the overarching objectives of this thesis as it discusses how green infrastructure is being developed and assesses the areas of planning policy which need to be engaged. The development of green infrastructure principles is also spatially diverse. Current research in the UK, Europe and North America also presents a range of opinions assessing the need for green infrastructure development. Although each of these geographical regions works within a western planning system, variations can be seen between them. This thesis

examines these differences and highlights where a confluence or difference in green infrastructure thinking can be seen.

In the UK, organisations including Natural England, England's Community Forests Partnerships and the Regional Development Agencies (RDAs) have all utilised green infrastructure and attempted to implement it within their development plans. These organisations are therefore at the forefront of the translation of green infrastructure ideas into landscape management practices. Likewise, documents including the Countryside Agency and Groundwork's (2005) *Countryside in and around Towns (CIAT)* and the Office of the Deputy Prime Minister's (2003) *Sustainable Communities: Planning for the Future* have also been at the fore of documents promoting green infrastructure in the UK.

Green infrastructure thinking is discussed in the latest rounds of Regional Spatial Strategy (RSS) developments in England. It can be suggested that the green infrastructure process is, at present, being championed by a number of important landscape-orientated organisations throughout the UK with varying success.⁸ However, the development of a forum for debate between RDAs, researchers and delivery agents is only the first step towards a greater integration of the concept into planning policy. However, due to the diversity of green infrastructure research, the concept continues to develop with fragmented or multiple meanings. One of the aims of this thesis is to describe and evaluate the disparate uses of green infrastructure, develop a discussion of its meanings, and potentially propose more appropriate areas for its use.

Although green infrastructure in the UK has developed rapidly over the last five years, North American research has been promoting its own growth since the late 1990s. Despite, or potentially because of, this longer timeframe, visible differences between UK and North American planning policy (at a local, regional and Federal level) can be seen. The development of green infrastructure thinking in North America has also been equally fragmented. This is highlighted in the work of the President's Council on Sustainable Development (PCSD), which stated that:

green infrastructure strategies actively seek to understand, leverage, and value the different ecological, social and economic functions provided by natural systems in order to guide more efficient and sustainable land use and development patterns as well as to protect ecosystems.

PCSD (1999)

The PCSD outlines a number of the issues viewed as essential to green infrastructure, which are debated and analysed within this thesis. The PCSD, unusually for a North American agency, outlined a holistic interpretation of green infrastructure linking ecological, economic and social factors with the development of a more sustainable planning process. In other literature sources, the ecological value of green infrastructure is promoted most frequently with only a secondary review of social and economic needs (Williamson, 2003; Ferguson, 2002). The PCSD's rhetoric is now, however, being echoed in the research of a number of other North American practitioners (i.e. Benedict and McMahon, 2006; Ahern, 2007) who discuss the holistic nature of green infrastructure and its

⁸ Success is measured by the way in which green infrastructure has been debated, planned and delivered in policy terms by the authors or commissioning body.

relationship with an integrated planning process. These authors highlight the shift in green infrastructure thinking from being solely ecologically-focused to a broader system of multiple influences (ecological, economic, and social). The role of the PCSD can therefore be seen as a call for green infrastructure to be developed beyond a simple conceptual level and move it firmly into mainstream planning and development policy; green infrastructure is now increasingly being seen in North America as a set of vital elements for sustainable and multi-functional environments, and are seen as being equally as important as other built or grey infrastructure.⁹ However, this approach is changing and the resources commonly referred to as environmental or ecosystem infrastructures by the Conservation Fund (www.greeninfrastructure.net, 01/05/2008) and Ahern (2007) are now being viewed as central elements of an integrated green infrastructure approach to planning being attributed the same value as other grey infrastructure developments.

The difference between *ecosystem*, *environmental*, *landscape* and *green infrastructure* is not, however, readily apparent as all encompass comparable elements. Strang (1996) discusses how landscape infrastructures include green, blue and built elements of the landscape and should be viewed as a way of supporting the circulatory systems of a space. However, van Bohemen (2002) states that the various tags (*ecological*, *landscape* or *green*) can be viewed as semantic metaphors that promote the flow of energy, water, raw materials, and people within and across a system. Consequently, the use of different infrastructure names does not necessarily detract from the primary notions of connectivity, access, and strategically-connected networks that underpin green infrastructure. A connective or integrated approach to landscape and its management, therefore, appears to be a logical progression for green infrastructure, especially in terms of North American research.

The role that both green and blue infrastructures hold has been discussed more recently within UK research (i.e. Kambites and Owen, 2006; Blackman and Thackray, 2007). Both the North East Strategy for the Environment - NESE (Environment Forum North East, 2006) and the Mersey Community Forest (Mersey Forest, 2006) have ascribed value to the growing interest in ecosystem services. Ecosystem services have been described as the processes by which the environment produces resources utilised by humans. They can be presented in four sub-categories, namely supporting, provisioning, regulating, and cultural services, each of which provides benefits for human populations. Within the NESE documentation, ecosystem services and environmental infrastructures offer a composite outline of what green infrastructure should constitute. This report notes that ecological or environmental services or infrastructures should focus equally on ecological, economic or social functions that promote long-term landscape sustainability.

The role of ecosystem services becomes increasingly relevant if they are discussed in relation to urban greening projects. By using two examples, Sustainable Urban Drainage Systems (SUDS) and green building techniques (green walls and roofs), green infrastructure is being linked with urban

⁹ Grey or built infrastructure refers to landscape elements that do not hold an ecological or sustainable function (see Davies *et al.*, 2006). Like *green* infrastructure, *grey* infrastructure is equally fragmented and subject to a number of semantic interpretations.

sustainable design initiatives and the Sustainable Communities agenda (Beatley, 2000; Kloss and Calarusse, 2006; Schrijnen, 2000; Rodie and Feehan, 2008). The role that environmental or ecosystem infrastructure holds in current research has received both positive and negative feedback. Critics have stated that adding new labels to the already fragmented subject of green space management lowers the likelihood of green infrastructure becoming widely accepted (i.e. Davies *et al.*, 2006). However, supporters of all three terms (*environmental infrastructure*, *green infrastructure*, and *ecosystem services*) state that they have each been used in planning practices to promote a more sustainable use of the landscape (Benedict and McMahon, 2006; Blackman and Thackray, 2007).

The value of green infrastructure as an integrated approach to green space management can therefore be said to meet the needs outlined by Kloss and Calarusse (2006) by aiding the development of a framework for appropriate landscape management. However, whilst it is clear that an understanding of the influences involved in creating current planning policy is important, there must also be a review of what is actually being planned and how these landscapes are categorised. An acknowledgement of different green infrastructure typologies in Chapter 2 will therefore also be discussed to assess this relationship. The current state of green infrastructure research is at an interesting crossroads. Although the concept is developing a broad remit and has been applied to a number of different areas of planning (e.g. health), there are still an equal number of areas to be investigated, some of which will be discussed in this thesis. The remainder of this chapter will focus on the opportunities of green infrastructure research and how this thesis will examine this progress.

1.5 Green Infrastructure: the future

Where can green infrastructure go from here? Are the developments of green infrastructure toolkits and planning guidelines a positive step forward? Do we need a consensus of what green infrastructure is in order to promote its use? Can we afford to wait for these ideas to be accepted? If so, what are the alternatives - traditional green space design, innovative urban design, or SUDS? Should there be a more forceful research agenda promoting the use of green infrastructure as a way of creating better places to live, work and recreate? These questions and others have been discussed within the research literature but as yet no substantial or collective conclusions have been made. They also support the theory that, at present, there is a lack of a unified or coherent conceptual basis for green infrastructure research. This has been linked with the proposed difficulties seen in translating these ideas into planning policy and practice (Davies *et al.*, 2006). Consequently, this thesis addresses these concerns and promotes a more coherent and holistic discussion of green infrastructure and its utility in landscape planning. Due to the relative infancy of the green infrastructure concept, there has yet to be a collective confirmation of what constitutes green infrastructure or green infrastructure planning. Kambites and Owen (2007) outlined how they felt these two ideas differed: one is a concept (green infrastructure thinking) whilst the other is a practical process for landscape management (green infrastructure planning). Both, however, have research value and are explored within this thesis.

A starting point for this discussion may focus on whether there needs to be a clear consensus for green infrastructure and the ways in which it is viewed by different practitioners, academics and users.

At present, the research literature states that green infrastructure is still a relatively fragmented term (conceptually) and some authors state that only by bringing together its different elements can a coherent set of ideas be developed into statutory planning policy. This view is further compounded by the lack of a cohesive or overarching definition of what green infrastructure actually is. Thus, by proposing a definition and typology that attributes ecological, economic and social influences in Chapter 2, this thesis promotes a conceptual base for green infrastructure to be assessed against. Unfortunately, whilst there are such contradictions surrounding what green infrastructure is, its function and where it can be located, this level of acceptance will not occur. However, some may question whether such a universal understanding or consensus is needed, as the current diversity and breadth in green infrastructure thinking may actually allow a broader range of researchers and practitioners to engage with the concept. This debate will be discussed further in Chapters 6 and 8.

Furthermore, there has been a call for green infrastructure to be viewed as a necessity and not an optional amenity (Davies *et al.*, 2006; Ahern, 2007) and arguments supporting this view will be discussed in Chapter 2. The range of benefits of green infrastructure planning will also be outlined, suggesting that these benefits heavily outweigh the costs of green infrastructure development.¹⁰ Therefore, by attributing green infrastructure with the same values as ICT, water, sewage, and transport infrastructure, it could deliver a large number of potential benefits. If green infrastructure is to become an accepted method of landscape planning, the contradictory interpretations of what it constitutes are likely to decrease. With familiarity comes acceptance and potential use of the concept (Ahern, 1995; Fábos, 2004). This, then, is a goal for green infrastructure: to be discussed as a serious, cost effective and innovative landscape management strategy that fulfils a number of planning remits, i.e. Community Forestry (Konijnendijk, 2003), CIAT (Countryside Agency and Groundwork, 2005), or the Urban Renaissance (DETR, 2000), to sustainably protect or promote ecological, economic and social land use. Green infrastructure may, therefore, need to develop as a pivotal approach to landscape management if it is to be incorporated into mainstream planning guidelines.

The level of acceptance by researchers and practitioners (i.e. Williamson, 2003; Countryside Agency, 2006) needed for green infrastructure to become a mandatory planning process is high. It may take a prolonged period of evidence collection and dissemination to achieve this goal. However, through its inclusion in forest plans and RSS, green infrastructure is being developed as an appropriate land use management process (Kambites and Owen, 2007; Ahern, 2007). Further support for this process will also enable green infrastructure to become increasingly visible in mainstream planning practices. Professor Michael Dear (Global Places, Local Spaces Conference, UCL London, 2006) discussed this view, stating that landscape management is about integration, landscape integrity and positive visions for landscape development. Green infrastructure may, therefore, hold a role as an enabler for disparate research areas to be brought together to promote the common goals of *liveability* and *sustainability*.

¹⁰ Costs refer to changes in economic, ecological and social activities and infrastructures.

The remainder of this chapter, and indeed this thesis, will explore the debates outlined above. It will develop these ideas to provide a narrative for green infrastructure thinking, where its development is in 2008-09 and assess what the future holds. However, a timeframe will be placed upon the work incorporated into this study. This provides a way of situating this work within a specific time span in order to allow this thesis to be written with a specific start and finishing point. This timeframe allows the green infrastructure literature to be contextualised; the conclusions of this thesis are thus able to assess how green infrastructure has been developed and what avenues or opportunities it has for further development. Secondly, a timeframe will place a boundary on the materials incorporated into this work. The timeframe commences with the PCSD's statement in 1999 and the end date for inclusion of green infrastructure materials is placed at the end of 2007. However, additional literature will be incorporated from 2009 to enable a continual contextualisation of current green infrastructure debates.

1.6 Research Questions

The overview presented above sets out a number of the debates relating to green infrastructure development. These issues are explored in more detail in the following chapters, but this initial introduction has highlighted a number of the key themes that will be examined, e.g. the role of access, connectivity, multi-functionality, and policy and practice integration. The aims of this work, therefore, remain grounded in the need to develop an understanding of what green infrastructure is, how it is planned, and what green infrastructure means to different users.

The research questions themselves are split into three sections and relate to the title of the thesis. These sections are: *green infrastructure*, *environmental perceptions* and *spatial planning*, each of which is discussed firstly as independent areas of research and then collectively to show the relationship between these. However, although empirical data relating to each specific area has been developed, the overarching questions outlined in this chapter are debated across each green infrastructure theme. Although the whole thesis reviews green infrastructure development, the first area of research specifically examines the comparable and contrasting definitions, meaning and values placed upon it. Thus, the research questions outlined below explore the diverse and sometimes contradictory interpretations of green infrastructure to assess where there are parallels and differences between academic, practitioner and policy research. This chapter has already alluded to the fact that green infrastructure has been developed with a number of diverse and contrasting foci. This notion will be examined in the following chapters in order to assess:

1. What green infrastructure is proposed to mean?
2. Is green infrastructure viewed differently by different user groups, academics and landscapes practitioners?
3. Are differences found in the definitions of green infrastructure culturally generated?
4. What are the future opportunities for green infrastructure development (conceptually and in planning terms)?

The aim of these questions is to enquire as to where green infrastructure research developed from (i.e. which disciplines it originated out of)? What relevance does the concept have in conceptual terms and in practice? The purpose of these questions is to provide a discussion of the different layers of meaning or nuances that underpin green infrastructure thinking in order to explain the similarities and differences in its use. The aim here is to assess the underlying principles of green infrastructure, how they differ between different geographical and conceptual disciplines and users, and examine whether green infrastructure thinking is important in the development of multi-disciplinary research and practice. This will examine the finer level of detail between the conceptual development of green infrastructure in different locations and how these relate to the broader theories and interpretations of planning in the UK, Europe and North America. It will also provide an interesting comparison of the key drivers of the conceptual development green infrastructure, i.e. ecological in North America and holistic in the UK, to show whether links can be made between the development and use of the concept. It will also highlight whether intersections of conceptual development fit within policy debates and present opportunities for the development of a more robust evidence base of green infrastructure knowledge.

The second area of investigation reviews how individual and communal perceptions of the landscape affect how people view and interpret green infrastructure. This will explore issues of landscape perceptions, physical, psychological and social interpretations of space, and their relationship with a broader understanding of the principles of green infrastructure in order to answer the following questions:

1. How is green infrastructure being used as part of people's everyday lives?
2. What factors influence the use of green infrastructure?
3. How do these factors influence the choice and use of green infrastructure?
4. What landscape or site elements encourage people to use green infrastructure?
5. Do the reasons underlying the use of the landscape support the proposed principles of green infrastructure?

These questions assess the development of experiential perceptions to green infrastructure resources. This discussion outlines the breadth of influences that affect landscape interpretations in order to explain the most prominent factors in promoting use of the landscape.¹¹ The importance of experience in terms of landscape patronage is well researched and will be outlined in Chapter 4. These questions aim to assess the ecological, psychological, and social interpretations different groups hold when reviewing the values or use of specific green infrastructure resources. This line of questioning includes an examination of how the physical elements of the landscape and the subsequent psychological interpretations of it are developed in order to explore the complex integration of experience, knowledge and opportunities proposed in the research literature. Subsequently, this section reviews how interpretations affect engagement with green infrastructure

¹¹ Influences include: location of a site, accessibility, resource composition, the availability of different activities, and safety.

and the motivations to use a variety of spaces. By raising questions of interpretation and perception, this thesis aims to highlight how social understandings of the physical landscape affect use. These ideas can be linked with the need to develop more appropriate and focussed green infrastructure policy that focuses on developing accessible, connective and functional spaces. The discussion of green infrastructure principles and its use with policy is supported by an understanding of how people interact with the landscape, what they deem important, and how these perceptions can be translated into coherent and appropriate landscape planning practices.

The final research area examines the role of green infrastructure and *spatial planning* and outlines questions that will be debated in Chapter 8. These questions review the different management and negotiation techniques used to promote green infrastructure and ask the following:

1. Who are the actors that influence the development of green infrastructure (practitioners, academics, policy-makers, the public)?
2. Who decides whether green infrastructure is or is not developed?
3. How is green infrastructure being developed and implemented in the real world?
4. Can green infrastructure meet the broader ecological, financial and social needs of a constantly changing society?
5. At what scale are these questions being asked and addressed?

These questions focus on what is actually happening in current planning policy and practice to implement green infrastructure. Although it is not explicitly stated, the role of landscape sustainability will be emphasised in order to provide an examination of planning policy and practice relating to the creation and maintenance of green infrastructure resources. A discussion of current planning policy and green infrastructure practice will also highlight the links between the principles developed for the concept and how these are being translated into practice. Discussions with the main actors in green infrastructure use will include environmental non-governmental organisations (ENGOS), policy makers, and government officers working with the concept. Using these three sets of questions, this thesis develops a broad conceptual base for green infrastructure. Although these debates will continue to develop, the findings of this research outline the current position and possible future trends in green infrastructure theory and practice.

1.7 Thesis structure

This chapter has outlined some of the issues underpinning current green infrastructure debates. In the following chapters, these issues will be discussed in greater depth to explore the breadth of literature and research being developed with a green infrastructure focus. The following three chapters (Chapters 2, 3, and 4) review the three main areas of the thesis: *green infrastructure*, *environmental perception*, and *spatial planning*. Chapter 2 outlines and discusses the underlying principles that have aided the development of green infrastructure thinking. Chapter 3 presents a more human-centred discussion of how perceptions of the landscape develop and how different interpretations of the environment affect the ways in which people value and use spaces. This chapter proposes that interpretations of space are based on a range of influences and that green infrastructure development needs to assess the social and physical landscape if a deeper understanding of its utility to landscape

planning is to be assessed. Chapter 4 reviews the current use of green infrastructure and assesses the role of planning policy and planning practice in promoting its use. This chapter outlines a number of the key areas where planning policy needs to engage if green infrastructure is to be successfully developed.

Following these three review chapters, Chapter 5 discusses the methodology developed to investigate the research questions presented in this chapter. Chapters 6, 7, and 8 present and discuss the empirical data collected relating to *green infrastructure*, *environmental perceptions*, and *spatial planning*. The final two chapters (9 and 10) synthesise the conclusions of the three previous chapters against the broader research questions and literature. Chapter 10 provides conclusions and recommendations and assesses where there are still opportunities for further green infrastructure research.

1.8 ESRC CASE Award collaboration with the North East Community Forests (NECF)

The research undertaken for this thesis has been influenced by the research of England's Community Forests and, in particular, the North East Community Forest (NECF). As an ESRC CASE Award, this research was developed in partnership with NECF to explore the role green infrastructure can play in developing the functions of Community Forestry and promote more liveable landscapes. NECF's role in this thesis has been one of support facilitating the development of project work and examining the values of green infrastructure in relation to a number of social and landscape issues. Each of these projects has been utilised by NECF to support their green infrastructure planning programmes. Although these projects were small in nature, they provided evidence that can be discussed as being directly relevant to the overarching debates relating to green infrastructure development.

The project work undertaken in connection with NECF also provided this thesis with an insight into the values of collaborative academic and practitioner research. Although this process is secondary to the discussions of green infrastructure outlined, it has enabled a broader understanding of how research can be developed with an implementation focus at a number of scales. Secondly, the interaction between a delivery agent such as NECF and an academic institution provided this research with an opportunity to develop a different type of dialogue between two public institutions. Both of these issues have aided the development of this thesis and provided a useful arena for its discussions of green infrastructure. I feel this experience has benefited the outcome of this thesis by providing a clear implementation focus to the debates being made.

Chapter 2.0: Literature Review: Green infrastructure

The previous chapter outlined a number of areas being investigated in current green infrastructure research and discussed some of the principles attributed to the concept. The following three chapters review the literature relating to the development of green infrastructure as a concept and as a planning policy. Chapter 2 reviews the green infrastructure concept and its use as a policy method. Chapter 3 addresses the role of cultural perceptions and the subsequent use of green infrastructure resources, whilst Chapter 4 reviews green infrastructure in terms of spatial planning.

The first of these chapters, Chapter 2, discusses the foundations of the green infrastructure concept. Within this review, a discussion of its main principles (e.g. connectivity, multi-functionality and integrating networks) is made examining the roles of community forestry, green space planning, Greenways, green corridors and ecological networks in the development of green infrastructure. This chapter concludes with a presentation of the proposed benefits attributed to green infrastructure. Throughout this discussion, the Office of the Deputy Prime Minister's *Sustainable Communities* (ODPM, 2005) and the Countryside Agency and Groundwork's *Countryside in and around Towns - CIAT* (2005) agenda's is reviewed as working examples of green infrastructure planning.

Chapter 3 examines the difficulties in defining green infrastructure and the diversity in personal and communal landscape perceptions. This discusses the different cultural perceptions, the interpretation of green infrastructure and its value as a multi-functional landuse process. Chapter 4 outlines the role of the UK planning system in the development of green infrastructure and examines the regulations and policy frameworks that green infrastructure is subject to. The literature in the UK and in North American is reviewed. This discussion examines global research on green infrastructure development and provides a baseline for comparisons of UK, European and North American case studies. The second part of Chapter 4 examines the issue of scale in green space planning. This review will address the proposed meanings of scale, productions of space, and the usefulness of these debates when delivering multi-functional landscapes.

Throughout these three chapters, the literature relating to landscape ecology, landscape planning and social geography is examined to assess how green infrastructure can be discussed within an interdisciplinary context. The following section of Chapter 2 discusses the important question of what *green infrastructure* is and addresses the diverse meanings that the terms 'green' and 'infrastructure' hold within the academic and practitioner literature.

2.1 Green Infrastructure – a green or grey concept?

Although there has been a relatively rapid development in green infrastructure research, there are still questions as to what 'green infrastructure' is as a concept and as a landscape delivery mechanism. Some authors have even queried the validity of a green infrastructure approach to landscape planning as simply 'old wine in new bottles' (Davies *et al.*, 2006:6). Moreover, a number of authors debating green infrastructure have considered it as a redevelopment of existing concepts relating to green space planning (i.e. MacFarlane, Davies and Roe, 2005). However, there is an important semantic

element to this debate that questions the validity of the term 'green infrastructure' as the correct terminology for the elements it is said to represent. Both the term 'green' and 'infrastructure' have been discussed and presented elsewhere as offering a range of contrasting and sometimes contradictory meanings (CABE Space, 2005). As such, the concept is still fraught with contradictions. Examples of the disparity between the proposed definitions of green infrastructure can be seen in the research of TEP (2005:1), Benedict and McMahon (2002:12), TCPA (2004:6) and Williamson (2003:4).¹² Each of these offer a definition that emphasise a diverse range of components that constitute green infrastructure and delve into what Davies *et al.* (2006:6) call a semantic pick-and-mix of theories and terminology. Consequently, the Green Infrastructure North West website proposes that green infrastructure '...differs from conventional approaches to open space planning because it considers multiple functions and benefits of greenspace in concert with land development, growth management and built infrastructure planning' (Green Infrastructure North West, 2006, <http://www.greeninfrastructurenw.org.uk>). What is apparent is that green infrastructure is generating debate and this discussion will form a significant part of the following chapter.

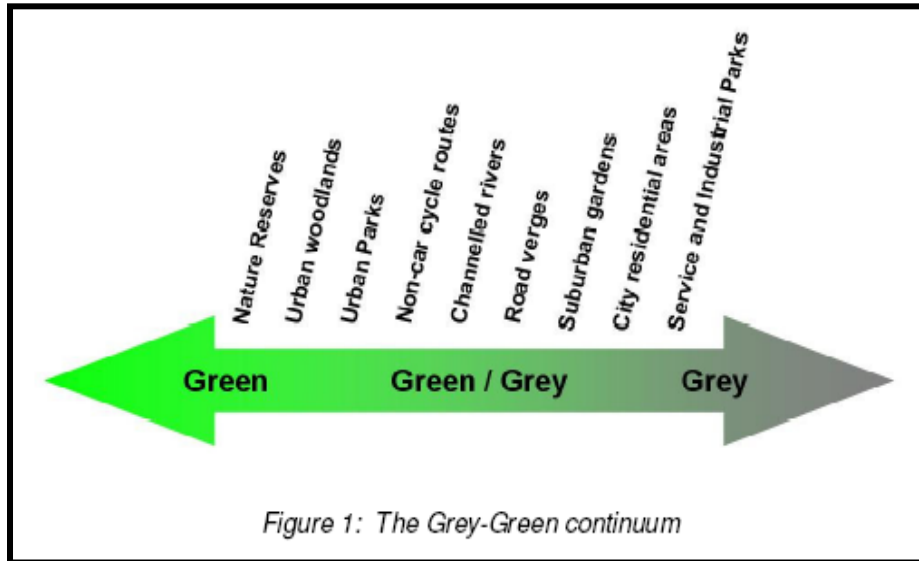
These contrasting definitions raise important questions, such as what constitutes green infrastructure and in which theoretical discipline should it be located? The term 'green' can be used to reflect the environment, environmentalism, nature or recycling, but can also be viewed as a Marxist or Feminist concept (Dobson, 1995; Benedict and McMahon, 2006; Dapolito Dunn and Stoner, 2007). 'Green' has strong connotations with the environment, but Professor Mark Shucksmith (personal communication, 29/06/2006) questioned the green *value* or emphasis of green infrastructure. In answer to Shucksmith, the work of Williamson (2003) and Ahern (2007) can be presented to support the use of the term 'green' in green infrastructure, emphasising the ecological functions associated with the concept. The work of Benedict and McMahon (2002, 2006), TEP (2005) and the Town and Country Planning Association (TCPA, 2004) could also be used as they propose an ecological viewpoint of what 'green' infrastructure presents, but note that different landscape elements at different spatial scales also constitute green infrastructure. These authors highlight that ecological elements and the role of natural resources as integral to what 'green' infrastructure is. Furthermore, ODPM (2005) noted that 'green' infrastructure can also play a role in promoting sustainability.

The UK government, therefore, use the term 'green' to link their remits for creating and maintaining sustainable landscapes with the physical environment. In contrast to Benedict and McMahon and TCPA, ODPM's use of green infrastructure is related to their specific promotion of a wider sustainability agenda and does not relate solely to ecological elements as set out by the TCPA. TEP (2005), however, go further in their use of ecological terminology by noting the value of network connectivity (both ecological and social) in their use of the term green. An example of how connectivity and sustainability can be developed is in the development of Sustainable Urban Drainage Systems (SUDS). SUDS provide spaces that physically connect ecological components and, by doing so, can create more sustainable water systems. In terms of developing 'greener' or greening infrastructure,

¹² See Table 2.1 for a discussion of these definitions.

SUDS provide an indication of how connecting different elements of the landscape promotes different ecological ideas concurrently (Cave, 2002; Ferguson, 2002; Beatley, 2000).

Figure 2.1: The Grey-Green continuum (Davies *et al.*, 2006:24)



What TEP are highlighting is the role of ecological or natural corridors as a primary element of green infrastructure. Between the work of Benedict and McMahon, ODPM, TEP and TCPA, it becomes clear that there are a number of different elements (connectivity, sustainability, ecological processes and functionality) supporting *green infrastructure* as being *green*. Davies *et al.* (2006) go further and note that the principal functions of green infrastructure should be used to define the concept. In their work, they note that the semantic nature of the term 'green' can be viewed along a Grey-Green continuum where the functions of green infrastructure cannot be rigidly defined because of its interactions with different landscapes. Figure 2.1 presents the Grey-Green continuum highlighting where different features can be placed along this moveable scale. The continuum represents a view that both grey and green are not necessarily steadfast infrastructure descriptions. Consequently, elements of the built landscape can be both grey in form (e.g.. a cycle lane) and green in function (e.g. sustainable transport network). The continuum, therefore, proposes that there is a relationship between the interpretation, function and use of a space. However, as these elements can be moved along the continuum according to how green or grey they are, the figure, like its authors, present a varied use of green infrastructure. Furthermore, the use of the term green is subjective to each user and can constitute a number of diverse meanings.

The use of the term 'infrastructure' can be discussed in a similar way to the term green. Infrastructure has also been theorised as holding contrasting definitions depending on the context of the user. In Benedict and McMahon's work (2002; 2006), they clearly state that their use of the term infrastructure is as a forceful and direct one. They note that infrastructure relates to essential ecological elements of a given landscape (e.g. biodiversity and landscape characteristics) and propose that green infrastructure is a must and not an afterthought in landscape planning. Benedict and McMahon use infrastructure to highlight their call for landscape elements to be planned with the same priority as

communications, sanitation, roads or other infrastructure (Benedict and McMahon, 2006). To Benedict and McMahon, ecological functions constitute the green (ecological), whilst the physical element itself represents the infrastructure (functionality) of the concept. Alternatively, other authors, for example Charles Little (1990), use the term infrastructure as part of the conceptual and physical network of connective green spaces. In his Greenways research, Little promotes the view that the use of the term infrastructure, like Greenways itself, is strongly linked to the proposed connective value of the spaces being debated. Other authors have supported this view including Schrijnen (2000), Ahern (1995), Botequilha Leitão and Ahern (2007) and Fábos (1995, 2004), each of whom suggests a different viewpoint but support the use of infrastructure as a metaphor for connectivity between ecological, economic, political and social networks.

Little and Benedict and McMahon all promote the connective nature of infrastructure, with Benedict and McMahon specifically referring to infrastructure in an ecological context, moving away from the semantic use of infrastructures noted by Hidding and Teunissen (2002).¹³ In their work, Hidding and Teunissen highlight how infrastructure is traditionally concerned with industrial, service and urban functions, whereas Benedict and McMahon propose a primarily ecological standpoint. Consequently, the development of green infrastructure contextualises the concept as both a physical connective space but also emphasises the ecological value of a broader green agenda. Again, the role of infrastructure can be viewed on a grey-green continuum describing how different landscape functions and environments can be viewed. The use of the term 'green infrastructure' can therefore refer to the development of sustainable networks of places (to live and work) or assess how physical and a metaphorical interpretation of infrastructure aid this process. With an examination of the research literature discussed in this thesis, green infrastructure is proposed to be the connective features (physical and metaphorical) linking different environmental elements across the rural and urban landscape, thus providing multi-functional (ecological, economic and social) benefits for diverse populations.

2.2 Definition of Green Infrastructure

There are currently as many definitions of green infrastructure as there are authors working on the concept.¹⁴ As in most academic and practitioner research, the definitions used by an organisation or an author relate directly to the focus of their own green infrastructure research. Conservationist authors (i.e. Benedict and McMahon, 2006) strongly emphasise the ecological and biodiversity components, planners may review the concept in terms of policy implementation (i.e. Ahern, 1995; Fábos, 1995), while recreational Greenways and green infrastructure specialists may focus on the benefits gained through development (i.e. CABE Space, 2005a; Kleiber, Hutchinson and Williams,

¹³ Whilst green and grey infrastructure refers to the natural or 'green' and the built environment respectively, a third category 'landscape infrastructure' has also been proposed. Landscape Infrastructure represents a convergence of the systems of public works, industrial activities, agricultural operations, waste generation and the systems of hydrological, vegetal and geological processes that underlie patterns of urban development (Centre for Landscape Research - University of Toronto: <http://www.clr.utoronto.ca/projects/landscapeinfrastructure.htm>, 02/07/2008)

¹⁴ In Chapter 1 a brief discussion of some of these definitions was made. The following section will expand and develop this discussion further to propose a working definition of green infrastructure for this thesis.

2002).¹⁵ However, although there is an almost ever-increasing diversity in the definitions developed for green infrastructure, there are common themes which underlie each of them. Below, the Countryside Agency (2006) offers a recent definition of green infrastructure in which they highlight a number of themes addressed in this chapter. The definition provides an insight into the complexity of the green infrastructure concept by noting the roles of connectivity, multi-functionality and the development of better ecological, economic and social places across a number of scales as prominent elements of the concept:

Green infrastructure comprises the provision of planned networks of linked multifunctional green spaces that contribute to protecting natural habitats and biodiversity, enable response to climate change and other biosphere changes, enable more sustainable and healthy lifestyles, enhance urban liveability and wellbeing, improve the accessibility of key recreational and green assets, support the urban and rural economy and assist in the better long-term planning and management of green spaces and corridors.

Countryside Agency (2006:1)

The broad scope offered by the Countryside Agency's¹⁶ definition may, however, be a representation of the organisation's broad remit rather than a lack of focus in their green infrastructure thinking at both a policy and a delivery level. The definition also highlights the complexity of defining what green infrastructure is. By noting the role of different ecological and social systems, the Countryside Agency promotes the view that green infrastructure can be an all-encompassing approach to planning that can be used by a diverse range of practitioners. A further comparison of the complex nature of the green infrastructure concept can be made by examining a selection of other definitions (see Table 2.1). These definitions were taken from a range of documents debating green infrastructure as both a *concept* and as a *delivery mechanism*. However, this diversity may prove problematic as it potentially lowers the likelihood of different users using such a range of ideas in their own research. A narrower or more focussed outline of what constitutes green infrastructure may, in the long term, increase its acceptance and be used as an adaptive landscape management process. This debate will be examined further in Chapter 6.

Table 2.1 Green infrastructure definitions and principles

<p>Green Infrastructure: the physical environment within and between cities, towns and villages. The network of open spaces, waterways, gardens, woodlands, green corridors, street trees and open countryside that brings many social, economic and environmental benefits to local people and communities.</p> <p style="text-align: right;">TEP (2005:1)</p>	<p>Green Infrastructure: the physical environment within and between cities, towns and villages. The network of open spaces, waterways, gardens, woodlands, green corridors, street trees and open countryside that brings many social, economic and environmental benefits to local people and communities.</p> <p style="text-align: right;">TEP (2005:1)</p>
<p>Green Infrastructure is a sub-regional network of protected sites, nature reserves, green spaces and greenway linkages. Green Infrastructure should provide for multi-functional use...it should operate at all spatial scales from urban centres through to open countryside.</p>	<p>Green Infrastructure is a sub-regional network of protected sites, nature reserves, green spaces and greenway linkages. Green Infrastructure should provide for multi-functional use...it should operate at all spatial scales from urban centres through to open countryside.</p>

¹⁵ Additional areas that green infrastructure may attribute benefits to include education (Fjørtoft & Sageie, 2000) and health (Mell, 2007a).

¹⁶ In 2007, the Countryside Agency, English Nature and the Rural Development Service merged to form Natural England.

TCPA (2004:6)	TCPA (2004:6)
<p>Green Infrastructure is an interconnected network of green spaces that conserves natural ecosystems values and functions and provides associated benefits to human populations. Green Infrastructure is the ecological framework needed for environmental, social and economic sustainability. Benedict and McMahon (2002:12)</p> <p>Our nations natural life support system - an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains sir and water resources and contributes to the health and quality of life for America's communities and people Williamson (2003:4)</p>	<p>Green Infrastructure is an interconnected network of green spaces that conserves natural ecosystems values and functions and provides associated benefits to human populations. Green Infrastructure is the ecological framework needed for environmental, social and economic sustainability. Benedict and McMahon (2002:12)</p> <p>Our nation's natural life support system - an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains sir and water resources and contributes to the health and quality of life for America's communities and people. Williamson (2003:4)</p>

From the definitions presented above, the following elements are seen as being frequently reported as constituting green infrastructure: *access, spatial variance, multi-functionality, natural and human benefits, biodiversity, sustainability and connectivity*. Each of the four definitions above notes that green infrastructure is, or should be, part of a wider ecological network linking different ecological features. These features range from the specific landscape elements noted by TEP and the TCPA to more general uses of the term 'green spaces' as noted by Benedict and McMahon and Williamson. Therefore, it can be suggested that one idea consistently found in definitions of green infrastructure is the role of connectivity and the development or maintenance of wider green infrastructure networks. Secondly, each of the four definitions specifically mentions the wide-ranging benefits green infrastructure hold. Benedict and McMahon note the benefits humans can gain from green infrastructure, whilst TEP present three proposed spheres of benefits, namely social, economic and environmental. TEP thus note that green infrastructure should not be thought about as providing benefits for only one sphere of influence but for a number concurrently.

Plate 2.1 Properties of Green Infrastructure

Connectivity



Multi-Functionality



Integrating user groups



In the wider debates relating to green infrastructure, this point may be central in promoting the concept as a practical approach for delivering multiple and diverse benefits. The proposed benefits noted by TEP show similarities with the sustainability agenda of ODPM highlighting the need to discuss economic development, social justice and environmental protection in a collective context with green

infrastructure (TEP, 2005; Campbell, 1996; ODPM, 2003). The role of multiple benefits is further highlighted by the role sustainability plays in the definitions of TCPA and Williamson. Both note that the uses of landscape designation or protected landscape status are important components of green infrastructure, placing the broader targets of conservation policy at the centre of the concept. Benedict and McMahon go further than TCPA and state that green infrastructure should provide a high level of environmental, social and economic sustainability. The role of sustainability in defining green infrastructure has also been noted by ODPM, who stated that functional green infrastructure is needed to create a positive sense of place, provide environmental protection and enhance the quality of life for those who live and work there (ODPM, 2005).

ODPM, therefore, propose that they believe green infrastructure has a role to play in developing sustainable places by outlining the need to develop quality landscapes and protect human and ecological components of the natural and built environment. The need to develop better places to live through the creation of multi-functional and connected environments has also been noted in the work of Davies *et al.* (2006). In their research, multi-functionality is viewed as a process of delivering multiple benefits on the same site, aiding social inclusion, health, education and improving a sense of place.

Table 2.2 Actor interpretations of what constitute principles of green infrastructure

	Benedict and McMahon (2002, 2006)	Countryside Agency (2006)	Countryside Agency and Groundwork (2005)	Davies <i>et al.</i> (2006)	Gallent <i>et al.</i> (2004)	Gobster and Westphal (2004)	Lindsey <i>et al.</i> (2001)	ODPM (2003)	TCPA (2004)	TEP (2005)	Weber, Sloan, and Wolf (2006)	Williamson (2003)
Accessibility			X		X	X						
Concept and a resource	X	X		X								
Connectivity and networks		X						X	X			X
Integration of different cross-boundary ideas (people places and policy)		X						X	X	X		
Multi-functionality	X	X	X	X		X		X	X	X		
Multiple benefits	X	X					X	X	X	X		
Planning	X	X	X	X				X	X	X	X	
Scale		X								X		
Sustainability	X	X						X				X

The discussion of several different definitions of green infrastructure above highlights that the concept holds a panoply of meanings. However, as noted previously in this chapter, there are a number of principles that underpin the concept. Firstly, green infrastructure provide connectivity between different places (Williamson, 2003; Weber, Sloan and Wolf, 2006; TEP, 2005; Benedict and McMahon, 2002); secondly, they provide multiple benefits for a number of diverse user groups (Lindsey *et al.*, 2001; ODPM, 2005; Gobster and Westphal, 2004); thirdly, green infrastructure have the potential to act as natural resources, whether a sink or reservoir, for large-scale environmental systems; and, fourthly,

green infrastructure should be used to develop interconnected networks of accessible and functional open spaces (Gallent *et al.*, 2004; Hidding and Teunissen, 2002).

Each of the areas noted above in Table 2.2 are proposed as being central to the construction of green infrastructure as a practical delivery mechanism and support the development of a new working definition of green infrastructure that will be used throughout this thesis. The definition draws on the discussions presented in this chapter and proposes that:

Green infrastructure is the resilient landscapes that support ecological, economic and human interests by maintaining the integrity of, and promoting landscape connectivity, whilst enhancing the quality of life, place and the environment across different landscape boundaries¹⁷

This definition will be referred to throughout this thesis to examine whether the proposed definitions and principles of green infrastructure researchers and practitioner use similar or contrasting ideas to support their use of the concept. The value of this definition is, therefore, one of comparison. However, the foundations and historical underpinnings of green infrastructure are also important in assessing how these principles have been developed. In the following section, the historical development of green infrastructure thinking and planning will be made to assess how and why specific landscape planning practices or theories have been attributed to the green infrastructure concept.

2.3. Green Infrastructure typologies

Within discussions of any green space planning practice, an examination must be made of how the spaces are composed. Davies *et al.* (2006) developed a typology that they felt could constitute green infrastructure (see: Chapter 5, www.greeninfrastructure.eu, 01/03/2008). This typology, developed using stakeholder participation, outlined that green infrastructure is made up from a number of diverse landscape features and components¹⁸ and presented a number of classifications proposed to hold a 'green' value. The Davies *et al.* typology system mirrors work developed by Ahern in his classifications of Greenways. Ahern based his typology classifications on issues of *scale, goals, landscape context* and *planning strategy* rather than on elements or issues discussed in reference to the development of the green infrastructure concept (Ahern, 1995).

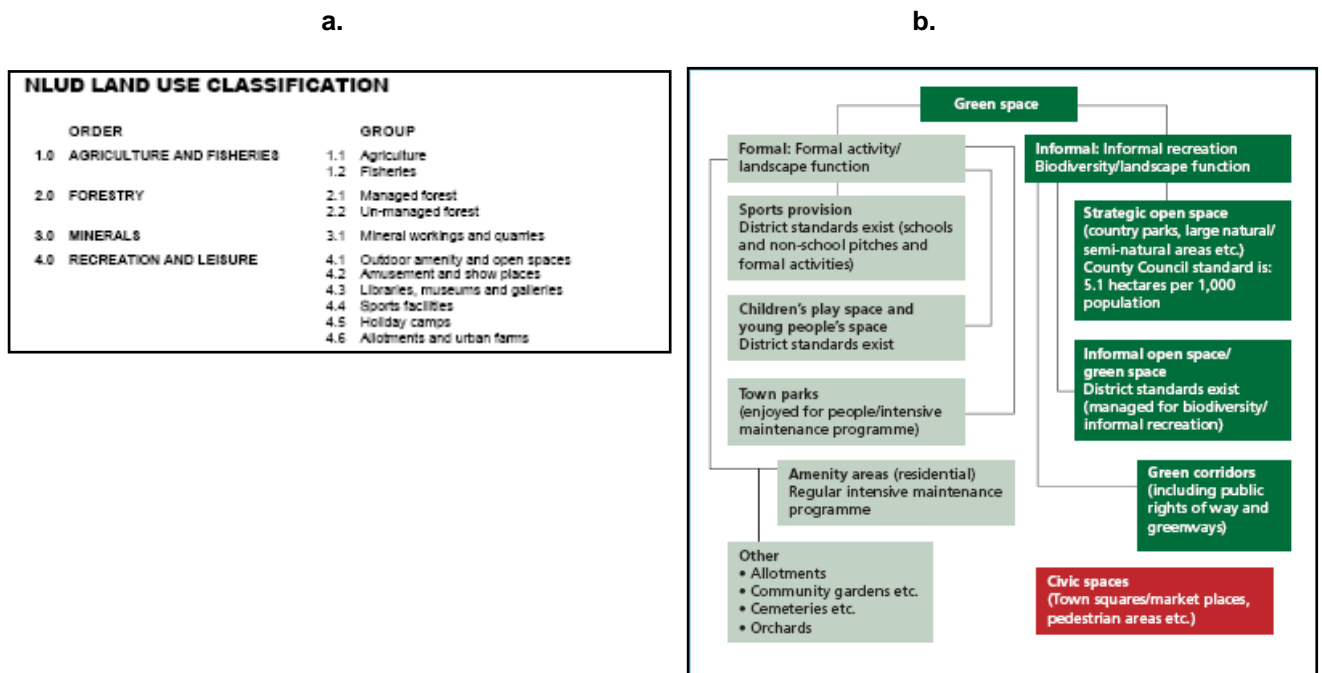
Using Ahern's typology to assess green infrastructure provides an opportunity to explore the difficulties in categorising green spaces. Different landscape elements, for example a cemetery, may be managed to provide a site for reflection and spiritual respite but could be located in an ecologically important landscape. It may, therefore, be imperative in the development of green infrastructure to acknowledge the variance in land use and actual land classifications. The Royal Commission for Environmental Pollution (RCEP) have also attempted to develop a typology for green infrastructure

¹⁷ This definition will be used as a basis for the discussions presented in Chapter 6 to test whether the characteristics or principles are reported by practitioners and academics in a supporting manner.

¹⁸ The stakeholder sessions included members of environment non-governmental organisations and green infrastructure planners amongst its participants. Within the sessions, each participant was to define what elements green infrastructure composed. From these responses the typologies were developed.

(RCEP, 2007). The RCEP outlined the categories *formal*, *informal*, *green space corridors*, *strategic green spaces*, *sports grounds* and *public private spaces* as their broad classifications of what constitutes green infrastructure. When compared to the stakeholder analysis of Davies *et al.*, this system compares favourably. It also highlights similarities to the use of the National Land Use Database (NLUD) classifications system (see Figure 2.2: www.nlud.org.uk, 01/12/2007). These classifications can be assessed alongside Ahern’s typologies of landscape context and scale as the differences in size and function of each element allows it to be classified according to a number of conceptual ideas into specific classifications. Consequently, the classifications of specific elements (developed through context, scale and goals) provide a framework through which green infrastructure elements can be defined.

Figure 2.2 NLUD (a) and RCPE (b) land use and green space classifications
(www.nlud.org.uk, accessed 01/12/2007)



It is, however, important to state that, without a clear idea of what green infrastructure is made up of, it is difficult to debate the different semantic and disciplinary values of the concept. A green infrastructure typology therefore needs to be discussed in conjunction with the literature, assessing both its conceptual basis and its value to landscape management practices. Furthermore, the complex, ecological, political and social influences of its development can also be reviewed. An assessment of this kind therefore allows an examination of the underlying principles (e.g. connectivity, multi-functionality, and access) to be reviewed.

To return to Ahern, his work outlined three key areas in classifying greenways, namely scale, spatial context and landscape functionality, each of which can also be viewed as being central to green infrastructure debates. In his work, Ahern discussed Greenways against these criteria, assessing their value and examining the proposed wider ecological benefits. By reviewing green infrastructure in respect to Ahern’s typologies, the current research on the subject appears to fall into similar

categories. The work of Benedict and McMahon (2006), TEP (2005) and the TCPA (2004) propose a functionality-based typology, whereas the current RSS in England discuss the development of green infrastructure in a spatially distributed context. It can, therefore, be suggested that although discreet categorisations of green infrastructure can be made there are also a number of overlapping elements (i.e. Davies *et al.*, 2006; MacFarlane and Roe, 2004). This view is developed further by Kambites and Owen (2007), who note that the integration of political, social and environmental policy with green infrastructure planning is essential to its success. Consequently, where Ahern's Greenway classifications are discussed against scale, spatial context and landscape functionality criterion, this thesis will propose a refined typology for green infrastructure. The typology proposed will outline how green infrastructure fits with the following areas: form, function and context, and can be broken down into ecological, economic and social criteria reviewing the value of specific landscape or green infrastructure elements (see Table 2.3).

The proposed typology shows similarities to Ahern's discussions of landscape functionality and the role a space plays in people's lives. The role of form is used in both typologies, relating to the physical characteristics of a space and the resources that can be found there. Where the typologies differ is in the use of context as a classification. For green infrastructure, the context relates to the complex ecological, economic and social influences of a space and the broader role of cultural influences on the landscapes. This concept allows green infrastructure to be viewed as a holistic process that can be discussed at different spatial levels simultaneously as it relates to both individual and the wider landscape.

Finally, Ahern also noted that green infrastructure is currently at a point in its development where its future success lies with its supporters. Ahern suggests that, as the world is in a state of constant change, the big opportunity is due to the necessary re-construction of existing infrastructure and the possibility to build infrastructure in a 'green' way (Ahern, 2007 personal communications; Nelson, 2004). Ahern himself updated his research on Greenways and applied a similar typology to that proposed for green infrastructure.

Table 2.3 Proposed typology classifications

Typology classification	Element or function
FORM	<i>Ecological</i> (physical space, connectivity, elements) <i>Economic</i> (costs of a space, design) <i>Social and cultural norms</i> (users of a space, aesthetics of a space, motivations)
FUNCTION	<i>Ecological</i> (biodiversity, conservation) <i>Economic</i> (industry, business, regeneration) <i>Social</i> (education, recreation, health)
CONTEXT	<i>Ecological</i> (biodiversity, supporting networks, ecological mobility) <i>Economic</i> (costs of a space, economic development, sustainability) <i>Social and cultural norms</i> (location, facilitations, motivations, perceptions)

The role of green infrastructure as a diverse set of landscape elements thus provides it with an inherent ability to adapt to a wide range of research and planning scenarios. The level of adaptability

also enables the concept to be discussed by a range of users who can incorporate elements of the concept into their own work. Consequently, a range of landscape elements can be considered green infrastructure due to the diversity in form, function and location, plus it can also be viewed as multi-faceted or scaled.

2.4. The historical development of green infrastructure

The previous sections of this chapter reviewed a number of definitions and typologies of green infrastructure. In the following section, the historical processes that have aided the development of the concept are presented. This section looks at the development of the urban green space literature in both the UK and North America to contextualise the work of Olmsted, Howard and the Greenways' movement. This section is followed by a debate on the growth of Community Forestry, Sustainable Communities and the CIAT agendas. The aim of the following section is to highlight how the development of green infrastructure in the UK has been influenced by these programmes and compares the focus of this research alongside the broader aims of green infrastructure planning.

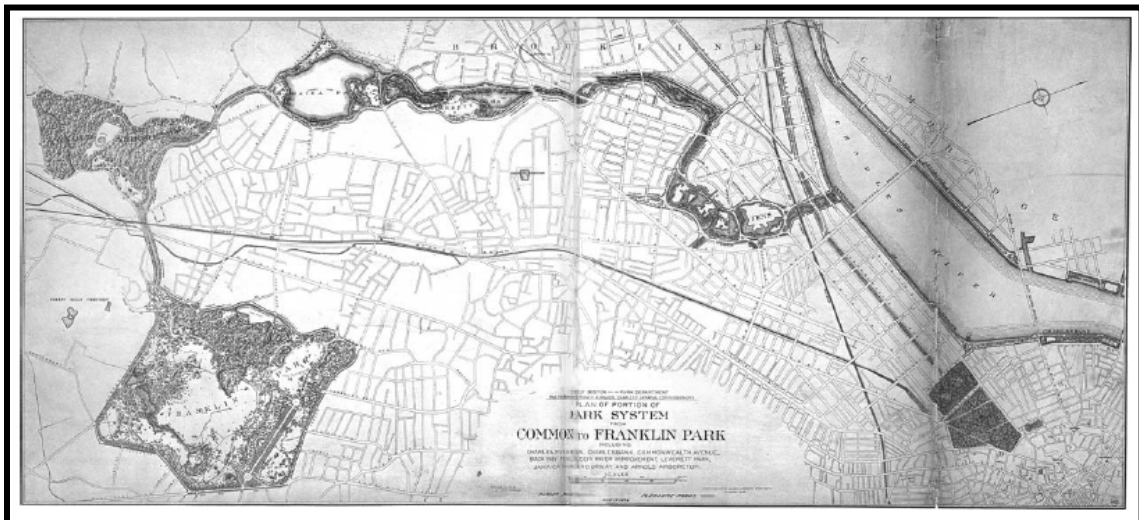
2.4.1 Urban Parks, Frederick Law Olmsted and Garden Cities

Urban parks in North America are often perceived as having come to prominence in the mid to late 1800s through the work of Frederick Law Olmsted and his landmark projects in New York and Boston. Within his work, Olmsted envisaged networks of green spaces that provided opportunities to connect people from all socio-economic backgrounds across whole urban landscapes. Olmsted achieved this by developing multi-functional landmark projects that motivated these same people to congregate and patronise these spaces (Little, 1990). It has been suggested that Olmsted's work is integral to the progress made in designing and managing green spaces, as he was one of the first landscape architects to develop green spaces with such a unique level of thought and imagination. Olmsted thus aimed to provide access through efficient and cleverly designed spaces that offered refuge from the rigours of city or industrial life (Hiss, 1991). He accomplished this in New York and Brooklyn in the large signature spaces of Central Park (1858) and Prospect Park (1868), which worked as focal points for people. Whereas, in Boston, his 'Emerald Necklace' (1878-1880) has been noted as one of the first planned green networks offering widespread accessibility, flood mitigation and multiple functions (Figure 2.3).

Moreover, Olmsted is seen as a pioneer of urban green space management with his visions being utilised by his sons, Frederick Jr and John Charles, and Henry Wright who became renowned for developing metropolitan scale landmark projects. Wright himself was also one of the first practitioners to hold community participation sessions during the scoping stage of his work and was one of the first planners to fully appreciate the role of local participation in planning. Wright believed that development, which would provide the facilities that people needed, would be seen as increasingly valued spaces and promoted a more sustainable level of patronage. Wright and the Olmsted brothers are also credited with leading the call for developing projects that crossed both physical and administrative boundaries by promoting the idea of multi-organisation partnerships developing multi-purpose environments (Fábos, 2004).

Just as Olmsted and his successors worked to develop green networks across rapidly urbanising North American cities, Fábos (2004) has suggested that the growth of Greenways followed a similar trajectory. Greenways was initially developed in the 1960-70s as a way of preserving the ecological resources of a landscape and highlighted the conservation role of riparian and ecological corridors. Unfortunately for ecologists, over time the ecological focus diversified to incorporate recreational and leisure functions and, in the 1980s, the main focus of Greenways became the connection of people with spaces to recreate. However, Fábos highlighted the role Greenways played in linking diverse demographic groups across urban landscapes as an approach to mitigate the problems of social exclusion and fragmentation (Fábos, 2004). Although Fábos may be seen as a modern interpreter of Olmsted's work, he and other Greenway theorists and planners (e.g. Little, 1990) appear to support the mandate of the US President's Commission on American Outdoor Recreation (1987), who stated that Greenways were a vital component linking American landscapes across the urban-rural divide. Olmsted's work can therefore be used to support a theory which manifests itself within the work of Fábos, whereby Greenway developments are a method of creating circulatory systems of green spaces that work in and across urban landscapes, connecting people and places (Fábos, 2004).

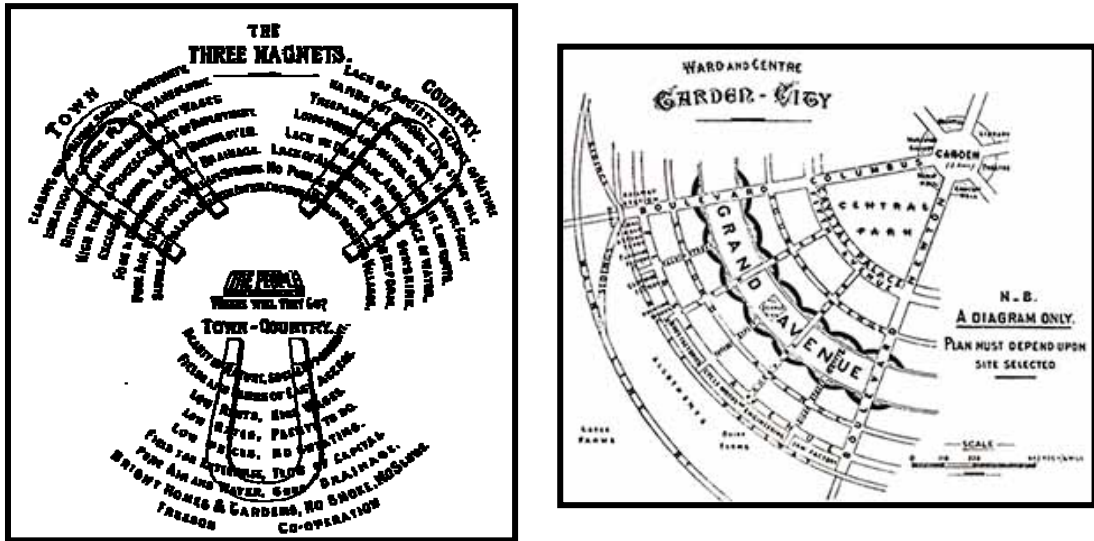
Figure 2.3. Olmsted's Emerald Necklace system, Boston, Massachusetts (Fábos, 2004:323)



More recently, the role of Greenways has been discussed in conjunction with the rise of the green infrastructure agenda. Benedict and McMahon (Conservation Fund, USA) have been at the forefront of this debate, stating that green infrastructure has restated the ecological focus that Greenways previously held (2002, 2006). Fábos, however, challenges this idea by writing that contemporary Greenway planning is based on the integration of ecological, heritage and recreational values. Fábos states that, whilst Greenways have developed with a number of overarching principles, green infrastructure is still primarily associated with ecological functions in the USA. He does, however, agree with Benedict and McMahon (2006) and Williamson (2003) that the fundamental issue of connecting people with green spaces is vital if Greenways are to be successful. Consequently, Fábos suggests that Greenways should be designed as multi-functional spaces if they are to fulfil their mandate of delivering both human and ecological benefits (Fábos, 2004).

Whilst Olmsted was developing landmark projects in the United States in the mid to late 1800s, Ebenezer Howard was conducting similar work in the UK. Howard's work, like Olmsted's, was considered radical for its time as he proposed designing and building connected polycentric networks of small (maximum population 32,000) urban spaces (Howard, 1985). Working in an era when industrial production dominated the UK landscape, Howard's work proposed the introduction of extensive networks of green spaces to counter the effects of pollution and industrial growth. Through this system of green infrastructure development, Howard hoped to control and slow urban expansion and avoid the urban coalescence seen across contemporary Britain. Howard's plans for each Garden City (e.g. Letchworth) were designed to incorporate a sustainable transport system, housing, green infrastructure, accessible employment and other services. These designs aimed to deliver a large proportion of green spaces located in close proximity to housing and employment to encourage their use in everyday life (Howard, 1985). Howard's vision echoed the work of Olmsted, who stated that he wanted '...a ground to which people may easily go after their day's work is done' (Olmsted quoted in Hiss, 1991:44). Howard's Three Magnets diagram (Figure 2.4) presents a visual representation of the vision for Garden Cities. This figure highlights the positive and negative attributes of urban and rural life, promoting the view that, by developing the two simultaneously in Garden Cities, the positives would outweigh the negatives (Howard, 1988). Howard thus aimed to incorporate the functional elements of both the urban and rural landscapes into his designs to aid the development of more favourable living conditions.

Figure 2.4. Howard's Three Magnets Diagram and Garden Cities (Beavers, 1985:60; 51)



Although Howard's work has subsequently been criticised as not relating to the changes in class structures, transport, employment, housing, and planning practices in the UK, the principle of developing urban greenspace networks is still a viable one (Sarkissen, 1976; Cervero, 1995). English Heritage, as one of the UK's leading public green space managers, promotes this agenda in its conservation of Howard's work in London, whilst CABI Space have suggested that urban green infrastructure can, and has, aided social cohesion, health and well-being. CABI Space's work can therefore be viewed as promoting green infrastructure as a provider of diverse benefits in urban and

urban-fringe landscapes (2005a, 2005c). Green infrastructure may, therefore, be viewed as returning green space planning to what Mike Davis calls the 'Olmstedian values' of innovation and connectivity (Davis, 2006:273).

2.4.2. Greenways and Green Infrastructure

The legacy of Olmsted and his successors has led Fábos (1995) and Gobster and Westphal (2004:162-163) to state that there have been three distinct stages in the development of green spaces in North America. Olmsted and his colleagues are seen to represent the first period, *boulevards and parkways*. The second era was dominated by the development of *trail-orientated recreational Greenways*, connecting urbanised North America with wilderness and outdoor lifestyles. The current era uses the influences of its predecessors to develop Greenway networks that are *multi-functional*. Each of these categories offers an insight into how the planning focus of specific eras differs. In the work of Olmsted the development of ornate and landmark projects linking green space and urban areas were deemed prestigious.¹⁹

More recently, Little's work states that Greenways can and do take many forms and noted that diversity is one of their main strengths. In his work, Little presented five Greenway categories: *urban-riparian corridors, recreational greenways, ecological corridors, scenic and historic routes* and *comprehensive networks*, each of which could be found in a variety of landscapes across North America. Fábos and Ryan (2004) synthesised these categories into a list of Greenway functions, suggesting that they are, firstly, ecologically significant corridors and natural systems, secondly recreational routes and networks of (linear and static) features and, finally, that they should provide heritage and cultural links. These functions have been widely discussed (e.g. von Haaren and Reich, 2006) but appear to combine the diverse foci of research examining Greenway planning and interpretation. The typology proposed by Fábos and Ryan also compares to the research work of Ahern, whose classifications for Greenways outlined how form, spatial context and multi-functionality categorised Greenway development (Ahern, 1995).

Benedict and McMahon (2002) have also been prominent authors who have discussed the ecological functions of Greenways. Their work presents the argument that the main function of a Greenway is to conserve the ecological resources found along it, an idea similar in theory to their understanding of green infrastructure. However, although their work has been supported by von Haaren and Reich (2006), the majority of the Greenway literature emphasises the economic and recreational value of them. Moreover, Fábos (2004) suggests that the development of green spaces in North America is subject to intense debates relating both to the economic and ecological value of land. However, Benedict and McMahon (2006) wrote that they had updated their thinking, stating that the emphasis for Greenway development should be a combination of recreational and ecological functions. This shift proposes the idea outlined by Lindsey (1999), the Countryside Commission (1998) and Bischoff (1995) in that Greenways must be multi-functional in order to fulfil a broad range of social and political remits. Benedict and McMahon's reappraisal also suggests that the influences of economic and social

¹⁹ Although in contrast the original development of the Emerald Necklace was to provide a mitigation system for the annual Charles River flooding in Central Boston.

ideas are beginning to permeate the research of authors who previously viewed Greenways solely in terms of their ecological value.

The difference in focus suggested above has also been reported by Bryant (2006), who emphasises the ecological role of Greenways in the conservation of urban green spaces. However, like Benedict and McMahon, Bryant acknowledges that the development of Greenways is now heavily dependent on fulfilling different agendas such as regeneration and liveability. Nicholls and Crompton (2005) present an insightful analysis of this process by stating that the development of recent Greenway projects appears to have evolved to cope with the changing social and economic climate of North America. The ability of Greenway projects to meet a number of social and ecological challenges suggests that their focus has diversified from being simply recreational routes to multi-scaled, trans-boundary spaces that promote economic development, social inclusion and recreation (Lindsey, 1999; Luymes and Tamminga, 1995). In doing so, Greenways have achieved their objectives (e.g. multi-functionality) whilst servicing disparate populations, who have the time, means and knowledge of what recreational amenities are available. The functions of connecting places through linear corridors are fundamental in Greenway development, but also provide opportunities to unify disparate parts of expanding metropolitan regions. These benefits indicate why Luymes and Tamminga (1995:391) and Little (1990) suggest the greenway movement in North America is burgeoning.

As suggested previously, Greenway developments are an approach to landscape planning that offers a diverse range of functions for its users. Greenways are, as Walmsley notes, a '...device for stitching together fragmenting cities and their urbanizing hinterlands...' (1995:81) but also has the purpose of delivering multi-functional benefits. Lindsey (1999) notes that Greenway trails should offer a range of opportunities for different user groups. The Countryside Commission (1997) notes the recreational benefits Greenways provide, whilst Annalise Bischoff (1995) suggests that Greenways aid health and well-being agendas. Although each of these areas provides valuable benefits for users, the role of Greenways and connectivity continues to appear as a prominent feature. Hobden, Laughton and Morgan (2004) reviewed the role Greenways play in aiding regeneration and proposed that there is a potential paradox in the movement of people from the suburbs to live nearer to nature. They suggest that the rate of urban sprawl contradicts the move towards nature, but propose that Greenway developments attempt to create or install nature alongside expansion.

Nicholls and Crompton (2005) present similar findings, suggesting that Greenways have the potential to demonstrate potential benefits for ecological development which, in terms of land use planning, is vital. They also note that 'from a perspective of urban planning, such amenities [as Greenways] should, therefore, be recognised as valuable components of well-designed urban areas' (2005:340). Establishing Greenways may therefore be classed as an appropriate planning approach where social values can be discussed in direct relation to the economic development of landscape planning practices. Ryan, Fábos and Allan (2006) support this, stating that Greenways in North America, like green infrastructure in the UK, can be used as a process for delivering multi-scale projects that provide benefits at different scales. The role of co-operative planning is again suggested by Platt (2000) who, like Bischoff (1995) and Hobden, Laughton and Morgan (2004), notes that Greenways

can attract development funds whilst providing economic benefits by connecting different spaces with various users and opportunities.

Greenways also show similarities to the historical planning of compact European cities such as Amsterdam, Helsinki, and Copenhagen (see Fig. 2.4 and 2.9). In each of these cities, green wedges (e.g. Helsinki) or green finger projects (e.g. Copenhagen) have been created developing the urban fabric in conjunction with areas of high quality accessible green space (Beatley, 2000). Each city has also used a green infrastructure network to promote a number of the ideals promoted by Greenway planners, e.g. social inclusion, recreation, economic regeneration (Barton, 2000). Green wedges and fingers, therefore, allow planners and decision-makers to develop urban areas whilst retaining a visible proportion of functional green space. Thus, by developing spaces that link different parts of the urban and urban-fringe, the green wedges or fingers approach seen in Helsinki have enabled a more efficient flow of people but have also enabled the city's managers to coordinate transport, waste management, and pollution management strategies (Beatley, 2000).

The rise of the North American Greenway research shows similarities to the state of the UK and European green infrastructure research. Both concepts have been reviewed as offering a plethora of benefits and have been promoted as economically viable approaches to planning. However, Greenway planning in North America has a history of research since the 1950s and is now discussed as an essential component of the North American planning system (Fábos, 2004). Compared to this situation, green infrastructure research is still in its infancy. Nonetheless, as Benedict and McMahon (2006) and Bryant (2006) suggest, the focus of Greenway planning attitudes may change to incorporate innovative and forward-looking planning methods.

2.4.3. Green Infrastructure development in the UK, Europe and North America

The development of green infrastructure has varied in its focus in the UK, Europe and North America. This diversity has been described as being heavily dependent on the main planning issues in each of these geographical regions. The UK has seen green infrastructure develop through the ideas of Garden Cities and the protected designations of green spaces (Howard, 1985). The principles of Howard's Garden Cities have more recently been developed into national agendas, e.g. Urban Renaissance and in growth areas such as the Thames Gateway (ODPM, 2005). Howard's vision for creating spaces that promote a better standard of living involved integrating a larger proportion of attractive and functional space into urban areas, bringing nature closer to the city (Cervero, 1995). In Europe, the development of green infrastructure has been linked with the development of the urban greening agenda and the need to develop integrated green space effectively within high density landscapes (Beatley, 2000; 2009).

In contrast to the UK and Europe, North American green infrastructure development has its foundations in landscape conservation (Benedict and McMahon, 2006). The differences between these three systems thus falls predominately on the proposed holistic planning role green infrastructure is attributed with in Europe and the UK. Compared to this European system, the North American development of green infrastructure has historically emphasised the ecological before social

and economic benefits. This is now being rectified as the Conservation Fund and the EPA have begun to note the broader social values of the concept. The broad forms that UK, European and North American green infrastructure research takes has also been linked with a number of planning initiatives and agendas, including the Urban Renaissance, Smart Growth, Community Forestry and the Sustainable Communities agenda, each of which has utilised the proposed principles of green infrastructure to develop more functional landscapes that promote ecological, economic and social development.

2.4.4. Sustainable Communities

Sustainable communities are places where people want to live and work, now and in the future.

<http://communities.gov.uk/index.asp?id=1139866> (28/06/2006)

The migration of people towards urban areas in the United Kingdom, like many other urbanised nations has placed increasing pressures on the development of the landscape (Hidding and Teunissen, 2002; Burdett and Sudjic, 2008). The pressure being witnessed in urban centres is also now being felt at the urban-fringe, where sprawl and the development of polycentric networks of residential and industrial land has lowered the availability of land for development (Sir Peter Hall, 07/04/2006; Davis, 2006). The rate of global urban sprawl has been compounded by developments in transport and communication infrastructures that have allowed people to commute over greater distances. In turn, this has led to a greater demand for housing, transport, communication developments and other essential services. Thus, the cycle of increased development and demand has placed increased pressures upon green and brownfield sites to serve the changing nature of the population (Peet and Watts, 1996; Barnes, 2005).

The continued growth of urban areas has led ODPM (2003) and DTLR (2002) to suggest that the nation's population is now 80-90% urban based. This figure was reported by ODPM (2003) as placing disproportional pressures onto both service and green infrastructure in areas of growth, i.e. in South-East England, and has moved traditional urban-rural problems into the urban-fringe (Countryside Agency, 2006). Migration into urban centres to access employment, education, housing, and health care has long been associated with economic growth and has been seen in the UK since the Industrial Revolution (ODPM, 2003; Dennis, Henriques and Slaughter, 1969). However, there has been a counter movement of people away from urban centres to escape the pollution, population densities and stresses of urban life (Fábos, 2004). Migratory trends, firstly towards and subsequently away from urban centres, has raised questions concerning the quality and fragmentation of urban and urban-fringe landscapes (Hidding and Teunissen, 2002; ODPM, 2003). As a positive move in attempting to ameliorate these problems, a growing research literature reviewing sustainable communities has developed. This literature reviews how migration into and away from urban cores has affected both the physical and social landscape of the UK (Milbourne, 2004; Power and Wilson, 2000). Moreover, this research has investigated those factors that influence community development in order to make sustainable places. In response to this research, ODPM has championed research and policy aimed

at creating better places to live, work and recreate, culminating in the Sustainable Communities Plan (ODPM, 2003).²⁰

Sustainable Communities, although a relatively new term in the UK, is not a new idea in North America where Smart Growth has been extensively promoted. The Smart Growth agenda proposes reinvestment in existing landscapes to develop more efficient mixed-use communities as the main element of developing sustainable places. In a UK context, the Sustainable Communities remit includes the development of communities around integrated housing, commercial and essential infrastructure serving a variety of different income groups (Geller, 2003). In Figures 2.5 and 2.6, the main elements of both agendas can be seen. This figure shows that the integration of community, economic and environmental agendas can promote liveability, environmental equity and sustainable development (Shafter *et al.*, 2000). Consequently, Sustainable Communities, like sustainable development, are being proposed as an amalgamation of a number of complex relationships between multi-scale actors and influences.

Figure 2.5. Components of what makes a quality of place system (based on Shafter *et al.*, 2000)

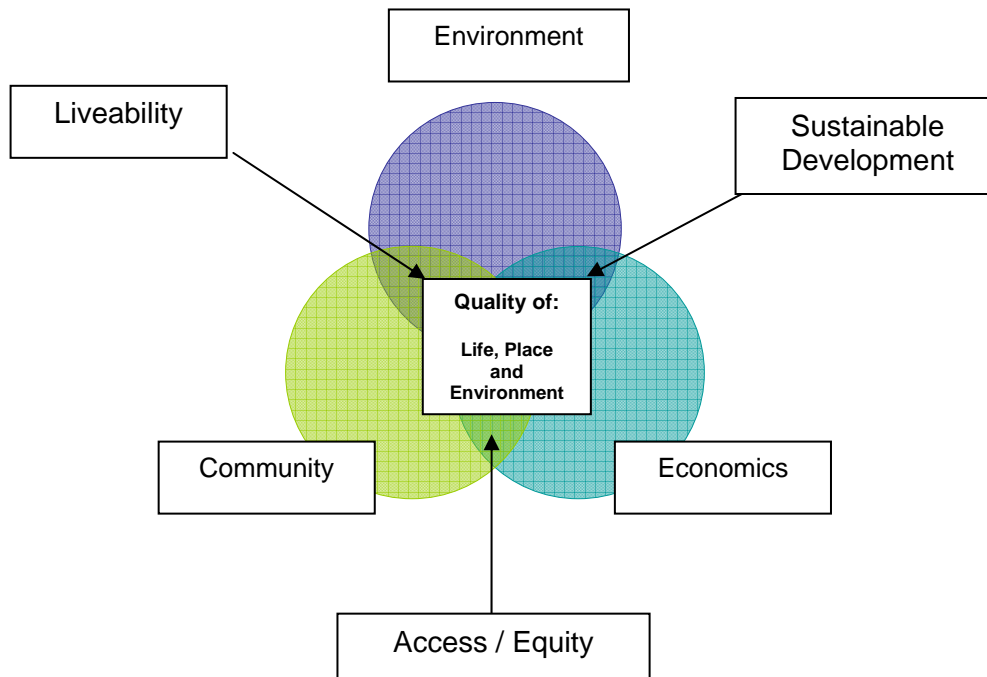
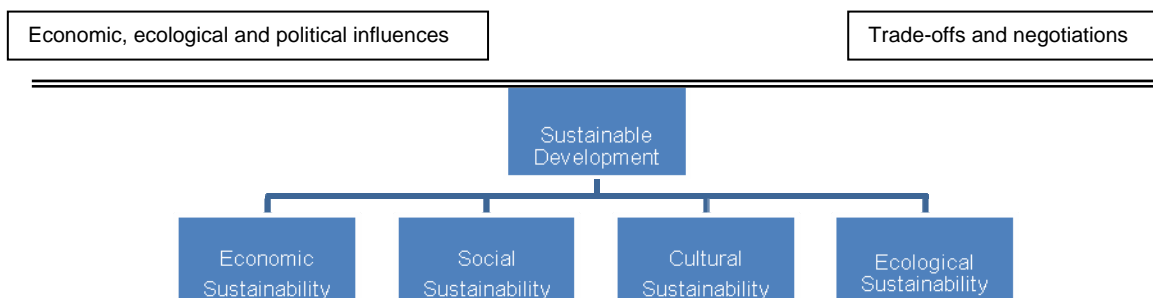


Figure 2.6. Elements of Sustainable Development: Adapted from Rannikko (1999)



²⁰ ODPM's remit has also included funding the creation of the Commission for the Built Environment (CABE) and their subsequent green space department CABE Space to examine the role the built environment can play in developing Sustainable Communities.

Leonard Duhl (2005) suggested that to successfully develop the Sustainable Communities concept planners should follow the same trajectory used in the healthy cities agenda.²¹ Duhl notes that the idea of connecting mixed-use landscape features and services is the most effective practice of sustaining the social and economic health of an area. Duhl thus re-articulates the foundations of Smart Growth in promoting a greater level of controlled diversity as a method for developing sustainable places. Barton (2005) also supports this view stating that, before development can be agreed, a review of what communities need must be made to assess how best to sustain a community in the long-term. ODPM's work on Sustainable Communities could therefore be viewed as Minton (2002) suggests, as providing a policy framework through which ODPM objectives can be achieved.

The Sustainable Communities Plan was initially drafted as a review to address low housing demand in the North of England and the Midlands, affordable housing shortages in the South-East, and as a call to improve the quality of public spaces. Within its remit, the plan set out its objectives to achieve better places by developing a policy framework creating communities and not just houses (ODPM, 2005:5). The Sustainable Communities Plan has consequently moved away from more traditional development objectives by acknowledging that the needs of communities and the environment are of the same importance as economic influences (Countryside Agency, 2006). The integration of economic, environmental and social influences highlight the integrated or collective role each of these three factors play in developing social equity, sustainability and liveable places. Kitchen, Marsden and Milbourne (2006) present a similar theory, describing how urban forests have used these three factors to examine the policy negotiations that are undertaken in developing better places to live. Shafer *et al.* and Kitchen, Marsden and Milbourne suggest the need for co-ordinated planning if regeneration and the development of desirable places is to be achieved. ODPM have also outlined a process to achieve this, as follows:

- Balance and integrate the social, economic and environmental components of their community.
- Meet the needs of existing and future generations.
- Respect the need of other communities in the wider region or internationally also to make the communities sustainable.

Source: Department of Communities and Local Government (2008)
<http://www.odpm.gov.uk/index.asp?id=1139866>

There are lessons to be learnt from the development of the Sustainable Communities Plans. Within the policy framework for sustainable community development, ODPM suggest a number of key areas that apply to both the physical and social landscapes. Their aim to integrate perceived qualities of life, place and environment into the development policy has led to a call for a greater understanding of the influences under which communities develop (Sibley, 1995). This view can also be used in the development of green infrastructure as the interactions between economic, environmental and social spheres need to be fully understood in order to create productive spaces (ODPM, 2003; England's Community Forests, 2004). The Sustainable Communities Plan was developed in part with a purpose

²¹ Healthy cities are proposed as places that are walkable, accessible, support local social and economic structures, support local production and consumption and provide alternatives to private car use.

of fulfilling the recommendations of the Urban White Paper (DETR, 2000) and to rejuvenate failing urban areas. Consequently, the principles of sustainable development and the needs and desires of communities must be reviewed to carry out this mandate. These influences can be seen in Figure 2.6 and highlight a number of different areas that need to be reviewed if a community is to develop sustainably. However, although the Urban White Paper and the subsequent Sustainable Communities Plan focussed heavily on the needs of urban populations, England's Community Forests Programme in contrast has spent almost twenty years delivering regeneration objectives in urban and urban-fringe areas.

Table 2.4. Principles of Community Forestry and Green Infrastructure

Principle	Community Forestry	Green Infrastructure
Promote access	✓	✓
Promote multi-functionality	✓	✓
Promotes connectivity	✓	✓
Strategically developed	✓	✓
Resource base	Expands and develops new forest resources	Develops the overall green infrastructure resource base
Public participation	Promotes public participation in management and site use	X
Scale	Developed as a sub-regional, metropolitan and local scale	Developed at all scales
Promote economic regeneration	✓	✓
Promote social inclusion and development	✓	✓
Keys into ideas of sustainable development	✓	✓
Long-term or short-term landscape management	Aim is long-term regeneration of the landscape	Both, short-term in developing or retrofitting spaces with more GI and long-term to meet challenges of changing climate and human needs

2.4.5. Urban Forests and Community Forests

Urban greenspaces and urban forests have a long history of development and shared principles in Europe, however the concept of urban forestry can be traced to North America in the later 1800s (Konijnendijk, 2006, see Table 2.4). Since then, urban foresters, city arborists, and municipal foresters have managed expanses of urban forests, but it was only in the early 1900s that legislation was developed to authorise centralised funding. In North America, urban forests are seen as the art and science of managing trees in and around urban centres for the social, economic and aesthetic benefits of local populations (Miller, 1997). Unfortunately, due to a lack of a clear definition for urban forestry, the concept was slow to be accepted by traditional foresters (Konijnendijk, 2006). More recently, in North America the concept of urban forestry has been linked with the development of Greenways and has aimed to integrate professional forestry techniques with the sustainability agenda.

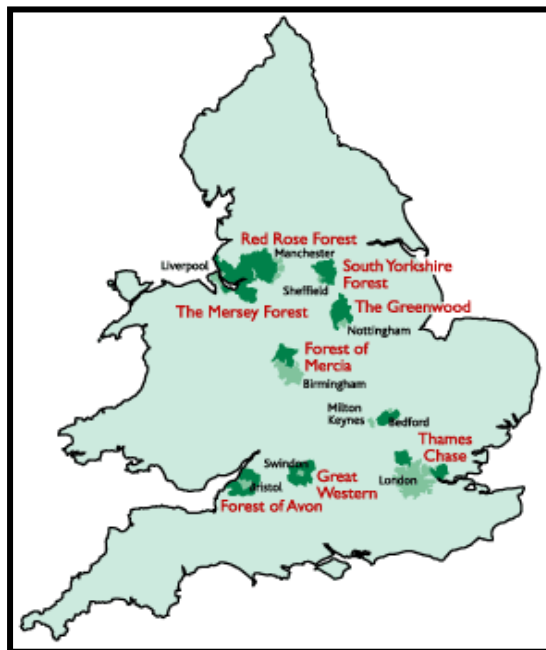
In Europe, the role of urban forestry has been viewed primarily in relation to increased urbanisation and industrialisation. As a planning approach, urban forests have been used to promote ecological conservation whilst providing social and economic benefits to local populations (Konijnendijk *et al.*, 2006). This role has been discussed in the context of England's Community Forest programme, where the social value and the broader concepts of forestry have been integrated to support regeneration, social and economic growth and aid liveability (Davies and Vaughan, 1998). Each of England's Local Forest Partnerships were also developed in close physical proximity to large urban areas in England

(See Map 2.1). Developed with a remit of demonstrating the role urban-fringe forestry holds in meeting regeneration targets, building sustainable communities and creating better places to live, community forestry has attempted to deliver this mandate through innovative environmental management (Kitchen, Marsden and Milbourne, 2006).

England's Community Forests were developed in an era of landscape dereliction in a post-productive England and are located close to centres of high urbanity. Approximately 26.4 million people live within twenty kilometres of a community forest, which cover approximately 452,649 hectares in total (Konijnendijk, 2003). The relevance of these locations is vital to an understanding of the programme as these areas '...represent an attempt to bring back nature to spaces where the environment has been exploited and damaged by extensive [industry]...' (Kitchen, Marsden and Milbourne, 2006:835). However, they note that through community forest projects there has been a shift in emphasis towards a collaborative process linking economic, ecological and social elements in decision making and planning. They go further and note that England's Community Forests play a central part in developing a 'more palatable, ecological healthy, though still commodified, nature' (Kitchen, Marsden and Milbourne, 2006:824).

Map 2.1. England's Community Forests

(<http://www.communityforest.org.uk/yourlocalforest.htm>, accessed 01/01/2008)



The role of reducing landscape dereliction outlined by Kitchen, Marsden and Millbourne has also been discussed by Hidding and Teunissen (2002) and Konijnendijk *et al.* (2006). Hidding and Teunissen discuss the role community forests have in connecting ecological habitats and human populations, but also in connecting spaces across administrative boundaries. They examine how community forests are a form of ecological and social network that enables people to move through previously inaccessible landscapes for multiple purposes. Hidding and Teunissen thus state that, by linking grey and green infrastructure and providing connective landscape elements, community forestry can lower physical landscape fragmentation. Konijnendijk (2006) also discussed this concept stating that, in the

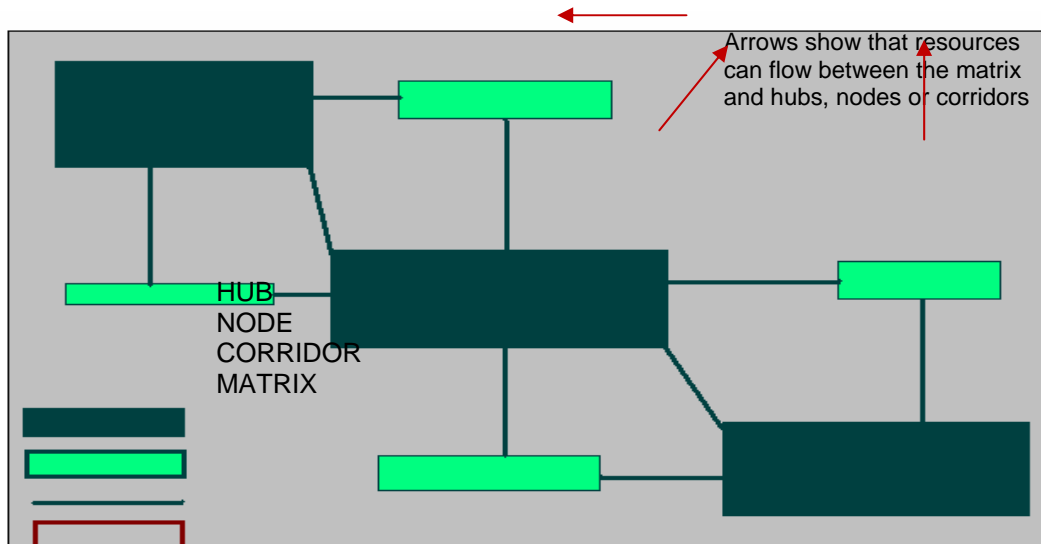
era of landscape decline, transient urban-fringe locations have become increasingly important to the long-term sustainability of communities and landscapes. The urban-fringe location of England's Community Forests, therefore, allows each forest partnership to work with multiple partners to discuss development issues to create better places to live. Konijnendijk *et al.* (2006), however, note that the shift in emphasis towards the urban-fringe is not without criticism, having occurred following many years of urban or rural-centred forest policies. This shift in focus may therefore be viewed as a move towards redressing the inequality of urban-fringe policy focus and acknowledging the long-term role Community Forests have for landscape management (Gunderson *et al.*, 2006).

2.5 The principles of green infrastructure

2.5.1 Ecological networks and green infrastructure

Ecological networks are those elements within the landscape that have the functional role of connecting different ecological features to form wider networks (Liu and Taylor, 2002). Although every environment functions differently, there are overarching themes that link ecological networks and the benefits they hold for green infrastructure thinking. One of the core principles of ecological networks is the formation of connective networks that allow migration and movement (ecological, economic or social) by connecting a number of supporting systems within a polycentric matrix (Farina, 1998). Thus, in a comparable way to how grey infrastructure have been used to link people, places and the environment, ecological networks can be used to links different ecological elements. Within the literature reviewing ecological networks, a series of benefits examining this process has been discussed aiding the sustainable development of landscape resources. These include the provision of opportunities for ecological and human mobility, species diversification, maintaining or increasing biodiversity, and the ability to aid the stabilisation of ecological systems by making additional resources available (Forman, 1995; Liu and Taylor, 2002). Each of these factors is assisting what Jongman and Pungetti (2004:4) call an ecological support system within human orientated landscapes. The literature also proposes a number of ideas that support the green infrastructure concept and include how networks can reduce landscape fragmentation by connecting smaller networks, aiding the connective nature of larger networks, e.g. Patch-Corridor Matrixes (Forman, 1995).

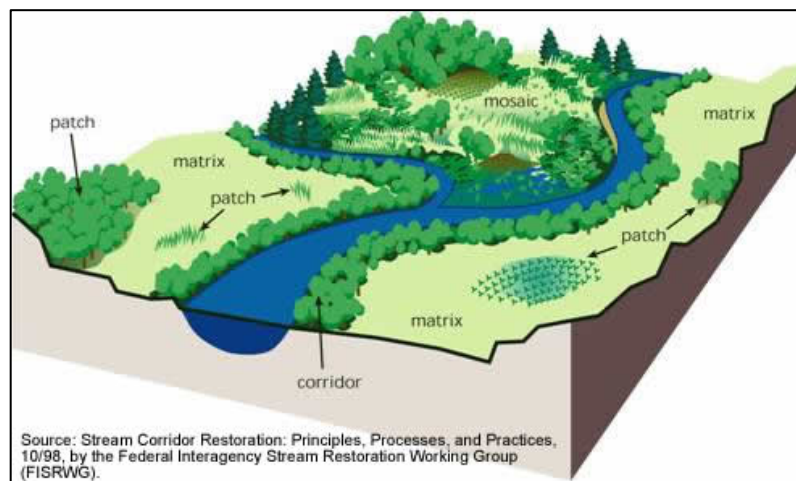
Figure 2.7. Patch-Corridor Matrix (Adapted from Dramstad, Olson & Forman, 1996)



2.5.2 Fragmentation²²

Landscape fragmentation and isolation has been discussed within landscape ecology as one of the main principles supporting network theory (Forman, 1995). Both Forman and Almo Farina (1998) have discussed how landscape fragmentation is a continual phenomenon in the relationship between ecological and human influences. This is a dynamic relationship, especially since humans started to develop wider tracts of land for industry, commerce and housing. With the process of land development ecological patches have become increasingly fragmented, which has resulted in the development of fragile (or balanced), isolated and homogenous elements (Peters *et al.*, 2006; Dramstad, Olson and Forman, 1996). Consequently, each landscape element in a fragmented system becomes progressively more isolated as it develops independently of other systems. Laurence and Laurence (1999), however, suggest that the creation of network systems is a process that can reduce the fragmentation of a landscape and reduce the stresses of development by allowing alternative capitals to be brought into a system. The roles of isolation and homogeneity are also noted by Peltonen and Hanski (1991) as holding both a positive and negative effects on ecological networks. They highlight how isolation enables stable and secure populations to emerge that may be threatened by higher order species if linked to wider networks. Beier and Noss (1998) also suggest a theory questioning the beneficial role of larger network systems as a positive factor for smaller populations. Alternatively, Cook (2002) and Henein and Merriam (1990) presented the positive role that connecting landscape fragments have for ecological and human populations.

Figure 2.8. Stream Corridor Restoration: Principles, Processes, and Practices. Federal Interagency Stream Restoration Working Group (FISRWG) (1998) ²³



The role of connecting landscape elements has also been derived from the theory of Island Biogeography (MacArthur and Wilson, 1967). Island Biogeography states that within a given landscape there is a causal relationship between the current species or biodiversity level and that of

²² Fragmentation is used here to highlight that patches can be valuable as singular elements but have a higher cumulative value within a matrix that promotes connectivity and transferences.

²³ Federal Interagency Stream Restoration Working Group (FISRWG) (1998) Stream Corridor Restoration: Principles, Processes, and Practices. (http://aq.arizona.edu/watershedsteward/resources/module/Biotic/biotic_pg1.htm, accessed 15/04/2009)

colonising species. This theory proposes that colonisation and extinction are fundamental components of isolated systems that can lead to a state of equilibrium between ecological resources and the population residing there. In terms of landscape fragmentation, Island Biogeography reviews isolation as the main conceptual idea supporting the processes of a given space. However, Huggett (1995) questioned whether true island isolation is possible with the progressive integration of patches following the development of new landscape networks. Island Biogeography, therefore, outlines the relationship between the landscape and its supported populations within a proposed isolated state. However, as Huggett states, whether it is possible to truly describe a space as isolated from the surrounding systems is contested, as it is difficult to be spatially isolated because of the numerous ways in which energies, capitals and populations can move across landscape boundaries. Landscape isolation and fragmentation are therefore important principles of a systems approach to landscape connectivity.

Figure 2.9. Landscape Connections in the Copenhagen and the Copenhagen Finger Plan
(Source: Den Grønne Sti – author; STORKØBENHAVEN – Beatley, 2000)



The role fragmentation has played in the development of landscape ecology and ecological networks can be shown through the Patch-Corridor Matrix Model described by Forman (1995). In this system, (see Figure 2.7 and Figure 2.8) a number of links, hubs and nodes combine to support the ecological populations of a system. The matrix itself is the wider location or landscape in which hubs, nodes and corridors are found that provides further resources that can be used in other hubs or corridors. Cook (2002) suggests that this enables a wider range of benefits to be developed within a given system. The system is simple in terms of its use of natural landscape features, e.g. woodland or fields (nodes) and uses features such as riparian corridors (links) to connect them. Moreover, ecological networks aid the assimilation of smaller systems with larger systems. The Patch-Corridor Matrix Model therefore stresses the importance of natural processes in developing the spatial configuration of the landscape. The maintenance of this system is crucial if the ecological integrity of the landscape is to be

preserved. Anna Stranton supports this view, highlighting that 'each element can itself be a system; and each system can be an element in a larger system' (Stranton, 2006:404). Fragmentation is therefore an important issue in ecological networks debates and, through the development of networks, landscape isolation can be lowered and larger systems can be connected. Green infrastructure may also have a role to play in this debate due to its ability to take many different shapes, sizes and forms. These infrastructures may therefore fulfil the numerous roles of hubs or corridors (Benedict and McMahon, 2006).

2.5.3. Mobility

Almo Farina states that the 'spatial arrangement of patches, their different quality, the juxtaposition and the proportion of different habitat types are elements that influence and modify the behaviour of species, populations and communities' (Farina, 1998:12). Farina notes that within discussions of ecological networks there is a fundamental relationship between ecological networks and human populations which impact directly on each other. Farina also discusses the role mobility holds in discussions of ecological networks. If linking fragmented landscapes is one element, then a second is the ability of both ecological and human populations to move freely through these systems. Peltonen and Hanski (1991) also add that, although some authors (e.g. Cook, 2002) may question the sustainability behind increased access, they believe that larger networks offer potentially larger benefits because of the spatial diversity of accessible landscape features that offer more choice (Figure 2.9).

Botequilha Leitão and Ahern (2002) present similar findings, noting that environmental sustainability relies heavily on the relationships between landscape elements, biodiversity and human interactions. Therefore, the development of networks within a landscape provides a greater number of potential areas for inputs that allow capital to flow freely between them. Thus the role of movement for ecological (E) and social (S) capitals is heavily linked to the physical availability of links and their social use.²⁴ Laurence and Laurence (1999) use this theory to assess the movement of arboreal animals, stating that allowing different species to colonise and migrate may actually lower environmental stresses. Although their work offers a very specific ecological example, it highlights how colonisation and dispersal can potentially provide additional resources to mitigate against the stresses of development or environmental change.

2.5.4. Landscape Connections

The third proposed principle of ecological networks is the role of connecting landscapes. Although this area was addressed in the assessments of lowering fragmentation and mobility, landscape connectivity is seen as a vital element of network theory (Laurence and Laurence, 1999). Henein and Merriam (1999) support this view, stating that landscape connectivity is integral to effectively allowing populations to disperse. Jongman, Kulvik and Bristiansen (2004) have also suggested that one of the

²⁴ The role of ecological (E) and social (S) capitals is strongly emphasised in relation to green infrastructure research. These two capitals have been viewed in conjunction with (P - Political) capitals to allow researchers to develop the ideas of Political Ecology in relation to green infrastructure (i.e. Kiel, 2003; Forsyth, 2003; Jahn, 1996).

main functions of a landscape is connectivity and connectedness. However, Beier and Noss (1998) present a note of caution by questioning whether the modifications made by humans to the environment generate further benefits or whether they actually hinder the process of connectivity. Herein lies a fundamental issue within green infrastructure: should ecological processes be viewed as independent ecological systems, or is green infrastructure a confluence of human behaviour working with or using ecological networks?

Forman and Gordon (1986) state that there should be an ecological emphasis placed upon connectivity. However, Benedict and McMahon (2006) have suggested that human influences are now crucial in these interpretations. Landscape connectivity in terms of the work of Benedict and McMahon therefore implies connecting both ecological and human populations across different boundaries. To focus this argument within a planning context, Botequilha Leitão and Ahern (2002) note that connectivity is fundamental to the spatial concepts that support land-use planning and conservation agendas (2002:72). The integration of ecological networks, human influences and spatial distribution developed in landscape ecology has, therefore, also become a key element in the development of green infrastructure.

Overall, ecological networks can be said to support ecological, social, recreational and economic activities by connecting different landscape elements and providing access to a wider network of resources (Jongman, Kulvik and Bristiansen, 2004). Through a process of connecting different landscape features, a number of diverse landscapes can be linked allowing mobility and the transfer of capitals to a wider range of users. This, in turn, can lower the possibility of isolation and extinctions by allowing ecological colonisation and diversity that support the sustainable growth of a system (Peltonen and Hanski, 1991). Ecological networks must also be seen to work at both an ecological level and as part of the wider ecological-human system of negotiations, modifications and uses (Peters *et al.*, 2006). If this is achieved, then ecological networks can be viewed as a prime example of green infrastructure offering multiple benefits at a number of levels.

2.5.5. Biodiversity

Biological diversity is also an important element of the discussions of ecological networks and green infrastructure. Within the research literature, especially that produced in North America, biodiversity is at the centre of green infrastructure thinking (Benedict and McMahon, 2002; Williamson, 2003). In terms of biodiversity green infrastructure provides the resources and the networks (i.e. the corridors or matrix) that promote the process of connectivity and mobility. A number of authors (i.e. Weber *et al.*, 2005) have also suggested that ecological resources or the levels of biodiversity are the baseline components that need to be maintained and enhanced in a green infrastructure approach to planning.

2.6. Green infrastructure: connecting people and the landscape

A second principle of green infrastructure is connectivity and the ability to link different groups of people across different physical and metaphorical boundaries. In the discussions already presented, physical connectivity was highlighted by a number of authors (Benedict and McMahon, 2002; TEP, 2005; TCPA, 2004; Williamson, 2003) as a central principle of green infrastructure. ODPM (2003) also

noted the metaphorical role green infrastructure plays in connecting people and places. Connectivity thus builds on the discussion of networks but describes more than creating connected networks. Connectivity within green infrastructure relates to the connection of ecological, economic and social influences at a number of contrasting scales. In theory, green infrastructure is a mechanism that can address contrasting and sometimes contradictory agendas by linking each to the wider issues relating to that area. At a practical delivery, level green infrastructure uses its role as a connector of people and places to develop functional spaces that span pre-existing boundaries (Konijnendijk, 2003).

The connective role of green infrastructure can thus be discussed in two ways. Firstly, green infrastructure offers a practical method of physically connecting people with different landscapes whilst, secondly, providing a forum for cross-boundary and multi-organisation collaborative planning (Kambites and Owen, 2007).²⁵ Both ideas present a view promoted by Castells (1995) in that modern societies are being transformed into network societies that link cultural, economic and social structures at a personal and a landscape level. Networks therefore provide niche areas for the movement of capitals they need to develop but can also provide regional, national or global arenas for these networks to function. The development of an integrated systems approach to capital flow states that a process of movement is fundamental to the maintenance of ecological, economic and social systems. This process is viewed by many as being multi-scaled and can aid system developments at a local, regional or national level (Selman, 2000; Benedict and McMahon, 2006). This view is promoted by Countryside Agency and Groundwork (2005) who state: 'The countryside in and around town represents part of the spectrum from the heart of the city to the depths of the countryside...' (Countryside Agency and Groundwork, 2005:3).

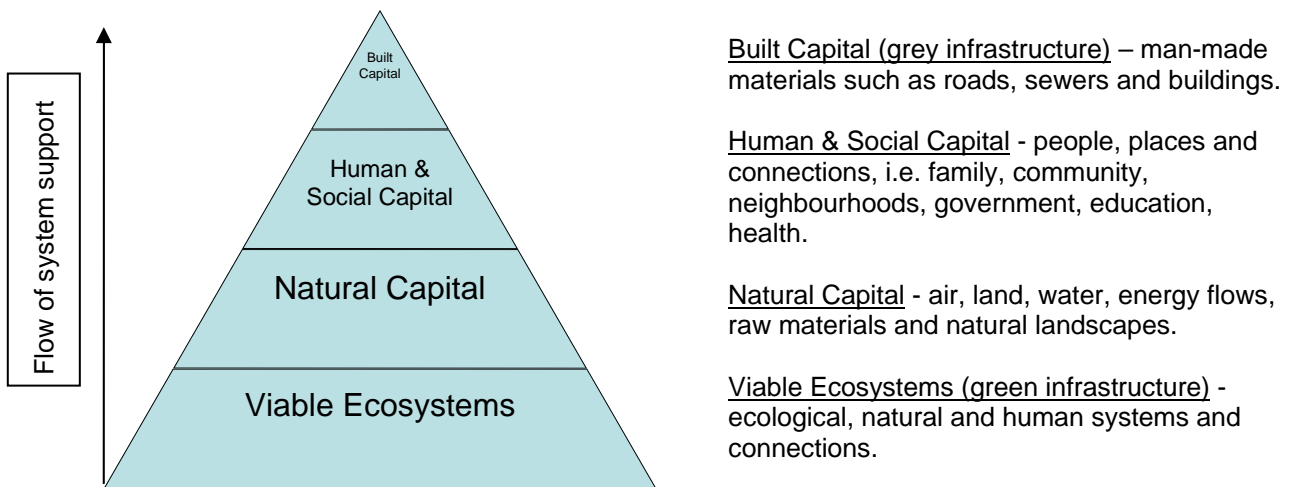
The above quote in the *Countryside in and around Towns* document sets out in a descriptive manner the diversity of landscapes in the UK and how issues of connectivity and landscape scale can be viewed. The UK has a wealth of urban, urban-fringe and rural landscapes, each of which are being continually modified in an attempt to develop better places for people to live (ODPM, 2003; Peters *et al.*, 2006). Coupled with this idea, the Department for the Environment, Food and Rural Affairs (Defra) and the Department of Communities and Local Government (<http://communities.gov.uk/index.asp?docid=1161236>, 28/06/2006) have commented that continued internal migration in the UK is leading to increased urbanisation and there appears to be a definite need to re-connect people with the landscapes they reside within. Herein lies another of the proposed strengths of green infrastructure as an enabler of people to locate, use, and move through accessible multi-functional landscapes (Blackman, 2008).

The fragmentation of landscapes discussed previously highlighted that green infrastructure could be used to lower this problem. However, the change seen in urban landscapes following industrial decline has had the effect of developing exclusionary spaces. In terms of green infrastructure, the opening up of enclosed spaces provides a proportionally larger area for people to utilise for work and life.

²⁵ The value of collaborative planning at a number of scales will be discussed in later chapters as being a central tenet of a green infrastructure approach to landscape planning. This process has also been discussed extensively in terms of community forestry and issue of scale, hierarchal attribution of value and a holistic bottom-up approach to planning.

However, due to their green rather than grey composition, they are not imbued with the same level of social meaning of exclusion or isolation. Minton (2002) describes this as a method of reconnecting people with the landscape through innovative design by developing mixed-use spaces that service entire populations. Escobedo *et al.* (2006) developed this theme by discussing how connecting people with green infrastructure can also promote economic regeneration and social cohesion, a view which has also been debated extensively by CAFE Space (2005a), the Social Exclusion Unit (2004), Luymes and Tanninga (1995) and Schönfelder and Axhausen (2003).

Figure 2.10. Support systems for Natural, Human and Built Capital (adapted from Williamson, 2003)



The connective role of green infrastructure focuses on connecting people, and places are subject to external (i.e. societal) pressures. As Escobedo *et al.* (2006) note, green infrastructure can help reduce these negative influences but they must be examined in relation to the overarching forces affecting a place. As such, issues of crime, education, social status, employment and wealth must also be debated if the dislocation of people with the landscapes that surround them is to be rectified (Sibley, 1995; Burgess *et al.*, 1988; Gilroy, 1987). However, green infrastructure can be described as connecting different organisations and people by providing landscape features that need to be managed collectively. Green infrastructure as a landscape management approach can therefore take many forms. One example, linear features, were discussed in the previous section and are found across different physical (landscape) and social (administrative) boundaries. Consequently, these features must also be managed collectively. Konijnendijk (2003) supports this view, highlighting the role multi-functional planning has in providing wide-ranging benefits but also connecting different landscape features. Davies *et al.* (2006) also present this view by discussing the role green infrastructure can play in breaking down political boundaries in the landscape

Underlying the role of green infrastructure as a way of connecting the landscape with ecological, economic and social processes, Williamson (2003) presents a review supporting how the natural and the built environment are connected through green infrastructure. Williamson's pyramid (Figure 2.10) visualises a support system that uses viable ecosystems as the foundation for natural, human and

built environments. The pyramid moves upwards towards the built environment where there is least (ecological) capital support. From a green infrastructure perspective, this diagram suggests that there is a role green infrastructure that can fulfil at each level within this system.

In Williamson's diagram, green infrastructure can be classed as a resource (viable ecosystems), a function (natural capital), loaded with interpretations and values (human and social capitals) or a provider of development opportunities (built capital). When reviewed against the principles of sustainable development, Williamson is noting that green infrastructure provides an ecological, political and social basis for development and needs to be valued accordingly.²⁶ This view can be further compared with the principle of connectivity by stating that, without the basic resource of viable ecosystems, then development would not be a feasible option. Consequently, there is an intrinsic (linear) connectivity between each of the levels in this figure

2.7. The role of multi-functionality in the development of green infrastructure

In the previous two sections, ecological networks and connectivity were discussed as two of the main conceptual ideas underpinning green infrastructure. This third section reviews the role of multi-functionality as a key idea in developing green infrastructure. Multi-functionality has been used most frequently in terms of green infrastructure as a way of ensuring that landscapes create a better quality of life, place and environment. This has been, to some extent, achieved through a process of integration and interacting within current governance and planning structures (Selman, 2002). The interaction of practitioners, planners and decision-makers has led to a number of areas being highlighted in the discussions concerning multi-functionality. These issues include the integration of different development agendas with planning policy frameworks; the need to understand landscape diversification when dealing with the development of multi-functional spaces; and an awareness of the ecological, economic, and social influences that promote multi-functionality (Kambites and Owen, 2007). An acknowledgment that multi-functional spaces may also lead to access to multiple economic, ecological and social benefits also needs to be made (Blackman and Thackray, 2007). Planners and policy-makers may also need to discuss the role multi-functionality can play in promoting cultural and economic links between people and the landscape.

The need to develop landscapes that provide functions for a number of demographic groups has been promoted widely. Through the development of Greenways, urban forestry, and urban greening, multi-functionality has become broadly accepted as one of the main tenets of green infrastructure planning (Little, 1990; Ahern, 1995; Beatley, 2000; Konijnendijk, 2003). Each of these authors suggests that the ability of a multi-functionality approach to landscape planning to be integrative at a number of different scales enables the delivery of what Konijnendijk *et al.* suggests are *green elements* fulfilling the many functions of physical infrastructures (2006:99). Matthews and Selman (2006) also theorise on the benefits of multi-functionality, stating that it has aided the move away from single use spaces in order to provide a broader range of benefits for a wider target population.

²⁶ This relates to the integration of ecological, economic and social practices that utilise resources within their capacity in order to lower unsustainable practices.

2.7.1. Integration and interactions of planning policy and agendas

Selman has been one of the most prominent authors researching the value of multi-functionality in the UK. In his work (Selman, 2002; Matthews and Selman, 2006), he has suggested that the integration of diverse agendas debating multi-functionality have aided a better understanding of the delivery of complex landscape systems. Matthews and Selman (2006) continue, stating in support of de Groot (2006) that, to achieve multi-functionality, you need a full understanding and acknowledgement of the cultural, ecological and economic influences impacting on a landscape. Selman (2002) himself highlights this process as a major step towards integrating planning policy with the visions of funding, delivery and landscape management. The work of the Countryside Agency (2006) and England's Community Forests (2004) have also discussed this view noting that, through the integration and co-operation of different organisations, their main agenda of promoting sustainable development can be achieved.

In terms of the Countryside Agency, this includes their promotion of the multi-functionality of the urban-fringe (Countryside Agency and Groundwork, 2005). Concurrently, England's Community Forests examined the role of multi-functionality in promoting regeneration, economic growth and developing better places to live. Both are good examples of public sector organisations that work with numerous partners and have been able to promote multi-functionality through integrated partnership projects. However, de Groot (2006) suggests that multi-functionality may not prove to be a universal objective for all landscapes. de Groot questions the validity of multi-functionality in areas where single use spaces are potentially more beneficial in ecological or social terms. Moreover, he continues by looking at the role that policy integration has on the process of design and delivery, noting that these areas are equally important, if not more important in producing viable spaces than pure multi-functionality. However, de Groot argues that if a collaborative and integrated approach can be used to deliver multi-functional spaces, then he and Konijnendijk (2003) both see this process as a platform for integrating spaces and people at a number of landscape scales.

2.7.2. Diversification

The role of integrating different policy agendas holds a critical role in discussions of multi-functionality. However, several authors have noted the role diversification plays in developing landscapes as a practical way of managing change in the environment (Countryside Agency, 2003). Davies and Scurlock (2004), for example, suggest that perceptions of the landscape and their subsequent use are influenced by the changes seen in cultural, ecological and economic influences. They see multi-functionality as a method of mitigating these changes by providing additional opportunities for landscape use. Matthews and Selman (2006) also suggest that the flexible nature of multi-functional planning allows a physical landscape to develop its ecological, economic and social capitals and consequently raise its capacity to cope with change. Selman (2002) supports this view, presenting the idea that an understanding of the ecological, economic and social capacity of an environment allows planners to develop spaces that value each element of the landscape as a singular system but also as part of the whole.

2.7.3. Accessibility to resources

Access to a wider resource base is one of the proposed primary functions of multi-functional spaces. The CIAT mandate is one of the best examples, showing how different organisations describe landscape access and its functions simultaneously. A more in-depth discussion of CIAT will be presented in section 2.8; however, it promotes the diversification of landscape functions providing better access to activities or opportunities for the populations who use these sites. These benefits can be ecological, economic or social, but are proposed as a method of creating interactive spaces that aid the quality of a place and consequently the quality of human well-being. The accessibility and availability of resources is at the centre of the CIAT agenda as it proposes that the utility of the landscape is fundamental to its sustainable use. Consequently, the roles of multi-functionality, location, landscape form and connectivity are important elements in this discussion (Gallent *et al.*, 2004; CABE Space, 2003).

The three areas outlined above have all promoted multi-functionality as a method of integrating and providing a broad range of benefits to a wide target population. Konijnendijk (2003) and Konijnendijk *et al.* (2006) examined the role multi-functional spaces provide in linking places and summarise that the broad range of benefits and opportunities green infrastructure provides actively encourages people to use them. Spaces can therefore link people across spatial boundaries because of the actual location of a resource, which may increase the capacity of the landscape to cope with this need. Konijnendijk (2003) has also stated that multi-functional planning, as outlined previously, allows different organisations to work across physical and administrative boundaries. Finally, the Countryside Agency (2003) states that landscape multi-functionality also aids the movement of people across physical spaces by providing a range of opportunities and benefits for the user. This, they state, allows people access to urban and rural landscape networks with the knowledge that they will benefit from their movement. Overall, multi-functionality has been described in the research literature as the ability to provide a wider range of opportunities and benefits (demographic, financial or ecological) at different scales, and has been highlighted as one of the primary elements of green infrastructure.

2.8. The benefits of green infrastructure

The previous sections of this chapter outlined a number of benefits green infrastructure is proposed to deliver. The role of green infrastructure in promoting better places to live, mobility, and the development of a higher proportion of *quality green infrastructure* have been discussed. Variations in the values attributed of green infrastructure in urban and urban-fringe locations have also been referred to by the Countryside Agency as:

The range of benefits under the CIAT agenda highlight that there is potentially a decreased difference between town and country as cities become greener and towns expand into the countryside. There has thus been a merging of the distinctions between the town and the countryside.

(Countryside Agency, 2006:2)

The benefits green infrastructure deliver for individuals and the wider population have been widely discussed in the academic and practitioner literature (Benedict and McMahon, 2006; City Parks Forum, 2003). One of the most effective documents to synthesis these benefits was the CIAT agenda

(Countryside Agency and Groundwork, 2005), which proposed ten areas where urban-fringe environments could be developed to promote better places to live. Although this document did not explicitly mention the role of green infrastructure in delivering the CIAT vision, it can be proposed as a good mechanism for doing so. Below are the areas outlined in the CIAT documentation in which they propose to achieve their vision:

A bridge to the country	A cultural legacy
A gateway to the town	A productive landscape
A health centre	A place to live sustainably
A classroom	An engine for regeneration
A recycle and renewable centre	A nature reserve

The Countryside Agency and Groundwork stated that these ten areas will enhance urban-fringe areas through the development of multi-amenity and functional environments. Davies *et al.* go further and report that green infrastructure should be seen as the key mechanism for delivering multi-functionality around urban-fringe areas (Davies *et al.*, 2006:10). Schrijnen also notes that, in Holland, the future prosperity of the urban fringe depends on the marrying of multi-functional green spaces with existing access and services networks (Schrijnen, 2000).

Thus, Schrijnen and Davies *et al.* propose that, to develop the urban-fringe as a productive landscape, multi-functionality must be considered especially when discussed alongside the development of existing infrastructure. Schrijnen is also supported by the Greenways research of Luymes and Tamminga (1995) in Toronto, Lindsey (1999) in Indianapolis and Little's appraisal of Greenways development in North America as a whole. These authors report that the processes of development witnessed within urban and urban-fringe areas have underpinned their notions of integration and the development of multi-functionality. The examples above highlight the growing literature relating to multi-functionality in urban-fringe areas and point out that negotiations of ecological, economic and social influences need to take place in order to develop a range of benefits. Moreover, the linking of planning policy with the idea of multi-functionality can be seen as translating the remit of green infrastructure discussed previously. These benefits include, but are not exclusive to, *health, recreation and leisure, education, regeneration, connectivity and access*. Each of these will be discussed in the next section, and will highlight how green infrastructure can be seen to serve a number of alternative functions and suggests areas where green infrastructure research needs to be examined.

2.8.1. Health

Research, according to Mass *et al.* (2005:587), has shown that the percentage of green space in a person's living environment has a positive association on the perceived health. Mass *et al.* also state that green space can and should be seen as a central planning mechanism for relieving stress and fatigue. This, they say, can be achieved by providing places for reflection and for recreation that provide an alternative location to home or work. The role of green space in promoting health has also been debated by Ulrich (1984). Ulrich stated that green spaces hold a key position in the restorative health of post-operative patients. His work proposed that moving within or even viewing green space

aided recovery times compared to patients who were able to view natural spaces. Kaplan and Kaplan (1989) have also debated the role of green spaces in a similar context, noting that with exposure to nature in suburban areas, people perceived themselves to be in better health compared to populations who reside in urban landscapes that have a lower proportion of green infrastructure.

The role of green space has also been discussed by the Countryside Recreation Network (CRN, 2006) who highlight the role urbanisation has had on health and well-being. The CRN examine how perceptions of green space have been linked with perceptions of both mental and physical health. They discuss that, due to the growing literature relating to the value of green space, that there are now over 2.5 billion visits to urban parks and green spaces and 1.5 billion visits a year to the countryside and seaside. If these figures are indicative of the changing mindset of people then green spaces, as Mass *et al.* (2005) state, should be debated as a central element of urban and urban-fringe planning.

The rise in the number of days people are spending in green spaces has provided much needed data for the UK Department of Health (DoH). The DoH stated that, with increases in access, the nation's health would improve thus lowering the costs to UK tax payers by approximately £8.2 billion per year (DoH, 2004). However, the growing awareness of health associated with green space is also proposed in the work of Powell, Martin and Chowdhury (2003) as being dependent on personal knowledge of, and a willingness to use, these spaces. This idea has been examined in a Danish context by Nielsen and Hansen (2007), who outlined links between personal motivations and green space use. They stated that green space planning must take into account the rationale that users must live within easy access of a green space if they are to use them more frequently (Pauleit *et al.*, 2003; Nicholson-Lord, 2003; Harrison *et al.*, 1995).

2.8.2. Exercise, recreation and leisure

Exercise, like health, has been promoted as one of the main benefits that green infrastructure provides. The role of exercise has been supported, as green spaces can be found across different landscapes and can comprise a multitude of sizes to suit the location. There has, however, been a recent process of green space reduction as local authorities have opted to sell playing fields and green spaces in order to meet financial and social constraints. Green infrastructure planning thus potentially offers a process to reverse this trend by providing a range of forms, sizes, and functions that can be retrofitted into existing landscapes.

CABE Space (2005a) has been one of the main supporters of green infrastructure with respect to healthy exercise initiatives. In their work they note that the provision of multi-functional spaces allows people to interact more frequently with the landscape. This interaction can include the use of spaces for team or individual sports as well providing spaces that can be used as an everyday environment for walking or relaxing (Giles-Corti and Donovan, 2003). In terms of children's physical and psychological health, the landscape can be viewed as a living room, a classroom, or a play area and, due to the diversity in use that children have, to some extent has been viewed as commodities that invariably have little say in how the landscapes are designed (Lewis and Lindsay, 2002). Consequently, what is appropriate for children's health needs to take into account the activities and

needs of this demographic group. This process is further complicated when the notion that children re-interpret the boundaries of a space depending on what activity or experience they wish to gain from it (Roe, 2006).

Thus, the theory of affordances²⁷ has been a useful way of assessing the opportunities open for children especially when linked with the development of inclusive spaces or green infrastructure (Fjørtoft & Sageie, 2000; Kyttä, 2002). The affordances provided by green infrastructure allow a number of complementary perceptions to be made simultaneously linking the potential, perceived, utilised, and shaped interpretations of the landscape (Kyttä, 2002). Opportunities and diversity in green infrastructure design have subsequently been proposed as aiding site use by allowing a greater number of interpretations to be made and a larger proportion of people to participate in it. Little (1990) presents a similar view, stating that the provision of Greenways in urban areas has allowed a greater number of people access to spaces they may previously have had to travel to.

Danny Dorling (2004) presents an alternative view to Little and CAGE Space by suggesting that attitudes towards a space are more important for recreational use than the space itself. Dorling highlights the growing links between wealth, education, access and health as influencing the process of negotiations between spaces and individuals, as an acknowledgement of the benefits of recreation are seen to outweigh non-use (an area that will be examined further in Chapter 7). Burgess *et al.* (1988) presented similar research but focussed on safety as the main driver of recreational use. In their work, safety from anti-social behaviour and crime were important issues, highlighting the view that personal values (of safety) were more important than the actual spaces. However, although personal values and societal use of spaces for recreation are important, the spaces themselves are also vital in attracting patronage.

Again, supporting the work of Little, Fjørtoft and Sageie (2000) propose that landscape versatility can heavily influence the choice or use of recreational space. Their research notes how children's play areas need to offer diversity and multi-functionality in both appearance and functions in order to attract users. Through good planning, green spaces can be used to actively engage populations with their environment through recreation. This in turn can help the development of coping mechanism for self-protection, self-restorative and personal transformation (Ulrich, 1986; Kleiber, Hutchinson and Williams, 2002). Recreational green spaces can, however, be viewed as providing possibilities for social interaction, social inclusion and exercise, each of which has been promoted by the UK government as vital elements in developing sustainable communities (Social Exclusion Unit, 2004; CAGE Space, 2005b). The role of appropriate and innovative design has been discussed as one of the main ways in which Nature-Deficit Disorder (NDD) can be tackled (Louv, 2005).²⁸ NDD can lead to psychological and physical impairments resulting in apathy towards the landscape or outdoor environments (Stanley, 2007). Through appropriate green infrastructure development, the effects of

²⁷ Affordances are the functionally significant properties of the environment that are perceived through the active detection of information and include properties that are both environmental and human (Gibson, 1979; Kyttä, 2002).

²⁸ NDD is a process whereby the relationship between people and the landscape decreases because of changing lifestyles and a higher instance of indoor activities.

NDD can be mitigated by re-establishing the relationship between people and the landscape (Louv, 2005).

2.8.3. Education

In the previous section, Fjørtoft and Sageie (2000) outlined the value to health and recreation of diverse green infrastructure. They also suggest that innovative green spaces provide both amenities and landscape diversity that aid discovery learning and promote the use of environmental education, i.e. learning through interaction, exploration, construction, reflection, and understanding (Wake, 2007). The achievements of discovery learning have been proposed as allowing children to engage both passively and actively with the landscape by placing them in a natural environment rather than a traditional classroom. The idea that the traditional classroom environment needs to be diversified is discussed by Valentine, who notes that the spaces that children live and play in are of equal importance to their education. Valentine states that the neighbourhood is 'one of the most important contexts for, and therefore influences on, children's social and cultural development' (Valentine, 1997:139).

Green infrastructure is proposed as a facilitator for diverse forms of learning. A child's understanding of the landscape has also been reported as important. Therefore, educating children about the landscape may affect their use of the landscape as an adult (i.e. NDD); hence, with childhood exploration and understanding of the landscape, there is the potential to improve the relationship between people and the landscape in the long term (Valentine, 1997; Roe, 2007). It has also been suggested that there is a growing concern about the lack of an interaction between children and the environment. This view has been discussed in relation to the effects on health and education of a sedentary or indoor lifestyle, with some authors stating that an understanding of the landscape is an important factor in situating and negotiating our lives (Roe, 2006). Thus, with the increased motivation and engagement of different demographic and ethnic groups a better understanding and changes in use of the landscape may occur (Social Exclusion Unit, 2005; Sibley, 1995; CABI Space 2005b).

2.8.4. Regeneration and economic growth

The benefits to regeneration and economic growth have been described by Davies *et al.* (2006) as an important element of what green infrastructure can deliver. Green infrastructure has been discussed by Williamson (2003) and Konijnendijk (2006) as providing high quality environments that encourage investment in both physical and economic terms. Investment in landscapes is especially relevant in areas of economic decline such as former industrial centres, e.g. the Durham Coalfield, as it provides an alternative focus for economic development or employment. Investment of this type can take many forms: country parks and community forest projects being two examples. ODPM in the 'State of the English Cities' (ODPM, 2006b) promote this view by examining the role environmental quality plays in improving physical and social regeneration.

2.8.5. Accessibility and social connectivity

Section 2.5.4 outlined how green infrastructure can be viewed as aiding connectivity. In the CIAT agenda this is paramount in promoting the countryside in and around towns to be accessible and

developed productively. The Countryside Agency and Groundwork also suggest that, by providing gateways and links between urban, urban-fringe and rural areas, people have greater opportunities to access a number of diverse landscapes. The role of linking people is seen as a prime motivator in promoting green infrastructure according to Groome (1990), who states that linking places enhances both the physical environment and allows cultural exchanges by providing access to alternative environments. Work by Davies *et al.* (2006) and the Countryside Agency (2006) in the UK presented similar research promoting accessibility, noting that by connecting people with a wider network of spaces more opportunities are available for use. Moreover, with increased availability it is hoped that other agendas concerned with green infrastructure, i.e. health, regeneration and education, can be incorporated into the uses of green spaces.

2.9. Summary

Green infrastructure has been shown to hold multiple meanings and benefits in this chapter. As a concept, green infrastructure encompasses a number of issues based in the development, sustainability and 'green' literature and has been examined to show how different practitioners or academics utilise the term. The discussions identify a number of the principles that many authors feel underpin the green infrastructure concept and the range of potential benefits for different user groups, be they practitioners or the public. By promoting the ideas of *connectivity*, *access*, *multi-functionality*, *strategic planning* and *scale*, these discussions have set out a number of key areas seen as integral to green infrastructure thinking. The literature also suggests that the historical development of green infrastructure has focussed on the changing role of green spaces in urban, urban-fringe and rural development. These changes have been examined in terms of both changing migrations and settlement patterns in the urban-fringe and the continual development of landscapes seen in the UK, Europe and North America in recent years. The discussions presented in this chapter informs the empirical research examined in Chapter 6, which reviews evidence gathered from academics and practitioners relating the proposed meanings of green infrastructure, its development and any potential further opportunities for its use. The principles proposed in this chapter are also assessed in Chapter 8, where the use of green infrastructure in landscape management practices and policy is discussed. Chapter 8 draws out which principles are being used to develop green infrastructure and again assesses where further opportunities lie for its development. In the following literature review, the focus shifts to the use of green infrastructure, the experiential value of green infrastructure and discusses how form, function and landscape context all affect our perceptions of the landscape.

Chapter 3.0: Literature Review: Environmental perceptions

Perception studies take many forms and cover both physiological and cultural issues. The following chapter outlines the polarised views explaining how environmental stimuli and the cultural surroundings of a person influence interpretations of the landscape. Through a discussion of the constructions of perceptions, this chapter addresses how landscapes are interpreted and attributed value. This chapter also examines how attitudes to nature develop and explores the differences that arise when discussing diverse physical and metaphorical landscape boundaries. This chapter will therefore examine what Nicholson-Lord (2003) calls the sense of coherence between natural elements; it asks how perceptions have led to continual debates over these boundaries. The relationship between human perceptions and interpretations will also be examined, particularly in respect of how personal and communal perceptions affect the interpretation and use of space.

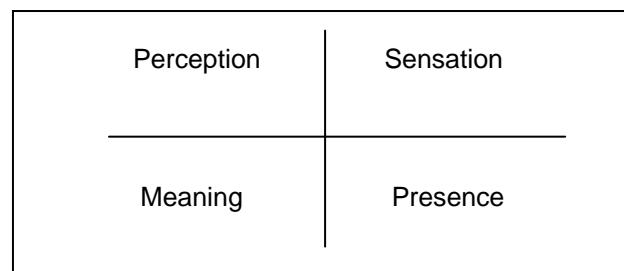
The discussion will be linked to green infrastructure to explain how the values and perceptions attributed to a given landscape or space are based on an understanding of its context (physically and socially), its form and its function. Through an understanding of how people view and interpret the landscapes around them, a number of theoretical discussions are made examining how the landscape or green infrastructure is perceived in respect to stimuli (landscape) and response (actions) models and with regards to the physical, psychological and social interpretations of the landscape. Green infrastructure will therefore be debated in terms of the interpretation of the physical and social landscape and how these views can be linked with the management and design of more functional spaces.

3.1 Perceptions and Interpretations

Landscape perceptions, as Rodaway stated, are the interpretation of the world around us and 'of spatial relationships and the identification of distinctive places to recognise our situation in a world and to have a sense of the world' (Rodaway, 1994:13). Perceptions, according to Rodaway, develop through the physical and social networks that people find themselves within. But how do perceptions develop and at what level (personal, communal or national) do perceptions take greatest significance? The following chapter explores these questions by presenting a review of the literature, outlining the physiological process of describing perceptual development and also by examining the mechanisms that socially construct perceptions. These two distinct categories have been extensively examined in the literature, particularly in relation to the value of both the human body and society in aiding personal perception. What is clear from this work (i.e. Atherton, 2002; Tuan, 1974; Ingold, 2000) is that existing theories of perception are dependent on the frame of reference of the observer. Perception is also a multi-faceted process that takes into account cultural, biological, linguistic and environmental stimuli which supply baseline data for individuals to process. This supports Tuan's theory that perception is an activity that enables people to experience the world. Moreover, the processing of complex stimuli such as shape, texture and the social meanings associated with these stimuli allow people to understand and engage with the landscape. An understanding of a landscape's form, function and meaning is, therefore, important in the development of interpretations of an area by an individual.

Rodaway promoted a model of simultaneous interpretations based on accounting for environmental, social and physiological stimuli. Rodaway's model (1994, see Figure 3.1) stated that perception was a culmination of meaning, presence and sensation developed through a process of interpretations and negotiations. He states that presence and sensation are linked to the attribution of meaning to stimuli, which can subsequently be understood or perceived. Identifying the roles of knowledge and experience are essential if the perceptual process is to be understood, a view that has also been discussed in the research of Tuan (1973). Atherton (2002), however, highlighted a potential flaw in Rodaway and Tuan's research and questioned the validity of linking perception and sense. This view suggests that people do not always feel when they look, and claims that the lack of a sensual judgement distances presence and sensation from meaning and perception. Furthermore, Atherton references Descartes' three stages to perception: firstly, natural stimuli (environmental stimuli); secondly, a system of processing between the brain, body and the stimuli (environmental-biological process); and, thirdly, judgements are made from the stimuli (interpretation of meaning) (Atherton, 2002). Descartes presents the view that perception is an interaction between stimuli, processing and judgements that assess environmental and social stimuli through a biological (i.e. neurological) process of interpretation. Levi-Strauss developed this further, suggesting that a process of decoding the meaning of these stimuli is central to the development of interpretation (Ingold, 2000).

Figure 3.1. Rodaway's constructional components of perceptions (Rodaway, 1994)



Levi-Strauss and Descartes both argue that the development of perceptions relates directly to both the physical and biological world. However, Ingold's assessment of Levi-Strauss places a greater emphasis on neurological cognition, whereas Descartes presents a more structured processing system to explain human perception. What is important though is that Descartes discusses the discrepancies between what people see and the judgements they make, presenting the view that perception is a judgemental process. Tuan (1974) also noted these differences, suggesting that experience, education and the level of exposure and understanding of a stimuli alters the perception of it. This appears to be a logical progression, but Van Sluytes *et al.* (1990) suggest the view that there are a number of levels of perception (i.e. for survival or warmth) that are developed through interpretations of colour, heat or shape and then developed through experience. However, the theoretical research of Descartes and Levi-Strauss suggest that perceptions related to the experiences of life and innate perception could only be viewed as a single component in this process.

The differences in approaches to understanding perceptions have been synthesised by Rodaway (1994), who suggests three models of perception. These three models are behavioural, cognitive and ecological. In his description of the behavioural model, Rodaway notes that perception is developed

through a stimuli cause and effect model. Secondly, he states that the cognitive model is based on appropriating meanings to objects, signs or spaces. Here, Rodaway presents a model based on learning and decision-making. Finally, Rodaway presents an ecological model based on innate perceptions of environmental stimuli. Each model has its own merits and as a whole they offer a broader scope for understanding the complex systems of perceptual understanding. Perception, however, also needs to be seen as being influenced by experience of a stimuli, i.e. a landscape. Gow (1995) notes in his work that perception is a process of a person's exposure to and knowledge of a place, whilst Nassauer (1997) presents a similar view, stating that perception is based on the experiences of life, education and social interactions. It therefore appears that an acknowledgement of the functions of a landscape and the level of knowledge or exposure to it have a clear relationship with our understandings of that landscape.

Durkheim (Ingold, 1996) and Valentine (Valentine, 2001) also noted that experience is linked with perception and is a part of the interpretation of everyday life. Durkheim suggests that every sensation or event witnessed by a person is linked to their interpretation of the wider world (Ingold, 1996:59). Valentine also suggests a theory by arguing that experience is directly linked to specific times and spaces in a person's life. She states that these spaces are subsequently linked to societal or personal perceptions of similar locations, which support a process of reinforced meaning. Valentine suggests that perceptions are linked to events and places and are interpretations of the influences a person situates themselves within. Valentine and Ingold, therefore, both argue that the environment is interpreted and understood in relation to a person's place in the world and that Durkheim's attempt to polarise the two may be troublesome (Valentine, 2001; Ingold, 1996). Hendry (1999) also discusses the work of Durkheim, noting that the separation of people and the environment in terms of perception is potentially problematic. Henry states that, although the environment cannot be said to determine social systems, it is interpreted or categorised by those who live within it according to their existing or evolving perceptual systems (1999:221). Therefore, Hendry restates Rodaway's models of perception by advocating a combination of Rodaway's behavioural and cognitive models as a way of explaining perceptual development, and implies that Durkheim's separation of people and society is flawed because she and Ingold see social constructions as fundamental elements in developing accurate perceptual interpretations; an idea that will be discussed further in Chapters 7 and 9.

Exposure and an understanding of the environment that surrounds a person therefore appear vital in the development of perceptions. This view has also been supported by Cloke *et al.* (1991), Valentine (2001) and Smith (1993), who argues that the production of meaningful spaces is based on the understanding of the components that comprise the space or system. Cochrane (2001) supports this view in that the connectivity people build between places and meanings is a vital element in their environmental understanding. Therefore, as Smith suggested, space '...is produced in and through social activity that in turn produces and is produced by geographical structures' (1993:97). Although space may be constructed in physical or metaphorical contexts, it is still subject to interpretation through societal boundaries and should be viewed as a process of negotiation between personal interpretations and the understanding of the wider landscape (van Houtum *et al.*, 2005). The growth of

understanding and theorising about landscape, therefore, needs to acknowledge that landscapes are embedded with meanings as people constantly reassess their place within them (Bowler, 2001).

3.2. Landscape: ecological, physical, social and symbolic perceptions

Landscape values and perceptions relate to the categorisation, organisation and identification of colours, shapes, spaces and their subsequent meanings (Green, 1995). Therefore, as Bowler (2001) and Cochrane (1993) note, there is a broad literature discussing the links between people, the landscape and perception.

3.2.1. Social perceptions

Social constructions of landscape have been attributed to a number of different influences, including exposure, knowledge, patterns or formations, and through personal interactions with a landscape (Urry, 1995). Each of these factors has been noted as aiding the formation and development of the values used to attribute meaning to different landscapes (Xu *et al.*, 2006). However, an understanding of how this process works is vital if a discussion of perceptual understanding of green infrastructure is to be made. The work of Durkheim (Ingold, 1996) and Valentine (2001) noted previously outlined how real world stimuli can be interpreted by the individual and processed as perceptions.

Xu *et al.* (2006) highlight the role that values have in the development of personal perceptions. They write that attitudes based on the understanding of a person's upbringing, education, family networks and place of birth can be important to this process. Green (1995) presents a similar idea in that the social environment a person develops within (i.e. physical and psychological) affects his or her perception. There are also coding systems attributed to different cultures, e.g. western, Asian or African, that link the people of that society with their environments. This view has been discussed by O'Rourke (2005), Gunner (2005) and Urry (1995) who all note that social constructions of a given landscape are centred on the localised narratives of a particular place. David Harvey presents a good example of how the world in which people live affects their perceptions, stating that:

...the space and times of representation that envelop and surround us as we go about our daily lives likewise affect both our direct experiences and the way we interpret and understand representations.

(Harvey, 2006:131-132).

Harvey's quote highlights that the physical landscape and human beings are part of a symbiotic relationship where each constantly affect the other. Harvey's research supports that of Urry, who wrote that the dynamic patterns people view in the landscapes around them (e.g. settlements, economic or human) constantly make people reassess their views of the world. Thus, a cognitive approach to social perceptions allows people to renegotiate their understanding of and interaction with the environment through a system of interpretations, value statements and perceptions. The research of Ulrich (1986) is one example where this system can be seen to be at work. Ulrich researched the restorative use of visual green space in hospital grounds and found that people associated the outdoor scenes of nature with human meanings (e.g. health, warmth, growth and regeneration). Those people with a view of green space recovered more quickly than those with no such view. These results can be

interpreted through a social context suggesting that patient perceptions of green space were associated with well-being and thus the patient perceived themselves in better health. Furthermore, Xu *et al.* (2006) state that attitudes towards landscapes depend on the values people place upon them and their perceived benefits. In Ulrich's case study, if people perceived green spaces as healthy they may also perceive themselves to be benefiting health-wise. Xu *et al.*, however, state that the role social meanings play in landscape perception is fraught with individuality that makes overarching or universal meanings hard to quantify. Urry highlighted a similar situation in his interpretations of landscape functions, as landscapes have become increasingly commodified as spaces that hold economic or monetary values (Urry, 1995). Where Ulrich identifies a perceived physiological component in the perceptions of the landscape or green spaces, Xu *et al.* and Urry also suggest that an economic value of a space can be given equal credence.

This commodification of the environment affects the interactions people have with the landscape and may consequently affect perception. Kaplan and Kaplan (1989) have been prolific authors in their review of this process. In their work, the Kaplans, like Neill (2004), note that personal interactions with the landscape offer an insight into the perceptions of a person. They state that understanding the function and composition of a landscape aids the development of perceptions. The commodification of the landscape may also have the potential to develop exclusionary spaces that lower the interaction with and positive perceptions of a space (Gilroy, 1987; Power and Wilson, 2000).

3.2.2. Physical landscape perception

Although social constructions hold a central place in the development of perceptions, the physical landscape is equally important. The physical structure and function of a landscape are essential elements in the meanings attributed of a place (Kaplan and Kaplan, 1989). Thus, although perception may be discussed as being developed in terms of social context, an understanding of the physical landscape and its function is also very important in the process of landscape interpretation. It was Rodaway who stated that '...sense both as a relationship to a world and the senses as in themselves a kind of structuring of space and definition of place' (1994:4) highlighting, like Harvey (2006), that the physical world is an integral component of the perceptual process. This view is underpinned by an understanding of the functions and compositions of the landscape, which are then processed into perceptions. Neill's (2004) research like Rodaway's work appears to support that of Nassauer (1997), who stated that human and natural landscapes need to be reviewed simultaneously.

Other authors have also supported this view including Chronis' (2005) research at the Gettysburg Storyscape, Herbert's (2001) research on British literary places, and Halsall's (2001) discussion of Dutch railways. These three examples all state that the physical landscape is equally as important as the social constructions placed upon it. Herbert notes that the places associated with the Brönte sisters, Dylan Thomas and Jane Austin also have an ecological and physical meaning that is not linked with these authors. He states that, although people now associate these places predominately with literary figures, the composition of the landscape also holds a powerful meaning. Halsall notes that in the Netherlands the landscape has a long and direct association with the lives of the local

people. Thus, within his review of the Stoomtram Hoorn-Medemblik Railway he writes that the social meanings associated with the railway were secondary to the physical functions of the landscape. Finally, Chronis reported similar findings at the Gettysburg Storyscape where there appears to be a closer relationship between the social and physical landscape due to its historical links with American sovereignty. Further research that places the landscape at the centre of the development of perceptions includes that of Vallega (2003) and Stewart *et al.* (1998), who state that the physical composition of the landscape is used to allow people to construct a perception of it. These authors do, however, acknowledge the role of social events and landscape constructions in the views people have of a landscape. However, as Stewart *et al.* stated in their work on Mount Cook (New Zealand), this was secondary to the actual physical function of the landscape.

3.2.3. Perceptions of symbolic landscapes

Symbolic perceptions are understood as a combination of the social and physical constructions of the landscape. The development of attitudes and values placed upon symbolic locations has been discussed as a process culminating in places being defined both socially and physically (Gunner, 2005; O'Rourke, 2005; Frazer, 1933). The links between symbolic perceptions and the social and physical constructions of the landscape can be seen in the work of UNESCO (United Nations Educational, Scientific and Cultural Organisation) who recognise and protect environments that link the physical landscape with social and spiritual influences. In UNESCO's discussions of The Landscape of God: Three Parallel Rivers of Yunnan Protected Areas, they state that:

Wide, dragon-like rivers wrap around the mountains. It is a truly distinctive landscape. Three great Asian rivers the Yangtze, the Mekong and the Salween run parallel to each other in the northwest of Yunnan province in China. People live here at 2000 meters above sea level. The landscape is known as the White Water Terrace. Naxi people believe that this is "Where God resides". The Terrace Mountain is made of limestone. Water running from the top of the mountain contains a high concentration of calcium which is accumulated over a long period to create spectacular water terraces. There is a form of altar here. This is a sacred place for the Naxi people.

UNESCO website

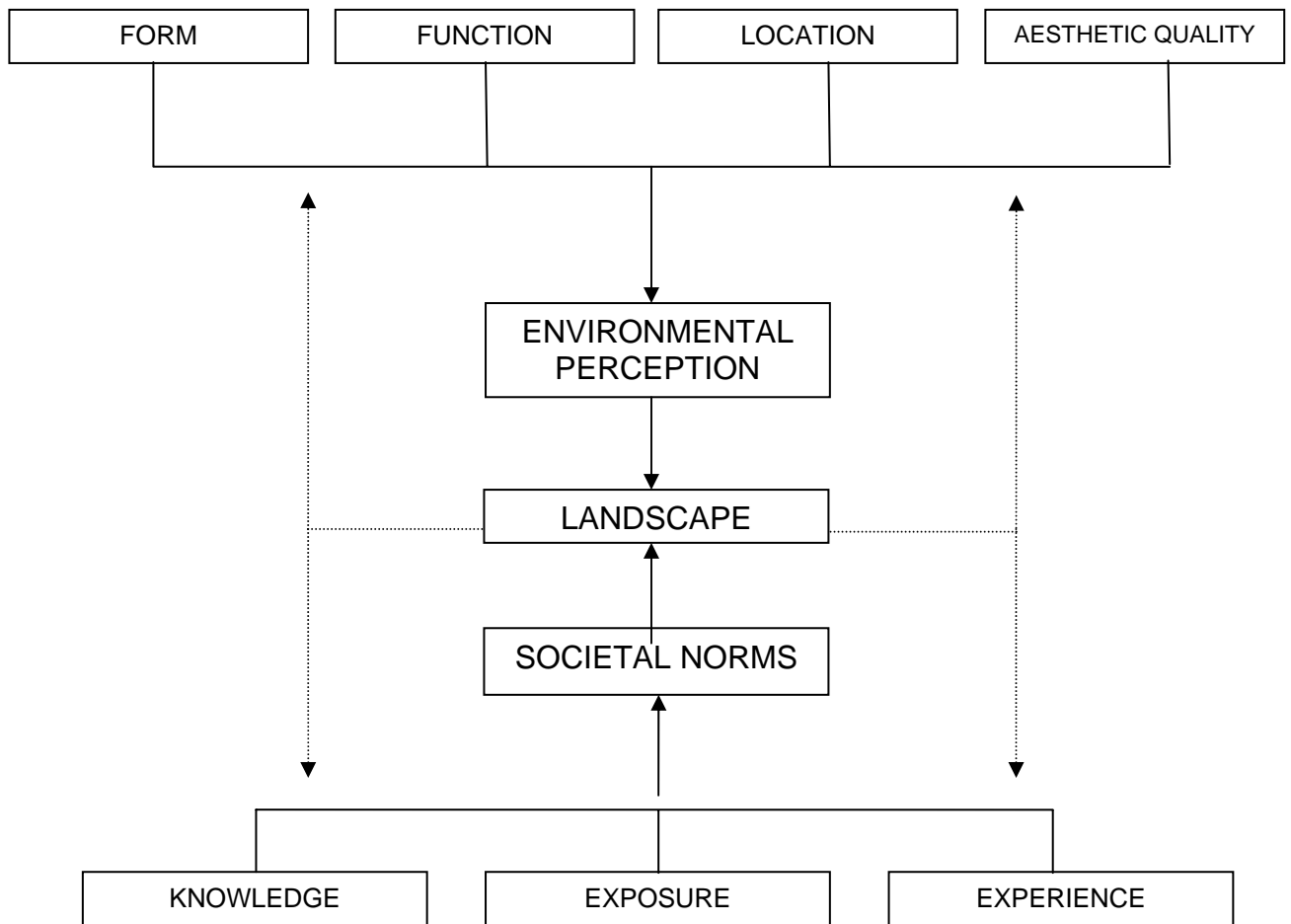
http://portal.unesco.org/culture/en/ev.phpURL_ID=31069&URL_DO=DO_TOPIC&URL_SECTION=201.html, accessed 03/07/2008)

UNESCO thus advocates the protection of landscapes that have multiple meanings. They promote cultural, physical, and spiritual understandings highlighting the value of multiple or layered interpretations of a space. These examples indicate the links between people and the symbolism they develop for a site. Schama (1996) writes that inherited myths and memories (e.g. those with symbolic value for local people) share two important characteristics, namely their longevity across generational perceptions and their power to shape institutions. Constructions of the landscape transcend temporal change and can be examined at different scales to understand the symbolic links between people and places. However, despite the support given to the theory that values are constructed at different social, cultural and ecological scales, as Marcucci (2000) suggests, that perceptions may not actually be discussed in any other way and notes that landscapes cannot be viewed as intrinsically important because value attribution is a specific human concept placed upon preferential landscapes.

3.3. Perception and consumption of landscapes

Previously in this chapter a review of how social, physical and symbolic meanings influence landscape perceptions has been made. However, although these constructions of landscape allow people to perceive the environment they see, landscapes are also being consumed.²⁹ Authors like Urry have discussed the consumption of landscapes as a way of people using their constructions and perceptions to place additional value on them (Urry, 1995). By consuming the landscape, people reinforce their understandings of what the environment is but can also allow broader narratives to be interpreted. As Chronis (2005) highlighted, the physical landscape has a social meaning as a place for people but, through consumption and commodification of that landscape, people can attribute additional value to these spaces. The attribution of value, especially a financial value, was seen by Urry as a part of the wider commodification of the landscape. In the 1980s, spaces of representation (conceived space) and representations of spaces (perceived space) become increasingly embedded in the commodification of the landscape and created a dual perception of space, both real and imagined (Appleton, 1995).

Figure 3.2 Areas of interpretation and stimuli that support landscape perceptions (source: author)



²⁹ The consumption of the landscape refers to the process by which an individual or group attach additional meaning to a location in order to attribute a higher ecological, financial or social value to it.

Lefebvre's production of space model (Lefebvre, 1991) complements the views of Urry and Appleton. His model has three main components: spatial practice, representations of space, and spaces of representation. In each, the theory is outlined that interpretations and perceptions of space are based on a constant recognition, interpretation, and production of space³⁰ (Lefebvre, 1991). Lefebvre states that space can be described as lived, conceived or perceived and these relationships compare to Harvey, who also discusses personal and communal perceptions of spaces (Harvey, 2006). Harvey states that the representations and values (i.e. the commodification) of a landscape directly affects our interpretation of it and vice-versa. This view is also presented by Kaplan and Kaplan (1989), who suggest that the commodity or value of a landscape is derived from its function. Landscapes are therefore subject to the same systems of value attribution as other products (e.g. food or homes) where the benefits gained have to fulfil human needs to be consumed or valued (Nassauer, 1997). This is a view that Xu *et al.* (2006) have also debated, suggesting that the value of landscape is part of the wider process of interpretation and value attribution that is developed through the different individual characteristics. Furthermore, the view of landscape promoted by Green (1995) in Section 3.2 refers predominately to the ways people interpret the landscape, e.g. colours and shapes, or fear, warmth happiness and links with learnt knowledge of landscape aesthetics. Green suggests, like Nassauer and Xu *et al.*, that the perceptions people hold relating to landscapes can be viewed as placing aesthetic value at the forefront of interpretation.

Urry suggests that, in the current climate, landscapes are primarily valued for their resources and functions rather than their aesthetic qualities. He notes that a shift in the focus of landscape perceptions has occurred and that a financial value is now placed on a landscape which relates to the interpretation or relationship with 'green' or ecological views of a landscape (Macnaghten and Urry, 1998). Urry suggested that, by primarily valuing the resources and functions, its aesthetic value has been lowered. This is a theory that is discussed in Chapter 7, where the physical composition of the landscape is discussed in conjunction with evaluations of landscape form and function. Overall, commodification of the landscape has developed as society has changed. In the post-productive landscapes of the UK, landscape value has moved through a cycle of interpretations, from aesthetics to a productive value and back again. Landscapes have been increasingly commodified through the development for industry or housing. This commodification has led to a shift in the perceptions of landscape, which will be discussed further in Chapter 7.

3.4. Landscape perception: physical boundaries, exposure, knowledge and societal norms

Hiss (1991) wrote that exposure dulls the senses and makes perceptions weaker, boundaries blur, and people find it difficult to distinguish between places. Alternatively, Moore-Coyler and Scott (2005) argue that familiarity with a landscape enables people to perceive subtle changes to the landscape. This view has also been suggested by Burgess *et al.*'s (1988) work on public safety and preferences

³⁰ The three classifications can be explained as a) *Spatial practice* refers to the production and reproduction of spatial relations between objects and products, b) *Representations of space* 'are tied to the relations of production and to the 'order' which those relations impose, and hence to knowledge, to signs, to codes, and to 'frontal' relations" (1991:33), c) *Representational spaces* refer to spaces 'lived' directly 'through its associated images and symbols and hence the space of 'inhabitants' and 'users'".

in parks and green spaces. They argued that when people have experiences of a place then they are able to perceive changes that affect their safety. Both Hiss and Moore-Coyler and Scott's views appear to have support in the perception literature, which discusses whether exposure to a landscape actually heightens or lowers a person's perception of boundary changes.

In Rodaway's model of perception, he outlined how behavioural, cognitive and ecological models of perception are developed (Rodaway, 1994). Rodaway also noted that the effect of moving through an environment and learning from environmental stimuli allows a person to perceive differences. It can be argued that his model supports the work of Moore-Coyler and Scott who state that, although environments may be viewed as mundane or everyday, with exposure, an acute ability to acknowledge and distinguish change may occur.³¹ Tuan (1974) suggested a similar argument, noting the dichotomy between rural and urban environments and examines how perception changed with exposure and knowledge of an environment's function. Tuan states that with prolonged exposure an individual would be able to identify changes across boundaries, e.g. differentiate between urban to rural areas because of the inherent differences in landscape function. This view may appear straightforward but, if Hiss's view on perception is examined, then prolonged exposure to an urban-fringe environment would lower a person's ability to differentiate between these urban and rural environments. Consequently, it is important to understand how the value of both the form and function of a landscape or green infrastructure resources affect our interpretations of these spaces.

Alternatively, Lowenthal suggests that 'the way people view... seems to be a matter of universal concern, but the past plays very different roles in different cultures' (Lowenthal, pg. XVIII). In this statement, Lowenthal is proposing that exposure can alter personal and communal perception between different landscape and cultures as this diversity becomes increasingly apparent. Gallagher (1994) presents a similar view, stating that cultural norms and exposure to specific landscapes affect perception. By reviewing the work of Lowenthal, Gallagher and Tuan, a number of factors affecting the perceptions of landscape boundaries related to exposure are raised. These include (social) context, the length of exposure and the ability of an individual to note subtle or major differences between the environments he or she moves through. The function of a landscape, therefore, becomes equally important. Function, as noted by Nicholson-Lord (2003), thus allows people to value spaces and to discuss how these values change with movement across boundaries.

People view landscape changes depending on the extent of their interactions with it, and it has been argued that landscape knowledge affects perception in a comparable way. Ward (2002) notes that perceptual systems evolve from the surroundings within which people find themselves. This helps to guide people through everyday environments. This supports the stimuli-perception-action model outlined by Descartes. Appleton (1975) states that landscapes offer a backdrop of stimuli that people use to orientate and perceive their surroundings by. Both Appleton and Ward note that the landscapes around people provide them with a knowledge base through which they learn about the environment. This development of knowledge can then be used to perceive the landscape and assess differences

³¹ This idea has formed one of the foundations for research into compliance and understandings of the European Landscape Convention (see Roe, Jones and Mell, 2008; CoE, 2007).

or environmental change. Consequently the physical, social and symbolic constructions and meanings of landscape discussed previously are equally important in allowing people to attain knowledge of their environment.

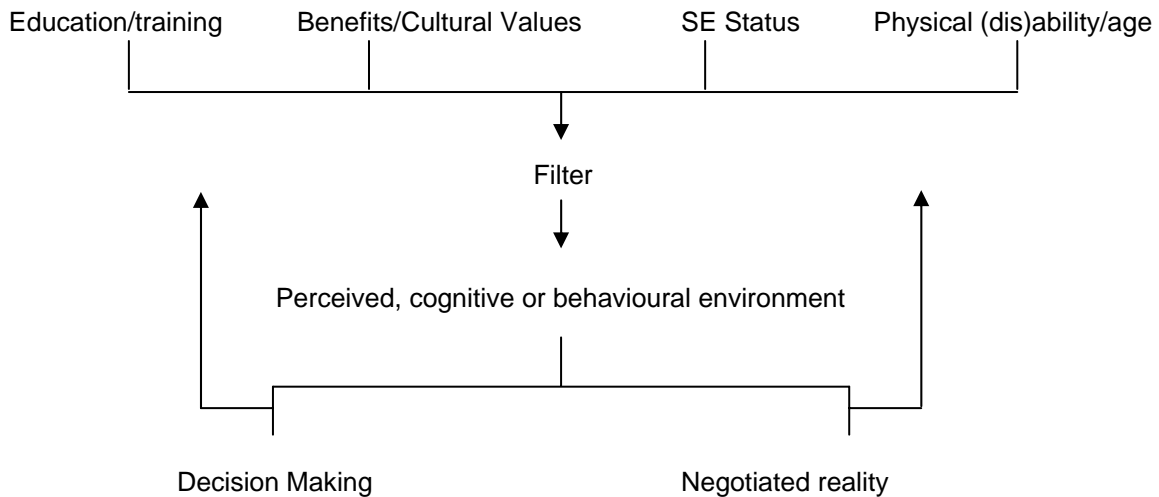
The attainment of knowledge of the landscape, however, also needs to be viewed as a fluid and dynamic process. Urry (1995) notes that moving through an environment allows people to fully understand what is there. If the role of movement is coupled with knowledge of a landscape, then changes in landscape function and boundaries can be better understood. Appleton also uses this theory, stating that people position themselves within landscapes using their knowledge as a method of assessing change. Knowledge of a landscape's function and form is therefore important if change is to be noted. Ward (2002) uses an example of spatial mapping to illustrate this point, noting that the codes and symbols involved in mapping are based on knowledge of a landscape and the functions it fulfils. If these symbols were unknown then the perception of a landscape would be very different and landscape classifications would lose their meanings.

The final element to be addressed when reviewing boundaries and perception is the role social norms play in influencing attitudes to landscapes. Social norms are created through the development of relationships with internal understandings of the landscape and external influences that are subject to change (Matless, 1998). If we view contemporary media as an indicator of societal norms, then it is clear that the images portrayed on television shows a way of life most people would identify with as normal for specific areas. Similar ideas can be related to the arts where the works of Lowry (*Going to the Match*, 1928; *Dwelling*, 1927), Turner (*The Golden Bough*, 1934), or Constable (*Salisbury Cathedral*, 1825; *The Cornfield*, 1826) have all been used to provide specific societal interpretations of England (Matless, 1998). Music has also been viewed as promoting societal norms. Songs such the traditional arrangement 'We Shall Overcome' to more contemporary artists such as Billy Bragg's 'Between the Wars', the Stiff Little Fingers' 'Alternative Ulster', or Neil Young's 'Journey Through the Past' have all outlined a number of scenarios where the landscape described in each song is considered relevant in the lives of the composer and shows an understanding of the physical, political and social landscapes around them.

Bujis, Pedroli and Juginbuhl therefore note that 'social activities interfere and produce [different] forms of landscape' (2006:376). Here, the authors note that social norms affect the perception of landscapes because they impact on the understanding of both physical and social functions. They go on to state that this leads to differences between the perceptions and proposed values that different groups use to assess the same landscape. Gallagher (1994) establishes the same argument by explaining that people from enclosed or dense forest environments find it difficult to define perspective in open lands. This is linked to their perceptions being honed to view the environment close to them. However, when placed in an open environment, they are unable to adjust to the changing perceptual depth or exposure and their interpretations fail to account for the distance. Sullivan and Taylor Lovell (2006) argue a similar view using roadside perceptions. They note that the productive values of large open spaces (e.g. farmland or orchards) are viewed favourably compared to similar tracts of land that are dominated by industry. These notions of 'good' and 'bad' landuse are also discussed by Matless

(1998), who outlines differences in the perceptions of old and new money, north and south landscapes, and the right and wrong ways of managing English landscapes. Matless outlines how norms in perceptions influence the behaviour of people within specific landscapes, e.g. rural villages compared to urban areas. Therefore, it is possible to interpret the perceptual differences that revolve around an understanding of societal functions where the space itself is showing how the values of one environment differ from another.

Figure 3.3. Social influences affecting landscape perceptions (Jeans, 1974)



Kaplan and Kaplan (1989) have also presented findings that support this argument, stating that landscape boundaries can be associated with human management. They suggest that the combination of space and human involvement affects the perception of a given landscape. One example from their work uses the perception of 'natural' and urban environments as the 'text', assessing how people view boundaries within landscapes. Kaplan and Kaplan found that, although the function or value of a natural space may be low, people perceived it to hold greater functional value because of the lack of physical boundaries within it. Their research also found that although urban areas hold a greater value for some people these areas are noted as being confined by the boundaries of the built environment or as spaces that are spatially fragmented. The perception of urban landscapes, therefore, differs from those in rural areas, as they appear compacted by the other elements of the built environment compared to the visual openness of rural areas. Therefore, the function of a space is important but has to be examined in relation to the social contexts placed upon a landscape (i.e. Palang, Alumäe and Mander, 2000; Lange, 2001). One dominant view that has come to the fore in these studies is the idea that boundaries are explicitly associated with the function of a landscape. Therefore, the social impacts on a landscape must be noted as holding an important role in how societal norms are developed. Figure 3.2 (author's diagram) and Figure 3.3 Jeans (1974) outline diagrammatically how different aspects of human life and the physical landscape affect our perceptions.

Jeans notes that social-economic class, education, cultural values and physical characteristics all affect perceptions of a landscape. Figures 3.2 and 3.3 also highlight that even after each influence is filtered and perceived there is a feedback loop through which further perceptions and influences can be incorporated into the system. Thus, Jeans links the roles of exposure, knowledge and societal norms with the formation of interpretations and perceptions. The feedback loop also supports the view of Urry (1995), who stated that perception is a fluid and dynamic system of continual negotiations, interpretation and value attribution. This is also clear when dealing with changes in landscape formation and boundaries; everyday life and spaces need to be perceived, negotiated and re-assessed continually to provide an individual with an accurate view of the world around them (Atherton, 2002; Bujis, Pedroli and Luginbuhl, 2006; Ward, 2002).

The reviews presented above have been made to highlight how perception is a complex and dynamic system of negotiations, value attributions and change. As Kohler states (2000), no two people perceive a place in the same way; this suggests that landscapes will be continually reinterpreted by different people on a daily basis. Perception and, in particular, landscape perception must therefore be viewed as being imbued with meanings based on the constructions of the world and the subsequent interpretations of these meanings. Without an acknowledgement of these influences, it becomes difficult to assess what landscapes mean and how perception works. The links between the physiological aspects of perception and cognitive and behavioural influences must also be understood if accurate interpretations of landscape are to be made.

3.5. Landscape perceptions and green infrastructure

The contrasting ways in which perceptions are generated has a vital impact on the ways in which people use the landscapes around them. Issues of safety, attractiveness and functionality have all been discussed in this chapter as providing people with stimuli and information that aid their perceptual development (Kaplan and Kaplan, 1989). The role perceptions play in promoting site use is therefore a key aspect for green infrastructure planners, as is an understanding of how these interpretations of the landscape can be applied in landscape management and design practices. The complex process of interpretation that people undertake when reviewing a space may therefore affect how a site is used. It also affects how that site is perceived in relation to other landscape elements and the broader network of spaces that people reside within (Rodaway, 1994). Consequently, planners need to assess the value people attribute to different landscape elements if they are to serve a community in the long-term, an issue that will be addressed again in Chapters 7 and 9. The research literature also suggests that planners must be aware of the social interpretations that influence the perceptions that a place holds. Gunner (2005) and Chronis (2005) both outlined how spaces are imbued with social and cultural meanings - values that need to be addressed when developing spaces. What is essential is that the ideas of form, function, and the relationship of a space and a person's experiences are acknowledged in order to enable a space to function to its highest capacity.

3.12. Summary

This chapter has outlined a broad range of theories and ideas that underpin perceptions of the landscape. Exposure, societal norms, and knowledge have been discussed as key elements that enable individuals to develop their interpretations of a given landscape. These ideas have been supplemented with a discussion of our understanding of landscape boundaries, our knowledge and exposure to landscapes, and explored how these ideas work collectively to support the interpretive process. It has also examined the role of Rodaway's, Descartes', and Ingold's models of perceptions and highlighted how the stimuli-response and interpretive models of perception allow an understanding of cognitive and social interpretations of the landscape to be made. This chapter has outlined these ideas and reviewed them in terms of whether they affect our interpretations of the spaces that surround us. This has examined how the context of the landscape, i.e. whether its physical elements or its social interpretations and meanings form the basis of our perceptions of it. What this chapter has suggested is that perceptions are a combination of these influences and that the theories outlined by Rodaway, Ingold and Tuan are still relevant in our understanding of how interpretations develop. An understanding of landscape perceptions, therefore, provides green infrastructure researchers with the following. Firstly, it outlines a number of positive attributes that have been associated with landscape perceptions; the role of specific physical landscape features is especially relevant here. Secondly, it also highlights a number of areas noted as holding negative associations with the landscape (i.e. fear or safety). Consequently, the literature on perceptions has outlined several ways in which interpretations of the landscape develop and proposed a number of physical, psychological and social characteristics upon which to base green infrastructure perceptions research.

Chapter 7 examines how perceptions affect the use of the landscape and asks how ecological, psychological, and social influences affect our understanding of the landscape. The aim of this and the previous chapter has been to outline the discussions relating to the development of different understanding and perceptions of green infrastructure. This discussion has focussed on the following areas: the concept and how perceptions of the landscape affect how people interact with it. These ideas have formed the basis of this literature review and issues have been discussed relating to green infrastructure development. The following chapter will outline how the definitions, meanings and understandings of green infrastructure are being utilised by landscape planners and practitioners. This will examine where green infrastructure has been successful and where opportunities for further research lie.

Chapter 4.0 Literature Review: Spatial planning

Davies *et al.* (2006) provide a cautionary note for practitioners and planners attempting to develop green infrastructure. They state that, to effectively plan green infrastructure, professionals are required to have a *conceptual understanding of environmental systems, knowledge of multi-functionality as it applies to green areas and an understanding of how environmental, economic and social issues intermingle in relation to sustainable communities and sustainable development agendas* (2006:17). Herein lies a valuable lesson for green infrastructure planners: that an understanding of *all overarching influences* must be known if a space is to be developed as a high quality environment. Consequently, the role of planning policy is to provide a framework where knowledge and expertise can be communicated and used by planners, practitioners and developers. It is, therefore, imperative that the planning system in the UK is viewed as an essential component of green infrastructure development by providing criteria for its integration into planning and policy. The National Audit Office and ODPM have both promoted this view, stating that planners need to ensure that high quality green space is developed in line with statutory planning regulations (ODPM, 2006a). Nicholson-Lord provides a comparable view of the role of planning regulations in developing high quality environments; he writes that without green space people will 'go mad' (2003:10) and argues, like ODPM, that green spaces need to be delivered through an effective planning system and with thoughtful design.

In the following chapter, the role of the planning system will be reviewed to highlight how different areas of planning policy and practice can be used to deliver green infrastructures at a number of different scales. Kambites and Owen (2007), however, developed an interesting review outlining the differences between green infrastructure thinking and green infrastructure planning. This is a crucial point to make as the conceptual development of green infrastructure thinking has looked primarily at the underlying principles of the concept. Notwithstanding this as a practical approach to landscape management, these principles have to be translated into achievable activities or policies. Consequently, a framework needs to be developed to translate green infrastructure thinking into achievable targets. This process is being undertaken through the production of green infrastructure guides and toolkits, some of which are reviewed in Chapter 8, and within the latest round of Regional Spatial Strategies (RSS) but as yet has not been developed into a formal framework. Agencies such as CABI Space (2003; 2005b) and Natural England are currently working on the production of such a framework but have yet to produce grounded guidelines. It is therefore imperative to provide green infrastructure planners with a strategic policy framework if they are to deliver innovative and sustainable landscapes.

The following chapter outlines a number of areas of spatial planning policy and practice in the UK and the USA that show the diversity of green infrastructure development. This shows the differences between the planning structures of these two geographical areas before highlighting specific examples of policy and projects that link the ideas of planning policy, scale and appropriate development. The chapter concludes with a discussion of how these ideas can be examined collectively and makes reference to how they will be discussed in later chapters.

4.1 Green infrastructure and the British planning system

‘...all too often we experience places that are unwelcoming, unkempt and difficult - or even dangerous to use...’

ODPM (2003:6)

The development of better places to live, work and recreate was highlighted in Chapter 2 as a fundamental vision that can be achieved by green infrastructure planning. By providing multiple benefits for diverse user groups, green infrastructure enables various ways in which planning and development goals can be achieved. However, although the green infrastructure concept is strongly underpinned by ideas of connectivity and multi-functionality, it still needs to be discussed within a policy context. ODPM states that places can be experienced in both positive and negative ways and this is a key area where planning policy can influence landscape design. Benedict and McMahon highlight this process, stating that green infrastructure planning must be seen as of equal importance as other infrastructure to aid long-term sustainable planning (2006:XVI). This is a view that has been further described by Randrup (2006), who writes that planners ‘...have started to realise that more integrated green space planning and management are required to meet current societal demands when operating in high-pressure environments’ (2006:91). As a result, Benedict and McMahon and Randrup are calling for a greater level of co-operative planning at different planning scales (local, regional and national) in order to develop better places to live, especially in light of the reservations of Dover (2000) and Turner (2004), who have both queried the value of green infrastructure planning.

The following section of this chapter outlines how the research of Benedict and McMahon and Randrup are being incorporated into the planning of green infrastructure in the UK. Within this review, UK and North American examples will be used to illustrate how different planning systems place alternative emphasis on their planning priorities. This section examines how planning policy within the UK has moved the debates relating to the provision of green infrastructure towards the forefront of contemporary planning and will address how it can be supported for future development. The section will go on to examine how green infrastructure has been used for delivery of sustainable landscape planning in current planning, i.e. through RSS and landscape partnerships. This final section outlines issues of scale and asks the question: at what level should green infrastructure be developed? The chapter also discusses whether a concept that offers such a broad range of landscape opportunities should be constrained by existing processes of planning policy and practice.

4.2. Green space planning in the UK

The Urban White Paper (DETR, 2000) set out an agenda that has been discussed as the forerunner to the UK Government’s Sustainable Communities Plan. In the Urban White Paper and its rural counterpart, the Rural White Paper (Defra, 2000), the UK government outlined an agenda to develop better places by creating communities built upon the innovative design of public spaces. The outcome of these reports was to achieve an ‘Urban Renaissance’ (and a fairer countryside) and develop a more holistic view of planning, taking into account the value of grey and green infrastructure as well as

social, economic and environmental agendas. These two papers put forward a similar view to that proposed by Geller (2003), who assessed the North American Smart Growth programme as encouraging better design by allowing extensive negotiations between public and private planning groups. In essence, what Geller outlines is a collective review of the social, economic and environmental polarisations seen within modern society, which can be assessed against public policy frameworks, i.e. Sustainable Communities, CIAT and Local Development Frameworks (Geller, 2003; Minton, 2002). Planning policy thus holds a key position in the drive to deliver better places by providing a framework and the regulations that planners adhere to.

The UK Planning Policy Statement (PPS) 1: Delivering Sustainable Development (ODPM, 2005; DCLG, 2007) outlines a number of areas aimed at improving the condition of our surroundings and reviews the relationship between the natural and built environment and their users. PPS 9: Nature Conservation (ODPM, 1994), on the other hand, highlights the importance of linking networks of ecologically important elements to protect wider patterns of open space. Both of these PPSs show that there are policies currently in place that are discussing green space but, as the Countryside Agency notes, the fragmentary nature of the UK planning system has developed a somewhat static or inflexible system that may fail to take into account the changing nature of the built and natural environment (Countryside Agency, 2006:ii). Therefore, appropriate planning guidance is required in order to achieve the ideas of Benedict and McMahon, who discuss the need for a balanced, strategic, joined-up and comprehensive planning process that supports the development of sustainable places.

Calls for more strategic planning frameworks has been reviewed in the work of Blank, Senior and Webster (2002). This is seen as a pivotal process promoting rational decision-making, which is also a view that has also been discussed by the Countryside Agency in their review of planning policy frameworks. The Countryside Agency reviewed how Regional Economic (RES), Development (RDS), and Sustainable Development Strategies (RSDS) feed into the Regional Spatial Strategy (RSS). They propose that RSS oversee a regional level approach to development that can then be contextualised at a regional, sub-regional and local level with Local Development Frameworks (LFDs) and action plans (Countryside Agency, 2006). However, although spatial planning offers a broader physical remit to landscape planning, there are a number of Planning Policy Statements and Guidance (PPS and PPG) which have been developed by The Royal Town Planning Institute (RTPI) to provide support for planners and developers. Arguably two of the most relevant policies are PPG 17: Planning for Open Space, Sport and Recreation (ODPM, 1991) and Section 106 Planning Agreements (TCPA, 1991).

PPG17 was revised in 2001 and it has been seen as providing a more relevant 'green' focus for policy guidance (RTPI, 2005). The main objectives of PPG17 include supporting the urban renaissance, promoting rural revival, addressing social inclusion and community cohesion, increasing health and well-being and promoting sustainable development. It is clear from this review of PPG17 that it has been updated to fulfil elements of both the Urban and Rural White Papers and can be used to support the Sustainable Communities (ODPM, 2005) and social inclusion (Social Exclusion Unit, 2004). PPG17 also discusses the issue of scale, open spaces, sporting and recreational spaces. The RTPI (2005) have stated that a 'needs assessment' must be undertaken when discussing the use of PPG17

in order to deliver development in the appropriate location. Thus, the RTPI suggests that open and green spaces are a suitable provision for development at any scale (ODPM, 2002).

In support of developing quality green spaces, the UK planning system also introduced Section 106 Planning Agreements in the Town and Country Planning Act (HMSO, 1991). These agreements are negotiated between local planning authorities and developers in order to gain planning permission. The main focus of these agreements is to contribute to the development of sustainable communities by securing agreements to fund infrastructure development implemented within a specific development project (RTPI, 2005).³² Therefore, by using planning agreements, negotiations can take place to deliver green space as a trade-off for commercial or housing developments. A number of the areas approved under Section 106 Agreements are noted below by the London Borough of Islington:

- Improvements to or the creation of local open space areas or parks.
- Public and community transport initiatives.
- Cycle access and cycle parking/storage provision.
- Environmental improvements such as tree planting, works to privately-owned land.
- Creation, enhancement or protection of nature conservation sites, natural features, trees or other sites.
- Community facilities and premises and access thereto.
- Conservation or enhancement of buildings, structures, or places of historic, archaeological and architectural interest.

London Borough of Islington (2003:6-7)

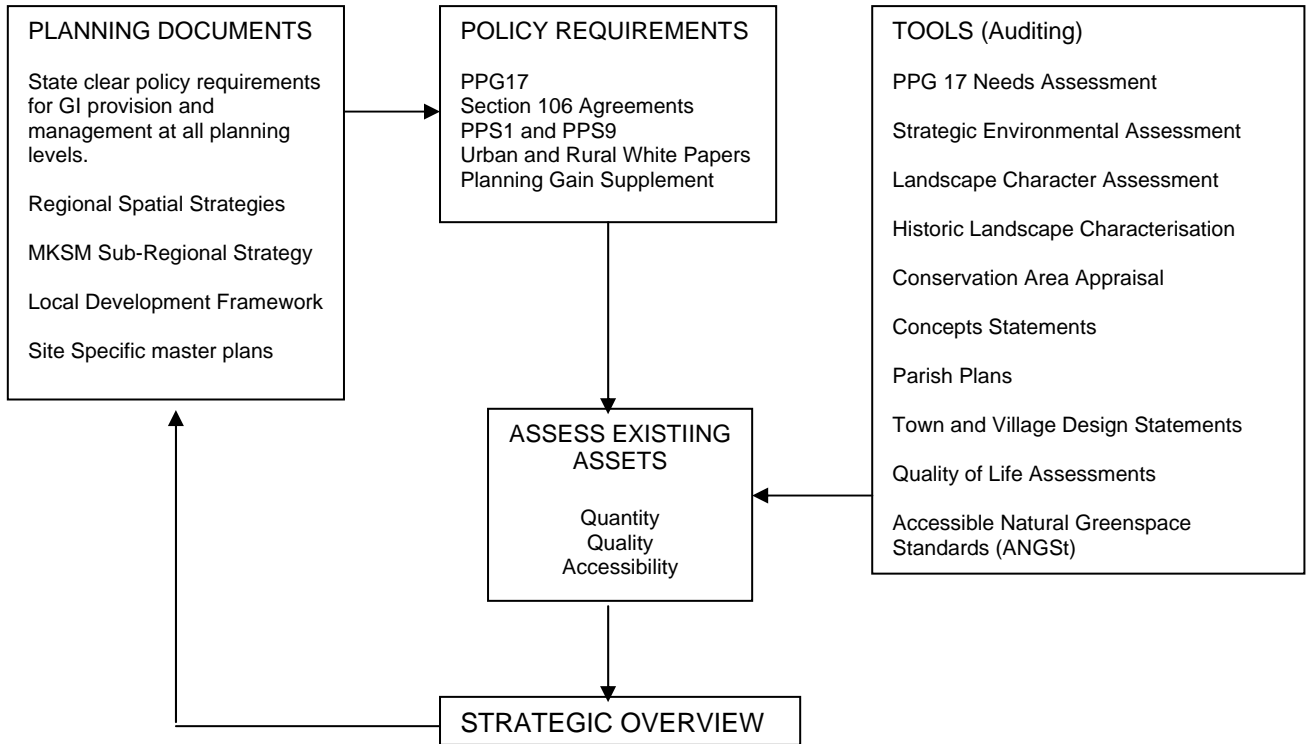
The list above is by no means exclusive but reviews some of the landscape features that benefit from Section 106 Agreements. Subsequently, if this is reviewed against the list of what constitutes green infrastructures in the work of Davies *et al.* (2006), there appear to be several overlaps between how and where environmental resources can benefit. Green infrastructure can, therefore, be seen to provide a delivery mechanism offering broad benefits which can be utilised in a variety of locations. The work of the London Borough of Islington has also been discussed by Surrey Heath Borough Council. They note that the use of planning obligations should not be used to address specific locational problems, but should be a part of a broader planning process designed to alleviate the overarching problems of a place. Hence, planning should be appropriate and reasonably related in scale to a proposed development in order to secure the provision and maintenance of green infrastructure (Surrey Heath, 2006).

The work of Surrey Heath, the Borough of Islington, the RTPI and CABI Space all reviewed how PPG17, Section 106 Agreements, and PPSs 1 and 9 promote the sustainable development of landscapes. Each policy brings a level of guidance to the planning and development of landscapes that can be used as an enabler or negotiation tool. Within Section 106 Agreements, green infrastructure can be developed as the trade-off for planning gain. In PPS 1 and 9, green infrastructure can be used to develop sustainable communities whilst supporting ecological, economic and social spheres. Consequently, within the UK planning system there are an increasing number of policies or

³² Thus, the main areas discussed within Section 106 Agreements include: the restrictions of development for specific uses, the requirement of specific operations to be carried out, requiring land to be used in a specific way and sums of money to be paid for specific users.

guidance that can be used as negotiation tools supporting green infrastructure implementation. This also supports the DTLR's statement, that the development of parks and green spaces contribute to the changing economies of the UK and should underpin regeneration and development policy (DTLR, 2002:11).

Figure 4.1. Strategic Framework for Planning and Delivery (Environment Agency and Countryside Agency (2005))



The DETR makes it clear that regeneration must play a significant part in any discussion of appropriate planning policies for green space development. Furbey (1999) agrees stating that, owing to its roots in economic, environmental and social spheres, regeneration is a powerful metaphor that emphasises what policy-makers are trying to achieve. Moreover, any attempts to channel green space planning into looking at one specific issue potentially means a loss of information and potentially aids the development of policy that does not benefit the environment or the people within it (Barber, 2006). Figure 4.1 above provides a flow chart of how these different policies and standards fit within such a framework. In the figure, planning documents are subject to planning requirements and are assessed against additional auditing tools. Each of these areas is then assessed against the existing resource base of an area before a strategic overview is produced. This overview is then fed back into the planning documents and any modifications that a planning authority feels are appropriate can be made. One of the roles of planning policy is thus to offer reflective guidance whilst still maintaining the integrity of the landscape within agreed standards. This process will be returned to in sections 3.6 and 3.7 after an analysis of contrasting development of green infrastructure in the USA is discussed. The variation between the UK and the USA offer a stark contrast in the focus of planning policy and the governance structures that support landscape and environmental planning.

4.3. Green Infrastructure Planning in the USA

In contrast to the development of green infrastructure planning in the UK, its growth in North America has followed a different path. Although the PCSD's (1999) discussion of green infrastructure predated its actual development, it had to contend with a number of planning issues not seen in the UK. The process of planning in the USA is heavily fragmented. Federal, State, Metropolitan, County and Local level planning practices have all been developed but there appears to be little lineage or feedback between these scales. Due to the diversity in planning control found at each level, it has been difficult for policy to translate from a Federal to a County level and visa versa. Consequently, policy and practice have developed to meet the needs of a particular place or jurisdiction and do not necessarily fulfil the remit of Federal planning policy.³³ The planning of Greenway highlights this process well. Little (1990) provided a number of examples of successful Greenway developments where the planning focus, implementation, and delivery of the project have succeeded in crossing administrative and physical boundaries. However, because of the variation in legislative powers between local, county and metropolitan regions, co-operation or implementation of this nature is often fraught with administrative, funding and maintenance problems.

In an attempt to balance the issues of cross-boundary implementation, specific projects have been developed which allow planners to work around or with these problems. The ideas behind Smart Growth provided a framework by which planners could link their projects and jurisdiction with others. Similar ideas also underlie Green Urbanism, where the broader sustainable nature of urban forms is promoted over the physical boundaries a space occupies. Consequently, green urbanists are attempting to highlight the overarching benefits of a space in order to develop a forum for spatial and administrative co-operation (Beatley, 2000). This can be viewed as supporting the ideas of Kambites and Owen (2007) in the UK, who stated the connectivity between people, spaces, and different physical and administrative boundaries were essential elements of successful green infrastructure planning. The ideas that Kambites and Owen establish have been used extensively in Greenway planning (i.e. Lindsey *et al.* 2001; Ryan *et al.*, 2006) and have promoted a way of enabling green infrastructure to fulfil the same functions for Greenways.

However, if green infrastructure is to be planned strategically in North America, then the lack of a framework where Federal policy can be translated effectively at the County or Metropolitan scale must be addressed. Despite the research of Rottle (2007), Williamson (2003) and Benedict and McMahon (2002, 2006), the lack of a strategic policy at a Federal level still hinders green infrastructure development. Consequently, it has fallen to organisations like the Conservation Fund and the American Planning Association (APA) to develop and promote the concept and, in 2007, the US Environmental Protection Agency (EPA) stated that the green light was on for green infrastructure (Dapolito Dunn and Stoner, 2007). In this review, the EPA outlined how the current research into green infrastructure has provided baseline evidence in support of the concept and they have used this

³³ This is seen as a contrast to the UK planning system where there is an assumed level of feedback and interaction between national planning policy and its implementation at a regional, sub-regional and metropolitan scale.

to promote strategic thinking that could address the key issues of sustainable landuse and the quality of life.

The development of an evidence base and a more holistic approach to landscape planning is a view that the Conservation Fund has long called for. The Conservation Fund, as one of the largest environmental research organisations in the USA, has called for green infrastructure to be supported since the PCSD's announcement in 1999. Their work has promoted multi-scale green infrastructure planning and management as a method of developing this evidence base of research that can then be submitted to Federal agencies. What they found is that, through a diverse range of State, Metropolitan and Country level initiatives, there is a portfolio of projects that have been shown to be financially viable and ecologically important (Weber *et al.*, 2006). Therefore, although there is no clear Federal level policy for green infrastructure planning, the development of a multi-scale evidence base is starting to feed up to the Federal level. This progress is closer to the UK system where sub-regional and regional agencies have been able to present evidence to DCLG and Natural England (nationally) in order to influence the development of regional and national green infrastructure policy.

4.4. Regional Spatial Strategy (RSS)

One of the proposed differences in UK and US planning comes in the form of the regionally important strategic policies, which are prominent in the UK but not the USA. The role of the strategic planning process and guides has become increasingly important for landscape developers. Regional Spatial Strategies (RSS) outline the Regional Development Agency (RDA's) vision and the contributions made by environmental and planning organisations at the Examination in Public (EIP). The RSS therefore holds a key role in the discussion as to where and how the landscape at a local and regional scale should be developed. Consequently, if green infrastructure is to be adopted as an effective delivery strategy then it must be debated within these strategic documents. This is highlighted by TEP (2005) who note that the range of benefits green infrastructure promotes needs to be reviewed in a variety of ways including:

In particular, the integrating function of the RSS as a strategic planning document should ensure that the multi-functionality of Green Infrastructure and its relevance to other spatial planning issues such as housing, jobs, transport and services, is embedded into current planning thinking.

TEP (2005:8)

This includes assessing housing, transport, education and recreational policies that could benefit from an integrative green infrastructure strategy developed at a regional scale. The RSS thus holds an important role in allowing diverse organisations to come together and discuss their visions or targets for landscape scale planning initiatives. Through the RDA, these ideas are synthesised into the regional vision which is then reviewed alongside the other regionally important strategies. Although the RSS brings together diverse subject matter, the final report does not always meet with widespread approval. This is especially apparent when dealing with new or innovative landscape management practices (i.e. green infrastructure) where a level of scepticism may be apparent due to a proposed lack of evidence supporting the concepts' benefits (Weber, Sloan and Wolf, 2006). However, despite

the potential lack of planning for specific landscape management practices, RSS have the potential to develop cross-boundary visions for regions (ODPM, 2003). Consequently, by strategically developing planning policies at a regional level, RSS provides opportunities for multi-partner and cross-boundary initiatives to be developed whilst still conserving broader tracts of land.

4.5. Implementation of Green Infrastructure

To return briefly to the concepts of landscape ecology as outlined in Chapter 2, the issue of connectivity suggests the view that green infrastructure can be developed at a number of different spatial scales. Landscapes are linked by their functions, structures and interactions and consequently different landscape elements should not be thought of as independent of each other (Forman, 1995; Farina, 1998, 2003). Alternatively they should be viewed as networks of interacting spaces that can be linked as green infrastructure resources. Tittle and Parkways (2002) present this argument by reviewing how places can support and interact with local populations by providing mechanisms that increase mobility, energy transferences and diversification in both human and ecological spheres. Thus, green infrastructure can be viewed as providing an effective approach to providing connections across landscapes.

Plate 4.1. Various Green Infrastructures at different scales.



In Plate 4.1 a number of green infrastructure elements are presented highlighting the different connective manifestations it can take. It should be noted that the ability of green infrastructure to exist as pavement greenery, street trees or as moor lands is one of the most valuable attributes of the concept, thus allowing it to deliver benefits at different spatial scales. This view can also be used to promote green infrastructure as a multi-scaled natural resource for managing large or complex systems. As the images show, green infrastructure can mean small areas of greenery in city centres (left), large expanses of upland hills (centre) or multi-functional urban parks (right). These three images offer only a small interpretation of the different ways in which green infrastructure can be developed.³⁴ The designation of spaces ranges from the very small with communal or neighbourhood level benefits to urban-wide spaces and upwards to regionally or national accessible and important spaces such as water catchment reservoirs, National Parks or expansive forest regions. However, despite these spatial variations in size, each different scale still provides the overarching benefits of

³⁴ (See Appendix 1E in Davies *et al.*, 2006 for a broader review).

green infrastructure. Consequently, if natural or designed green spaces are a 'gateway to a better world' then green infrastructure can be visualised as a process delivering this mandate, thus bringing a better world closer to the individual (Nicholson-Lord, 2003:20).

4.6. Landscape scale partnerships

The links between the developments of RSS and landscape scale partnerships can be explained through an understanding of flexible landscape boundaries. Both RSS and landscape scale partnerships work on the presumption that boundaries, be they physical, social or administrative, are flexible and change with the needs of a project or landscape. RSS cross administrative boundaries to develop a regional scale strategy, whilst landscape scale partnerships can also be seen to undertake and achieve this process, though they can be created through a wider range of partners (Kambites and Owen, 2007).

Landscape scale partnerships were, however, discussed at the launch of Natural England (North-East) on 12 October 2006³⁵ as one of the major ways of delivering sustainable landscapes. By working with partners and focussing on a landscape scale approach to planning (e.g. planning for forested lands, upland moors or river catchments), Natural England stated that integrated management can meet the objectives of multiple partners. Landscape scale partnerships have thus been viewed by some organisations as the best method of delivering sustainable environments (Williamson, 2003; TEP, 2005). In research conducted by the Forestry Commission, it was acknowledged that working with partners who dealt with landscape scale environments provided a greater depth of knowledge for managing landscape scale environments (e.g. watersheds, grasslands, forests or mountain ranges) and lowering the fragmented practices of different landscape managers.³⁶ TEP presented a similar view, stating that partners working at different landscape scales (e.g. national or regional) can aid the development of the environment by working alongside Government Office or the RDAs within the context of regional planning (TEP, 2005). The arguments presented by Williamson (2003) and TEP (2005) are further underlined by CABI Space (2003) who state that, in terms of green infrastructure, projects should be developed through multi-scale stakeholders with insights and a working knowledge of the landscapes in question. In the same report, CABI Space developed this view by stating that landscape scale partnerships were a useful mechanism for developing '...a vision shared by politicians, officers, key partners, stakeholders and communities that provides a framework for effective resource allocation and maximises funding and public support' (CABI Space, 2003:7).

CABI Space therefore promotes the role landscape scale partnerships can hold in developing landscapes for a broader target population. In respect to green infrastructure, TEP also suggest that multi-partner landscape management can lower conflicts relating to the spatial employment of green spaces. TEP suggest that 'Green Infrastructure does not respect... arbitrary boundaries and can play an important role in helping to "reassemble" the landscape into a coherent functioning entity that

³⁵ Although Natural England (North-East) was officially launched on 12th October 2006, the organisation came into existence on 1st October 2006 following the amalgamation of the Countryside Agency, English Nature and elements of the Regional Development Service.

³⁶ Forestry Commission, www.forestry.gov.uk/news1/D3FC8E604FF528EA802571DB004783D9, 6/10/2006.

spans and is mutually beneficial to urban and rural contexts' (2005:5). TEP thus develop CABI Space's argument, suggesting that large-scale landscape management can lower the conflicts between different authorities by providing projects that are delivered collaboratively by multiple partners. TEP's research should be viewed as providing a framework of good practice for delivering landscape scale projects, a view that has also been embedded into the remit of Natural England.

4.7. City-regions, Community Forests, Sustainable Communities

Moving from a landscape scale of management to a regionally specific viewpoint, the role of city-regions has been discussed as an increasingly relevant spatial concept (Goodchild and Hickman, 2006). It has been suggested by Tewdwr-Jones and McNeil (2000) that this process is developing because of fundamental shifts in government and political structures aimed at modernising the UK planning system through dispersed regulation and a regional partnership approach (Rydin, 1998). Some authors also portray city-regions as a way of balancing the focus on London and the South-East with a regional approach to government (Dutton, 2003). However, the value of the city-region concept has been contested because of the lack of a clear definition of what it constitutes. ODPM have, however, identified city-regions as enlarged territories with core urban areas that draw people to work and live (ODPM, 2006c:5). ODPM go on to state that city-region scale planning can play a vital role in redressing 'place blind' policies and expenditures (2006c:16). City-regions can also be seen as a way of promoting effective leadership and democratic accountability within a hierarchical structure of cities that was lost with the removal of metropolitan authorities in the 1980s (Tewdwr-Jones and McNeil, 2000, Chatterton and Unsworth, 2004).

This view, however, does not fully explain why the city-region concept has such a heavy emphasis on the economic development seemingly at the expense of social and environmental influences (Girardet, 1990). ODPM does, however, outline how the concept can be developed and discussed by regional Government Offices and RDAs who are able to interpret the central mandate of city-regions at a regional scale. Again, it appears that the city-region concept may be subject to a similar flaw to that of the Northern Way as it may fail in its attempt to link different authorities and delivery partners. City-region planning may also fail to enhance the effectiveness of planning if it fails to meet the challenges of re-establishing the regional level of governance. Davies *et al.* (2006) discussed this issue, highlighting that city-regions could aid collaborative management and lower the barriers to cross-boundary cooperation.³⁷ The development of a greater number of unitary authorities such as those developed in Durham or York may therefore play a significant role in developing this relationship.

Where city-regions and the Community Forest programme are compatible is in providing cross-boundary administration and cooperation. Within the Community Forests programme (see Chapter 2) the role of effective landscape management and planning were key elements in the drive to deliver sustainable environments. Both processes provide for multi-partner cooperation operating over a number of landscape and administrative boundaries. Consequently, both of these concepts appear to have been developed as a practical method of increasing the dialogue between planners, developers

³⁷ This can be achieved through the promotion of multi-partner working, competitive bidding and development, and additional funding streams.

and a region's population. By developing this dialogue, a deeper understanding of what city-regions, Community Forests and Sustainable Communities should encompass can be examined. Opportunities arising from this dialogue could also further the debates relating to green infrastructure. Green infrastructures, as previously noted, can be delivered at a number of scales and have been debated by Benedict and McMahon (2006) as an appropriate delivery mechanism at all scales. Furthermore, green infrastructure planning at a city-region or a more localised level could effectively employ green infrastructure as a method of delivering the targets or functions of multi-partner planning.

Brown and Dühr (2002) highlight another important issue relating to the spatial delivery of green infrastructure, namely the sustainability agenda. Within the Community Forests and Sustainable Communities plans, economic, environmental and social sustainability are collectively discussed as major influences on landscape development. Sustainable development agendas have been located firmly in the recent PPG revisions and development strategies. By locating the sustainability agenda in current planning guidelines, the UK government is providing a clear insight into the direction it feels green space planning should travel. The City Parks Forum (2003) in the United States presents a similar argument, stating that green infrastructure can play a major role in effectively managing larger environmental systems, i.e. watershed or river catchments. It notes that green infrastructures can be the essential landscape scale element that feeds into the natural resource management at local and regional scales. The city-region concept, community forestry and the Sustainable Communities Plan consequently all offer programmes highlighting how co-operative land management can be developed at a number of scales through a partnership approach. Through these agendas, green infrastructure can be delivered in a variety of diverse, yet appropriate scales, providing evidence that supports the calls for it to be further developed as a delivery mechanism. However, green infrastructure is subject to government and development policy frameworks that must be negotiated to deliver multi-functional landscapes. Even following planning policy negotiations, there is a further area to be reviewed to fully understand the delivery role of green infrastructure, namely scale.

4.8. Scale

Green infrastructure as a delivery mechanism offers a number of benefits for practitioners planning at different landscape scales. The work of Benedict and McMahon (2006), Davies *et al.* (2006), CABI Space (2003) and the City Parks Forum (2003) all highlight how green infrastructure can be planned from a very local level to a broader pan-regional scale. Planning at different scales according to these authors offers the potential for planners to develop spaces that are more appropriate to the needs of the environments they are managing. However, the City Parks Forum suggests that green infrastructure should be debated at a larger landscape scale because of the benefits to climatic and landscape resource management. This view is supported by Taylor, Paine and FitzGibbon (1995), Lindsey (1999) and De Sousa (2003) who attempted to highlight how planning across administrative regions offered the greatest potential for the sustainable management of natural resources, a theory also discussed by Kambites and Owen (2007). In these studies, it is possible to identify the scale at which different authors believe green infrastructure should be planned. Various authors have noted the localised, metropolitan and regional benefits that green infrastructure can provide, but rarely has a consensus been reached as to how best to employ new resources on the ground.

However, in recent green infrastructure planning documents and guides, i.e. Green Infrastructure North-West (www.greeninfrastructurenw.co.uk, 2006), an examination of a number of projects at various landscape scales has been made. Each of the projects discussed benefited from integrative green infrastructure planning at a variety of different landscape scales. Green Infrastructure North-West therefore propose that scale may not be a hindrance to further green infrastructure development as it was perceived as being deliverable at various spatial scales.

Discussions of scale in planning are, however, vital if, as Green Infrastructure North-West state, the delivery of green infrastructure is to be developed in the most appropriate manner. Benedict and McMahon (2006) have placed an increased emphasis on the role of appropriateness compared to their earlier work by developing their conservationist view of what and where green infrastructure should be planned. They write that planning visions are composed of a number of trade-offs and agendas which are not necessarily tied to administrative boundaries. They go on to state that biogeographical landscape designations are becoming increasingly important, as planning of this type allows whole landscapes to be examined collectively. Antrop (2000) takes a different standpoint stating that, as landscapes can be discussed in both abstract and real terms, people have the ability to think about them at different scales. Antrop notes that the interactions between people, places and the wider world is an important reason to consider scale when discussing landscape; he writes that 'integrated analysis should focus upon the continuous interaction between spatial structures and functioning at different hierarchical scale levels' (2000:28).

Benedict and McMahon offer a comparable stance, stating that landscapes do not conform to the boundaries created by humans, a point that is discussed by Selman and Knight (2006). In their writing, Selman and Knight promote the view that discussions of scale in planning and landscape management are vital as landscapes do not always have recognisable or discreet boundaries. They suggest that the landscape scale systems should be a focal point for environmental planning. To highlight this, Selman and Knight propose that the dynamic functions of the landscape cannot be constrained by the 'units' developed by humans and planning policy. What Selman and Knight (2006) therefore present is an argument that planners should take a landscape systems approach to planning rather than increasing the polarisations between landscape function, use and development by planning for discreet spaces.

However, De Sousa suggests that there is a potential difficulty here in that the financial impetus for developing landscapes can undermine landscape scale planning. De Sousa (2003) highlights how planning in North America is imbued with the financial gains that a landscape can deliver. Consequently, planners develop plans that offer the greatest return for a piece of land but not always for the system itself. In De Sousa's analysis, he notes that the primary planning issues in his Toronto research are cost, incentives, goals and economic benefits, which provide an insight into the economic value of multi-scale planning. However, he does note four scales that planners in the Toronto case study use, being community, local, municipal and region, each of which he suggests are essential to green infrastructure management. In much the same way that Benedict and McMahon support

planning at different scales as a method of protecting biodiversity, the Thames gateway developers see their project as a fundamental element of regeneration in South East England (ODPM, 2005).

Each of these authors suggests different reasons why scale is an important discussion point in planning, an issue also seen in the work of Weber, Sloan and Wolf (2006). Their research on the Maryland Green Infrastructure plan provides a useful examination of the agendas set out above, discussing how they have been negotiated in multi-scale planning projects. Weber, Sloan and Wolf present a review of the processes the state of Maryland went through in the development of its green infrastructure plan, highlighting how appropriate multi-scale discussions were essential in its development. They outline how social and political landscapes are negotiated in regards to the physical landscape as applied by De Sousa to Toronto. They go on to state that the range of landscape issues are such that planning at a single scale hinders delivery as it would neglect the multiple functions played by spaces at different scales. Consequently, the Maryland Green Infrastructure project was developed to assess landscapes as financial, physical, political and social entities that need to be planned if the environment is to be developed or managed effectively.

Where authors such as De Sousa have discussed landscapes in terms of scales, Antrop sees landscapes as a range of elements found within a physical space. He states that housing, education, transport and green infrastructures are all important components in the development of better places and can be assessed at different scales to discuss the potential social benefits available (Antrop, 2000). In the CIAT document, different scales appeared to be discussed simultaneously as a collection of systems of functions. Although the CIAT has been discussed as focussing heavily on urban-fringe areas, it can be interpreted as offering a mandate for multi-scale planning. The vision proposed by the CIAT was developed further with the formation of Natural England, which has a remit of delivering programmes across diverse landscapes. A review of the research literature suggests a view that appropriate landscape scale is seen as holding an important role in the debates surrounding landscape development. Authors like Antrop, the City Parks Forum and De Sousa have all suggested that discussions of landscape development cannot take place if discussions of scale are not made. This view is also important to the wider discussions relating to green infrastructure. In this chapter, the connective role of ecological networks was made, highlighting how landscape fragmentation could be lowered through green infrastructure delivery. If this view is reviewed alongside issues of what scale green infrastructure should be delivered, the debates of appropriateness become increasingly relevant.

4.9. Scale and Green Infrastructure

The discussions of landscape scale policy and planning at an appropriate scale are both important to the understanding of green infrastructure planning. Examples, though, also need to be examined if these somewhat abstract or contested concepts (scale and appropriateness) are to be explored in practice. The following section will present examples of multi-scale green infrastructure planning to examine these ideas.

The Northern Way is one example of the shift in policy, focussing on different landscape scales. This project was developed to form a connective landscape linking the urban areas of North-East and North-West England with the Yorkshire and Humber region. These links have been fostered to allow the movement of people, financial resources and institutions to provide a catalyst to employ green infrastructure across administrative and physical boundaries (Cullingworth and Nadin, 2006; Goodman and Hickman, 2006). Projects like the Northern Way highlight the comparisons that can be made with research from North America that has attempted to move the administration and development of spaces into the broader strategic levels of planning to provide regional (e.g. New England) initiatives. Although these projects may appear to be based around connecting broad physical spaces, they all also fulfil the agendas aimed at improving local regeneration and development. The Thames Gateway project is another example that has been planned to work at both the local and the regional scale. This multi-scale project has been designed to develop local areas into sustainable communities whilst concurrently regenerating the broader gateway area socially and economically (ODPM, 2005). This multi-level approach to planning has been debated as being an essential element of the Thames Gateway's development if its ambitious targets are to be met.³⁸

By using Cullingworth and Nadin's descriptions of how planning can work at a number of scales simultaneously, Weber, Sloan and Wolf (2006) noted that their green infrastructure work in Maryland has been undertaken through such a process. They state that, as green infrastructure is becoming increasingly accepted in the United States, practitioners have started to address issues of localised and regional planning or development. Benedict and McMahon (2006) support this view by stating that, as green infrastructure is not necessarily a concept with a fixed definition (or scale), it becomes more appropriate as landscape planning diversifies. Thus, the proposed diversity in landscape elements, and consequently their scales may, as Selman and Knight (2006) note, make broader and more holistic landscape management increasingly viable. Selman and Knight (2006) also go on to note that the historical segregation of planners, practitioners and landscape developers has led to a polarisation in how landscapes are developed and what scale is deemed appropriate.

Using Selman and Knight's assumptions that historically there have been separations in the planning system, green infrastructure is proposed as merging some of these boundaries. Thus, fuzzy boundaries between administrative units (local authority, unitary authority, or city-region) can be reviewed to increase the cross-boundary and multi-partner working partnerships. Haughton and Allmendinger (2008) develop this theory, stating that there are a range of outlets for policy development which have developed following the restructuring of local and national governance structures. This could benefit policy implementation as it would lead to a level of administrative practice, which is sometimes lacking (Kambites and Owen, 2007). With a review of Weber, Sloan and Wolf's research, it is also apparent that multi-scale planning can play an integral part in developing the green infrastructure concept. They and the City Parks Forum (2003) both note that the narrow focus of some planning agendas has hindered the development of green spaces and state that green

³⁸ The Thames Gateway has recently been acknowledged by Natural England as providing an exemplar of high quality and functional green infrastructure in the development of the Thames Gateway Green Grid.

infrastructure offers a mechanism that can redress this imbalance. In Figure 3.2, ODPM suggests a framework through which green space can be incorporated at different planning scales.

Through this system, ODPM and now the DCLG suggest that green space planning can be integrated into all levels of the planning system. They also suggest that the successful integration of each of these scales can aid strategic green space planning, particularly the use of green infrastructures. It has also been argued by the Environment Agency and Countryside Agency (2005) that green infrastructure planning should encourage local, regional and national agencies to integrate their agendas to develop green space matrices across physical boundaries (e.g. the Thames Gateway Green Grid). Finally, the role scale can play in developing the landscape must be viewed as providing opportunities for diversity and innovation to be delivered across supposedly fixed administrative boundaries. However, if these boundaries are viewed as fluid or dynamic, then green infrastructure planning offers a mechanism where a broader range of benefits can be delivered at local, community, regional and national scales.

Figure4.2. Incorporating different scales in landscape planning (ODPM, 2006a:62)



Mandates: Department of Communities and Local Government, Regional Development Agency

4.10. Summary

This chapter has outlined a number of the key issues relating to planning policy and practice with green infrastructure development. Green infrastructure, like all contemporary planning concepts, needs to engage with the structures of policy development if it is to be mainstreamed. The issues summarised in this chapter that relate to the spatial and strategic approach to green infrastructure are fundamental elements underpinning its development. Similarly, scale and appropriate integration of green infrastructure within different planning frameworks need to be discussed in conjunction with the debates relating to the concept. The integration of spatial implementation, scale, and a strategic view for green infrastructure need to be understood if the concept is to be utilised in planning policies and strategies. The roles of RSS are therefore crucial to the development of the concept and have been discussed to highlight some of the processes by which green infrastructure can be developed into policy. This chapter has also outlined how different geographical regions use and review green infrastructure. Research from the UK and North America highlight the differences in the focus of green

infrastructure planning in these geographical regions. They also note that some similarities can be seen in the planning frameworks that support the concept. The ideas of integration, appropriate development, and the links between research, practice, and policy development will be discussed in Chapters 6 and 8 to examine where the links between research and development and the actual implementation of green infrastructure are. This chapter, therefore, provided a review of the frameworks within which green infrastructure is currently situated, highlighting where opportunities lie to develop the concept and what strategies need to be taken in order to promote green infrastructure use by planners, developers and researchers.

Chapter 5: Methodology

5.1. Introduction

Due to the contemporary nature of green infrastructure research, the three main areas of investigation in this thesis required a range of methodological techniques to be used in order to develop a robust evidence base for each. The discussions presented in Chapters 1 to 4 presented the conceptual literature associated with green infrastructure outlining the main arguments behind each of these three topics. In the following chapter, our understanding of the meanings and principles of green infrastructure is addressed through a directed approach to understanding based on primary interview and surveying sources. The translation of these conceptual ideas into policy and practice was assessed using a combined approach of interview and policy sources. How our perceptual understandings of green infrastructure have developed was assessed through the use of a visual preference survey that aimed to explore how immediate and more considered responses are reflected in green infrastructure discussions. Using a range of methods which draw on a range of policy, practice and participant sources, the data collected and analysed for this thesis supported the use of a complimentary multi-method approach.

5.2. A multi-method approach to data collection

The following chapter outlines the rationale behind the development of a multi-method approach to data collection. This examines the discussions related to each method used and argues that, although other methods are commonly used to collect information, the mix of sources used in this thesis enabled it to direct the analysis undertaken to produce the recommendations made in later chapters. The main objectives of this chapter are therefore to argue that the use of a combined approach to primary and secondary qualitative data collection supports our understanding of green infrastructure, its use in policy and practice, and our perceptual understandings of the landscape to a far greater extent than using a single method or approach. The discussions behind these choices are also presented in order to highlight the specific benefits of using each method. The methods utilised in this thesis are aimed to present qualitative results that would subsequently provide a greater depth to the discussions presented. Although some quantitative data is noted, these results are based on the qualitative analysis conducted on discussions and descriptions of green infrastructure and its development.³⁹

A multi-method approach provided this research with a number of options regarding data collection. It also enabled a level of overlap to be developed, where the values of each of the three main areas of investigation could be assessed individually and then collectively. Consequently, the use of a multi-method approach provided a greater cumulative value to the discussions presented in Chapters 6-8 than the use of a single method. The primary reason for using different methods is to satisfy the need to collect a range of data from a number of sources in order to increase validity of the results through

³⁹ A qualitative approach to data collection was deemed more appropriate as it allowed a finer level of analysis to be made that reviewed the nuances and subtleties of green infrastructure discussions. Also, due to the contemporary nature of the subject matter, the variations in these examinations were more likely to provide suitable data for discussion if assessed through qualitative methods.

increased methodological rigour (Greene and Caracelli, 2003; Denzin, 1978). Each of the Result & Analysis chapters thus addresses our need to understand how people, policy and the landscape are linked with our perceptual understandings. This, in turn, affects the ways in which we use and see the landscape. The use of a number of different methods, therefore, supports the links between integrating primary and secondary data sources to achieve a deeper level of knowledge. The objective of the discussions outlined in this chapter was therefore to provide a set of methodological principles and understandings of green infrastructure that can be taken forward by other researchers and practitioners. The data presented in Chapters 6, 7 and 8 subsequently highlight the diversity of source material gathered and the multi-focussed discussions of green infrastructure made within them.

Strauss and Corbin have also suggested that the methodological structure of a research project must be developed with these outputs in mind. They stated that the conceptual basis of research, the methods used and the subsequent data collected, form a logical progression from the proposed aims to the outcomes of a project (Strauss and Corbin, 2003). Developing an understanding of the intersection between theory and practice is therefore a central element of this thesis, which attempts to expand the green infrastructure knowledge base (Benedict and McMahon, 2006; Silverman, 2001). It also provides supporting evidence of the potential values of green infrastructure and explores a number of under-researched areas that make up its use in both the practitioner and academic literature. Greene and Caracelli (2003), Robson (1993) and Denzin and Lincoln (2000) have all argued that the use of a multi-method approach to research can help safeguard against unexpected results by providing supplementary and complementary data with which to assess responses related to specific and replicable questions. However, it is acknowledged that unexpected results may actually highlight a greater level of variance in the thinking towards a phenomenon. Strauss and Corbin (1998) thus argue for the use of a multiple methods approach as a way of developing a flexible and responsive approach to research that incorporates theoretical and methodological foundations with the view to exploring a developing research agenda.

The use of a multi-method approach to research that allows descriptive, explanatory and exploratory data to be gathered, which explores a number of alternative avenues, is therefore a direct benefit of this process. These differences, however, also allow comparisons to be made between data sets to highlight any incongruence or new themes that become apparent (Greene and Caracelli, 2003). Due to the role that each method plays in a multi-method approach, they help develop what Hakim calls a '...more rounded, holistic approach than other [research] designs' (2000:59). Consequently, the aim of the approach outlined in this chapter is to highlight how these methods can be used concurrently to generate data that fulfils both the theoretical development of green infrastructure and the specific research questions asked within it.

The range of data gathered in this thesis therefore addresses the diverse nature of green infrastructure conceptually, spatially and in practice. By approaching this thesis with the view of assessing the spatial variation in its development sources from the UK, both Europe and North America have informed and aided the development of this research. The same process has been applied to the assessment of green infrastructure policy and its subsequent implementation. One

consequence of this approach is that this thesis presents a broader spatial understanding of green infrastructure that would not be possible if only UK sources had been used in isolation. The discursive breadth of the data presented in the remainder of this thesis, therefore, draw on the depth of information obtained from a multi-method approach applied in a multi-spatial context. It is, however, acknowledged that focussing this research on one geographical area may have provided a clearer line of argument for this thesis. Notwithstanding this, it was decided that the contemporary nature of the subject matter supported the use of a broader range of source material and methodologies. Subsequently, the diversity of the data gathered suggests that, although the breadth of material is less focussed, it highlighted that a number of similar principles and themes can be identified in the data gathered from the UK, Europe and North America. Thus, it can be proposed that the breadth of data obtained outweighs the need to establish a traditional triangulated methodology for a spatial region, as the results provide a depth of information that can subsequently be applied to a number of spatial locations and contexts.

Therefore, although this chapter presents discussions relating to three main methods, several themes and principles supporting the use of green infrastructure, environmental perception, and spatial planning are noted throughout. The view that the most appropriate methods, participants, data, and locations were all addressed in collecting the data is also explored. The need to utilise a number of complementary techniques, if comparable data is to be obtained, is also made, arguing for the use of a multi-method approach. In light of this, the remainder of the chapter will be structured as follows:

Firstly, a discussion of the post-positivist approach to social research will be presented. This highlights the role of a multi-method process of research and describes why it is an appropriate and relevant way of exploring green infrastructure. It also outlines some of the theoretical underpinnings of the post-positivist research agenda and how it can be applied to contemporary subject matter. The use of a multi-method approach will be followed by an examination of each of the techniques used to obtain primary and secondary data. Each method is assessed in order to highlight its value in collecting data relating to green infrastructure, how they fit within the overall structure of data collection, and examine the choices behind what makes these methods the most appropriate within this research. The value of interviews, documentary analysis, and visual surveys are all debated, exploring their utility and addressing how the data collected from each was analysed. The main objective of this examination is to consider collectively the cumulative value of each method and how it presents a significant strand of research to wider green infrastructure debates.

The discussion of appropriate methodologies will be further supported with a discussion of the research populations and sampling techniques used. This will once again assess the appropriateness of the methodological structure used in this research and argue that, despite the diversity of results presented, the quality of data collected outweighs the potential issues attributed to sample size or methodological focus. A further objective of this chapter, therefore, aims to address the issue outlined by Pepper who stated that 'one cannot simply go out and try to collect all [the] data from the world before attempting to induce some structure from it...' (1996:261). This chapter thus argues that, although one cannot investigate every facet of a topic, a thorough knowledge of a number of

methodological approaches and the most appropriate tools for data collection and analysis can be developed successfully (Maxwell and Loomis, 2003).

5.3. Theoretical Position – Post-Positivism

The collection of appropriate data that assess a core research issue has become increasingly important in the development of academic understanding and follows the principles of Social Constructivism, which viewed the real world as a construction of human-nature interactivity. It is therefore acknowledged that attributed knowledge is a process of interpretation and perceptions based upon experience and learning. This moves away from a traditional positivist stance that states that knowledge is unchallengeable and is based on static assumptions. Consequently, post-positivists argue that, when social enquiry discusses contemporary issues (i.e. green infrastructure), these debates must be based on assumptions that continually change. Green infrastructure research therefore sits well with this approach and a search for objectivity in its development can be achieved through a flexible methodological structure (Philips and Burbules, 2000; Bernstein 1983; Deleuze and Guatarri 1987). Thus, the post-positivist view moves away from traditional cause and effect theories into a more humanly-induced green infrastructure research agenda where human interpretations are subject to change, which has led to changes in social science research and the development of this research.

Consequently, by placing our understanding of the conceptual principles of green infrastructure and their associated assumptions at the centre of this research, it has allowed a broader examination of the social construction and use of it to be made (Flinder and Mills, 1993). This has been achieved through a translation from cause and effect relationships to a discourse where explanations of the complex interactions of human, environmental and political influences are central (Bird, 1989). Furthermore, this approach proposes that, because the world is in a constant state of change, when individuals view the world it is according to their own interpretation of and is not therefore a static process (Bird, 1989). Comparisons can therefore be made if the most appropriate methods are used to investigate an issue. Smith extended this view by arguing that 'to describe what we experience, we have to use concepts, and these are not dictated by what we observe; they are either *a priori* in the mind, or they are a result of a prior theoretical language. There are, therefore, no brute facts, no facts without interpretation, and interpretation always involves theory' (Smith, 1996:13).

Smith therefore advocates that learning and experience are closely linked with the development of our theoretical knowledge and are central components to understanding. This view can be applied to the development of green infrastructure where current research is aiding our understanding of the subject. Denzin and Lincoln (2000) also suggested that this transition has provided a forum where the development of a deductive form of research is appropriate in investigating contemporary research issues, i.e. green infrastructure. Flinder and Mills (1993) discuss this view proposing that, when a concept is examined through a triangulated system of theoretical, real world investigation and a multi-method framework, it can provide a more in-depth foundation for analysis that accurately describes the world around us.

A post-positivist approach was therefore utilised in this research as it allows the theoretical assumptions made in previous research (i.e. Benedict & McMahon, 2002; Little, 1990; Lindsey *et al.*, 2001) to be expanded upon and explored further. This approach reflects the theoretical developments previously made in green infrastructure research and applies them to the current research and practice (i.e. Natural England, 2009; Landscape Institute, 2009). Consequently, this process provided this research with a firmer methodological grounding as it does not exclude a methodology because it does not conform to an established empirical perspective (Flinder and Mills, 1993). Flinder and Mills suggest that previously, where only traditional or empirically-generated data was deemed valuable, a post-positivist framework promotes placing its emphasis upon developing research through a combination of empirical data and solid theoretical assumptions. This is supported by Crano and Breuer (2002) who note that, given the choice, a researcher should always choose methodological rigour over empirical control.

However, the following caveat also must be made. Human knowledge is not infallible and a post-positivism framework allows assumptions to be challenged through further debate. Moreover, in contrast to empiricist and positivist perspectives, a post-positivist view of a multi-method framework supports an adaptive approach to research development. This process is achieved by developing a methodological structure that allows data to be captured that discusses both *etic* and *emic* behaviours (Flinder and Mills, 1993). Etic is a description of a behaviour that is familiar (e.g. a general event). Emic is the description of behaviour that is personally meaningful (e.g. localised to a person's life). Assessments of these behaviour types will be reviewed against the theoretical assumptions of green infrastructure to highlight how personal and theoretical narratives differ. In Chapter 7, these behaviours are analysed as central elements in our understanding of how and why people value the landscape. Chapter 7 also addresses how these views can be used to influence green infrastructure developments at a local, regional and national scale.

In support of this view, Lakatos (1979) suggests that a post-positivist approach re-focuses research away from the empirical nature of the positivist tradition. Instead, it promotes an examination of the more complex environmental-human influences on green infrastructure development. Habermas explored this point stating that, as the world can be created and experienced simultaneously, research must take both these issues in its theoretical and methodological development (Habermas, 1975; 1972). Ward (2002) and Ingold (2000) also examine this view in their analysis of perceptions and interpretations, debating how our understanding of the world based on knowledge and experience influences our interactions with it and how we value specific locations.

These views, therefore, like those of Lakatos (1979) and Smith (1996), place the focus of social research on understanding the multiple relationships that interact within a given phenomena. In this research, the conceptual development of green infrastructure is assessed along with its use in landscape planning and our interpretations and understandings of these landscape elements. Consequently, as Flinder and Mills (1993) and Denzin and Lincoln (2000) suggest, this thesis promotes the view that engagement with the conceptual and methodological foundations of green infrastructure is essential if its values are to be examined. As an emerging concept, green

infrastructure promotes the discussion of a number of ecological-economic-social interactions and, as such, is viewed as being in a continual state of evolution. Our understanding of these changes is therefore based on a number of conceptual assumptions⁴⁰ mixed with an examination of the relationships people have with the landscapes around them. The use of a multi-method approach to this research thus provides it with a broad methodological foundation, where these developments and interactions can be assessed to report on the changes seen in green infrastructure development and support the gathering of a robust evidence base.

The following three sections outline each of the three methods (interviews, documentary analysis, and a visual preference survey) used in this research to gather data. By examining the value of each and addressing the theoretical literature supporting the use of these three methods, these sections discuss why they were chosen for this project. Each method will be examined to discuss its focus and the process of analysis with the aim of showing how data collected from each supports our understanding of green infrastructure and its development.

Table 5.1. Interviews Conducted, Institution and field of expertise⁴¹

Name	Institution	Position	Field of Expertise	Date of interview
Ahern, Jack	University of Massachusetts, USA	<i>Professor</i>	Greenways, Green Infrastructure planning, environmental management	27/02/2007
Brown, Robert	University of Guelph, Canada	<i>Professor</i>	Landscape Architect, microclimate designs, landscape ecology	03/02/2007
Charlton, Gary	Natural England (formally Countryside Agency), UK	<i>Team Leader Urban and Urban-Fringe Policy Team</i>	Countryside in and Around Town, Green Infrastructure	20/12/2006
Clingan, Graham	Stockton Borough Council, UK	<i>Strategy and Development Manager</i>	Green Space Planning, Countryside in and Around Towns	10/01/2007
Conn, Christine	Department for Natural Resources - Maryland States, USA	<i>Director, Ecosystems Analysis Centre</i>	GI planning, environmental planning, GIS	01/05/2007
Gill, Susannah	Mersey Community Forests, UK	<i>Green Infrastructure Co-ordinator</i>	Climate, Green Infrastructure Planning	03/01/2007
Hall, Richard	Natural England, (formally English Nature), UK	<i>Senior Specialist in Planning and Advocacy</i>	Biodiversity, Green Infrastructure	10/01/2007
Hopkins, David	Martson Vale Community Forest, UK	<i>Green Infrastructure Office</i>	Green Infrastructure planning	31/07/2007
Konijnendijk, Cecil	WOODScape Consultants, Denmark	<i>Director</i>	Urban Forestry, urban planning	12/01/2007 and 08/08/2007
Lewis, Megan	The Land Connection, Illinois, USA	<i>Executive Director</i>	Planning, urban planning, green space planning	16/03/2007
Littlewood, Steve	Leeds Metropolitan University, UK	<i>Senior Lecturer</i>	Planning, Green space management	04/01/2007
McGloin, Chris	Mersey Forest (formally NECF), UK	<i>Assistant Project Development Officer</i>	GI Planning, GIS, Forestry policy	07/09/2007
Murphy, Donna	Great North Forest, UK	<i>Green Infrastructure Co-ordinator</i>	Rural planning, Green Infrastructure Planning	24/07/2007
Nolan, Paul	Mersey Community Forests, UK	<i>Director</i>	Community Forestry, GI planning, landscape planning	03/01/2007
Oppermann, Bettina	Free University of Hannover, Germany	<i>Professor</i>	Open space policy and communication in planning	08/08/2007
Pauleit, Stephan	University of	<i>Professor</i>	Landscape planning	

⁴⁰ See Chapter 2 for further details.

⁴¹ All respondents are representing their own personal views and do not necessarily outline the views of the organisations they represent.

	Copenhagen, Denmark			08/08/2007
Randrup, Thomas	University of Copenhagen, Denmark	<i>Professor</i>	Urban planning, green space planning	08/08/2007
Selman, Paul	University of Sheffield, UK	<i>Professor</i>	Cultural landscape, Landscape planning,	27/07/2007
Turner, Tom	University of Greenwich, UK	<i>Senior Lecturer</i>	Greenways, green space planning, urban parks	08/12/2006
Weber, Ted	The Conservation Fund, USA	<i>Strategic Conservation Analyst</i>	Strategic Conservation, landscape, GIS	27/04/2007
Williamson, Karen	Heritage Conservancy, USA	<i>Senior Researcher</i>	Landscape Architecture, planning and design	08/03/2007

5.4. Academic, practitioner and researcher interviews – rationale

One of the main purposes of this research was to examine views of what green infrastructure is. Previous chapters outlined a number of discussions presenting the broad range of elements and principles that have been debated as constituting green infrastructure. Within these discussions, Davies *et al.* (2006) noted green infrastructure could be described as a semantic pick and mix of concepts, theories and practices. Consequently, the interviews conducted in this thesis aimed to highlight:

- a) What different academic, researchers and practitioners feel constitutes green infrastructure.
- b) What the fit of green infrastructure is in landscape planning and with other green space planning processes were.
- b) Whether there is a consensus of what green infrastructure is.
- c) How green infrastructure should be developed in the future.

Interviews were therefore used to unpack the diverse definitions and meanings attributed to green infrastructure. As a first point of entry into this debate, the main academics researching the concept were surveyed to assess whether a universal (or a more individualistic) view of green infrastructure exists. A number of England's Community Forests were also interviewed to examine how one of the most prominent supporters of green infrastructure has used the concept in their work. Green infrastructure practitioners were also interviewed alongside Community Forest staff to provide insights into the differences between academic and practitioners views. Spatial and geographical differences in green infrastructure were also examined by conducting interviews with participants from the UK, Europe and North America. This process helped to identify whether geographical or sectoral differences of practitioners or academics affect the use and definitions of green infrastructure, a view which forms a central debate in Chapters 6 and 8.

In support of using an interview methodology, it is important to note that, due to the evolving nature of green infrastructure, there is a growing capacity in the number of professionals working with the concept (Bailey, 1994). However, although the field of green infrastructure has developed rapidly between 2005 to late 2008, a relatively consistent number of experts have been working on the

concept.⁴² A high proportion of these experts were interviewed in this research to provide an examination of the broad professional understanding (academic and practitioner) of green infrastructure (Gerson & Horowitz, 2002). These participants are shown in Table 5.1 along with their specific interest in green infrastructure. Table 5.1 highlights the number of academics, local authority officers, and ENGO staff in the UK, Europe and North America, all of whom provided useful insights into how green infrastructure has developed and influenced the process of landscape planning at a number of scales.

An interview methodology was deemed the most appropriate approach to data collection with these participants compared to questionnaires or focus group discussions, as it enabled a range of respondents to be surveyed using a number of grounded principles and concepts based on the most recent findings and assumptions in green infrastructure research (Bailey, 1994). It was also less prone to time and response constraints as individual interviews could be scheduled more easily, and group discussions and requests were more likely to be received positively resulting in interviews taking place than in questionnaire surveys. These questions were drawn from a reading of the research and practitioner literature and mirrored the arguments being made regarding the meaning, value and proposed utility of green infrastructure. These interviews also formed one of the first large-scale investigations of green infrastructure in a broad geographical and conceptual sense rather than the more traditional single location assessments of development and conceptual thinking (Hakim, 2000). The main objective of an interview methodology was therefore to provide a forum for discussions that allowed the historical development of green infrastructure and more recent research findings to be discussed collectively.

It has also been argued that, without an understanding of its conceptual foundations of green infrastructure, its current use and formulation in policy would not provide the level of detail required to determine its future development trajectory (Ely *et al.*, 1991). The aim of undertaking interviews was thus to explore and gain information on how the ideas that underpin green infrastructure have taken shape and who is leading this process. These ideas have been discussed to some extent in the research literature, but a further exploration of these views with academics and practitioners in three leading geographical locations provided greater scope for comparisons to be made. Practitioner and academic participants were engaged in order to assess how these conceptual ideas are being used in practice, assessing if different user groups support their understandings of green infrastructure development in their implementation of projects (Robson, 1993). Furthermore, by assessing the links between participant responses and their use in practice, guides or strategies, we can examine the value of these discussions and how, or if, they have been translated into practice (Ely *et al.*, 1991). This is an important statement to make if our use and development of principles for green infrastructure are to be grounded in empirical data. If this process can be achieved, it can potentially be used as a foundation for future research. Chapters 6, 8, and 9 will examine whether this process has been achieved and where opportunities for future research exist.

⁴² Since 2005, Natural England, the Environment Agency, a number of conservation trusts, an increasing proportion of Local Authorities and RDAs, and government office have all developed green infrastructure development or policy posts.

The focus of each interview in this research explored four main areas. These areas were: a) discussions of green infrastructure definitions, b) its development, c) its use, d) the future of process. Each of these areas has been discussed in the research literature but few documents have examined each of these as a part of the collective knowledge of green infrastructure (see Appendix 3 for an outline of the interview schedules). Consequently, by enabling participants to discuss the links between what they understand green infrastructure to mean, how it developed, and how it can be used, this research provides a forum where a breadth in conceptual values and practical implementation strategies can be examined collectively. It also provides respondents with an arena where they can identify the links between these four areas to support their understanding of green infrastructure. In some responses, this was based on the research outlined in the literature and in others on participant uses of the concept. The use of interviews, therefore, enabled both this research and the participants to examine their interpretations of what green infrastructure is and contextualise it against the wider research, which defines and debates the concept.

The questions used in each interview were developed in two forms. Firstly, questions including *What do you think green infrastructure is?* were used to focus on one of the main issues of this thesis, i.e. perceived meanings and definitions of green infrastructure. These were supported with additional questions such as *What elements do you think constitute green infrastructure?* which aimed to address specific expressions of green infrastructure and its component parts. The aim of asking a combination of focussed and more open questions was to obtain a deeper understanding of the main issues relating to green infrastructure. This process was also used to prompt further discussion if an initial response did not appear to fully develop the concepts being debated (Mason, 2002; Bridge, 1992). The use of a range of questions also provides this work with a number of options in the approach taken to interviewing different academics and practitioners. By allowing the focus of each interview to flow from the questions being asked, more diverse and contextualised discussions were developed. These focussed on the questions asked of all participants but also provided scope to link green infrastructure with historical understandings of green space planning and policy. Greater depth was achieved because the types of questions asked were not too restrictive.

Furthermore, the interviews conducted enabled each participant to integrate and explore a number of ideas into their responses and allowed them to support their understandings with links to policies, theory or practice (Gerson & Horowitz, 2002). The integration of these areas was central to the debates presented in Chapters 6 and 8 outlining the interaction of policy and practice with the integration of conceptual principles. The focus of the interviews, therefore, provided a directed approach to asking people for their understandings, their uses of, and their thoughts regarding the future of green infrastructure. These discussions informed the later chapters of this thesis, which present an examination of these ideas and presents recommendations based on the data analysed in Chapters 6, 7, and 8.

To gather this data, a semi-structured interview approach was used. This was in part due to the diverse nature of the subject area and due to the research populations partaking in the study. These populations were drawn from demographic groups working both within and outside the field of green

infrastructure and green space planning. Owing to the differences in the knowledge of participants, the interviews reflected areas of interest to the respondent whilst keeping the integrity of the research focussed on green infrastructure (Robson, 1993). The ability of interviews to develop a conversational style also enabled a level of adaptability that accorded greater diversity between the topics being discussed. However, a semi-structured approach maintained the green infrastructure questioning of the interview (Burgess, 1992; Kvale, 1996). The use of this approach thus allowed a range of ideas to be integrated into the interview process that enabled this research to link diverse areas of green infrastructure thinking with policy development and implementation strategies. The main issues supporting the use of an interview approach within this thesis can be outlined as follows:

- Scope of discussions with different participants (Robson, 1993)
- Ability to discuss a number of concepts, ideas and planning issues with different participants (Patton, 2002)
- Incorporation of geographical, academic and practitioner knowledge and expertise (Mason, 2002)
- Scope to investigate green infrastructure ideas as they arise with participants (Bridge, 1992)
- Highlight a high level of integrated thinking and historical context for green infrastructure (Ely *et al.*, 1991)
- Level of replicability within interviewing process (Kvale, 1996)
- Conversational nature of process can and did elicit a high level of detailed and insightful information (Burgess, 1992)

5.4.1. Interview analysis ⁴³

The analysis of each interview assessed the participant use of themes and principles related to green infrastructure. Based on discussions of specific ideas such as connectivity or the historical development of green infrastructure as outlined in Chapter 2, each interview was analysed in terms of what was discussed, how these ideas were presented, and the variation in their focus. In a similar way to how the green infrastructure documents were analysed, the content of each response was debated against the broader context of green infrastructure development. Consequently, themes and linkages between different areas of implementation and conceptual understanding could be identified and a narrative explaining the focus of green infrastructure could be made. This process was supported using the key green infrastructure ideas drawn from the literature as a basis for interpretation and discussions. These themes (connectivity, access, strategic development, multi-functionality etc) were all used as key trigger words or phrases for these discussions and subsequent analysis. These themes also provided signposts that each of the areas of questioning could be discussed alongside any new development or idea. Moreover, this allowed a number of ideas to be clustered, highlighting where complementarity between ideas could be seen and where interesting avenues of diversion existed (Ely *et al.*, 1991). This process also allowed each of the interviews to be assessed as a single

⁴³ Each interview was digitally recorded and transcribed. Interview transcripts show verbatim discussions and have not been edited. Consequently quotes presented in Chapters 6, 7 or 8 are recordings of actual discussions.

question and answer event, which could then be discussed in a specific spatial context (i.e. UK, European or North American), with a community forest or practitioner context, or as an academic or practitioner response. Each of these areas was subsequently examined collectively to highlight where similarities and differences lay.

The analysis of each interview was performed in terms of its specific responses to each area of questioning and then against the data received from other participants. This process provided a deeper analysis of how individual academics and practitioners viewed the development of green infrastructure to be made, but also enabled each response to be contextualised against similar responses. In effect, this approach provided the analysis with a greater level of detail as it compared a number of approaches and understandings of green infrastructure simultaneously. By undertaking this process, this analysis provided a contextual examination of a number of academic, geographical, and political factors that influence green infrastructure. This could not have been achieved if a more focussed set of participants was interviewed⁴⁴ or if the breadth of information discussed had been smaller.

The use of an interview technique and analysis was therefore deemed to be the most appropriate method of developing a large set of qualitative data. It provided a direct approach to working with participants to discuss a number of contemporary ideas and allowed the scope of the interviews to be relatively diverse in order to address the concepts and ideas being presented fully. As a consequence of this, a level of diversity was installed within the interview process that allowed a range of influences and conceptual avenues to be investigated. It also provided scope to integrate a number of contrasting ideas simultaneously and explore the intersections between green infrastructure policy and practice. An understanding of green infrastructure, its development and use, and how different participants respond to it, is therefore a key element of the concept's utility in academic and practitioner spheres (Hakim, 2000). Therefore, by providing a forum for discussions of the conceptual progress and practitioner uses of green infrastructure, an interview methodology enabled a broader depth of investigation to be achieved (Silverman, 2001). The data gathered from this process also influenced the green infrastructure document analysis and the visual preference survey by providing an examination of the concepts outlined in the literature that can then be discussed and challenged. These discussions could subsequently be debated against actual policy production and implementation to highlight whether ideas and concepts are actually being developed in practice.

5.5. Documentary Analysis – rationale

To support the data received from interviews, an analysis of green infrastructure policy and implementation documents was also undertaken. The main objective of this process was to highlight whether the ideas, themes or principles outlined in the interviews corresponded with the information presented in a range of policy and practitioner documents (Denscombe, 2003). Undertaking such a process provided this research with an understanding of how the principles associated with green

⁴⁴ This would have meant one location was investigated or one set of respondents, e.g. academics. If this approach had been followed, the breadth of data would potentially have been far more restricted compared to the use of a wider research interviewee approach.

infrastructure are being utilised in practice or in the formation of landscape policy. A survey of this nature also examines the focus of the research literature and whether this work is being translated into practice. This is an important area of green infrastructure development to discuss as, although several research sources present compelling arguments for supporting it, if these agendas are not followed by discussions in policy documents then the forward motion of the concept may be lost (Hakim, 2000).

The broad objective of a documentary analysis was therefore to assess the use and focus of green infrastructure practice of a number of RDAs, local authorities and ENGOs. This analysis provided a platform where the exploration of policy and practice influences could be made and then be assessed against prior discussions of green infrastructure development. Furthermore, the aim of this process was to provide an analysis of the main themes and discussions relating to green infrastructure, which could be discussed alongside the interviewee responses to assess areas of complementarity and diversity. The value of this lies in its ability to provide supporting data, which assesses how the rhetoric presented in interviews is translated into practice (Scott, 1990). It also provides key insights into how ideas or concepts can be integrated into documents depending on whether they are focussed on delivery or a conceptual understanding of green infrastructure. This is an important debate in the development of green infrastructure, as the concept can be reported and discussed. However, without a clear mechanism or avenue for delivery, green infrastructure may not progress. Consequently, there is a value in providing a snapshot of how green infrastructure is discussed in documents produced between 2005 and 2008 in the same manner as the interviews, in that it allowed green infrastructure to be examined, thus providing information which can improve our knowledge of its development and utility in landscape planning (Platt, 1981; Scott, 1990).

To achieve this process, a range of documents was analysed to assess their use of green infrastructure, its focus, its delivery or development focus, and the process outlined to actually improve the green infrastructure resource base. These documents included regional, sub-regional and city-region scale documents produced in England between 2005 and 2008 and focussed on a number of areas of green infrastructure development (e.g. policy, implementation, scoping, and economics). The documents included each draft RSS and EIP in England to provide a regional and strategic planning analysis of our understanding of green infrastructure. This was supplemented with a review of specific green infrastructure scoping studies, planning guides, and scoping studies undertaken at a sub-regional or city-region scale. By analysing documents at these scales, this approach provided scope to highlight how regional policy influences delivery at a more local scale and how these locally focussed documents fed into regional policy (Denscombe, 2003; Robson, 1993). A dual system of interpretation could therefore be undertaken that highlighted how green infrastructure was discussed strategically and in a delivery sense.

The value of this process is in providing additional data that supports our understanding of the formation of policy and the practitioner intersects with green infrastructure. A list of the documents analysed can be seen in Table 5.2 below. This table presents the range of documents analysed and outlines their focus. An interpretation of these documents thus provides a deeper level of information,

which can then be assessed alongside individual understandings of green infrastructure to present a better picture of where development is taking place within the policy.

Table 5.2. Reviewed green infrastructure documents

Document Name	Focus	Date Published
East of England RSS	Policy	2004
East Midlands RSS	Policy	2005
North East Draft RSS	Policy	2005
North West Draft RSS and Final Version	Policy	2006/2008
South East RSS	Policy	2006
South West Draft RSS	Policy	2006
West Midlands RSS	Policy	2006
London (RSS)	Policy	2004
Yorkshire and Humber RSS	Policy	2006
East of England EIP	Policy	2006
East Midlands EIP	Policy	2007
London EIP	Policy	2007
North East EIP	Policy	2006
North West EIP	Policy	2007
South East EIP	Policy	2007
South West EIP	Policy	2007
West Midlands EIP	Policy	2007
Yorkshire and Humber EIP	Policy	2007
Leeds Metropolitan University: Centre for Urban Development and Environmental Management (CUDEM)	Planning guide	2006
Milton Keynes & South Midlands Environment & Quality of Life Sub Group Green Infrastructure Planning Guide	Planning guide	2005
North East Community Forests, Newcastle University and Northumbria University Green Infrastructure Planning Guide	Planning guide	2006
East Midlands Green Infrastructure Scoping Study	Scoping study	2006
Green Infrastructure Planning in the Swindon Urban-Fringe	Scoping study	2006
Planning Sustainable Communities: A Green Infrastructure Guide for Milton Keynes & the South Midlands	Scoping study	2005
Cambridgeshire Horizons - Quality of Life Programme: Cambridgeshire Green Infrastructure Strategy	Strategy	2006
Bedfordshire and Luton Green Infrastructure Consortium - Bedfordshire and Luton Strategic Green Infrastructure Plan	Strategy	2007

The selection of documents for this analysis was based on a number of criteria. Firstly, each of the documents had to be publicly accessible in an electronic or hard copy format. Documents that were unavailable in the public domain were not used so as to ensure that all the information presented and analysed could be considered the most contemporary thinking on green infrastructure at a given point. Using publicly available materials also made it easier to access information as well as to contact its publishers to discuss a document's contents if necessary (Robson, 1993). Publicly available documents also present, especially in terms of RSS, the strategic options and priorities of an organisation which can then be assessed against their additional comments. These publicly accessible documents were also analysed, as they presented the opportunity to compare and contrast between different types of documents and they could be cross-referenced at any point.

Secondly, documents were only analysed from England. Despite the interviews and visual surveys presenting a multi-regional perspective of green infrastructure, only documents from England were assessed due to availability and accessibility of their authors. These documents were also assessed because there is a more co-ordinated approach to landscape policy development in England that is not necessarily in place in other countries. Consequently, in England there is a level of uniformity in regional policy production relating to RSS and EIPs which makes spatial assessments easier. This is not the case in the USA or in Central Europe where comparisons can be made, but the differences in their planning systems makes it harder to compare between locations. The USA in particular has a number of different processes that cannot easily be translated between the city and sub-regional scale.

Thirdly, at the time of the assessments there were a far greater range of green infrastructure documents being released in England compared to other geographical regions. This included national, regional and sub-regional government authorities and ENGOs. In other geographical areas, this level of policy production was not noted as being as strong in relation to green infrastructure. Therefore, by focussing on documentation produced in England, this research was able to make assessments within a specific and regulated planning system to analyse the similarities and differences being presented.

The scope of this analysis was also important in assessing how green infrastructure was being discussed and used. The use of RSS and EIPs provided guidance on how green infrastructure was being examined at a regional scale and presented debates outlining its value in strategic planning, but also included descriptions of where it could provide ecological, economic and social benefits. The level of detail presented in these documents could therefore be assessed against each of the other regional-scale documents to compare the development and presentation of green infrastructure by each RDA. The level of detail that these documents provided formed a base that can be assessed further against the strategic focus of sub-regional and city-region documents.

The plans and scoping strategies complemented the discussions outlined in the RSS and EIPs outlining the reasons behind why green infrastructure should be developed at a sub-regional and city scale. The value of these documents was in their translation of specific ideas or principles into discussions of opportunities and investments programmes. They also provided a more focussed analysis that took the regional targets and ideas of the RSS and contextualised them at an appropriate delivery scale. This analysis was further supported with a review of the green infrastructure strategies produced for Cambridge and Bedfordshire and Luton. These documents present discussions at a finer scale than the plans or scoping strategies, as they articulate the (broader) regional targets at a local level and identify opportunity areas where green infrastructure should be developed. The analysis of these strategies consequently presented specific areas for investments based upon the identification of a number of focussed development agendas, e.g. historic environment or landscape scale projects (Hakim, 2000). Consequently, by providing an analysis of how regional documents present strategic targets or areas for investments and how these visions are presented in scoping strategies or discussion documents, we are able to assess how policy initiatives are being developed (Scott, 1990).

Furthermore, by analysing strategically-focused documents, scoping and proposal documents, and intervention or delivery document, this research has been able to assess the process of policy translation into practice. It also allows a better understanding of how initiatives are translated into delivery by outlining how strategic development targets are articulated in delivery documents (Platt, 1991). This is an important process to debate as, with a better knowledge of these interactions, we can assess where opportunities lie for more effective planning and implementation strategies relationships. The main reasons supporting the use of a documentary analysis within this thesis are therefore:

- Detailed level of analysis of policy, process and development to assess alongside interview responses (Robson, 1993)
- Ability to examine the strategic policy initiatives with actual planning practices (Scott, 1990)
- Range of documents available and scope of their focus (Denscombe, 2003)
- Good outline of developing concepts and their use in policy (Platt, 1991)
- Clear insights into what particular elements of green infrastructure are deemed valuable (Hakim, 2000)
- Ability to examine multi-area developments in green infrastructure planning (Robson, 1993)
- Replicability of the process to assess a range of documents within a given planning system.

5.5.1. Documentary Analysis – analysis

The assessment of each document took the form of a content analysis. This process was based on an extensive reading of the research and practitioner literature, which led to the development of a number of assessment criteria or categories (Scott, 1991). These categories were based on the overarching themes and principles of green infrastructure, its function, and its use in policy or as a delivery mechanism. Consequently, the reading of green infrastructure within this analysis was informed by conceptual developments and discussions of its utility in landscape planning, both of which are important elements of our understanding of the concept. These categories examined the main focus of each document's presentation of green infrastructure and related these discussions to the principles discussed in Chapter 2 and in Table 5.3. Secondly, the use of green infrastructure terminology and its principles were also conducted in the analysis of each document in order to examine the layered meanings and uses of the concept. The objective of this process was to discuss, at a finer scale, the actual use and meaning behind green infrastructure discussions rather than just report its use.

The categories used within this process were: access/accessibility, benefits (multiple), biodiversity, connectivity, ecological focus, economic focus, integrated functions, integrated people, integrated policy, mobility, multi-functionality, networks, political focus, quality of life/place/environment, scale, social focus, strategic/strategy, sustainability, and sustainable communities (see Table 5.3). Each category has been discussed extensively in the research literature as providing key elements for our understanding of green infrastructure. As such, each was used as a way of analysing a number of

green infrastructure references simultaneously as it also allowed a discussion of where intersections of themes and uses were seen in policy initiatives, practice, and wider discussions.

Table 5.3. Principles of Green Infrastructure

Principles	Theoretical Discipline	Key Literature
Accessibility	Landscape Planning,	Countryside Agency and Groundwork (2005), Gallent <i>et al</i> (2004), Hidding and Teunissen (2002)
Landscape connectivity	Landscape Ecology	TEP (2005), Jongman and Pungetti (2004), Jongman <i>et al.</i> (2004)
Landscape integration	Landscape Ecology, Political Ecology, Landscape Planning	Countryside Agency (2006), TCPA (2004), Bryant and Bailey (1997), Benedict and McMahon (2006)
Multi-functionality	Landscape Ecology, Political Ecology, Social Geography, Landscape Planning	Davies <i>et al.</i> (2006), Kambites and Owen (2007), ODPM (2003), Lindsey <i>et al.</i> (2001)
Multiple Benefits	Social Geography, Planning	TEP (2005), Benedict and McMahon (2002), ODPM (2003), Williamson (2003), Lindsey <i>et al</i> (2001), Countryside Agency (2006)
Assessments of landscape fragmentation	Landscape Ecology	Farina (1998), Forman (1995), Laurence and Laurence (1999)
Integration of different cross-boundary people, places and policies	Planning, Social Geography, Landscape Ecology	TEP (2005), TCPA (2004), Weber, Sloan and Wolf (2006), Countryside Agency (2006)
Capital negotiations	Political Ecology, Social Geography	Countryside Agency (2006) Gallent <i>et al.</i> (2004), Peet and Watts (1996), Selman (2000)
Social norms and perceptions	Social Geography	Ingold (2000), Kaplan and Kaplan (1989), Tuan (1974), Rodaway (1994), Sibley (1995)
Scaled landscape variance	Landscape Ecology, Political Ecology, Social Geography, Landscape Planning	ODPM (2005), Cullingworth and Nadin (2006), Farina (1998), Environment Agency and Countryside Agency (2005)
Spatial disparities	Landscape Ecology, Political Ecology, Social Geography, Landscape Planning	Countryside Agency and Groundwork (2005), Beatley (2000), CABE Space (2003), Williamson (2003)

Each document was assessed by analysing each reference to green infrastructure against each of the principles noted above. Every reference made to green infrastructure was recorded prior to examination. A content analysis was then conducted for each document, firstly assessing what the statement concerning green infrastructure said. This consisted of assessing whether the term was being used to describe specific principles, policy initiatives or landscape elements. Once this process had been undertaken, each use of the term was clustered using the principles noted in Table 5.3 to highlight trends and themes in the documents reviewed. By assessing the context of green infrastructure terminology use within each document, it was possible to examine what the overarching understandings of the term were. This was supplemented using the remainder of the statement or comment to describe how the use of green infrastructure linked to the ideas presented (or the actual policy being promoted). This allowed a layered assessment to be made. Firstly, the use and focus of green infrastructure (or its proxy terminology) could be assessed and, secondly, this could be supported by assessing its use against the broader themes or ideas being discussed in each document (Robson, 1993).

The primary objective of the process was to explore whether green infrastructure was being used in simple terms, e.g. as green space terminology, or whether it was being discussed in a more detailed manner of its principles and values. By assessing each document's use of green infrastructure, firstly on individual statements and then against the broader issues and uses of green infrastructure, this assessment was able to examine a greater level of description and context in each review. The collation of this data into themes allowed the level of detail highlighted in each statement and its relationship to the core principles of green infrastructure to be made. Furthermore, although this process was conducted without the aid of a statistical computer package (i.e. NVivo), the assessment allowed the nuances of each document to be discussed against broader green infrastructure debates. Consequently, the subtle uses of green infrastructure terminology may have been lost if a computer package was used for the assessment as, although these programmes link key phrases and words, they cannot provide as detailed an analysis in terms of documentary context.

The approach taken in this research to highlight, analyse, and interpret each statement referring to green infrastructure manually, therefore, provides a platform in order to make the links between statements and the uses of green infrastructure at a finer level (Bazeley, 2007). However, this research acknowledges that the production of context-rich data records can be served well using statistical analysis packages. Formalised coding systems have therefore not been used in this research, but a system of analysis has been presented based on the linking of key principles and themes. Consequently, although key statements, trigger words and terminology have been used to describe and discuss the use of green infrastructure in each document by not using an NVivo, it has allowed a greater understanding of the more directed and discreet uses of the concept to be made (Richards, 1999). Moreover, although some authors would challenge the idea of not using a computer package, this thesis argues that the directed and thorough manual assessment used potentially provides a greater understanding of the green infrastructure nuances being presented. An extended discussion of each document is reported in Chapter 8 which assesses the use of green infrastructure and describes how the focus of different documents affect its reporting. These discussions are examined against the main delivery or strategic targets outlined in each document in order to highlight how green infrastructure fits within the debates of policy production and planning practice.

5.6. Visual Preference Survey

The third method used to gather data in this research was a visual preference survey. The central objective of this method was to provide this thesis with a body of information, assessing the perceptions and understanding different user groups and individuals in relation to green spaces or green infrastructure. With a better understanding of how perceptions are formed and the influences respondents describe in their assessments of landscape images, this preference survey has been used to highlight the potential physical, psychological and social factors that can influence landscape policy or development. The use of this technique, therefore, provides a key link between the development and translation of conceptual landscape principles into policy and delivery programmes. Moreover, by providing landscape planners, architects, and developers with a greater level of understanding regarding perceptions, more sustainable, functional, and user-friendly spaces may be developed. Although assessments of new green infrastructure projects based on the analysis of this

thesis have not been conducted, the themes discussed in this chapter and Chapter 7 could form the basis for such an analysis.

The role of a visual preference survey is also to gain a better understanding of the links between our understandings of the landscape (stated understanding) and our actual use or preference of the landscape. An assessment of this process provides a discussion of the relationship between how different respondent groups discuss their feelings towards the landscape and how this translates into actual behaviour. A discussion of this nature will provide a number of avenues that landscape architects, planners and developers can use to inform their development choices.

Recently, there has been a move towards the use of more contemporary methods of obtaining data in research (Hakim, 2000). Innovations in oral history, the use of logs and diaries to assess the development of individual understanding, and the role of visual stimuli or survey work have offered a range of complementary options for researchers. This process has been seen in the collection and use of visual data as a method of obtaining a deeper understanding of views and attitudes relating to visual stimuli and, in the case of this thesis, green infrastructure. Visual data is therefore more than just a picture, a video or an image. It is also an engagement with, knowledge of, use of, and an experience of a landscape or location. This is argued by Emmison, who states that images 'are signs that bear an iconic resemblance to the reality they represent' (2004:3). He goes on to outline the theory that, unlike interviews or questionnaire surveys, the use of images is imbued with a set of layered meanings that relate more directly to people's lives, their experiences and interpretations and are perceived as such. Emmison also stated that images preserve, store, and represent experiences and are similar in form to human recollections or memories. This point is of particular relevance to this study, as an understanding of how perceptions are developed is central to our discussions of how the look and function of green infrastructure affects our use of it. In Chapter 1, this process was identified with the Hyde Park analogy where perceptions of a group of people differ despite the space being fundamentally the same. This theory has also been discussed by Banks (2001), who highlights a three-way method of viewing visual data, namely (i) appraisal (What is it?), (ii) analysis (Who took it, when and where?) and (iii) interpretation (What does it mean? What does one do with it?). Each of these three areas will form part of the analysis presented in Chapter 7, where what respondents see, what they relate these images to, and how these factors influence their descriptions of an image will be made.

Banks, however, went on to note that, through an initial appraisal of an image, people start to analyse the setting, the form, and the subject or narrative of the image before offering their interpretation of that image. In theory, both Emmison and Banks argue that a person brings to an image a catalogue of cultural, historical and social experiences that aid their analysis and interpretation of a specific location. Carr *et al.* (1992) and Geffroy (1996) supported this view, noting that the relationships between the physical infrastructures within an image and its psychological connectivity to wider narratives are central elements of human interpretations. Understanding how people negotiate the attribution of physical and psychological meanings to a location will form a central part of the analysis presented in Chapter 7.

To conduct this survey, twelve images were selected for use in this research. Each image was selected from a portfolio of green infrastructure images (developed between 2005 and 2007). The function of these images was to present a variety of landscapes to respondents who were then asked to view and discuss the images in terms of both their positive and negative interpretations. It was important within this process to provide images that offered a range of views and landscape elements, a number of locations, and different scales to provide each respondent with a set of heterogeneous images that highlighted the variety in form and function of green infrastructure. Respondents were not asked to rank images as this would not necessarily have produced the same level of data. Alternatively, participants were asked only to name their most and least preferred option and explain why a greater level of detail was presented in the former. A ranking approach may have produced a more quantitatively robust result, but in this work a qualitative approach was deemed more appropriate.

Table 5.4. Images used in visual surveys

Image	Location	Properties (based on on-site observations)
1	West Jesmond Cemetery, Newcastle	Urban setting, trees, green space, aesthetics, tranquillity/spirituality
2	Leazes Park, Newcastle	Urban location, green space, ordered management, recreation opportunities
3	Marsden Bay, South Tyneside	Rural/coastal location, ecological functionality, water, wildlife and birds
4	Calthorpe Project, Central London	Urban setting, flora and fauna, trees, activity/opportunity place
5	West Park, South Shields	Urban location, trees, orderly management
6	Wardley Manor, South Tyneside	Urban-fringe location, open green space, new pathways, industrial units
7	Misterton, North Lincolnshire	Rural location, snow, right of way fences and path
8	Herrington Country Park, Wearside	Urban-fringe location, ordered management, water, wildlife, trees
9	Steel Rigg, Northumberland	Rural location, Hadrian's wall, farmers fields, hedges
10	Coram's Field, Central London	Urban location, flora and fauna, benches, green space, trees
11	Bedes World, South Tyneside	Urban-fringe location, recreation activities, trees, shrubs, flora and fauna, industrial units
12	Ouseburn Valley, Newcastle	Urban location, river/water, bridge, trees, shrubs

Each image was selected based on the discussions outlined in existing research. The works of Bischoff (1995), CABE Space (2008), Brush *et al.* (2005) and Bell (2001) all proposed a number of landscape elements that are deemed to elicit different responses, e.g. the use of trees, water or buildings. The use of variation in each image's focus (urban, urban-fringe, rural), composition (single or multiple features), and meaning (historical, physical, social) provided scope for a range of interpretations to be made. Thus, by presenting a set of images that showed such variation this survey aimed to elicit a situation where similarities and contrasts between the images could be made; participants could then either assess specific elements of each image against another or assess the whole range collectively. Furthermore, by presenting the images in this manner, it allowed each respondent the time to think about what they were looking at (Where is it? What is it comprised of? What is going on there?) and assess the image in terms of their experiences and landscape knowledge (Banks, 2001; Carr *et al.*, 1992).

Each image was also selected as they were representative of a range of green infrastructure resources found in different locations and at different scales. The difference in landscape focus seen in images 3, 4, 6 and 9 outlined how scale (i.e. urban and enclosed vs. rural and open) can be used to discuss understandings of space. Likewise, the use of manicured or planned spaces (image 10) compared to more open or natural space (images 3 and 6) presented participants with the opportunity to describe their perceptions of managed or natural locales and features. The presentation of man-made structures compared to open spaces also aided the development of such discussions. Each image was therefore presented as they highlighted a range of green infrastructure attributes that could be considered valuable, or not, depending on personal interpretations and experience of the landscape.

Several authors have supported the use of a diverse range of images in preference surveys. Banks notes that, through an initial appraisal of an image, people start to analyse the setting, the form and the subject or narrative of the image before offering their interpretation. Therefore, by presenting a set of twelve images to participants, the survey aimed to increase the level of cross-image interpretation and discussion. This process is supported by Carr *et al.* (1992) who argue that it is important to review the relationships between physical infrastructures within an image and its psychological connectivity to wider narratives if a better understanding of a location is to be made. Banks' three-stage process also compares favourably with Emmison's (2004) work highlighting the role that experience plays in aiding our interpretation of an image. In theory, both Emmison and Banks both therefore state that a person brings to an image a catalogue of experiences that aid them in their analysis. A number of these ideas were presented in Chapter 3 and will be developed further in the analysis presented in Chapter 7.

It can also be argued that both Mead (1995) and Foucault (1977) support the three-stage process of viewing Banks proposes but only if a conceptual approach is related to such works. Mead's work highlighted the role of images in understanding the world, stating that to make sense of the world people must appraise, analyse and interpret. Alternatively, Foucault's work examined how images are linked to a development of knowledge and the subsequent change in the relationships between the function of a location and our understanding of it. The research of both, however, can be used to promote the idea that an image provides an insight into a wider interpretative world imbued with cultural, historical and social meanings. Consequently, only through an engagement with these issues can an understanding of an image's personal and societal meaning be made (Wagner, 1979; Banks, 2000; Geffroy, 1996; Harper, 1988; Carr *et al.*, 1992).

However, a note of caution was proposed by Foucault (1977) who suggested that, although people may be able to empower themselves through an engagement with an image, this process may also hinder their responses depending on the nature of the images presented. If an image is emotive, controversial or unsavoury understanding or interpretations of what is being asked may also be subverted. Countering this issue, Geffroy (1996) proposes that the selection of the images for review is paramount to the success of a project. Geffroy goes on to note that the cultural, historical and social contexts of an image have all been noted as key reference points obtained from visual

interpretations, which potentially have to be controlled. Geffroy alludes to what Emmison notes as the 'subversive, dangerous and visceral' nature of images that are still apparent in some research projects (Emmison 2004:14; May, 2002; Robson, 1993; Dockery, 2000). As a consequence of these discussions, each image was selected to present elements of green infrastructure and attempted to avoid the use of imagery that could be interpreted as negative (Sibley, 1995). Alternatively, neutral images presenting the links between the landscape and human behaviour were presented in order to avoid causing distress or emotive responses.

Each image in the survey was used as it showed a location or a landscape that highlighted a number of principles associated with green infrastructure. Principles shown included notions of connectivity and access (image 9), recreational use (image 8), social engagement (image 4), biodiversity and conservation (image 6), and social history (image 11). Consequently, each respondent was asked to assess the image and their perceptions of its function or utility. These discussions are presented in Chapter 7 and highlight how each of the principles noted above were paramount in a number of responses.

The objective of this process was to understand how the physical elements of the landscape and the psychological and social factors people place on them influence our understanding of the landscape. This includes asking people to assess how an image makes them feel, what they believe goes on there, and whether they would like to go to that place. These questions were all discussed when participants were asked to identify which images they liked and disliked. The visual preference survey was also utilised as it provided a more efficient approach to data collection than other methods. Video and image diaries have been developed that allow participants to identify what they feel are valuable green infrastructure, but this was not a viable process due to participant engagement, timing and cost constraints. Likewise, computer assessments based on participant selection of green infrastructure was again deemed too time-consuming and equipment may not have been available. Discussion groups were also considered but were not undertaken, as the group dynamic of such events can lower the level of detail received from the individual. It is, however, acknowledged that these methods could have been used to gather data, but the time and access constraints placed upon this research supported the use of the visual preference survey. The ease of its replicability also meant it could be used in different locations without the problems of organising a longer process of investigation of discussion events.

Plate 5.1. Visual Survey images

Plate 5.1 - West Jesmond Cemetery.

Plate 5.2 - Leazes Park.

Plate 5.3 - Marsden Bay.



Plate 5.4 - Calthorpe Project

Plate 5.5 - West Park

Plate 5.6 - Wardley Manor



Plate 5.7 - Misterton

Plate 5.8 - Herrington Country Park

Plate 5.9 - Hadrian's Wall



Plate 5.10 - Coram's Field



Plate 5.11 - Bede's World



Plate 5.12 - Ouseburn



In conducting the survey, each image was presented to each respondent as a part of a set of twelve. Each image was displayed on an A4 laminated sheet and each participant was provided with all twelve images simultaneously. All participants were asked to assess the presentation and meanings of each image in relation to the whole set. Only at this point were they asked to state their positive and negative preferences. Participants were encouraged to make comparisons between the images and present these discussions in terms of the preferences they showed in their responses (Geffroy, 1996). No time limit was imposed on this process so participants could take as much time as they needed to make their judgements. This process was used throughout the investigation to provide a uniform basis for interpretation and discussion. All responses were noted on pre-printed questionnaires and returned. Responses were then collated and analysed against a pre-defined criteria of physical, psychological and social interpretation as well as for specific elements or attributes (Robson, 1993). These assessment criteria were based on the principles outlined in the research literature as being integral to perception surveys (see Bischoff, 1995; CABE Space, 2008; Brush *et al.*, 2005; Bell, 2001). The criteria supporting the use of a visual preference survey in this research are therefore:

- Ability to provide immediate and more considered interpretation of the landscape and its uses (Emmison, 2004)
- Range of data available that can be translated to planners, developers and landscape architects (Mason, 2002)
- Scope of the assessment in terms of using a proportionate number of the categories outlined in the literature as key elements of the images (Nassauer, 1997; Kaplan and Kaplan, 1989)
- Insight into the physical, psychological and social understandings of the landscape (Carr *et al.*, 1992)
- Additional data referring to an individual's knowledge of the landscape, its systems, and its impacts on their lives (Geffroy, 1996; Brush *et al.*, 2000)
- Replicability as the process can be undertaken with a broad range of participant groups (May, 2002)
- Uniformity and researcher control in what is being viewed and what questions are being asked (Robson, 1993).

5.6.1. Visual Survey Analysis

Following the return and collation of each survey a qualitative analysis was performed, which assessed the specific elements respondents had noted and the overarching themes related to these.

Following this initial process, each response was placed within one of three identified discussion categories: *physical*, *psychological* or *social*, depending on whether the response related to landscape elements, an interpretation of feelings or emotions, or was derived from social experiences. These three categories were identified within the research literature and were consequently used as a basis for analysis. The work of Bischoff, CABE Space and the DLTR noted previously aided the development of these categories and provided a baseline that outlined a number of elements which have been reported as consistently influencing our understandings of the landscape. Further work by Sibley (1995), Harrison *et al.* (1995), Valentine (2001), and DCLG (2009) has also supported the use of these three main categories. In the work of Sibley, he notes that social experiences and locations heavily influence our understandings and interpretations of the world around us. Bischoff noted that, when people are asked to identify what they like about a location, invariably they respond with physical elements as they are the most immediate visual stimuli. Understanding the process of interpretation can therefore be viewed as being split between immediate interpretations and a deeper process of perceptions and was outlined in Chapter 3. The use of physical, psychological, and social factors, therefore, facilitates such a discussion as they provide a platform where both forms of interpretation can be debated.

Once each response has been categorised, the overarching themes relating to each of the three categories was made. In this analysis, a number of ideas were repeated and were used as a basis for recommendations made in Chapter 8. The interaction between physical and psychological-social interpretations is therefore important in developing our understanding of green infrastructure and its utility. Using these three categories facilitated a discussion to be made that identifies where commonalities between perceptions of positive and negative interpretations are and how they relate these to the fundamental principles of developing green infrastructure (Robson, 1993; Emmison, 2004). The level of detail described in the responses aided this process as psychological and social influences were discussed in greater detail, providing a better level of information which could then be assessed against development or design criteria. This also supports the previous discussion where a multi-layered approach to analysis was discussed. The use of these categories and the responses gathered suggest that green infrastructure resources are interpreted differently depending on what is being asked. The analysis of this survey, therefore, supports the use of a set of qualitative data that discusses the complex factors which influence our understanding and enjoyment of the landscapes around us. The data collected thus enables a more pragmatic examination of the green infrastructure concept and its use in policy to be made that highlights how these infrastructure or resources are used in the real world (Robson, 1993). Therefore, although the visual preference survey does not sit as easily within a policy development, use and analysis process, it does provide an additional and valuable insight into how landscape resources affect people and communities.

The three methods discussed in the previous sections present a number of supporting reasons for the use of each. Focus, the ability to engage with a broad range of participants, the qualitative nature of the data received, and the level of interpretation facilitated between the methods used provided this research with a number of comparable data collection options. It is, however, acknowledged that further research could have been used to improve the visual preference survey, but time and

constraints made other techniques unsuitable. The same process of discussion was used in the development of interview and the documentary analysis. These two methods were deemed to be the most appropriate way of generating a large data set based upon more in-depth interpretations of the questions being asked. The ability to review the findings from each to assess how, and where, green infrastructure developments have been successful was an area which was promoted throughout. Subsequently, whilst other methods could have been incorporated into this research, they may not have delivered the same level of depth to our understanding of green infrastructure.

5.7. Research Populations

A variety of respondent groups were engaged with during the data collection process for this thesis. Academics, practitioners, and groups with an interest in the landscape were all involved in assessing the development of green infrastructure, our understanding and interpretation of it, and its use in landscape planning. At the outset of this research, green infrastructure did not hold the same position in terms of importance in policy and practice that it holds now. As a consequence of this process, the groups targeted for engagement were more discreet than if the project was conducted in late 2009-2010. A range of participants in a number of geographical locations who are knowledgeable about the conceptual development and uses of green infrastructure were therefore approached to take part in this research. This, however, limited the number of respondents who participated in this process. The nature of the research population therefore comprised experts working with green infrastructure, either conceptually or in practice, to support the analysis outlined in Chapters 6 and 8. The data gathered from these respondents was supplemented with the visual preference survey with student and conservation groups who informed the debates presented in Chapter 7. Consequently, although the number of participants engaged with was not as numerous as some literature suggests (i.e. Robson, 1993), each respondent's data addressed a specific area of questioning that had a wider cumulative value for this research.

The three main participant groups engaged with were: (i) academics working on green infrastructure, landscape and regional planning, or geography; (ii) ENGO practitioners who have developed and worked with green infrastructure policy development and its implementation; and (iii) student and conservation groups. Each of these three groups is identified in Table 5 alongside the broad focus of questioning they faced.

Table 5.5. Research Populations

Who	Where	Why
		GI development and use
Academics	UK, Europe, North America	Answer questions relating to the development of GI, its future and its meanings.
Practitioners	UK, North America	a. Answer questions relating to the development of GI, its future and its meanings. b. Answer questions relating to other areas of GI development (i.e. multi-functionality). c. Discussions of GI in practice
		GI Perceptions
Students	UMass (USA), UNN (UK)	Assess how different groups of students perceive GI differently.
Conservation Volunteers	UK – Gateshead Conservation Volunteers	Assess how different groups of people perceive GI differently

Once again, the contemporary nature of green infrastructure research restricted the composition of the research sample to those involved in the concept's development, use, and management. Moreover, although a broad spatial perspective was incorporated into this research by approaching respondents in the UK, Europe and North America, this process was attempted to help lower the effects of using a limited research population. Consequently, although experts in green infrastructure development participated in this research, their numbers were relatively low. A full list is shown in Table 5.1. However, although the critical number of respondents needed to develop data that can be generalised proposes the use of a higher number of participants than used in this study, the quality of the respondents was deemed more important (Robson, 1993).

By debating the development of green infrastructure with academics and practitioners who were amongst the first wave of people developing research on the subject, they provided a crucial depth to the data. Members of the Conservation Fund in the US and the Community Forests and Natural England potentially provided much more valuable data than those academics or practitioners who have worked with green infrastructure more recently.⁴⁵ The appropriateness of these respondents therefore enabled a much deeper and directed analysis of the subject matter to be made. This also applies for the academics who took part in this research. These participants have been at the forefront of landscape planning and green infrastructure issues and thus provided both a depth of knowledge to questioning but also contextualised its development against other relevant green space initiatives. Furthermore, they provided key insights into the production of research and its translation into policy, a process also presented by practitioners in regional level ENGOs and the Maryland DNR. A more focussed and discreet participant group was therefore deemed more appropriate than the sampling of a wider but less expert set of respondents. The data collected and discussed in Chapters 6 and 8 supports this key by presenting a greater depth and understanding of the issues impacting or influencing green infrastructure development.

The participants for the visual preference survey were drawn from UK and US respondents. Each group was selected due to their interest in landscape issues, their availability to participate in the study, and access. The respondents were selected through good working relationships with their organisations or groups. Access was provided through the presentation of information and self-selection. The student groups were approached as I had access to these groups over the course of the research. Students, however, self-selected to participate following an initial briefing regarding the focus of the research. The number of responses included in this research could be seen as being relatively low, as a number of students did not wish to participate. Those who did are noted in Table 5.6, which highlights the variation in research numbers. The participants of the conservation group were approached through a professional relationship with Gateshead Council. Once again, members of the group were canvassed to participate and those who agreed were briefed and provided questionnaire materials. Issues of access and timing were therefore crucial in conducting this survey.

⁴⁵ In the UK there is currently a trend of employing green infrastructure officers within Local Authorities. However, whether these officers have a firm grasp of green infrastructure is open to discussion. The participants in this research can therefore be assessed as being experts in this field and not officers whose remit covers green infrastructure.

The limited number of groups surveyed is acknowledged as an issue, but the level of detail gained from each provided a sufficient level of detail from which to assess the themes behind stated preference responses.

Table 5.6. Research areas, populations, and sample size

Project	Perceptions of green infrastructure.	Who?	Focus	Sample size
University of Massachusetts	Use of slides to assess different thoughts on landscapes.	Landscape Architecture and Regional Planning students	N/A	11
Newcastle & Northumbria Universities	Use of slides to assess different thoughts on landscapes.	Geography and Environmental Management students	N/A	27
Gateshead County Council Conservation Volunteers	Use of slides to assess different thoughts on landscapes.	Current and former conservation volunteers.	Community outreach and conservation	23

This work acknowledges the potential drawbacks of both self-selected participation and working with participant groups with knowledge of the research subject matter. However, the self-selection method was utilised as it enabled this research to attract participants when access to student numbers, through teaching or professional introductions, was not possible. Consequently, although a bias could have been developed in the data because of the preconceived knowledge of students, they did provide a broad range of data which may otherwise have been hard to generate. Some of the responses gathered suggest that a certain level of academic knowledge is being reported, but overall the participants focused on responding to the images and were not predominately academic responses. Likewise, the use of conservation volunteers places a level of bias on responses, as people are interested in the subject matter being debated. However, the participants in the conservation volunteers group were drawn from a number of age groups, male and female, and a mix of professions. Subsequently, the level of uniformity one might expect from an interested volunteer group was not seen in the responses from this group. Alternatively, as with student responses, a broad range of information was gathered which addressed personal, communal and scholarly issues. Thus, although a level of standardisation between respondents may have been expected, this was not necessarily visible within the data gathered.

One of the primary objectives of engaging with a range of academic, practitioner, student, and conservation groups was to develop an evidence base where trends and themes could be assessed across a number of research areas. Links between the development and planning of green infrastructure are readily apparent and the use of interviews and documentary reviews supported this process. The participants who provided evidence in this research also facilitated this approach. The role of student and conservation volunteers was to provide supporting data that outlined why participants liked or disliked specific landscapes and the values they placed upon them. Consequently, although the participant numbers were relatively small, the broad nature of their experiences, interests and understanding of the landscape made their views of equal importance as practitioner and academic responses in assessing the value of green infrastructure. A level of translation and

complimentarity was therefore seen between the three main areas of research and the responses of participant groups in each. This research does, however, acknowledge the potential drawbacks of a limited sample population, a lack of generalisable data, potentially skewed samples, and a failure to gain consensus or depth to responses. A different response was, however, seen in this research where the more focussed research population produced a higher level of focussed and discreet data for analysis due, in part, to their professional or personal investment in the subject material. Consequently, although the results of this work cannot be generalised, they do present a number of themes which are supported by the research literature and within the responses of different participant groups. Furthermore, a larger sample could have been used but it may not have provided any further information.

5.8. Replicability and triangulation

The use of three main methods to gather the information for this research raised questions about its replicability and the ability to triangulate between participant responses. The broad spatial focus of the work also presented issues but are discussed in the following section. The use of three methods to gather data which addressed a range of concepts, principles, and uses of green infrastructure meant that comparisons could be made. However, although the focus of each method presented information that aided the development of a better understanding of green infrastructure, they were not able to be triangulated. Links between the document of interviews and the analysis of documents have been presented in this chapter and can also be seen in the cross-referencing of literature in Chapters 2 and 4. A level of complimentarity could therefore be said to exist between the data gathered from these two methods. The use of a set of grounded principles and definition outlined in Chapter 2 therefore aided this process, as key themes for understanding green infrastructure could be used as a basis for assessments. Consequently, although it is difficult to reconcile the differences in the focus between the interviews and documents analysed, the data gathered presented a number of complementary responses. The lines of questioning used in this process did, however, replicate each other. Empirical triangulation was therefore not achieved in this process, but replicability and intersections between these areas could be said to exist.

In contrast, it was more difficult to link the visual preference survey with the main themes examined using the other two methods. As the preference survey focussed directly on interpretations of the landscape and our understandings of it, no direct questioning regarding green infrastructure was made. Consequently, linking and comparing this data with the two other sets was more problematic and made triangulation difficult. However, the data gathered did support the broader concepts of green infrastructure as respondents discussed the physical elements of a landscape, their uses of it, and the benefits they felt they could obtain from it, which were areas that underpinned the other two methods. Responses of this nature therefore provide additional data that could be integrated into our understanding of the landscape and proposes links to how green infrastructure principles can be interpreted against them. Therefore, although the line of questioning varied between the three main methods, the data gathered was used to develop a deeper knowledge of green infrastructure and participant uses of it.

Moreover, although this process does not conform to standard interpretations of triangulated methodologies (Robson, 1993), it does provide an approach where replicability can be achieved. The methods used and the focus of the questioning could be replicated as the interviews and documentary analysis were derived from a baseline of green infrastructure literature and principles. Conducting such an analysis again would therefore require another researcher to update the question schedules and criteria for analysis. They would not, however, have to reformulate the main focus or approach to questioning. A similar process could be utilised in terms of the visual survey where the standardised nature of the approach could be replicated and altered depending on the focus of a specific research project. The diverse geographical scope could also be replicated as further researchers and examples of green infrastructure in practice develop. Therefore, although a number of issues hinder any estimations of this being triangulated research, the focus of the questioning has led to a level of data being gathered that highlights where the integration of ideas addressed between the different methods intersects to develop our knowledge further. This process could be replicated in other studies relating to green infrastructure as long as the principles used to underpin our understanding of the concept are acknowledged and used consistently between approaches.

5.9. Spatial focus and justification

The diverse focus of this research reflects the broad nature of green infrastructure development globally.⁴⁶ Research being conducted in the USA, the UK, and Europe has all influenced green infrastructure and its use. Examining practitioner and researcher responses from each of these three geographical locations has therefore enabled this thesis to highlight the nuances of green infrastructure development in each area. This was deemed important in order to provide a theoretical context to this research, which could have been lacking if only one spatial locale was addressed. Reflecting the developments of US research compared to that from the UK or European counterparts thus provides this thesis with a greater level of depth in the comparisons made in Chapters 6 and 8.

By moving away from discussions focussed on one location, i.e. North-East England, and engaging with the wider debates and uses of green infrastructure may therefore have diminished the ability to triangulate results. Although using one location would have allowed a much deeper analysis to be made, because of the comparable nature of responses, it would not have allowed this work to address the broader development issues attributed to green infrastructure. Consequently, by assessing the use and understanding of green infrastructure in the UK, the USA and Europe, this research has been able to present debates that key into specific spatial understandings of green infrastructure. This would not have been possible, to the same extent, by using only one region. Moreover, due to the different speeds of green infrastructure development, focussing on one region would potentially have failed to examine critically all the factors influencing its development. Comparisons in the UK of the North-East, North-West and Marston Vale regions therefore provided a much greater depth of understanding as they present the avenues used to develop and use the concept. They also assess this development in a similar timeframe. This notion can also be extrapolated to a national and international scale and can be applied to this thesis, whereby using UK, European and North American examples supports a

⁴⁶ This implies a discussion of more than one geographical region but could also be noted as being a discussion of a western perspective.

broader understanding of ideas and trends but contextualises these in terms of specific planning policy cultures.

The timing of this thesis also supports the use of participants and research from different geographical locations. As a developing concept, the use of green infrastructure has increased through a more in-depth understanding and awareness of the concept. This process differs in each geographical location and, as such, this thesis presents data that assesses the temporal and spatial differences in green infrastructure development. If this thesis were to have looked at the timeframe 2009-2012, it could have included a far greater use of Asian and Gulf State examples, as these regions develop a more robust green infrastructure evidence base. During 2005-2009, however, the main drivers of green infrastructure have been located in the UK, USA, and Western Europe, areas which formed the basis for the research undertaken in this thesis.

5.10. Summary

The methodological techniques and the justification of their use outlined in this chapter have aimed to impart an understanding of why each were selected and used. At each stage in the development of this thesis, the question of necessity in terms of use of each methodology was addressed. Interviews were used to provide a forum for discussions of green infrastructure to be made. These were based on the main themes derived from the literature and previous research in the field of landscape planning. The focus of these interviews aimed to identify the drivers, influences and meanings of this developing concept and was a process that had not previously been undertaken with such a wide geographical and practitioner focus. The data collected within these interviews was supported by documentary analysis of planning policy, strategic guides and implementation plans. The use of these documents supported the development of a number of green infrastructure principles which could be related to the responses gained from the interviews. Analysing documents also enabled a development timeframe to be proposed, tracing the literature and discussions associated with green infrastructure. Again, this proved to be useful in comparing responses and documents to actual planning and implementation practices.

These two areas, therefore, provided clear scope for the integration of principles and debate. The objective of the visual preference survey was to supplement this process by establishing a debate relating to how people see and interact with the landscape and green infrastructure. The application of this process thus provides planners with a range of data that can be used to assess the value of development visions and future use.

The combined use of these methodological techniques provided a range of comparable data which addressed the use, our understanding, meanings, and function of green infrastructure. They provided scope to address geographical differences by allowing interviews to be supported with policy, which can be assessed through examinations of its use and our understandings of it. Each method was therefore deemed necessary in order to answer the specific questions focussing on the meaning and development of green infrastructure (Chapter 2), our perceptions of it (Chapter 3), and the application of these two areas in policy and implementation (Chapter 4).

However, the number of participants surveyed in this research could have been increased, as could the range of documents analysed. There are, unfortunately, limits to the level of data that could be collected and analysed without diluting the evidence being presented. Thus, new developments in green infrastructure research were not assessed post December 2008, thus providing a discreet timescale for this thesis and the reporting to be made within. Further work may, however, have added additional information or nuances to the discussions presented in the following Research & Analysis chapters. However, it was decided that the breadth of material presented constituted a substantial and robust evidence base for discussion. A greater number of participants would potentially also have allowed the recommendations made in this work to be generalised to future green infrastructure research. However, constraints in access to participants, timing and focus of some elements of this research presented problems in this process. The discussion of the methods presented in this chapter do, however, highlight the links between the focus of the techniques used and the depth of data gathered. Consequently, the choices made can be said to meet the objectives and needs of this research and the results presented in subsequent chapters. The nuances of each method and the use of a multi-method approach, therefore, supported the development of the discussions presented in this thesis and allowed a layered approach to our understanding of green infrastructure to continue to develop. Improvements could have been made, but the data presented in the following Results & Analysis chapters suggest that the level of detail gained from this approach enables a thorough debate of green infrastructure and its use.

Chapter 6.0: Results & Analysis

6.1. Introduction to Results and Analysis (Chapter 6, 7 & 8)

The methodological structure set out in the previous chapter outlined how the research questions proposed in Chapter 1 would be examined. The following three chapters will present and analyse the empirical data collected, examining how different areas of green infrastructure thinking, environmental perception research and spatial planning were described and debated by this research's respondents. Each of the following three chapters will present a discussion of the overarching research questions to contextualise the development of green infrastructure thinking in terms of its development and functions, but will also examine more specific elements of its use. Chapter 6 will outline the research undertaken, reviewing green infrastructure, its definitions, its meanings and its uses. This conceptual discussion will be supported in Chapter 7 with the presentation of a debate of how specific elements of the green infrastructure literature are perceived by different groups in order to assess how they perceive, interpret, and interact with green infrastructure. The final chapter, Chapter 8, will show how green infrastructure is being developed and implemented by different delivery and implementation organisations. Overall, these three chapters will present a view of the current work being conducted on green infrastructure, and present ideas for its development, but will also examine how green infrastructure is being discussed in terms of specific social phenomena. Consequently, discussions of green infrastructure are made to examine any commonalities in respondent discussions and provide a basis for future debates.

6.2. Chapter 6 Synopsis: Green Infrastructure; definitions, uses, and the future of the concept

The first of these three chapters presents responses from academics and practitioners to the research questions, addressing what green infrastructure is, what it is used for, who is using the concept, and what the future holds for green infrastructure thinking. The aim of this chapter is to present a discussion of green infrastructure that outlines a number of overarching ideas or definitions of what it is proposed to be and allow future discussions to use these ideas as a baseline of information. Chapter 6 presents a number of findings obtained from different academic sources in the UK, Europe, and North America and assesses the development of green infrastructure as a practical framework for delivering its broader conceptual ideas into practice. These discussions will also assess the ideas that underpin the differences or commonalities that different respondents present in their discussions of green infrastructure. This area of green infrastructure thinking has become increasingly relevant when the ideas of respondent groups are discussed in conjunction with how they are actually developing and using the green infrastructure concept in their own work.

6.3. Chapter 7 Synopsis: Environmental Perceptions; interpretations, uses and landscape multi-functionality

Chapter 7 reviews the perceptual responses gained from participants examining their interpretations of different green infrastructure resources. This chapter outlines how perceptions of different landscape elements differ between different respondent groups. It draws on data gathered from a visual

preference survey. The data obtained from the visual surveys provides a broader discussion of how different respondent groups value a given landscape, and how these ideas are constructed using a range of experiences, memories, and social norms. The range of data presented in this chapter highlights how different phenomena are perceived in very different ways by different participant groups. However, although there may be differences in the images or preference between different groups examined, a number of overarching themes were developed and are discussed. These themes include diverse demographic interpretations of landscapes, the role of culture in landscape appreciation, and assessments of how the function of a space underpins these different ideas. Each of these ideas is presented to explore how green infrastructure is viewed by different cultures and organisations.

6.4. Chapter 8 Synopsis: Spatial planning; policy and practice, and the future of green infrastructure planning

The final Results and Analysis chapter reviews the use of green infrastructure as a landscape management technique. By reviewing a range of planning and policy documents in conjunction with interviews with academics, landscape practitioners, and environmental organisations, this chapter outlines how green infrastructure is being developed and implemented in the UK, Europe and North America. The range of documents reviewed includes planning guides or toolkits, green infrastructure scoping exercises, Regional Spatial Strategies (RSS) and Examination in Public Reports (EIPs) and Community Forest green infrastructure projects. These documents were reviewed as they represent a broad range of green infrastructure thinking, i.e. strategic planning or as a delivery mechanism. The broad aim of this chapter is to examine how different organisational agendas affect green infrastructure development and review how these ideas are articulated in the plans, policies and guidance. The relevance of this chapter for green infrastructure development is to assess how far the concept has been translated into practice. This builds on the debates outlined in Chapters 2 and 6. Consequently, this chapter assesses how far the process has progressed from its initial debates to its transition into practice. This review is a crucial process for planners and green infrastructure supporters as it provides an assessment of where they have been successful, and where further research and support is needed.

Overall, the following Results and Analysis chapters address the research questions proposed in Chapter 1. The diversity of these questions supports the three different approaches taken in these chapters and promotes the use of a multi-method approach outlined in Chapter 5. These three chapters therefore hold the role of translating the ideas found in the research literature into empirical data sources for analysis. In the following three chapters, these data sources will be analysed to provide insights into the debates relating to green infrastructure in order to progress these arguments further.

Chapter 6.5: Results and Analysis - Green Infrastructure: definitions, uses and the future of the concept

6.6. Introduction

The research literature on green infrastructure sets out a number of comparable and contrasting definitions, uses and reviews of the concept. This following chapter will review academic and practitioner responses to these differences and assess their understanding of the development of green infrastructure. These responses are gathered from UK, European and North American academics working in the areas of green space, green infrastructure and landscape planning who have written on, or discussed, green infrastructure. Offering a comparison to the academic responses, green infrastructure practitioner discussions from the UK and the United States are presented highlighting whether the conceptual developments and practical users of green infrastructure differ in their views on the concept's utility. Furthermore, the use of practitioner responses provides an insight into how environmental organisations with different levels of influence, e.g. at a national (the Conservation Fund) state level (Maryland Department of Natural Resources), differ in their use of the concept. This chapter will therefore present a review of the different understandings of green infrastructure, how these interpretations developed, how they are used, and what the future holds for them.⁴⁷ This builds on the discussions outlined in Chapter 2 but provides a deeper analysis of where green infrastructure thinking lies at present.

This chapter is presented in the following systematic way. Firstly, an analysis of different green infrastructure definitions is presented in order to highlight the principles and elements different respondents attribute to it. Supplementing this discussion, the elements that different respondents consider to constitute green infrastructure are also presented to contextualise their thinking. This is followed by a review of whether the academics and practitioners surveyed feel there is a consensus in green infrastructures thinking or planning. This is an important discussion as, within the research literature, there appears to be little consensus relating to what green infrastructure should be or do. The next section reviews a discussion of green infrastructure development; how it developed, who championed it, and why it was deemed important. Finally, a discussion of where future opportunities for green infrastructure thinking or planning lie is made.

6.7. Definitions of Green Infrastructure

In Chapter 2, a number of elements were proposed as underpinning green infrastructure thinking. These ideas included (but were not exclusively): accessibility, green infrastructure as a resource, connectivity, integration of policy (landscape or green infrastructure), people and management, scale and multi-functionality. The following discussion asked practitioners and researchers how they defined green infrastructure and what they thought constituted it. The responses included a number of the

⁴⁷ This chapter aims to answer the following questions: a) what is Green Infrastructure proposed to mean? b) Is Green Infrastructure viewed differently by different user groups, academics and landscapes practitioners? c) Are differences found in the definitions of Green Infrastructure spatially generated or distinctive? d) What are the future opportunities for green infrastructure development (conceptually and in planning terms)?

characteristics named above, but also suggested other areas that could be seen as being integral to green infrastructure.

However, one of the first questions to ask when dealing with definitions, is whether one definition is needed? Graham Clingan, formally of Natural England and now of Stockton Council, proposed the alternative question: To what extent do we need a definition? This suggests that it may be more beneficial for practitioners to have a broad set of values or landscape elements that everybody can buy into rather than through the generation of green infrastructure definition. Notwithstanding this, Jack Ahern (University of Massachusetts) proposed that definitions allow people to find the commonalities and differences within their work and enable people to progress their thinking into different areas. Using Ahern’s view, it is possible to question Clingan’s vision that elements are the most appropriate way of defining a concept. Furthermore, by suggesting that a level of acceptance (in terms of definitions) is more beneficial because of the commonalities between research agendas, Ahern is proposing a weakness in Clingan’s view that sees it as too simplistic.

Ted Weber (Conservation Fund) views this argument in a more pragmatic way, presenting one of the most systematic definitions by outlining the official definition of the Conservation Fund itself (see Table 6.1). He also provided a list of ten key ‘principles’ that underpin the development of this definition. These ten principles relate directly to the Conservation Fund’s work promoting connectivity, and ecological, economic and social benefits alongside the development of landscape multi-functionality. The principles look at the role of an adaptive planning system, issues of scale, participation and engagement and landscape context as being equally important as supporting ‘the ecological framework for environmental, social and economic health - in short, our national life-support system’. In one sense, these principles provide a framework through which other organisations can understand and develop their own green infrastructure thinking. Karen Williamson is one such researcher who uses the Conservation Fund’s work to underpin her own definition with the Heritage Conservancy. She again outlined the role of green infrastructure as ‘our nation’s life support system’, but discussed the roles of connectivity and conservation as the two key functions of green infrastructure. She suggests that, although the role of green infrastructure is hierarchal, e.g. conservation and natural processes should be prioritised, that the ‘health and quality of life for America’s communities and people’ are also very important. This role is also emphasised by Ted Weber who noted that ‘green infrastructure benefits are afforded for all, to nature and to people’.

Table 6.1. Ted Weber and the Conservation Fund’s definition and ten key principles of green infrastructure planning

Definition - Green infrastructure is?	Principles
An interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife. Used in this context, green infrastructure is the ecological framework for environmental, social, and	<ol style="list-style-type: none"> 1. Green infrastructure networks are identified and planned before development; 2. Green infrastructure initiatives engage diverse people and organisations, obtaining input from representatives of different professions and sectors; 3. Green infrastructure plans establish connectivity, for linking natural areas and features and for linking people and programs; 4. Green infrastructure networks are designed to function at different scales, across political boundaries, and through diverse landscapes;

<p>economic health – in short, our natural life-support system.</p> <p style="text-align: center;">Benedict and McMahon (2002:12)</p>	<ol style="list-style-type: none"> 5. Green infrastructure planning activities are grounded in sound science and land-use planning theories and practices; 6. Green infrastructure networks are funded up-front as primary public investments, using the full range of available financing options; 7. Green infrastructure benefits are afforded to all, to nature and to people; 8. Green infrastructure is a framework for conservation and development; 9. Green infrastructure planning respects the needs and desires of landowners and other stakeholders; 10. Green infrastructure planning takes context into account.
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Both Weber and Williamson offer definitions which highlight a number of the characteristics outlined in Chapter 2. They also offer practitioner responses from the USA where the development of green infrastructure has tended to focus on ecological functions and the long-term conservation of natural resources. Reinforcing this view, Christine Conn from the Maryland Department of Natural Resources (DNR) outlined a definition focussing more on the scientific detail of green infrastructure. Conn noted that the State of Maryland defines green infrastructure:

from a landscape perspective – [as] a network of the State’s most ecologically important lands consisting of large blocks of contiguous forests and wetlands (> 250 acres) that are connected to each other through corridors (1100 feet or Floodplain, whichever is widest)

Christine Conn, 01/05/2007

Conn’s definition sets out the view that green infrastructure is based on networks of ecologically important elements and suggest criteria based on species diversity and size when allocating a green infrastructure label. She goes on to state that the specific size thresholds are based on research that defines spatial size, species and conservation targets. Megan Lewis (formerly APA) presented a similar view, but did not provide such specific spatial or ecological criteria when she stated that:

Green infrastructure is an interconnected network of Greenways and natural lands that include wildlife habitat, waterways, native species and preservation or protection of ecological processes.

Megan Lewis, 16/03/2007

The view from these North American practitioners follows very clearly the characteristics outlined in the Conservation Fund literature. They highlight the role of ecological connectivity and conservation as primary elements of a green infrastructure approach to planning. Scale and size are also noted as prominent elements, combining the need for greater connectivity and an integrated process of landscape management. These responses thus locate green infrastructure thinking within an ecological context which places biodiversity, conservation and maintenance of an ecological resource at the centre of their thinking.

In contrast to the North American responses, UK practitioners presented definitions that proposed a more holistic view of green infrastructure. A greater level of integration between social, ecological and economic influences was outlined by many of the UK respondents who suggested that creating landscape multi-functionality that provides diverse benefits was paramount to the conceptual understandings of green infrastructure. Richard Hall of Natural England noted two key areas that

green infrastructure must be defined within. Firstly, linking networks of spaces promoting social and ecological connectivity; secondly, he suggested multi-functionality was an essential element of green infrastructure thinking. Hall proposes that these factors could be the *'buy in factors'* that Clingan had highlighted but suggested that, as multi-functionality and connectivity were written into many of today's principal planning policy documents (i.e. PPS1, PPS9 or PPG17), that they need to be supported by planning policy makers if they were to be constitute parts of green infrastructure.

Hall's views are supported by representatives of two of England's Community Forests: The Mersey Community Forest and the North East Community Forests (NECF). Chris McGloin of The Mersey Forest stated that green infrastructure is the multi-functional elements of land (e.g. water, trees, and sustainable transport routes) within and surrounding grey infrastructure (buildings, roads, railways) (McGloin, 07/09/2007). Donna Murphy (NECF), on the other hand, simply defined green infrastructure as 'a network of multi-functional open spaces'. Both Murphy and McGloin highlight that the multi-functional nature of green infrastructure is vital to their understanding of it. However, although Paul Nolan and Susannah Gill (The Mersey Forest) support this view, they provided a greater depth in their understanding of green infrastructure.

Nolan, like Ahern and Hall, suggested that green infrastructure should 'perform social, environment and economic functions'. He went further by stating that The Mersey Forest definition presented an understanding of green infrastructure as an overarching concept, regarding both human functions and ecosystems as central to the concept (Nolan and Gill, 03/01/2007). Here, The Mersey Forest presented an idea proposed by the Conservation Fund in that green infrastructure can be seen as providing the life support system for towns and cities. Nolan and Gill therefore propose the ideas of functionality, social-economic-environmental functions, and ecosystem services⁴⁸ as the main components of their definition. Consequently, the prevalent consensus from practitioners was that multi-functionality, connectivity, conservation, social and ecological benefits, and the integration of policy with practice were the elements most commonly defined as underpinning green infrastructure. However, Nolan also stated that practitioners place a greater emphasis of deliverable functions (i.e. ecosystem services) than academic researchers as they have to implement the functions they are attributing to the concept. Academic researchers, however, may view the concept in a myriad of ways as they do not have to put their conceptual ideas into actual planning practice. It is therefore pertinent to suggest that academic definitions provide a broader depth of conceptual or abstract thought in terms of green infrastructure definitions than that of practitioners.

One of the main ideas proposed by a number of academics was that of 'infrastructure': how different infrastructures interact with ecological, economic and social systems and the integration of these systems with green infrastructure thinking. Paul Selman (University of Sheffield) explains this view as follows:

⁴⁸ Ecosystem services were explained by Nolan as providing the following benefits: a) necessary support for natural functions, i.e. soil formation, b) provision of food and fuel, c) regulation of the climate, atmosphere and water, and d) non-material benefits such as aesthetic quality. Also see Landscape Institute (2009) Green Infrastructure: Connected and Multifunctional Landscapes for further details.

If you're building a new town the first thing you do is put in the infrastructure, where you put in the roads, the drains and the electricity and so on. Nowadays we could say than even before that we should put in the GI as you have to think how is the water circulation going to work here? How is biodiversity going to be fused by all the private gardens and public parks, the Greenways and so on? How are you going to get people actively moving to maintain their health and exercise through this? How are you going to get air circulation and purification of air taking place? It's that infrastructure that goes in ahead of the grey infrastructure sometimes that [has] obviously got to be retrofitted but that's basically what it is. It's the basic infrastructure that maintains the essential life support functions.

Paul Selman, 25/07/2007 - emphasis added

Here, Selman uses the idea of infrastructure as a conceptual framework for thinking about landscape. He breaks it down into specific components, but underlying this is the value that green infrastructure should be installed with a more explicit focus than other infrastructure. Selman goes on to note that green infrastructure is 'fundamentally...an interconnected functioning single system...it isn't simply an accumulation of features. It's the integrity of the whole thing, connectedness, inter-connectivity, inter-activity that underlies the whole thing'. What Selman proposes is supported by Ahern, who links green infrastructure to the wider green debates in the USA. Ahern remarks that, as one of the most prominent landscape management processes, Smart Growth uses a more holistic systems approach to assess each activity of a given system simultaneously. Ahern goes on to propose that green infrastructure should be interpreted through a similar systems approach highlighting the need for balance, landscape functionality, conservation and development simultaneously.

Although Selman and Ahern provide clear indications that they consider a systems approach and functionality as essential elements of green infrastructure, Steve Littlewood (Leeds Metropolitan University) makes an additional point similar to that of Graham Clingan. Littlewood suggests that, because of the inherently complex nature of green infrastructure, there is 'a tendency to throw back a convoluted definition' of what it means (Littlewood, 04/01/2007). This, he states, would not allow a deeper understanding of the concept to be developed but would in fact lead to green infrastructure being labelled as another green space term without attributed meaning. He does, however, note that even within a convoluted definition of green infrastructure certain elements can be proposed as being essential. These include multi-functionality, policy and practice integration, and the meeting of specific landscape management or development criteria. Again Littlewood, like Selman and Ahern, notes the importance of functionality. However, Robert Brown (University of Guelph, Canada) states that there may not be a need for green infrastructure terminology as other definitions such as 'green space system' or 'green network' are more applicable and already in use. Green infrastructure thinking, therefore, does not need to reinvent the approaches to green space planning that currently exist. Brown does, however, offer a view that soft landscapes, i.e. not the built environment, should form part of any green space or infrastructure definition (Brown, 03/02/2007). This is a view that Tom Turner (University of Greenwich, UK) also supports, highlighting that the non-human elements of a landscape are the defining elements of green infrastructure (Turner, 08/12/2006).

Overall, the academic and practitioner responses to what should define green infrastructure showed a number of similarities and areas of overlap to that of practitioners. These were founded on a practical use of the concept, the literature discussed in Chapter 2, and other sources more in line with specific

practitioner roles. What is certain is that the ideas of interconnectedness, multi-functionality, landscape quality, and specific landscape elements are all part of what defines green infrastructure. This, however, does not progress the debate any further towards a singular definition for what green infrastructure is. Perhaps, as Clingan and Littlewood propose, this isn't necessarily a bad situation as it offers an innate flexibility for researchers and practitioners to use the concept as they see fit. However, it may provide too broad a scope to aid its acceptance. Consequently, use of the term may need further assessment to examine whether a modified definition can be generated. Diversity can therefore be seen as a weakness, or as a strength, in developing a clear or defined meaning for green infrastructure, but in terms of landscape management a robust definition of green infrastructure based on a collective understanding potentially make implementation easier.

6.7. Elements of Green Infrastructure

As the above discussion highlighted, there are a number of comparable and contrasting views on what green infrastructure is. There also appears to be a debate brought forth by practitioners and academics discussing the relevance of this. This discussion becomes increasingly apparent within examinations of what green infrastructure actually constitutes, i.e. what elements should or should not be classified as green infrastructure. An example of the differences includes naming specific protected or ecologically sensitive sites as primary elements constituting green infrastructure rather than 'ecological resources'. This could be compared to a view that places education or the relationship between a person and a place at the centre of green infrastructure thinking, which proposes that there may be differences in the uses of specific landscape elements or the perception of them. An examination of these ideas is important in understanding why researchers or academics promote specific ideas of what green infrastructure constitutes. Although there are still debates about the utility of using a system approach to green infrastructure planning compared to a view of individual elements, this discussion provides an insight into the spatial differences of UK, Europe and North America uses of green infrastructure.

At a basic level, Brown discussed green infrastructure as being the differences between *soft* and *hard* landscapes. He states that green infrastructure comprises the soft or ecological elements of a landscape, not the harder, impervious or built elements. By promoting a very broad view of what green infrastructure is, Brown provides scope for a wide range of elements to be seen as green infrastructure but places specific boundaries on what it does not constitute. McGloin outlined a similar view, saying that green open spaces and waterways were the basic elements of green infrastructure. Again, McGloin is using the idea of soft or ecological landscape components to underpin his understanding of what green infrastructure is. He also goes on to note that built infrastructure, even those with connective qualities (i.e. roads or railway lines), do not constitute green infrastructure.

Murphy (NECF) concurs with both McGloin and Brown by writing that there are a number of landscape elements that can be green infrastructure (e.g. parks, gardens, woodlands, waterways) but notes that built or urban areas (e.g. homes, roads) are not. This is an interesting point, as Murphy does not openly express the possibility of green infrastructure being integrated with green building techniques. McGloin, in contrast, stated that 'buildings without green roofs' cannot be green infrastructure, but

buildings with green designs or such features can. McGloin discusses the potential for green infrastructure to be integrated into hard or built landscapes as long as they promote a green idea, e.g. ecological systems or climate control. Turner also articulates this view, stating that water and habitats are the basic elements that constitute green infrastructure. However, routes which do not provide ecological values cannot be considered green infrastructure. Turner uses the ecological foundations developed in his ideas on Greenways to review green infrastructure, a view that sits well with the responses of McGloin and Brown.

A number of researchers have developed this idea further. In the previous section, both Weber and Selman outlined their understanding of complex interactions that underpin green infrastructure. In their discussions of what constitutes the concept, they move away from solely reviewing the ecological or built nature of infrastructure. As Weber states:

Green infrastructures encompasses a wide variety of natural and restored native ecosystems and landscape features, including conserved natural areas such as wetlands, woodlands, waterways , and other wildlife habitat; public and private conservation lands; working lands of conservation value such as forests, farms, and ranches; and other protected open space.

Ted Weber, 30/04/2007 - emphasis added

Weber thus offers an alternative set of landscape classifications to those discussed previously. He promotes the different conservation foci of landscape elements rather than their basic ecological composition. Each of these classifications supports the conservationist focus of the Conservation Fund and outlines how different landscape types can promote a spatial base for functional green infrastructure. Also, by outlining how public and private, working, natural or restored, and other protected areas all have value, Weber suggested that the conservation focus of their work can cross different landscape boundaries, stating:

Retaining connectivity, as appropriately sited and configured corridors can accomplish, can help to offset the functional losses caused by fragmentation...[and that] a green infrastructure network can be described as an interconnected system of core areas, hubs and corridors.

Ted Weber, 30/04/2007

Again, Weber promoted a number of the ideas presented previously but contextualises his use of different landscape classifications as a way of retaining the overarching connective and functional nature of green infrastructure. Selman outlined a similar view, stating that it is the 'integrity of the whole thing, connectedness, inter-connectivity, inter-activity that underpins [green infrastructure]'. Selman, like Weber, promotes connectivity and the role of green infrastructure in supporting the development of ecological systems in his understanding of the concept. Following his discussion of the connective and functional nature of green infrastructure, Selman describes a number of landscape features that span different spatial boundaries, which are important to understanding green infrastructure, including riparian corridors, urban waterways, and linear sustainable drainage systems.

Whilst both Selman and Weber discuss the value of connectivity and functionality, they also propose similar views of what does not constitute green infrastructure. Weber states that green infrastructure is not recreational landscape features as they do not promote the primary focus of ecological functionality. Weber also states that, although gardens and golf courses may be green, they do not perform a primarily ecological function and consequently these spaces should not be viewed as green infrastructure (but recreational spaces based on landscape components). Weber, therefore, stated that green infrastructure must be firstly green (or blue) in nature and, secondly, green in its functional value thus placing both a compositional and functional criteria on his understanding of the concept. Selman however returns to the ideas discussed by Brown, noting in contrast to Weber that there is a 'sharp divide between the engineered grey infrastructure and the natural or semi-natural blue-green infrastructure'. Thus, although both Selman and Weber propose similar views of what constitutes green infrastructure, they differ in what they believe it does not constitute.

In their discussions, both Selman and Weber promote the roles of connectivity, a view proposed in Chapter 2 where a number of the elements relating to landscape ecology were discussed. Although Selman and Weber refer to the ideas of landscape ecology, Christine Conn, Karen Williamson and Cecil Konijnendijk promote them explicitly. Konijnendijk (12/01/2007) states that all connected green spaces, within a defined area, should be considered as green infrastructure (e.g. a systems approach). However, he noted that the functionality and benefits derived from a connected network were also essential elements of green infrastructure. Konijnendijk, therefore, promotes the view that both the ecological form and the landscape function of a space are valuable components of green infrastructure.

Karen Williamson is even more explicit in her use of landscape ecology terminology, referring to hubs and links as essential components of green infrastructure. In her response, she outlines how these features 'facilitate the flow of ecological processes' and support the movement of resources and wildlife across different landscape boundaries. Williamson thus promotes the role of hubs and corridors in supporting the ecological functions of a landscape or a green infrastructure network. Conn takes this view still further and outlines a set of guidelines that hubs, corridors and links need to conform to if they are to be considered as green infrastructure. Conn's guidelines⁴⁹ state that green infrastructure should be:

Large blocks of contiguous forests and wetlands at least 250 acres or 100 acres if these lands are unique habitat or are in existing protection. Corridors must also be either 1100 ft wide or are the floodplain width – whichever is wider. Another aspect of the State GI is that the network is not only mapped (hub and corridor), but is also prioritized for conservation value. We have a ranking system that ID's the high priority hubs. We also have a conservation assessment routine developed for parcels that allow us to score the parcel's ecological value based on what the parcel contains (i.e. wetlands, streams, species, etc), but also how important the parcel is for protecting the landscape scale ecological network.

Christine Conn, 01/05/2007

⁴⁹ See Maryland DNR website for further details (http://dnr.maryland.gov/land/green_infra.asp, accessed 02/09/2009). The research of Weber *et al.* (2005) and the Conservation Fund (<http://www.conservationfund.org/>) also provide similar standards and information.

Conn's response also outlines how different activities are undertaken in order to map these elements and is a process which provides a clear framework against which green infrastructure can be assessed. Conn, Williamson and Konijnendijk, therefore, all promote the links between landscape functionality and connectivity in their definitions of what constitutes green infrastructure. They also highlight the links between the literature underpinning green infrastructure thinking and its use by environmental organisations. These discussions outline how a number of different ideas have filtered into our understandings of what constitutes green infrastructure. These ideas can also be seen in Table 6.2, where it is clear that a number of the responses reviewed outlined both the landscape elements and a functional role of that element in understandings of green infrastructure. Table 6.2 also highlights a number of responses that place a primarily social or cultural perspective on specific elements. Again, it shows the difficulty in assessing what constitutes green infrastructure, especially when compared to the responses of Weber and Conn.

Table 6.2. Elements that constitute green infrastructure

Name	Element	Function of form
Robert Brown	Soft landscapes	
Christine Conn	Forests, wetlands, floodplains, streams	Large blocks of at least 250 acres, corridors over 1100ft wide, high priority hubs
Cecil Konijnendijk	All green spaces. open space, water resources	Integrated networks,, multi-functional and beneficial spaces
Megan Lewis	Parks, nature preserves, conservation corridors, greenbelts, trees/forests, working landscapes, wetlands, riparian corridors, streams, rivers, lakes, wellhead recharge areas, green roofs, bike and pedestrian trails,	Corridors, links
Chris McGloin	Green open space, waterways	Corridors
Donna Murphy	Parks, gardens, woodlands, green corridors, waterways, street trees, open countryside	Corridors
Paul Selman	Public parks, roadside verges, planters, green roofs, green walls, community forests, city farms, derelict lands	Networks integrity and composition, corridors, hubs, links
Tom Tuner	Water	Corridors and linear routes
Ted Weber	Natural and restored native ecosystems, conserved natural areas, wetlands, woodlands, waterways, wildlife habitat, public and private conservation lands; working lands, forests, farms, and ranches, other protected open spaces.	Connected spaces, links, connectivity
Karen Williamson	Green belts, recycled land, open space, working lands, nature reserves	Hubs, corridors, links, interconnected

6.8. Consensus between Green Infrastructure researchers

The discussion of definitions and what constitute green infrastructure has highlighted the diversity in thinking and in practice. It has also raised the question of whether practitioners need a more concise and defined understanding of green infrastructure because of their need to work within specific landscape boundaries or criteria. The responses of Weber and Conn would appear to support this view, although McGloin and Nolan do not find it as important. A further question that needs to be addressed is whether a consensus has been built between different researchers in specific spatial

locations regarding the development and implementation of green infrastructure. A number of authors provided responses, stating their concerns that a coherent consensus has not yet been achieved.

Brown is one such researcher, who stated that he has not found the term very useful and does not necessarily view the concept's development as important. Brown notes that, as different authors appear to be talking about the same things as previous green space researchers, there may not be an additional value in using the term '*green infrastructure*'. Conn outlines a similar interpretation, noting that at a Maryland State level organisations and people working on green infrastructure do show a level of coherence in their greenspace but not green infrastructure planning. However, when green infrastructure ideas are discussed at a more specific or discrete spatial level in Maryland, the use of an approach to green infrastructure planning differs. Conn does, however, go on to note that because green infrastructure is a flexible term it emphasises the role of green support systems in 'meeting particular programme, application and management' issues. Consequently, although Conn notes that there appears to be a lack of consensus between different administrative levels of planning in Maryland, there is a collective ethos of what green infrastructure is trying to achieve.

Ahern also outlines specific issues with the planning systems in the United States.⁵⁰ Ahern states that when people 'look at planning [in the USA] it's quite a different world in that we have a very ad hoc, unstructured poorly organised' system of planning. Although this view may be contested by Federal, State and County planners, Ahern's view provides an insight into why green infrastructure may lack a clear consensus. Ahern also noted that the use of different terminology (i.e. Greenways or Smart Growth) may be harming the uptake or understanding of green infrastructure as there are too many different options or definitions being circulated.⁵¹ It may therefore be prudent to state that a focussed discussion of green infrastructure and its meanings may be increasingly important to American planners as their system of policy and delivery vary at a local, metropolitan and state level. This may not, however, be as important in the UK as it has a more centralised approach to policy regulation and implementation.

Consequently, because there are a number of different planning initiatives being promoted, the US planning system may not be in a position to legislate for each collectively. Karen Williamson discusses a similar point but notes personal motivations and focus as the main problem in creating consensus. Williamson notes that each person or organisation who deals with green infrastructure brings with them their ideas of what it should be. Therefore, within any discussions or implementation of green infrastructure, different agendas lower the likelihood of a consensus being reached. Lewis presents a similar view, saying that the lack of consensus is due to the variety of ways that people view the landscape. Williamson and Lewis thus state that personal and organisational focus are the main reasons why green infrastructure has lacked a clear consensus. This is in contrast with Ahern's view in

⁵⁰ Ahern notes that the implementation of planning policy is fragmented as the translation of ideas between Federal, State, County, and City planner's shows very little signs of consensus building.

⁵¹ In response to Brown, who may appear to promote an anti-green infrastructure point of view, Brown, like Ahern and Conn, does suggest that the level of research and discussion of the concept may be one of the main reasons for any negative responses.

that it is the planning system that is too fragmented and fails to promote a clear idea of what green infrastructure is. One further idea promoted by Weber could provide a link between these two views. Weber outlines that one of the main reasons why a consensus has yet to be achieved is the lack of clear communication and education. Weber states that, with improved knowledge and understanding, organisational biases may be lowered and a consensus may be reached. These administrative differences may therefore be based on an understanding of the fragmented way (i.e. non Federal top-down approach) in which planning policy is developed and moderated at a number of scales, especially when compared to the centralised system of policy-making in the UK.

The above discussion shows that in North America there appears to be an ongoing debate relating to whether there is a consensus in green infrastructure thinking. A similar debate is also underway in the UK where researchers and academics have presented a number of comparable views. However, there does appear to be a greater awareness in the UK of the current problems in developing consensus with a number of green infrastructure researchers questioning how far the concept has actually progressed. Staff working with England's Community Forests are a good example of this process. In the responses gained from McGloin and Nolan, they both presented progress reports on how far they believed green infrastructure thinking had developed. In his response, McGloin stated that he felt that a consensus was slowly being developed due to the increased number of green infrastructure and open space strategies being published. He also stated that, because of the developments in government planning policy and guidance (i.e. PPS1), planners were now beginning to utilise green infrastructure ideas more frequently. He did however state that the problems of defining the spatial delineation of green infrastructure (e.g. rural or urban areas) has divided opinion between some planners and policy makers. Nolan presents a similar view, stating that there:

...are still discussions of whether green infrastructure is too urban and therefore you get rural based organisations saying it's not for us, [and that] its for infrastructure in and around towns.

Paul Nolan, 03/01/2007

Nolan also outlines a similar view to those presented by Conn and Williamson when he discusses the role that organisations hold in developing consensus. Nolan outlines that, because of different organisational agendas, developing a consensus is difficult as it has to be based on a process of negotiation and co-operation. He also noted that he envisaged green infrastructure planning as a coming together of different planning organisations to promote common targets rather than a way of linking different ideas under a green infrastructure label. In contrast to the proposed lack of coherence discussed by Nolan and McGloin, Murphy stated simply that she believes there is a consensus between researchers and planners working with green infrastructure. However, Murphy's view appears to be in a minority as both the staff from the Community Forest network and Natural England suggests that this view cannot be substantiated. Charlton suggested that, because of the different regional approaches being taken to implement green infrastructure, there is a lack of a consensus in England of what should be developed as green infrastructure across the regions. He goes on to state

that these different views and approaches need to be drawn together in a national policy agenda that builds on the momentum developed over the last five years.⁵²

Hall and Clingan outline a similar opinion stating that landscape planners and other environmental practitioners (e.g. Groundwork or the Land Restoration Trust) need to be educated in what benefits green infrastructure can promote if they are to understand the opportunities it can deliver. They also note that, because of the range of typologies developed focussing on green infrastructure, organisations need to be provided with focussed policy or implementation guidelines. Thus Hall and Clingan, like Weber, suggest that a more efficient and thorough practice of education and knowledge dissemination is needed to provide up-to-date information for planners and developers.⁵³ They therefore suggest that, through a process of dissemination, planners at different scales can develop a more focussed and coherent view of green infrastructure.

Although the production of focussed educational information may be viewed as necessary if a consensus is to be developed, there is also a further issue to examine. Littlewood outlined this issue, noting that what people believe green infrastructure to be is constantly changing. He develops this further by stating that what people believed green infrastructure to be five years ago differs drastically from what they believe it to be now. Littlewood suggests that through the development of an overarching set of accepted elements or principles that a consensus can be developed. Konijnendijk also supports this stating that, although there is currently a poor consensus, through additional research a general set of ideas can be developed that can draw different researchers together. He notes, like McGloin and Lewis, that the different organisational agendas of researchers needs to be acknowledged if the diverse views of what green infrastructure is are to be promoted with a coherent focus.

This review has discussed responses from the UK, Europe and North America relating to definitions of green infrastructure. Although there are differences in whether organisations believe this process is underway, some ideas are outlined consistently and there appears to be a call for better education and information relating to a green infrastructure approach to landscape planning. This is information that is proposed as needing to be developed into national (or Federal), regional and local planning policies if a consensus for green infrastructure is to be achieved. With the promotion of a set of criteria for green infrastructure policy, organisations will be able to use the concept but will potentially not be able to diversify or dilute its focus to the same extent. Each of the previous sections has therefore outlined the difficulties in achieving a single definition. There have, however, also been similarly fluid discussions examining where green infrastructure fits within the wider literature, asking whether it can be a useful concept, a process, a discipline or all of these? A number of positive responses were shown highlighting the level of utility it is garnering in the UK and North America. However, this is not universal and some responses still noted a level of scepticism relating to the value of a conceptual and practical understanding of green infrastructure, notably the responses of Brown and Clingan. Despite

⁵² In 2009, Natural England issued guidance notes on green infrastructure development that took these issues into account and outlined a systematic approach to its development.

⁵³ Examples include the ParkCity Seminar held by CABI Space (2009) and the Green Infrastructure workshops held by the East Midlands Green Infrastructure Network (2006 onwards).

these queries, the majority of responses noted a number of ways that green infrastructure can be used conceptually and in planning policy terms (this will be examined further in Chapter 8). Further discussion, though, is needed to provide a more robust evidence base to discuss any negative interpretations against.

6.9. Placing Green Infrastructure

Placing green infrastructure within a specific discipline has been described as problematic and not necessarily a desirable process (see Brown's previous comments). As the previous discussions showed, locating green infrastructure within one specific area potentially lowers its validity or use within some organisations. It may therefore not be essential to locate green infrastructure thinking within one discipline. However, Charlton stated that he believed green infrastructure should be at 'the heart of planning' and must be viewed as an essential component of planning by both central government offices and implementation agencies such as Natural England. Charlton promotes the idea that the process of green infrastructure development needs to be embedded into all levels of planning policy in order to meet the delivery focus of various infrastructure agendas. This includes national guidance (e.g. PPS1) or the new proposed PPS on eco-Towns, regionally within Regional Spatial Strategies and in sub-regional strategies such as the Luton and Bedfordshire Green Infrastructure Strategy. What he does not propose, though, is a specific discipline where green infrastructure should fit. Instead, he proposes a broader or universal use of the concept within existing landscape planning frameworks. Konijnendijk also promotes such a view stating that, although green infrastructure 'is primarily a concept', it is also an essential mechanism for implementing 'green' infrastructure ideas within and across landscapes. Selman presents a comparable view, suggesting that green infrastructure should therefore 'be at the very core of sustainable development planning'. Selman states green infrastructure should be an integral part of planning that meets the government's proposals for major expansions or developments. He also suggests that:

We should think of it [green infrastructure] in the same way that we think of other infrastructure. At the moment it seems set aside but I think as our ideas of sustainable planning develop it will simply become taken for granted.

Paul Selman, 25/07/2007

In contrast to the policy and implementation focus outlined above, Brown provides an alternative point of view by stating that, if green infrastructure is to be accepted, it should be located within the urban planning and design discipline. By situating green infrastructure ideas within this discipline, Brown suggests that it will be easier to communicate complex ideas to planners and designers. Brown also proposes that, because green infrastructure thinking draws heavily on landscape ecology principles, that this would also be an appropriate discipline for the concept. This would seem a reasonable assumption given the high number of references made to landscape ecology discussed previously in Chapter 2. Ahern perhaps best articulates his understanding of this discussion. When asked if green infrastructure was a concept, a process or as a discipline, he said:

All of them, there is a sequence isn't there. You need a concept for people to understand, you need something that people can recognise and then you need to translate that into policy terms. There are different names and different places you

can situate green infrastructure but at the end of the day you need some kind of terminology that people recognise, and that terminology has to be translated as a concept.

Jack Ahern, 27/02/2007

Whether green infrastructure should be proposed or articulated as a concept, a process or a discipline is as contested as the discussion of its constituent elements. It can, however, be noted that there is support and scope for green infrastructure to be developed as all three. The discussion above suggests this and proposes that green infrastructure could develop a conceptual framework for green space or infrastructure planning as well as an integrated approach to holistic planning policy. The scope of this discussion, however, suggests that further debate is needed to provide additional evidence in order to find a conclusion.

6.5. Development of Green Infrastructure

Within the green infrastructure literature a number of theories are proposed explaining how and why the concept has developed with a varied focus. This variation also appears to hold true across different geographical regions with responses from the UK, Europe and North America, all highlighting different influences underpinning specific spatial understandings of green infrastructure development. However, some researchers and academics have stated that green infrastructure has developed within a niche and does not have such a broad policy focus. Responses also suggest two theories supporting the development of green infrastructure thinking. Firstly, there are discussions of the planning policy focus that green infrastructure has developed within whilst, secondly, there are discussions of the processes through which green infrastructure should be developed. Both of these areas will be discussed in this next section.

6.10. Historical development of green infrastructure

One of the most frequently discussed ideas is the role that ecological assessments and conservation planning has played in developing green infrastructure. Turner suggests that an ecological foundation may provide the concept with a firmer basis than other green space planning ideas, e.g. Greenway planning. Brown supports this view, stating that the concept is being used primarily by conservation agencies, including the Conservation Fund, in a delivery and not a scholarly or academic sense. Lewis, however, proposes an alternative. Lewis associates green infrastructure development with its use in the President's Council for Sustainable Development (PCSD, 1999) review of sustainable land use in the USA. Lewis outlines how green infrastructure was one of the five strategic areas underpinning comprehensive and sustainable community development. Lewis thus locates green infrastructure development within a national (or federal) level framework rather than at a local or state level. Discussions of how green infrastructure has developed in the UK have followed a similar trajectory to that of North America. The concept's focus, and indeed whether it is discussed by different agencies, is subject to how the concept and its values are used. Consequently, some do not necessarily see green infrastructure as a valuable green space planning mechanism, whilst other respondents, including Charlton, see the long-term links between green infrastructure, sustainable development and an integrated approach to landscape planning. Charlton's view on the proposed

PPS on Eco-Towns is one such area, as is Nolan's discussion of ecosystem services in the North-West region of this process.

In the UK, Littlewood also outlined a number of ideas that green infrastructure thinking and planning still needs to address. Littlewood states that because green infrastructure is a relatively new idea it has, thus far, struggled to convince people of its value. He goes on to state that 'an active focus on green infrastructure hasn't been around that long and I don't see it as a mature thing now, it's not embedded now in [January 2007] people's thinking [but] it's becoming that way'. Littlewood therefore outlines that, although there is a momentum supporting green infrastructure thinking, it is, as yet, not fully developed. He does, however, discuss the growing realisation that if people want to develop sustainable communities then a planning package has to be developed that includes green infrastructure. His view on the RSPB wildfowl development at Fairburn Ings is one such development that incorporates ecological and social sustainability well. Littlewood sees that as an achievable process because of the current policy focus of Natural England and their promotion of green infrastructure thinking. The role of Natural England is also outlined by Charlton, who stated that the process of green infrastructure planning needs to focus on developing a consensus of what the concept is and be planned in a strategic and holistic manner. This includes an understanding of the landscape, its value and its function (e.g. in terms of European Landscape Convention definitions). Charlton goes on to note that the events organised by Natural England's Green Infrastructure co-ordinators regionally is a positive step in the right direction for this process. Through this system, Charlton suggests that the benefits and values of green infrastructure can be delivered at multiple scales across different landscape boundaries, e.g. the National Indicator (NI) 197 Biodiversity targets, which view good ecological management at a number of scales. The responses of Littlewood and Charlton outline how different agencies have begun to attribute some of the values of green infrastructure discussed in the research literature. Staff at The Mersey Forest have taken this acknowledgement further and discussed the development of green infrastructure within a specific North-West context.

Nolan and Gill outline how green infrastructure thinking has developed within the North-West region and within their Community Forest organisation. They present a historical view of green infrastructure development, outlining its role in their core activities since 2005, but they also contextualise its role in regional planning policies. Nolan and Gill state that:

You can trace it all back to a conference in January two years ago (January 2005) where before that Green Infrastructure was a bit strange and loose and there has been a gradual refinement and broadening out of the understanding and knowledge of what Green Infrastructure is in the North-West.

Paul Nolan and Susannah Gill, 03/01/2007

Nolan suggests that this refinement can be seen in the development of regional planning policy. He outlines how the former Countryside Agency promoted, and aided, the development of the North-West Green Infrastructure Think Tank, a multi-partner organisation that promoted the use of green infrastructure by regional planning agencies. The Green Infrastructure Think Tank also has a number

of partnerships with academic institutions in North-West England providing it with links into research and policy. The role of the Think Tank alongside the Community Forest network has been to lobby successfully to embed green infrastructure thinking in the North-West Climate Change Action Plan and the North-West Regional Spatial Strategy (RSS).⁵⁴ Consequently, Nolan reports that green infrastructure thinking in the North-West has taken the broad conceptual ideas of green infrastructure and focussed them into deliverable planning policies. The historical (or recent) development of green infrastructure therefore appears to suggest that there has been an acknowledgement of the concepts and values that have been translated into planning practices in specific locations, including Warrington and Liverpool. These developments have reviewed the research related to green infrastructure and utilised this evidence to support spatial planning at a municipal and regional level. However, there is a second view of the development of green infrastructure. This is a practice-focused development of green infrastructure planning and shows how the concept should be translated into a practical approach to landscape planning.

6.11. Development and practice of green infrastructure thinking

In contrast to the flow of ideas that have supported green infrastructure development, its use in practice appears to differ depending on each specific organisation. Throughout this chapter, the differences between the UK and North America have been discussed highlighting how different approaches to planning have affected the development of green infrastructure. Examples drawn from the UK, USA and Europe will be discussed to show how planning practice differs between different countries in terms of focus, funding and motivations to develop green infrastructure resources.

The Conservation Fund's role in the development of green infrastructure has already been outlined. In the USA, it has been one of the nation's leaders in green infrastructure thinking and planning and has been at the fore of research reviewing the value of the concept.⁵⁵ Weber also outlined the following ten-stage plan for the development of green infrastructure by looking at the ecological, financial and social aspects of its development, which are used as a basis for green infrastructure assessments by the Conservation Fund.

**Table 6.3. Conservation Fund approach to the development of green infrastructure
(obtained from communications with Ted Weber and Will Allen)**

1	Green infrastructure plan development processes should be directed by a leadership forum or advisory committee. These leadership forums should be composed of a diversity of stakeholders found within the study area.
2	Green infrastructure plans must include goals for the protection of ecological functions and processes, and may also include the protection of working lands, and open space for human benefit.
3	Green infrastructure plans must focus on landscape-scale approaches to conservation planning.
4	Network design criteria should be developed and based on ecological and land-use planning theories and utilise an integrated landscape-scale approach.
5	The network design should utilise a hub/corridor framework and incorporate a diversity of land uses.
6	The protection status of green infrastructure network lands should be identified and incorporated into

⁵⁴ Similar research has been presented in Goode's and Handley's reports for the Royal Commission for Environmental Pollution (Goode, 2006; Handley 2007) which examined the role of green infrastructure in adapting landscapes to climate change.

⁵⁵ Ed McMahon's recent presentation at the CABE Space ParkCity event in London supports this view, suggesting that the Conservation Fund are seen as North America's, and potentially the world's, leaders in green infrastructure planning.

	the analysis model.
7	The network analysis should be able to identify gaps in the network, allowing planners to target restoration efforts. Restoring hub and corridor gaps is a crucial component to any green infrastructure plan, as most network designs will contain at least some modified or degraded areas.
8	The final plan should include a geographic representation (e.g. maps) of the final network design.
9	A system for prioritising protection opportunities is another green infrastructure plan requirement. The network design should be evaluated against the protection status of lands and other factors identified through the goal-setting process to produce a prioritisation system that ranks and prioritises conservation opportunities.
10	Green infrastructure plans should not only identify a green infrastructure network design, but they should also provide a list of available tools for land protection, as well as identify sources to fund plan goals. The implementation strategy provided within a green infrastructure plan should highlight opportunities for utilising existing regulatory and non-regulatory land use tools for protecting important network lands. This may also include suggesting new tools that have yet to be utilised in a given planning area. Likewise, all available funding resources, including federal, state, local and private funding sources, should be documented in the plan along with a description of the opportunities that each provide. A good green infrastructure plan will outline a patchwork 'quilt' of protection strategies that match implementation tools and funding sources to the different spatial areas outlined in the green infrastructure network design. Implementation strategies should incorporate a diversity of land uses, as designated by the network design.

These ten points outline a basic framework that the Conservation Fund take when negotiating green infrastructure developments at a state, municipal and county level. Weber thus outlines a framework highlighting a number of important development and monitoring stages. The Conservation Fund, therefore, presents a system which green infrastructure planners can use to lead their developments from inception to monitoring. However, whether these ten stages are followed is still down to the motivation of the individual or organisation working with the Conservation Fund. Consequently, the Conservation Fund provides educational outlines that non-specialist green infrastructure practitioners can engage with in different landscape management situations. The Conservation Fund's ten-stage process also highlights a number of similar processes to those of the APA.

Lewis and the APA note that green infrastructure planning needs to work through a number of similar stages to any other landuse initiative. Lewis outlines the roles of 'inclusion as part of [the] visioning processes; formalization into policy on the municipal scale; incorporation into plans; enforced through planning management tools (zoning, land conservation mechanisms); and funding through capital improvements programs' as important elements in green infrastructure planning. Again, Lewis is outlining the need to engage with the actual focus and funding sources of a project if appropriate and sustainable green infrastructure is to be developed. This is a process that the APA has been heavily involved with in Chicago and Philadelphia. Lewis thus argues for the need to promote a participatory planning process in the development stages of a project, which are then located within a broader monitoring and assessment framework. Both are viewed as key elements in the successful development and use of a location according to the APA.

Conn and the Maryland DNR outlines a comparable approach, stating that green infrastructure development is a process of data collection, analysis and re-assessment within an existing framework of environmental protection. Conn suggests that the participation of the public, stakeholders, academics and planners in the development stages of green infrastructure planning are critical if the process of implementation is to be successful. Within this framework, Conn states that it has been easier to communicate the DNR's green infrastructure development plans within that framework as they have been able to 'emphasize that Green Infrastructure can be used to direct growth to

appropriate areas and to direct resource protection to other areas'. This has been the case in identifying strategically important wetlands in the Chesapeake Bay area and with the State's strategic forest assessments.

This focus provides the Maryland DNR with a financial justification to their development that is linked to state level economic development. Conn also states that with 'clear communication and some flexibility with "rule" making' that the negative opinions of green infrastructure can be lowered through active negotiations and the DNR's ability to 'present factual information that is not tainted by growth or political pressures was very important in getting buy-in from many stakeholders'. However, the stages of consultation, funding and visioning are still processes that can be fraught with tension and contradiction. Weber, Conn and Lewis thus all promote a logical process of ideas, assessments and management plans formation through which green infrastructure can, and has been, developed. They highlight the role of participation, communication and project focus as important elements in this process and review green infrastructure in ecological, economic and social terms, a process that is essential if the financial and social elements of green infrastructure planning are to be examined and defined.

In contrast to the North American views of green infrastructure, European academics have identified a number of other ideas underpinning its development. Working within a context of compact and functional urban planning, green infrastructure development in Europe has been linked with a number of different practices. Konijnendijk's research in Western Europe links the historical development of green wedges in the twentieth century with current green infrastructure planning. He notes that the development of green infrastructure has been closely related to the need to quantify the value of green spaces, especially in terms of their functions and services. In his opinion, the planning process is crucial in the development of green infrastructure as it provides:

...the conditions for developing an integrated network of functioning green space. In line with sustainability considerations, local stakeholders need to be involved in developing green infrastructure, so that desired functions are considered. Ecological processes are of course crucial as well, as these ultimately produce the social and environmental.

Cecil Konijnendijk, 12/01/2007

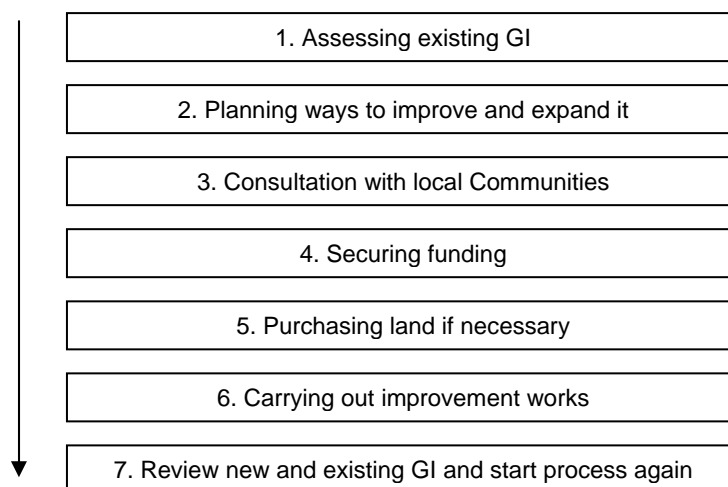
Konijnendijk presents the notion that the actual frameworks or processes that people plan within are essential to his understanding of the functions and qualities of a space. By outlining the needs to integrate opinions and practices, Konijnendijk promotes the idea of creating a socially-inclusive planning system that can meet the needs of ecological and human populations. In conjunction with this view, Konijnendijk also suggests how negotiations can be made between interdisciplinary actors (e.g. planners, ecologists, or economists) to achieve sustainable landscape planning targets. Konijnendijk thus promotes a collaborative approach to green infrastructure development that considers local, regional and national planning possibilities within a system of practical negotiations. What Konijnendijk proposes is a process similar to that outlined by the North American researchers whereby multiple actors are involved in the development and management process of green infrastructure resources. Through a process of continual communication and negotiations,

Konijnendijk suggests a way of continually assessing the needs of the landscape and how best green infrastructure can be implemented. This view, along with that of North American green infrastructure researchers such as Ahern, proposes a more collaborative approach to its development. However, within state and national organisations green infrastructure can be situated in a framework of development and analysis that provides landscape managers with a logical process for landscape management based on an understanding of the landscape and its values at different scales. The use of green infrastructure in the UK appears to have grown along similar lines and the Community Forest partnerships are a good example of this process.

One example presented by Murphy (NECF) noted that green infrastructure creation fits with the historical growth vision of the Community Forests and the practice-led development frameworks for landscape planning. Murphy states that green infrastructure is a concept that has been discussed for a number of decades under various names but only recently using more specific terminology. Therefore, green infrastructure is not necessarily a new concept but a new articulation of existing ideas. She goes on to outline how the use of green infrastructure has allowed a number of groups to be consulted, including local communities and national bodies, due to the encompassing nature of green infrastructure thinking who may previously have been overlooked. Using examples of Countryside Access sites in the North-East, Murphy highlights how the local authority for Sunderland, residents groups in Penshaw and Shiney Row, and NECF were able to develop the Herrington Country Park as a multi-functional green infrastructure using this approach.

Murphy does, however, promote a view that green infrastructure development should be based around a series of stages, each of which should provide evidence and feedbacks for future development. These stages shown in Figure 6.1 follow a similar pattern to those outlined by Ted Weber as they suggest that assessments, analysis, consultation, funding and development are all essential elements of planning for green infrastructure.⁵⁶

Figure 6.1. Steps in successful green infrastructure development (Murphy, 24/07/2007)



⁵⁶ Consequently there may appear to be a split between those researchers who believe green infrastructure is a new term that builds on previous ideas and is not actually a new idea. However the difference is somewhat overstated as a number of researchers play down this idea as long as the concept is still being discussed in relevant planning literature (i.e. Davies *et al.*, 2006).

Each of the areas shown in Figure 6.1 and Table 6.3 provides planners with a number of stages through which they can assess their resources and discuss how best to develop them using a green infrastructure approach. It also suggests that the securing of land and funding are essential elements in the process. This is especially crucial for publicly funded organisations, such as the Community Forests or Local Authorities, as capital outlays on land lower the available funding for management and development. This also restricts the amount of land available for green infrastructure development as housing developers, e.g. those in West Stockton, have the financial capital to outbid green space developments. Consequently, the ability to secure funding for management and development of green infrastructure is essential if appropriate opportunities for development are to be met.

McGloin returns to the area of green infrastructure meaning by providing a contrasting view to Murphy. He stated that green infrastructure is a new name for landscape planning, but takes into account the additional availability of information and data regarding sites primarily by using the increases in GIS technology to help make better informed decisions. McGloin, like Murphy, notes that green infrastructure has developed from a number of other green space planning ideas but brings them together into a coherent approach to landscape planning. McGloin goes on to note that the process of green infrastructure planning can be broken down into responding sections relating to the following questions;

- a) What have we got?
- b) Where is it?
- c) What do we need to protect?
- d) Where are the opportunities for increasing and enhancing?

McGloin again outlines a logical and strategic progression in green infrastructure thinking that reviews what resources are available, what is fragile and needs protecting, and where opportunities lie. He also notes that, although these areas offer a clear and concise process for development, the interactions between planners, developers and the public mean that a dynamic system of compromise and negotiation is required to effectively plan green infrastructure. This process of communication and negotiation is essential if the disparate views of different groups (e.g. housing developers and conservationists) are to be considered within the development process. McGloin also noted that the value of negotiation and community participation relating to the Country Park and Community Forest gateway sites in Herrington, Stockton, and Wardley Manor were central factors in the development of these sites.

Both McGloin and Murphy, like the researchers and academics from Europe and North America, therefore promote the use of an integrated approach to green infrastructure planning that utilises the knowledge and expertise of a number of different actors. They also state that there are strong links between the use of evidence and assessments in meeting the needs and opportunities of a landscape at local, regional and national scales.

6.12. The future of Green Infrastructure

Although there are various descriptions of how green infrastructure has developed, there does appear to be a consensus that a high functional value can be attributed to the concept. The next stage of this

discussion examines how different users of green infrastructure view its future development and implementation. Again, there are differences of opinion between academic researchers and practitioners, and across different spatial and administrative boundaries. This, however, highlights the diversity in opinion between different users and provides a number of interesting insights into how organisations view the concept. Brown is one researcher who has outlined this debate when he stated that green infrastructure has the ‘...potential to be a valuable concept for communicating with the general public’. However, Brown goes on to note that he has not ‘...seen much value in using it [green infrastructure] in research or teaching as there are more specific terms that provide more accurate and precise definitions’. Brown’s view highlights the difficulties that green infrastructure thinking is currently facing, notably the legitimacy of the concept. However, Brown does state that in general terms green infrastructure is a concept that researchers and landscape planners can understand, though it is not necessarily an academic one. Brown therefore suggests that, with the use and understanding of the term ‘infrastructure’, people may be able to make the extension to ‘green infrastructure’, meaning *the greening of infrastructure development*.

Although Brown promotes a role that the concept may be able to play, he also outlines the problems associated with grounding new ideas in conceptual and practical terms. Ahern, however, presents a different view to Brown by stating that green infrastructure:

...[is] a new way to address sustainability through the objective of the built environment...thinking that if a significant percentage of the population is going to be urban then the environment that supports them needs to be sustainable. Infrastructure of the environment is going to be a hybrid between retrofitting built infrastructure and readapting, reengineering built infrastructure so it can provide ecological functions.

Jack Ahern, 27/02/2007

What Ahern is suggesting is that green infrastructure may have, or need to have, the ability to provide numerous benefits, and that the availability of these benefits to different groups needs to be seen if the concept is to be taken on by planners. Ahern views the sustainable development of specific urban landscapes like the Highline Greenway development in Greenwich Village, New York, as an essential area for future green infrastructure research. He outlines that, as the urban environment continues to adapt to population and economic fluxes, the role of green infrastructure becomes increasingly relevant to creating high quality and functional landscapes. Williamson also notes a role for green infrastructure in creating sustainable landscapes. Williamson expresses the view that green infrastructure is a concept that encompasses a broad range of sustainable practices and promotes interactions between human and ecological populations, all of which have been used in the Heritage Conservancy’s development work in the Churchville to Playwicki Greenway and the conservation of the Musconetcong River.

Ahern’s view on the spatial distribution of green infrastructure has also been discussed by Charlton, who outlines how green infrastructure planning needs to deliver multi-functionality across different landscape scales. Charlton suggests, like Ahern, that green infrastructure has potential benefits for urban populations but he goes on to note that green infrastructure must also be thought of as a

planning mechanism that can support populations in urban, urban-fringe and rural locations. Consequently, Charlton advocates that green infrastructure must be flexible enough to work at a number of different scales whilst retaining its ability to deliver multiple benefits. A number of researchers have also supported the idea proposed by Megan Lewis, who stated that she would like to see green infrastructure promoted as 'the defining approach for green space planning'. Lewis suggests, like Brown, that green infrastructure can be used to raise awareness of the values of landscape resources in a more appropriate way than other infrastructure. She also highlights that the longevity of support for a green infrastructure approach to planning is reliant on its integration and acceptance of its various components and its theoretical foundations. Lewis therefore proposes that, by making different organisations and the public aware of the value of green infrastructure, the concept may be mainstreamed and become the defining approach to green space planning.

To achieve the goal of mainstreaming green infrastructure, a number of processes have been outlined as needing to be put in place. Charlton states that the holistic value of green infrastructure must be emphasised by those organisations championing the process. Whilst green infrastructure research highlights the ecological, economic and social values of the concept, these values must be presented to the public alongside supporting data, according to Weber. The promotion of the concept will then provide a forum for greater integration in planning theory and policy and allow the development of appropriate planning practices at different scales (see comments of Lewis and Conn). Konijnendijk supports this view, stating that green infrastructure planning needs to be an integrated interdisciplinary approach working at a number of different scales: administratively, politically and spatially. McGloin develops this idea by stating that green infrastructure should be closely related to the development of government policy and practice, thus moving further towards greater public-private partnerships. Furthermore, McGloin advocates the integration of government policy and environmental practice, with the public and developers. Again, this has been identified in the development of the North-East RSS and subsequent EIP. This is an idea that will be developed in Chapters 9 and 10 highlighting how green infrastructure thinking can be developed in the future.

Megan Lewis also emphasises that green infrastructure needs to be developed by public sector organisations if its values are to be fully developed and understood. However, she states that the role of public-private partnerships holds a vital position in funding and developing appropriate landscape management plans, an approach that is strongly supported by Nolan and Gill in their discussions of Community Forestry and the North-West Green Infrastructure Think Tank. Lewis outlines the value of such a relationship as crucial if funding is to be secured, and the public are to be consulted when green infrastructure is being developed. She also notes that the APA in the USA needs to lead this process if a national level initiative or agenda is to be developed that can then be translated into planning policy.

Nolan and Gill support this view, suggesting that green infrastructure needs the full support of public organisations and regional government offices if it is to be developed successfully. Nolan states that green infrastructure planning needs to be championed by the RDAs and incorporated into all regional spatial strategies (RSS, RES and RDS). This, Nolan and Gill propose, will allow green infrastructure to

develop a system of 'cascading support from different policy and practice' areas. David Hopkins (Bedfordshire County Council and Marston Vale Community Forest) outlines such a process in the development of Environmental Policy 1: Green Infrastructure in the East of England RSS. Within the consultation for the RSS, the Marston Vale Community Forests presented the findings from the Luton and Bedfordshire Green Infrastructure Strategy as evidence for the need for further green infrastructure development. A comparable process was undertaken by English Nature, the Countryside Agency and NECF in the North-East where ecological and social evidence was presented to ONE North-East to support the inclusion of green infrastructure in the RSS (see comments made by Hall and Clingan).

With such a system, Nolan and Gill envisage that a number of publicly funded organisations will continue to champion green infrastructure planning and provide a wider focus for its implementation. Examples from Nolan's work include partnerships between the Community Forest and the Environment Agency, Natural England, The Land Restoration Trust, and the Town and Country Planning Association, as well as numerous local authorities and community groups. McGloin again supports this view, stating that cross-boundary implementation of green infrastructure ideas offer the widest benefits to the public. Landscape regeneration work undertaken around St Helens, Liverpool and Warrington by the Community Forest have highlighted the success of this process in the North-West. He also notes that, because green infrastructure varies in size, location and focus, administrative boundaries would not necessarily cover appropriate development as they could be considered constrictive. McGloin, therefore, notes that in Stockton and Darlington the landscape character of the local resource base is being used to plan cohesively across administrative boundaries. Consequently, McGloin, like Konijnendijk, suggests that green infrastructure can provide a planning process that meets different functions across different administrative, political and spatial boundaries. Konijnendijk believes this is achievable because green infrastructure 'captures both the integration of green areas... functionality and speaks to the planners', thus providing evidence of both landscape form and function for development.

Integration in planning practices has also been reported as essential to future green infrastructure development. The use of reflexive 'learning by doing' practice was promoted by Clingan as an effective way of developing green infrastructure within an appropriate planning framework. Clingan suggests that the evidence and experience of conducting green infrastructure projects allows an organisation to assess its own role in development. It also provides a set of examples to assess the success and best practice processes for project work. This can also refer to securing funding and the role of working partnerships where experience provides different organisations with a toolkit of knowledge that can be used in different urban, urban-fringe and rural situations.

The Maryland DNR and Conn also report this view stating that, with experience, an increased value can be associated with green infrastructure assessments and implementation. Conn outlines how experience promotes a better working process and aids the development of a solid evidence base of green infrastructure best practice. Weber expands this idea, noting that learning through experience may be a time-consuming exercise, but is one that provides a wealth of information about the most

effective ways to assess a specific situation. Weber, however, suggests that although the development of best practices for data collection relies heavily on prescribed methodologies, empirical green infrastructure work needs to adapt as quickly as the concept itself. Consequently, Weber advocates a constant review of planning and assessment techniques in order to determine the value of green infrastructure projects at different scales.

Williamson also discusses how the roles of education, advocacy and engagement, which encourage more sustainable practices of landuse, are essential elements in the development of green infrastructure. Williamson advocates that only through more effective education for planners will awareness and understanding of the benefits of green infrastructure be raised. This view is supported in the work of Weber and Allen of the Conservation Fund, who have promoted the role of education and dissemination in the development of green infrastructure thinking. The Conservation Fund has now taken this forward by developing professional courses in green infrastructure planning. These courses focus on the value and benefits of the concept and its potential role in delivering sustainable landscape management practices. Aimed at professional landscape managers, the Conservation Fund is advocating the dissemination of information that will educate current and future planning professionals⁵⁷. The value of education is now also being seen in higher education, where green infrastructure thinking and planning are being taught in both undergraduate and graduate landscape planning programmes (i.e. those by Ahern at the University of Massachusetts).

The value of education, as promoted by Williamson and Weber, has therefore started to permeate into the mainstream education of students, academics, and practitioners and has aided the understanding of the green infrastructure concept. More recent workshops held by the East Midlands Green Infrastructure Network and Natural England in the East of England (Peterborough, Bury St Edmonds, and Cambridge) provide UK examples of green infrastructure being debated in practice. Charlton, Clinghan and Hall, and Murphy all noted the value of such events in disseminating the key green infrastructure messages to ENGO's planners and developers. However, Paul Selman offers perhaps one of the bleakest views of what may happen if green infrastructure as a concept is not fully developed. Selman outlines the negative environmental costs he envisages, linking these problems with landscape degradation, climate change and flood events. When asked if green infrastructure as a concept has a future, Selman replied:

Well, I hope it does have a future. I think I would go as far to say that if it doesn't have a future then we're probably shafted as a species. If we don't take it seriously, if we don't put substantial investment into a properly interconnected, functional blue-green infrastructure then I think the consequences for the loss of biodiversity, the urban micro-climate, flooding, and all the rest of it will be pretty disastrous. I don't think we can even contemplate the scale of house building that we're talking about at present without having a fundamental strategy with green infrastructure associated with it. I think the future for it [green infrastructure] is that it has to be accepted as an essential part of the future planning of cities.

Paul Selman, 25/07/2007

⁵⁷ Similar workshops have been run in the East Midlands Green Infrastructure Network (EMGIN) and Natural England in the North-East and North-West.

In this strongly worded statement, Selman proposes what could potentially happen if sustainable planning practices are not put into place. Here, Selman outlines the extreme negative implications to social and economic structures if physical sustainability is not placed at the centre of landscape planning. In contrast to Selman, Littlewood offers a more optimistic vision. Littlewood states that, as green infrastructure holds the potential to fit a number of different planning needs, including regeneration, the development of its core values (ecological, economic and social benefits, connectivity, access, and scale) will also promote its use. He does, however, go on to present a note of caution by stating that, if the green infrastructure concept is not fully developed and embedded into planning practice, then its values could be 'subverted' or its use could decrease.

Moreover, there appear to be a number of areas where green infrastructure researchers feel the concept can be developed in the future. These ideas include the role of multi-scale green infrastructure development that works at different spatial scales and across different administrative and landscape boundaries as outlined by Littlewood and Weber. Secondly, as David Hopkins noted in regards to the Luton and Bedfordshire Green Infrastructure Strategy, a holistic approach to green infrastructure planning needs to continue if the widest possible range of values are to be delivered. There have also been calls for better or more readily available access to funding streams to support green infrastructure as proposed by Donna Murphy in the North-East with NECF. This could draw on the evidence and good practice guidelines being developed in the UK and North America as a way of obtaining funds through effective lobbying and promotion. There have also been discussions on the need for better integration of public and private actors at local, regional and national levels to key into policy and funding streams. The North-West and Cambridgeshire regions are areas where this process has been seen in England. Ahern synthesises these ideas by suggesting the ecological, economic and social goals of green infrastructure be a way of integrating a number of contrasting ideas within a specific environment. Ahern also sees green infrastructure as an 'innovative and exciting idea' that can situate itself at the core of the sustainability agenda. Therefore, it brings together the ideas set out above into one narrative, which proposes green infrastructure as an alternative planning process to meet the challenges of the changing landscape. Or, as Ahern states:

There's an allure because it's something new, a cache, [there is] potential for it to be innovative and an exciting idea. Beyond that I like to think that it is a powerful idea and I see it as going a bit more into the core of the sustainability challenge because it recognises, embraces and tries to integrate with the grey infrastructure... Sustainability said we need to find ways to make everything work; spatially integrated, functionally integrated, socially integrated and economically and I think I see [this] with green infrastructure. Ecology in the city, ecology of the city – thinking like, that the urban environment [is] where a lot of people live, where the waste is generated and so forth, as not just an opportunity to do this but as an imperative to do this or a responsibly to try and confront these challenges to make things work in the urban environment.

Jack Ahern, 27/02/2007

6.13. The role of multi-functionality within green infrastructure thinking

In conjunction with the development of the green infrastructure, a number of researchers have evaluated the role multi-functionality plays in green infrastructure planning. By proposing that multi-functionality be placed at the centre of green infrastructure planning, it has allowed a range of

researchers to engage with the concept. This potential is due to the number of ideas promoted in the UK, Europe and North America that view green infrastructure from a variety of perspectives. Consequently, multi-functionality has been noted as a key element of green infrastructure thinking, i.e. one promoting a range of functional activities within a specific environment and plays a key role in linking these visions, concepts and systems, thus providing an insight into how landscape functionality is viewed in different social and planning contexts.

Brown outlines his thoughts, stating that he feels the concept of 'multi-functionality' has been a valuable idea in resolving land use conflicts, particularly in urban areas. He notes that as debates about development, and appropriate use of space, become more prominent, landscape multi-functionality will become 'more and more important and valuable as it becomes more well known'. Konijnendijk supports this view, stating that multi-functional planning 'is crucial as the various functions of [the] landscape need to be considered at all times' (Konijnendijk, 12/01/2007). Again, Konijnendijk follows Brown in stating that urban expansion and development will be one of the most important areas for multi-functional planning as they are the areas where the provision of a range of benefits are needed most. Konijnendijk emphasises the value of this process in high density developments where land is scarce, e.g. in Amsterdam or Rotterdam. In these areas, Konijnendijk states that multi-functional planning is a fundamental approach that is needed to meet the needs of a location; but also, as Brown notes, to communicate the visions of planners and developers with the needs of local, regional and national populations.

In contrast to Brown and Konijnendijk's practice-based approach to multi-functional planning, Selman provides a more conceptual interpretation. Selman proposes that multi-functionality is more than 'functions simply sitting together in the same place, it's more than simply co-location, it's about interactivity'. Selman points out that the conceptual basis of integrated systems underpins the role of multi-functional landscapes. An idea that he states is quite hard to achieve in land use planning because planners do not necessarily understand how to plan effectively for interactivity. He also goes on to suggest that multi-functionality, like green infrastructure, is a term that has infiltrated into top level policy making without being fully understood. Using an example of urban-fringe planning, Selman notes that multi-functionality has been seen as a way of planning transitional spaces without fully understanding the activities that go on there. He also notes in reference to urban-fringe planning that '[planners] want practical solutions that will work at a small-scale on the ground.'

Consequently, Selman suggests that multi-functional planning offers an approach that can fulfil a number of sustainable ideals in the UK. To meet their goals Selman proposes the notion that sustainable landscapes must be able to maintain their essential functions. Therefore, an approach that plans for multi-functionality aids this process by integrating a number of systems and functions collectively within a landscape. In terms of green infrastructure, the role of developing multiple functions across a known landscape fits with the principles of sustainable land use. By promoting ecological, economic and social benefits in a landscape, green infrastructure can utilise multi-functional thinking to integrate diversity whilst supporting core functions.

6.14. Green infrastructure thinking: definitions, development and the future

The aim of this chapter was to present the responses of a diverse range of academics, planners and landscape practitioners to discuss different aspects of green infrastructure development. This aim was coupled with a need to examine how different respondents viewed green infrastructure, and to assess what influences their use of the concept. This process was broken down into a number of sections reviewing the definitions, elements, development and future of green infrastructure, thus providing this chapter with both a conceptual and historical context of the concept. It also provides an evidence base highlighting how, where and why different practitioners and academics have supported the development of a green infrastructure approach to landscape planning and where there are still currently gaps in this knowledge.

This chapter has also outlined how the focus of different local, state and national (or Federal) agencies have utilised the concept and have linked this use with other landscape initiatives. Chapter 8 will develop this relationship further. This process in turn has provided an indication of how the roles of focus, size, funding and engagement in landscape planning have diversified with each interpretation and different definition of green infrastructure use. Therefore, although this chapter has been unable to present a definitive understanding of what green infrastructure is, as it set out to do, a better and more fluid understanding of how the concept is viewed in different locations has been presented. A number of principles have also been discussed and a variety of appropriate planning practices have also been examined which ground green infrastructure with a number a complementary concepts, an understanding of which will be developed further in Chapters 8, 9 and 10.

In terms of developing an acceptable definition, the responses gathered suggested that what green infrastructure means remains uncertain because of the inherent diversity in focus of those working with the concept. However, each of the definitions given in this chapter provides an insight into what people believe green infrastructure to be, showing diversity in its conceptual and practical use. These differences can be seen in the ways that UK, European and North American responses to the ideas of green infrastructure differ. In the UK the ecological, economic and social integration of planning policy and practice are central to a holistic approach to green infrastructure thinking. Academics and practitioners suggest the idea that innovative design can be used to promote sustainable landscape and the development of sustainable places. The need to promote an integrated system of green infrastructure planning at national, regional and local planning policy levels was also heavily emphasised. When compared to UK responses, North American views of green infrastructure show striking differences. North American academics and practitioners place their primary emphasis on the ecological function and value of a green infrastructure system. This focus states that green infrastructure needs to maintain biodiversity, enhance ecological networks and conserve the ecological integrity of a landscape before any economic or social benefits are considered. There are also links with natural resource assessments, and the promotion of conservation practices must be seen as being of equal importance to other development pressures. Subsequently, there is a basic difference in the focus of green infrastructure thinking between UK and North American research based on its ecological, economic and social functions or benefits.

The discussions presented by Konijnendijk, however, present similar ideas to those outlined in UK responses. Working within a holistically diverse system due to limited development space and high density pressures, Konijnendijk noted the innovative role of holistic green infrastructure planning as a way of meeting sustainability pressures. These ideas indicated the view that ecological functions must sit alongside economic development and social needs in an integrated planning system. In contrast to the UK and European responses, North American planning also appears to be a much more fragmented process where local, metropolitan, regional and national (Federal) practices are less co-ordinated. This, in turn, affects the role some people, including Bob Brown, see for green infrastructure. Owing to the fragmented approach to delivery and development of planning policy in the USA, developments in actual planning practice are mainly conducted at the state or county level. This suggests that there is a lack of a centralised or top-down approach to green infrastructure planning between counties, cities, and states across the USA. A review of this progress suggests that the development of landscapes which meet sustainability ideas (i.e. they support ecological, economic and human functions or activities) can therefore support planning initiatives to improve quality of life, but there needs to be a greater level of policy and planning co-ordination for this to be achieved.

In terms of the elements that constitute green infrastructure, the development of the 'soft' and 'hard' landscapes (i.e. green and grey) and infrastructure generally provided a base for further discussions. This has provided a platform where researchers discussed the value of 'green' infrastructure as a natural or ecological element, and as a green idea or agenda. Consequently, this chapter discussed how different interpretations of what constitutes green infrastructure can be interpreted in both physical and conceptual terms. With discussions of basic elements and landscape functionality within wider green infrastructure networks, different researchers also promoted the utility of different connective elements (i.e. riparian corridors). By stating that connective elements are fundamental to the concept of green infrastructure, the different forms and functions of a landscape have also been noted. These ideas were developed to discuss green infrastructure in terms of wider networks, delivery frameworks and specific landscape classifications. It can therefore be proposed that a number of contrasting elements underpin what green infrastructures are and offer a focus for different researchers and practitioners to discuss their research.

As with the development of a definition and what constitutes green infrastructure, there are also differences of opinion in whether there is a consensus for the concept. From the discussions presented, it has been suggested that the contemporary nature of the concept means there is not yet a clear focus or consensus to green infrastructure. This is clear when reviewing the differences in UK, European and North American discussions of the concept where, due to the relatively short time span in which green infrastructure has developed, different researchers may have used the concept to promote their own work rather than feeding it into the wider debates. However, with further research, a consensus may be developed promoting the fundamental ideas of the concept to be accepted and discussed consistently within the research and practitioner literature. This process appears to be underway with the development of green infrastructure guidance by Natural England and the Landscape Institute at a national scale and a number of RDAs and County Councils at a regional and sub-regional level (e.g. Cambridgeshire).

Although there is currently no overarching consensus about what green infrastructure is, there are clear visions for how the concept should develop in the future. These ideas include the need to source and obtain consistent and sustainable funding streams. Obtaining funding was discussed by a number of respondents as an essential component of green infrastructure development, a notion that is underpinned by a number of green infrastructure organisations in the public realm. Without funding, new green infrastructure development or research cannot be undertaken and current research may not provide sufficient or appropriate data to attract further monies. The role of funding, therefore, holds a key role in promoting green infrastructure planning and it was noted that it needs to come from a number of different sources. Examples of green infrastructure projects noted by Lewis in Chicago and Philadelphia highlight this process. Obtaining funding would also provide practitioners and researchers with opportunities to develop new evidence sources as proposed by Nolan and The Mersey Forest, in order to obtain long-term funding. Natural England and the RDAs, therefore, have an important role to play in this process as they offer centralised support with access to government grants. The Cambridgeshire Green Infrastructure Strategy Review (2009/10) is an example of where investment can increase the cumulative value of a region's resources. The development of new data sources was also proposed as a way of allowing researchers to develop data, which they can then lobby other organisations for a further integration of green infrastructure into planning policy. This is a process that can be seen in the Community Forests influence of landscape policy in the North-West and North-West and Natural England's emergence as the most prominent advocate for green infrastructure development with RDAs.

A third area of future development is education. Educational programmes for researchers and practitioners were noted as providing a key area where green infrastructure thinking could be translated into appropriate planning mechanisms. It was highlighted that this process needs to take place at local, regional and national levels if the values of green infrastructure are to be fully incorporated into planning practices. The Conservation Fund has been one of the first to achieve this by developing this process in practitioner workshops and professional development programmes aimed at educating landscape professionals in green infrastructure planning. Consequently, the role of funding, data collection, and education have all been reported as areas that need to be reviewed if green infrastructure, as a concept and a planning process, is to be accepted. However, acceptance of the concept also relies on the number of other factors including organisational focus and individual enthusiasm for the concept. Therefore, the development of appropriate channels for research and discussion need to be proposed that facilitate multi-partnership forums for green infrastructure thinking. Natural England is one organisation who could lead this process.

Through a combination of these processes, the concept will continue to develop and incorporate the growing research focussing on green infrastructure. The next stage for green infrastructure development is therefore to return to some of the ideas discussed earlier in this chapter. Does the concept really need a universal definition and is it needed? Would a set of principles be sufficient to meet conceptual and planning needs? Where are the next developments in its practical use? What needs to occur for the concept to be developed within mainstream policy? These questions have all been raised in the discussion presented in this chapter but will need to continue in the research

literature, planning policy debates and within actual green infrastructure planning projects. The debates noted above, though, do suggest that these questions are starting to be addressed and responses will continue to be debated in different areas of planning and policy development. This thesis will answer some of these questions in Chapters 8, 9 and 10 and highlight further developments and areas of green infrastructure research that will provide answers to some of these questions.

Chapter 7: Results & Analysis: Environmental Perceptions; interpretations and understanding of landscape functionality⁵⁸

7.1. Introduction

Perceptions of the landscape differ depending on a wide range of factors. Age, gender, place of residence and experiences all affect an individual's interpretations. The following chapter presents the results from three respondent groups in the UK and North America, assessing how they perceive and interpret the environments around them. This analysis outlines a range of areas relating to perceptions and the management of the landscape (i.e. ideas of form and function) examining how perceptions affect the broader interpretations of green infrastructure. The results outlined compare findings of a visual perceptions survey, exploring how different respondents perceive the landscape and whether their preferences can be described as being constructed through a physical, psychological or social understanding of the environment.

The central aim of this chapter is to examine the influences that underlie perceptions of green infrastructure. It is important that planners and researchers understand this process if they are to plan development that meets the social needs of those people who will use it, and the ecological needs of biodiversity management.⁵⁹ Although a number of authors have worked on issues of perceptions, i.e. Tuan (1979) and Kaplan and Kaplan (1989), the relationship between green infrastructure and landscape perceptions have not been fully explored. This chapter thus assesses how people view green infrastructure by asking respondents to value different social and ecological characteristics in images. It goes on to enquire whether, or how, these interpretations affect the subsequent use of these spaces. Again, these are important questions outlined in the practitioner and research literature; consequently, an understanding of how interpretations differ depending on the aesthetics of landscape form and function is important to the development of more sustainable and functional places.

The chapter will be structured in the following way. Firstly, it reviews the positive and negative interpretations of the landscape based on the responses gained from the visual preference survey. Secondly, an examination of whether respondents discussed ecological, psychological or social constructions of the landscape is made. This assesses how specific landscapes or landscape elements are perceived by the respondent groups, and is discussed in terms of how green infrastructure can be used by developers and planners to support the creation of places that promote multiple uses and positive interpretations.

This chapter, therefore, reviews how people view the landscape and discusses how these interpretations can be presented to planners as a set of development or design principles. Green infrastructure has been discussed in previous chapters as an idea promoting better places to live, work

⁵⁸ Green infrastructure will be used to describe the actual resources but also the characteristics of the concept proposed in Chapters 2 and 6. Green infrastructure will be used to describe the spatial distribution, the function, and context of the space. Greenspace will be used to describe the actual site under investigation, and the physical attributes of that space. Landscape will be used to describe the wider ecological, economic and social composition of the environment at a number of different scales.

⁵⁹ Examples from CABE Space's work highlighted this process in Chapter 2.

and recreate. Consequently, a review of how people interpret these ideas provides an insight into how spaces can be planned with different ecological, psychological and social interpretations in mind. These themes are discussed collectively at the conclusion of the chapter, examining where gaps in our understanding of landscape interpretations are and exploring how these gaps can be discussed in terms of planning for sustainable landscape use. This chapter goes on to suggest that perceptions of green infrastructure vary depending on what is being reviewed, a view that is supported throughout this thesis. The role of perceptions in landscape planning will therefore be a central area of discussion in this chapter addressing where, and how, understandings of people’s views regarding the landscape or green infrastructure can be utilised within the planning stages of a given development.

Table 7.1. Environment Perceptions Case study areas

Location	Respondent groups	Focus	Sample size
University of Massachusetts	Landscape Architecture and Regional Planning students	Landscape architecture, regional planning, green urbanism	11
Northumbria Newcastle	Geography and Environmental Management students	Environmental studies, rural studies, planning	27
Gateshead County Council Conservation Volunteers	Current and former conservation volunteers.	Community outreach and conservation	23

7.2. Visual Perception survey

This chapter examines the responses to a survey of visual perceptions conducted with students at the University of Massachusetts (Amherst, USA) and Northumbria University (Newcastle, UK), and a group of Gateshead Conservation Volunteers (Gateshead, UK). This analysis looks at the type of landscape or landscape features respondents preferred, and it discussed the reasons behind these choices. Each of the respondent groups presented in Table 7.1 provided data from people with a different perceived understanding of the landscape and helps to build a picture of how perceptions of a space can affect its function and its use. The analysis of this process will be used to assess what mechanisms are utilised by respondents to interpret the landscape and how these ideas can be translated into planning practice. This explores how different physical, psychological or social elements form the basis of perceptions and reviews whether interpretation are affected by specific influences within the landscape. This review also proposes to assess how people express these ideas and the focus they place on their discussions. A number of examples will be provided, showing how and why, and specific landscapes or landscape features are valued. This examination highlighted the elements or resources different groups of respondents found preferable, which are interpreted in terms of green infrastructure, to assess whether these elements are noted as being important resources and whether they can be integrated within current and future developments. The link between landscape

perceptions and green infrastructure thus reviews the categories and characteristic elements or emotions respondents discuss in their responses.

Table 7.2. Visual survey responses from University of Massachusetts (UMass), Northumbria University (UNN) and Gateshead Conservation Volunteers (GCV)⁶⁰

	UMass - Like	UNN - Like	GVS - Like	Total	%	UMass - Dislike	UNN - Dislike	GVS - Dislike	Total	%
1	0	1	1	2	3%	2	4	5	11	17%
2	0	0	1	1	2%	1	0	1	2	3%
3	3	10	6	19	33%	1	0	1	2	3%
4	2	0	0	2	3%	4	3	3	10	15%
5	0	0	2	2	3%	0	5	1	6	9%
6	0	0	0	0	0%	2	11	3	15	22%
7	1	8	2	11	18%	0	0	0	0	0%
8	0	3	1	4	7%	0	1	0	1	2%
9	3	4	6	12	20%	0	1	0	1	2%
10	1	1	3	5	8%	1	0	0	1	2%
11	0	0	0	0	0%	0	4	5	9	14%
12	1	0	1	2	3%	2	2	3	7	11%

7.3 Visual perception survey images

Within the research literature (i.e. Tuan, 1979; Bischoff, 1995), a number of ecological elements are reported as being important in discussions of landscape perceptions. Different types and shapes of trees, the presence of water, the level of perceived management at a site, and whether or not people can be seen in an image have all been noted as affecting perceptions of a place. In response to these ideas, each of these elements (and others) was presented in the twelve images utilised in this survey (see Appendix 1). By using elements that were previously reported as valuable in perceptual studies, this survey assesses the extent to which these elements are deemed important and contextualises these responses with the broader thinking on landscape perceptions and green infrastructure.

The images used present a broad range of landscapes including: urban, urban-fringe and rural locations, and provide scope for people to distinguish between what type of landscape and form they show preferences for. A survey of this nature, therefore, allows an analysis of green infrastructure characteristics and perceptions to be made. The value of such an analysis is to explore what preferences are most frequently discussed and relate these descriptions to design or appropriate management techniques. This process suggests that the choice of image is based on an understanding of notions of depth, light, colour and location and how these interact to underpin perceptions. The broad nature of the twelve images used thus provides scope for a wider breadth of discussion because of the variation in what respondents are being asked to assess.

The survey responses are shown in Table 7.2. and highlight the different interpretations, whether positive and negative, gained from each respondent group. The table notes that there are a number of differences between the landscapes that people liked (images 3, 7, and 9) and those they disliked

⁶⁰ The most frequently discussed images appear in bold.

(images 1, 4, 6, and 11). However, although there are differences in the perceptions of the landscape, a large proportion of responses agreed that images 3 (33%) and 9 (20%) were perceived most positively (53%). These two images are shown below and represent a seascape in Tyne & Wear and a rural landscape around Hadrian's Wall in Northumberland. What these results show is that there appears to be an attraction or value placed upon very different types of landscapes. The images reflect findings in the research literature (i.e. Tuan, 1979), which indicates the importance of landscape that provides links between the environment and social history (i.e. Hadrian's Wall), as well as physical elements such as water and diverse landscape features. The collective presentation of this mixture of elements suggests that there is an understanding of the elements associated with positive interpretations, a view that will be developed further in this chapter.

Plate 7.1. Images 3 (Marsden Bay) and 9 (Hadrian's Wall at Steel Rigg)



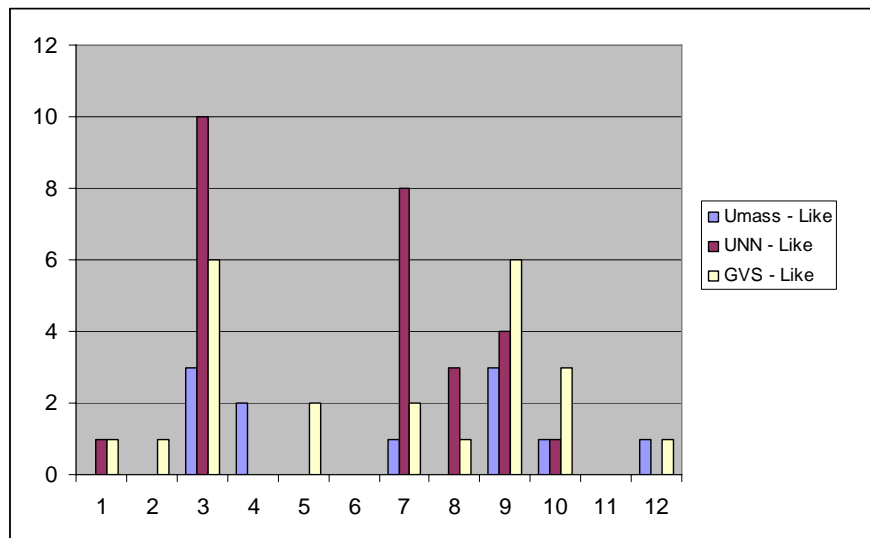
7.4. Positive preferences

When asked why they showed a preference for images 3 and 9, respondents stated their preferences to the ocean, the seaside and waves, the movement of nature, nature itself, and the fact that the landscape was untouched by human impacts. The images also provided some people with clear links to the history of a specific place (i.e. Hadrian's Wall). These responses highlight the complexity in the reasoning that supports different landscape preferences between physical and social landscape elements. Although people emphasised strongly the physical elements of the images, respondents also described the images in emotive terms using ideas of warmth, power and serenity as reasons why they liked images 3 and 9. Respondents, therefore, took the physical elements of the images and discussed them in the social context or perceived social or emotional value within them. Consequently, it can be proposed that experience, knowledge, and preference were all used in the decision-making process of respondent comments.

Chart 7.1 below outlines the range of positive responses collected for this review. It highlights that, although images 3 and 9 are the most frequently discussed, other images (7, 8 and 10) were also commented on positively. This implies that, although there appears to be a consensus on which

images are most popular, other images also display elements that respondents are drawn to. The different physical elements that each image is composed of therefore appear to be important to the individual. This seems especially true when relating the images to the wider discussions of what people find important in a given landscape (i.e. natural or cultural features). Although there is clear diversity within the responses gathered, the preferences for images 3 and 9 suggest that, within a given range of these, there will always be preferences towards one or two images that respondents feel are more interesting or special.

Chart 7.1. Visual survey 'like' responses from University of Massachusetts, Northumbria University and Gateshead Conservation Volunteers⁶¹



The high number of preferences for image 7 (Miserton, UK) also shows that a number of the areas of discussion and interpretations relating to images 3 and 9 can be applied to other images. The rural scene in image 7 was discussed by respondents as reminding them specifically of Christmas or their childhood. Subsequently, it may be reasonable to suggest that people showed a preference to this image because it held personal reference points to events or places they could associate with or that they knew and understood. Respondents also discussed image 7 in terms of the mystery and adventure that may be found in the image. Again, these socially constructed ideas are built on the physical features of the landscape followed by social interpretations. When reviewed against the perceptions of images 3 and 9, these ideas (nostalgia, memory, and mystery) suggest that respondents used preconceived ideas of what a landscape means by referencing and associating specific social or cultural events that they have witnessed or have knowledge of.

These constructions of place allow interpretations of that space to be understood in a broader social context. However, in all three respondent groups, images 3 and 9 were recorded as holding the most frequent preference. Consequently, there does not appear to be any significant differences in interpretations between the UK and North America in the respondent groups assessed.⁶² The responses do, however, show trends that support the research literature acknowledging the value of

⁶¹ The numbers of responses attributed to each of the twelve images are presented rather than a percentage, as some respondents attributed value to more than one image. Consequently, percentages would have provided skewed results as the sample size and respondents would not have matched.

⁶² This view may change if non-western respondent groups were surveyed (Tuan, 1979).

specific ecological and social components in landscape preferences. These elements provide an insight into some of the ideas that support the social constructions of place (memory, experience, understanding, and desires) alongside the role of physical landscape interpretation. In Appendix 2, responses to the visual surveys can be found highlighting the range of responses provided and how values and perceptions varied between each image and respondent group. However, although a discussion of which images are the most popular is important, the reasons behind these decisions potentially offers a greater insight into how landscape perceptions, in a green infrastructure context, are developed.

Our perceptions of a space can therefore also play a key role in the sustainable use of a landscape. Interpretations of a space thus potentially need to be positive if a location is to be functional and well used. Consequently, a review of the reasons supporting these choices is important in allowing practitioners to tailor green infrastructure development to promote use by multiple groups. There is, however, a potential issue in gathering such data. In this survey, a number of responses stated that they like the sea and the ocean in image 3, but do not attach any social or psychological elements to the landscape:

'I'm a big fan of the ocean and seaside. The cliffs are remarkable with the waves breaking against them'

'I like this image because I like oceans and coastlines. I like the shoreline and what remains of Marsden Rock'

'I like the coast. Not long beaches but cliffs and the sea. I particularly like the stack and waves'

'The wild scenery, rough sea, waves etc. The person on beach gives the photo perspective'

These responses all state that specific landscape elements are the reasons why they like a particular image. They note the rocks, cliffs, and ocean but add very little context to their responses. They do not review the activities that go on at the site, be it natural or social. Respondents simply outlined the natural elements they feel are valuable. In contrast, a number of respondents looking at image 3 and provided a deeper level of interpretation to their explanations discussions:

'Of all of the images, this landscape seems the least manipulated/altered by humans, and seems wild and much more 'natural' than some of the others'

'No human interference - all natural. The different shapes formed naturally by sea. Peaceful'

'Its natural and you can see that it's ever-changing. You can imagine what it used to look like and how it's changed without the impact of humans'

'Sense of isolation and size. I like feeling lost in a huge wilderness. The bird and human figures make the scene seem bigger than it is – very effectively'.

In their assessments, respondents use the ideas of management, natural vs. human interactions, isolation and size, and the peaceful nature of an image as the reason why they like an image.

Consequently, respondents place additional social values on their choice. This is, however, a secondary aspect of their interpretation, as these responses propose that the physical landscape is the primary factor underlying preferences rather than cultural or social reasons. This is a common response to image 3, as several respondents repeatedly noted the cliffs, the [cliff] stack, and the ocean as the elements that they thought were important. A key issue here is how we interpret the notion that the ecological elements of the image are the most important when compared to social or cultural ideas. From a green infrastructure perspective, this notion supports North American research as it places the ecological components and functions at the centre of green infrastructure debates. However, just as in the first responses noted above, preferences for natural features are not the sole reason why people show preferences for an image. In the three examples shown below, respondents outline interpretations based on social ideas that they feel are of equal importance as the ecological features themselves:

‘Humans are subordinate to, but present within, the landscape’

Respondent 4, Amherst

‘What stands out in this image is that it seems to be the only one of the batch that doesn’t show much human influence in altering the landscape - all the others have a path or bridge or fence - human constructs’

Respondent 11, Amherst

‘Adventure, the big horizon, the power of the waves and the rocks. I could find myself sitting there on the beach looking out to sea’

Respondent 13, Gateshead Conservation Volunteers

These three statements present a marked contrast to some of the discussions made previously in this thesis where the perceived management of a landscape was rated as important. The difference in this survey, thus, highlights that people can view the landscape through a number of different interpretative guises depending on what they are being asked to assess. Preferences may therefore be based on an understanding of a number of other factors (e.g. management or safety issues) but only with further investigation can these reasons be known.

What each of these responses shows is that, although they value the ecological composition of a given image, they also appear to discuss social values in their interpretation. By stating that the landscape appears to hold more power than human influence respondents are valuing the landscape, but from a human perspective. Consequently, although the landscape may be valuable ecologically, respondents also find it valuable because there is little or no perceived human influence over it. It may, therefore, be important for landscapes to show processes associated with naturalness (i.e. ecological processes) or show nature being more powerful than human management in preference studies if positive interpretations are to be gathered. However, although a number of the responses note that the natural processes are important, the actual interpretation of these actions is still culturally constructed. Our interpretations of the landscape, especially at a location such as Marsden Bay (image 3), are aided by our understanding and knowledge of the processes and landscapes that some people see as being natural. Marsden Bay, because of its geological and ecological composition, is however a heavily monitored and managed landscape. Image 3, therefore, appears to be a natural image, and is viewed by many respondents as such but is in reality heavily managed and regulated.

Moreover, discussions of what can appropriately be called natural need to be made if our understanding of ecological resources and social interpretations are to be made clear to planners or developers. Interpretations of green infrastructure, thus, needs to be viewed in the same way if the process of appropriate development is to take place and support local population (ecological and social) needs.

In contrast to the views of *naturalness* people hold for image 3 and image 9, it is viewed and interpreted as a landscape that has been developed and managed by humans for human activities. Image 9 shows Hadrian's Wall at Steel Rigg. This is one of the Northumberland National Park's most visited sites⁶³ and is an excellent location to discuss the integration and changes seen in agriculture, forestry and tourism. This image also presents very different landscape elements to image 3. In image 9, there is a smaller field of vision with the prominent feature being the wall and the associated background of farming and forestry. Due to the different landscape elements on view, alternative ideas and perceptions were presented which link the context of the image with its man-made features and social history.

The five responses below highlight the diversity of answers, explaining why respondents showed a preference for specific images. They include its representation of human engineering, the composition of the landscape functions of the area, its links with personal memories, and the image's ability to convey the qualities of strength, durability and freedom. The final comment simply states that they think the image 'sums up the English countryside'. What each of these comments suggest is that, unlike image 3 where the physical features of the landscape are the main reasons behind these preferences, in image 9 it is a combination of the physical elements combined with a social context that is important.

'I like this image because there is good contrast between the foreground and background. It represents human engineering'

Respondent 20, University of Northumbria

'The image shows agricultural land, forestry and tourism. The lack of man-made buildings and grassland makes the landscape very attractive'

Respondent 21, University of Northumbria

'The image reflects a peaceful rural image. The stone wall and the rolling hills remind of childhood'

Respondent 23, University of Northumbria

'Image of the wall conveys strength, durability, sustainability and freedom from a busy urban life'

Respondent 4, Gateshead Conservation Volunteers

'The man made wall seems to blend in with the beautiful landscape in perfect harmony with each other. You also get a sense of open space from the picture I think it sums up the English countryside'

Respondent 5, Gateshead Conservation Volunteers

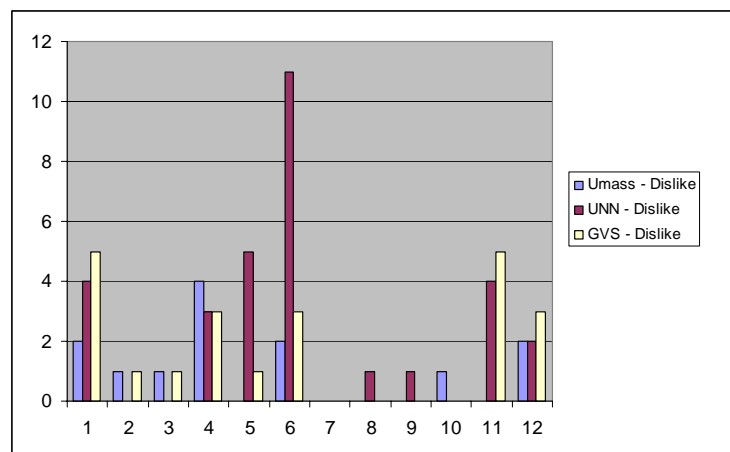
⁶³ Approximately two million visitors a year.

The differences in how people viewed image 3 and 9 provide an interesting insight into the debate examining how natural and social ideas of green infrastructure resources merge in landscape interpretations. Although some respondents placed the greatest value on the natural features of an image, they also supported their views with social interpretations. Therefore, although it is possible to review the preference to image 3 solely in terms of its proposed natural or ecological nature, this is not necessarily the case. This also supports the view that preferences for image 9 propose that social elements are valued most frequently but also discusses the ecological elements (and value) of the image. The discussion of positive landscape preferences thus appears to rely upon a process of primary and secondary interpretation. What people value seems to be developed through a number of layered interpretations of visual, physical and social ideas and associations. Consequently preferences appear to be built upon the idea that there is no singular interpretation of a landscape. Alternatively, it can be suggested that a high proportion of the responses noted underpinned their preferences with a number of ideas drawn collectively from cultural, ecological, and social sources.

7.5. Negative preferences

The above discussion presents a number of the positive responses provided, explaining why they feel certain landscapes should be classed as valuable. In the following section, the images people showed more frequent negative feelings towards will be discussed and will assess how the choices of what is valuable, and what is not, differ. This is especially relevant when compared to the reasons respondents outlined for positive preference to show where similarities or differences lie. The images that were most frequently reported as holding negative elements are shown in Plate 7.2 and in Chart 7.2. In the previous section, two images were noted as being most frequently referred to when respondents discussed what they felt were valuable landscapes. In contrast, four of the twelve images reviewed were noted as holding one or more elements that people felt presented a negative impression. The images noted as being disliked most frequently were two urban (1 and 4) and two urban-fringe (6 and 11) sites, although image 4 gained the highest proportion of responses (22% of all responses).

Chart 7.2. Visual survey ‘dislike’ responses from University of Massachusetts, Northumbria University and Gateshead Conservation Volunteers⁶⁴



⁶⁴ The numbers of responses attributed to each of the twelve images are presented rather than a percentage, as some respondents attributed value to more than one image.

Whilst each image is composed of a range of green infrastructure elements, there are similarities between them. Images 1 and 4 are both urban landscapes and it was felt that this made the images clustered, too managed or over-developed. In contrast, the urban-fringe and rural images offered a broader landscape image across different spatial boundaries. Unfortunately, the location of images 6 and 11 were viewed as derelict open spaces and positive elements were not attributed to it in these new developments. Bede's World (image 11) was discussed in equally poor terms with responses stating that the scene depicting village life was untidy and interpreted the industrial buildings in the background as unsightly. Personal understandings or preferences to urban, urban-fringe and rural sites therefore appear to hold a particular relevance in discussions of negative preferences.

Plate 7.2. Images 1, 4, 6 and 11



Each of the four images highlights different landscape elements and features and does not present a homogenous landscape, urban or otherwise. However, respondents were still drawn to a number of the same themes when assessing these spaces. Respondents noted the industrial nature of images 6 and 11 as primary reasons for not liking these sites. In contrast, images 1 and 4 were reviewed as being over-crowded, cluttered and imbued with negative social constructions (e.g. vandalism or graffiti). Respondents also appeared to vary in their assessments of urban and urban-fringe landscapes. A number of respondents appeared to look for deeper meanings in the images to find specific social and psychological elements that they then perceived as being negative. This is relevant when comparing the perceptions of positive elements. However, some of the views relating to the images being clustered, untidy or vandalised (i.e. image 4) do not necessarily reflect the actual space. Image 4 presents an image of the Calthorpe Project in Kings Cross (Central London), which is a critically acclaimed urban space promoting social inclusion, urban farming and community participation. However, because of its compact form, respondents stated that they thought it was

cluttered and untidy and may even have been vandalised. These perceptions may not correspond with what actually occurs at the site and thus interpretations of an image are circumscribed by how people view spaces in different contexts. Interpreting an image is, therefore, a very specific process and, when asked to identify areas they felt negatively about, respondents proposed at a greater range of influences than they may otherwise have done.

The reasons respondents gave when discussing the negative aspects of landscapes varied depending on a number of variables: the space (or image), what people actually see, what they think they see, the weather, and how they interpret a space in terms of their knowledge, experience and understanding of it. Below are a number of examples from participants, reviewing why they felt that one of these four images was the least valuable. These quotes show that the range of explanations given cover a range of cultural, psychological and social themes. This suggests that it may be very difficult to generalise what elements or features affect perceptions. However, like the positive interpretations, a number of themes do appear within the responses. Some responses centred on natural features or the lack of them, whilst most noted socially or psychologically constructed ideas. The quotes outlined below, therefore, discuss how participants drew on a large number of ideas to express how they felt about each image. They also suggest that the respondents interpreted each of these images in terms of its perceived management or naturalness and not just on a basis of what they saw in the image.

'It is not a glorified image of nature...it looks unkept'

Respondent 6, Amherst

'It seems a bit enclosed...by the buildings surrounding it. It's aesthetically not pleasing as it looks messy and poorly put together'

Respondent 11, Amherst

The responses from students at the University of Massachusetts suggest that they felt that the landscapes were not natural and therefore did not promote images of ordered nature (e.g. unnatural and therefore less valuable). The second quote in particular notes that image 6 (Wardley Manor) was aesthetically unpleasing as it appeared to be 'messy and poorly put together'. These responses suggest that respondents expected a certain level of order in the images and subsequently, because this was not present, they assessed the landscapes negatively. Landscape form and naturalness, therefore, appear to be important aspects of perception, a view that has already been highlighted in the discussions of image 3 in section 7.4.

'It's quite sad and also I think that it is quite plain. Other images contain a more dramatic landscape...'

Respondent 11, University of Northumbria

'The lack of standout features. It's an urban/green area not natural looking in anyway...lacking in any interest...[because of] the manufactured homogenous green of it looks like a former landfill site. No trees, no hills'

Respondent 20, University of Northumbria

The respondents from the Northumbria University noted similar themes to those from Massachusetts by highlighting the lack of standout features as part of their negative interpretations. However,

respondent 11, when discussing the cemetery in image 1, notes two other reasons for not liking the image. Firstly, respondent 11 suggests that the image made them feel sad and appropriates the social construction of death and sorrow onto the image. This appropriation may not however be universal and, as such, personal preferences may actually place an undue negative interpretation onto an otherwise functional space. Secondly, respondent 11 also notes that it is plain and is not therefore a dramatic or interesting landscape. This second point implies that the respondent feels that the image is lacking in features of merit and as such responds negatively. Respondent 20 uses similar ideas to discuss how they feel about image 6. In their response, they note how the image lacks interesting features and is a 'manufactured homogenous' space. Respondent 20, therefore, implies that they do not believe there to be anything of worth in the image. Both respondents from Northumbria University thus promote the notion that, without standout features, landscapes may not promote or receive positive responses. Thus, normal or redeveloped landscapes may be subject to more negative responses because people do not see how the landscape fits with the wider ecological, economic or social history of an area. Green infrastructure developments, therefore, need to bear in mind how composition, elements, and the overall look and feel of a space are integrated if they are to develop functional spaces.

The responses from the Gateshead Conservation Volunteers (GCV) again show similarities with the other respondent groups. Ideas of function and interesting landscape form were described by respondents again. However, GCV also discussed social and cultural perceptions of what is occurring at each site alongside their interpretations of what is actually visible.

'Can't help thinking the path leads to a pond full of old bikes and shopping trolleys. The objective is probably trying to turn industrial flat land into something unnatural and scrappy or the government's ideas of affordable housing'

Respondent 7, Gateshead Conservation Volunteers

'Closed in, claustrophobic, painted, all looks like graffiti. Too urban [with] buildings and trees blocking the view'

Respondent 22, Gateshead Conservation Volunteers

The first respondent from Gateshead notes the possibility of other spaces imbued with negative connotations being close to the image (e.g. the pond full of bicycles). This statement is unsubstantiated but the respondent has viewed the image in such a way that they feel this is a possibility. The respondent also states that image 11 (Bede's World) is turning industrial land 'into something unnatural and scrappy' rather than the order of an industrial unit. There is a contradiction in this statement, as it implies that the respondent feels that the industrial landscape has a greater historical value and that the changes seen in these images have a negative impact on the value of the landscape. The second respondent again uses ideas of social and economic change to support their assessment of image 4. Respondent 22 notes the close proximity of buildings as a reason for the image being claustrophobic. Respondent 22 also notes that the painting in image 4 looks like graffiti. This implies that they feel that there are social problems associated with this space because it is a high density urban space, e.g. crime or vandalism. The respondent has potentially used these ideas to support their response and placed an additional level of assessment onto the image that others may not have used.

Each of the groups surveyed outlined a number of different reasons to explain why they negatively responded to certain images. These ranged from the lack of natural features to the assumption that a landscape was badly managed. Respondents also noted social and cultural problems associated with urban spaces and post-industrial landscapes as reasons for replying with negative responses. However, one of the most common themes was the lack of important or standout features that people could relate to or remember. In a number of images, people stated that they were plain and uninteresting and thus found them boring or lacking a reason to value them. This differs to the reasons provided for why they liked specific images, responses which included that they found elements of the image important (e.g. Hadrian's Wall). Consequently, there appear to be clear differences in what people value and why they value it, depending on whether they are being asked to positively or negatively review landscape images.

Chart 7.3a. Visual survey responses from University of Massachusetts, Nothumbria University and Gateshead Conservation Volunteers.

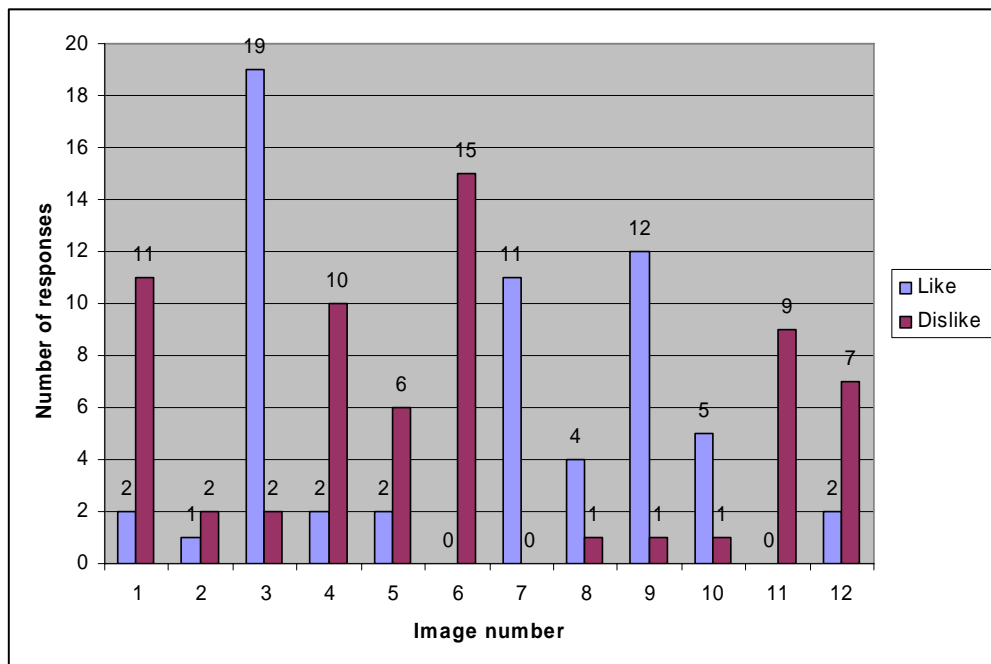
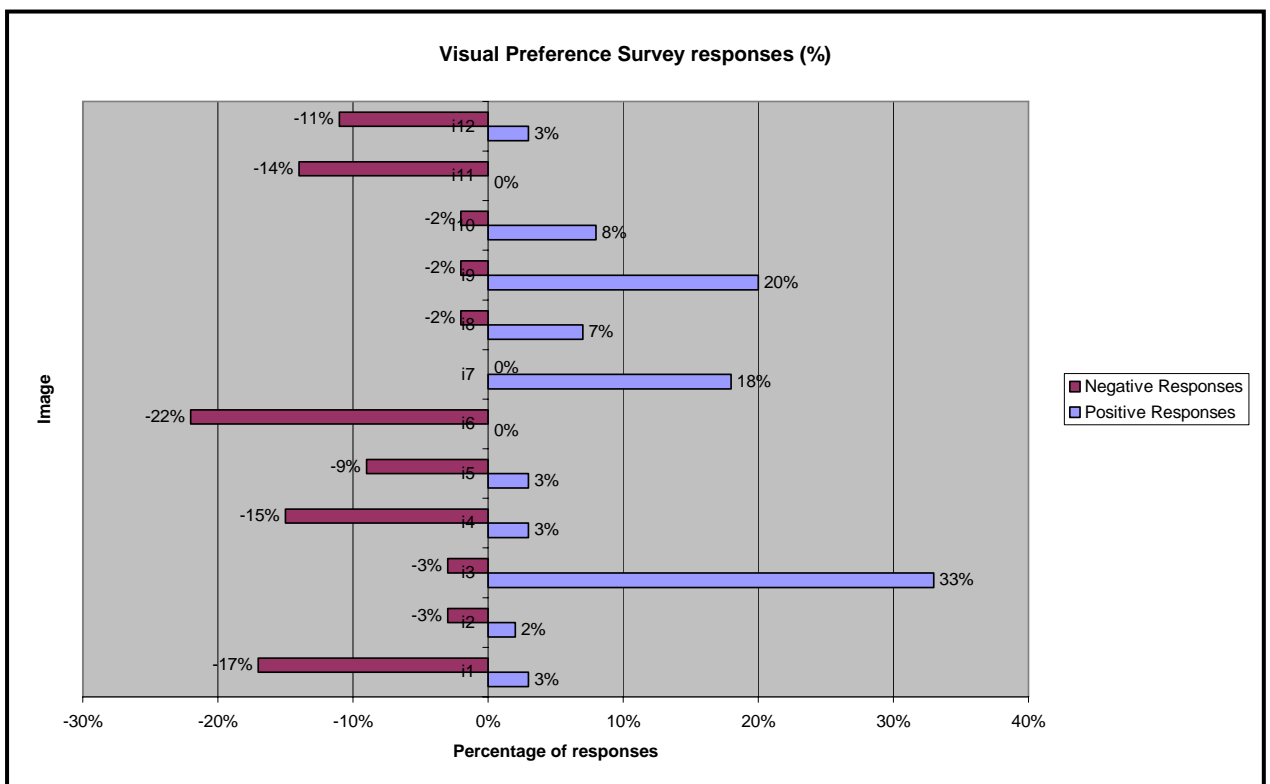


Table 7.2, Charts 7.3a and 7.3b above show the full range of responses gathered from the perceptions survey (see Appendix 2). The table and two charts highlight both the likes and dislikes showing that, although a number of the images are repeatedly noted as being either positively or negatively valued, several images elicit very little response from participants. It may, therefore, be possible to propose that only those images which are interpreted as either showing high quality and interesting landscapes or degraded landscapes classed as boring promote interpretation at more than a basic level from respondents. Consequently, by reviewing images that have standout features, e.g. a cemetery or Hadrian's Wall, people are able to identify elements of that space which they have preconceived interpretations of.

The responses to these images may also be reminiscent of spaces where respondents have been or have knowledge of, which allows the viewer to pick out the key elements of that landscape. In contrast, the images that elicited little or no response may not be in the respondent's mind as they are landscapes that they do not perceive anything special in. Therefore, these images (2, 5 and 5) hold no meaning for the respondent, above the fact that they are being asked to look at and assess them. Consequently, there is scope to review the interpretations of everyday landscapes against landscapes that appear to hold a more constructed value. Although some may see landscape images as just landscapes when asked what they value, people invariably discuss elements that stand out either positively or negatively. Thus, images can be said to be constantly constructed in terms of what people value and provide signposts to how these ideas differ between natural, psychological and social elements of the landscape. A green infrastructure approach to landscape planning, therefore, needs to take into account the role of specific ecologically or socially constructed landscape elements if they are to promote positive perceptions of a space. It could, therefore, be suggested that there is a need for green infrastructure planners to be educated in a broad range of landscape planning techniques to avoid the development of spaces that do not fulfil a clear function.

Chart 7.3b. Visual survey responses from University of Massachusetts, Nothumbria University and Gateshead Conservation Volunteers (positive and negative percentages)



7.6. Respondent preference choices (natural, psychological and social)

The influences supporting respondent choice of positive or negative interpretations also provides an indication of the factors people value when assessing the landscapes around them. By reviewing the reasons given it is possible to assess whether natural, psychological or social reasons are the main influences underpinning what people see when they look at the landscape. Each of these three categories provides clear demarcations for planners and landscape architects to utilise in their

visioning and planning of the landscape. The level of depth in terms of information and breadth of reasoning can also be supported in this process. A breakdown of these categories is shown below in Table 7.3 outlining the features noted by the GCV respondent group, along with the frequency that each characteristic was referred to.⁶⁵ Table 7.2 shows that a broad range of responses were provided covering elements of the lived environment, i.e. spaces of experience, and constructed elements of the environment where perceptions and interpretations of a space are noted. These two areas provide an important distinction in understanding the reasons behind interpretations as they rely on very different understandings and constructions of space. Therefore, due to the diverse range of factors being described, a number of complex interpretations are discussed within each individual's perceptions, experience, knowledge, and also the constructed meanings of a given landscape.

Table 7.3. Gateshead Conservation Volunteers' perceptions characteristics

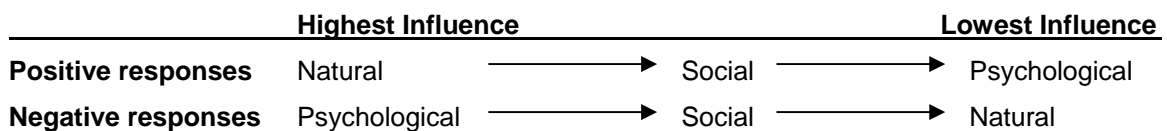
	Natural features	Social features	Psychological features
Question 1 Why do you like this image? What features do you like within this image?	Beach (1) Birds (1) Grass (4) Landscape (3) Natural (7) Natural (7) Open space (4) Patchwork (1) Sea (1) Snowy (2) Stormy/rain (3) Sunny (6) Vegetation (2) Wildlife (2) Woods (5)	Activity (1) Background-foreground (2) Bandstand (1) Childhood (2) Management (3) Wall (5)	Colour (5) Freedom (1) Life (4) Lushness (1) Peaceful (5) Security (3) Sustainability (1)
Question 2 What do you think is the most important part of the image?	Beach (1) Brook (1) Grassland (1) Landscape (2) Natural (3) Sea (2) Sun (2) Trees (1) Wildlife (2)	Amenity (1) Background-foreground (6) Bandstand (1) Life-Death (1) Man-made (2) Pathways (3) People (1) Sunbathing (1) Wall (1)	Colour (1)
Question 3 Why don't you like this image? What features do you not like within this image?	Sky (1) Winter (2)	Background-foreground (2) Bridge (1) Litter (3) Urban (1) Van (1)	Claustrophobic (1) Clutter (6) Cold (1) Colour (1) Depressing (4) Graffiti (1) Man-made (8) Poor form (1) Slippery (1) Too neat and tidy (2) Unattractive (1) Uninviting-uninteresting (9)
Question 4 What do you think makes this image less important or likeable than the other images?	Grass (1) No leaves (1) Sky (1) Winter (1)	Buildings (2) Government policy (1) Litter (1) Managed (6) Pathways (1) Sink estate (1)	Bland (3) Clutter (2) Emotionless (1) Lack of colour (1) Oppressive (1) Ordinary (5) Uncared for (3) Unclear (1) Uninviting-uninteresting (7)

The responses gathered from the three respondent groups showed a number of tendencies highlighting elements people liked and valued (questions 1 and 2) but also disliked (questions 3 and

⁶⁵ A breakdown of the responses for the University of Massachusetts, Northumbria University and GCV can be found in Appendix 2.

4). From the data gathered there appear to be correlations between positive interpretations of the natural landscape elements, whereas interpretations based on a more psychologically constructed understanding of the landscape tended to provide negative perceptions. This supports the notion that when people are asked to discuss what they like about a space they will firstly look at what the space constitutes, e.g. its natural features. People will then consider what they could do there and finally how that space makes them feel. In contrast, when asked to describe what they don't like about a space, respondents potentially work through this process in reverse. Firstly, they assess how the space makes them feel and then how they interpret the social values of that space before assessing its ecological components. This process shows similarities to the process respondents outlined in their preferences for each of the twelve images. Consequently, there appears to be a hierarchy of interpretive depth utilised depending on whether people are being asked to positively or negatively assess a space. Figure 7.1 outlines this process, noting that ecological and psychological elements appear to exist in almost polarised isolation from each other as positive and negative interpretations that seem to be drawn from one of these areas and almost never from both. Social constructions of the landscape, therefore, appear to exist in a middle state where they are associated with positive and negative interpretations.

Figure 7.1. Levels of influence on positive and negative responses



The hierarchy outlined in Figure 7.1 suggests that when people are asked to attribute positive values to a space they will discuss ecological components first. This proposes that positive interpretations of elements in a given landscape are interpreted immediately in visual and aesthetic terms rather than in a social or cultural context. It can, therefore, be argued that psychological and social factors are secondary areas interpreted after the ecological factors because they cannot be interpreted in a solely visual way. The attribution of positive values to spaces may therefore rely primarily on understandings of the natural world, which allows respondents to think about these spaces in a narrower sense. Compared to social and psychological constructions of negative interpretations this process suggests that, when people are asked to review positive attributes, they may find it easier because there is a lower level of experience of knowledge involved. Consequently, when people are asked to name positive elements, a wide range of ecological features are noted and include features that can be easily seen within the images and do not require an interpretation of the scene.

The process of attributing negative values with the landscape therefore appears to allow respondents the opportunity to think in greater depth about a location (or image in this survey). Respondents in all three groups provided a broad range of psychological or social reasons, and fewer ecological reasons, for not liking a space. Responses of this nature included the ways in which the landscape made people feel or what the image reminded respondents of as reasons for not liking specific images. In each of these responses, a psychological construction associated with the image was used to describe it. People, therefore, appear to view spaces that are overcast, in shadows, or dark as

potentially oppressive or claustrophobic. In contrast, open and bright spaces are perceived positively with associations of order or managed nature. These differences promote the view that people cannot be impartial when asked to review the negative elements of a landscape because of the increased level of interpretation needed to understand the composition and integration of the psychological, social and physical elements in a given landscape.

Subsequently, there are a number of proposed differences in how people view the landscape and why these perceptions differ. Due to the constant process of stimuli-reception-interpretation that people utilise, their perceptions of the landscape are constantly challenged and re-evaluated, a process that was discussed in greater detail in Chapter 3. Therefore, when people are asked to name negative attributes of a landscape, they evaluate and challenge the image before interpreting its component parts. Thus, where people note psychological characteristics or reasons why they negatively respond to specific landscapes, they are working through a process of social and cultural interpretation related to that space. A number of these ideas were discussed by respondents from Northumbria University and GCV and included issues of personal security, landscape productivity, and interpretations of the social contexts (e.g. vandalism) of an image. Respondents from these two groups did, however, outline how changes seen in the north-east region's infrastructure may also affect their responses. Consequently, negative construction or interpretations appear to be formed through an understanding of the psychological values that people discuss when shown a specific type of landscape or image.

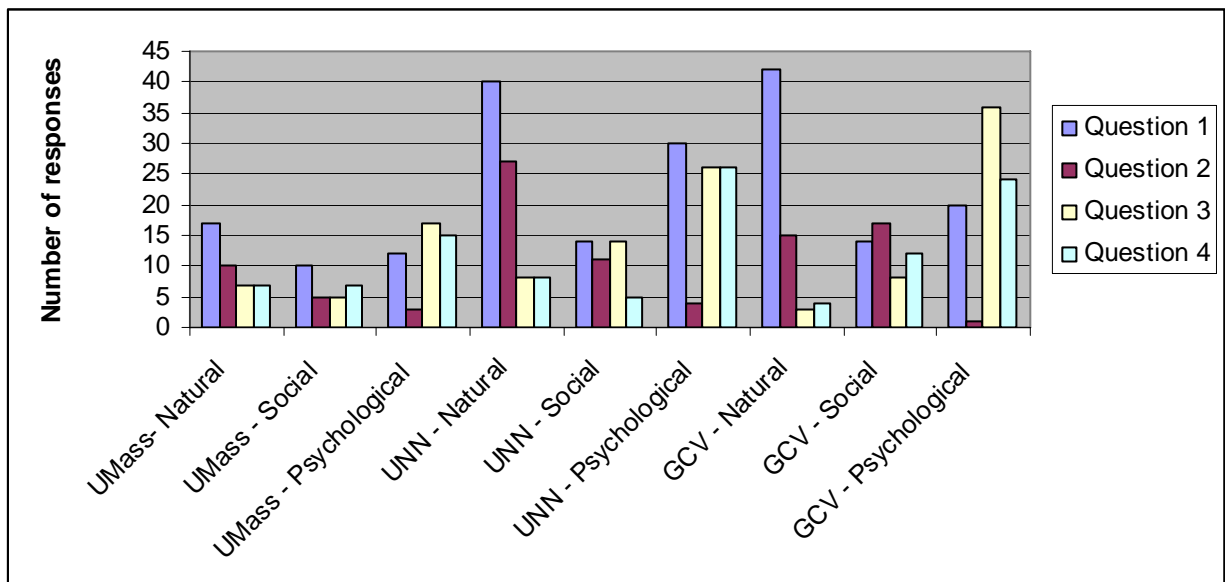
The role of interpreting what a space means therefore appears to be aligned with whether people are being asked to value things positively or negatively. Furthermore, it is important to provide a platform for both positive and negative responses to be made and assess the differences in the received responses when discussing landscape perceptions. The three groups surveyed showed how interpretations of a landscape were dependent on whether positive and negative responses were being asked for. The diversity in responses for both also present that respondents do not show uniformity in the elements they choose to discuss. This range also suggests that images which highlighted diversity may offer a greater number of elements that people can interpret or perceive as being important. Chart 7.4 highlights this process and suggests a trend that supports the above discussions, where positive elements are perceived as predominately ecological or natural elements and negative interpretations relate to psychological and then social aspects. Although not all responses follow this trend, there does appear to be a higher proportion of responses in the natural and psychological categories for each of the survey groups.

It may, therefore, be possible to argue that, despite the lack of a uniform correlation with the above assumption, there is a trend within responses that shows support for it. Consequently, the idea that landscapes can and are perceived in a number of different ways depending on the context appears to be supported. Interpretations of landscapes thus allow people to assess the actual space (i.e. what is there) and its context (i.e. what they feel about it), either simultaneously or individually depending on what is being asked. This compares favourably with the research literature outlined in Chapter 3 (i.e. Kaplan and Kaplan, 1989) where different landscape elements are imbued with characteristics that people view differently (positively or negatively) depending on what is being asked.

7.7. Implications for green infrastructure

Whilst Chapters 6 and 8 show clear or direct links with green infrastructure development, the links between landscape perceptions and green infrastructure are not as clear cut. Landscape preferences show links with the natural and social history of an area and highlight how different land uses affect social interpretations of the landscape. The role of landscape perception and interpretation is therefore to relate an individual respondent to the ecological, psychological and social context of a landscape. Consequently, the ways in which people perceive and value a landscape suggests that a number of different perceptual processes are used to discuss how a space is viewed and subsequently used. Although the form and function of a space appear important, asking people to provide assessments of a specific landscape is a somewhat unusual request. Consequently, the aim of this preference survey was to provide respondents with a situation where they could examine a number of images collectively and then outline the elements they thought were valuable. By providing images and not videos or engaging in site visits, the respondents had to use their preconceived notions of landscape functions and features to assess each image. This is a different prospect to having a 3D image, video or on-site visit.⁶⁶ The result of this process was that respondents used their knowledge, experiences and memories to evaluate the images rather than a primary or on-site interpretation. Furthermore, this process allowed each participant to explore what they thought was valuable in a landscape but was reliant on their preconceived interpretations. It also provided a set of images respondents could compare and contrast their interpretations against.

Chart 7.4. Visual Survey breakdown into the physical, social and psychological elements noted by respondents



The responses gathered from each of the three groups provided a wealth of data that highlighted the complex nature of interpretation. Respondents used a mixture of ecological, psychological and social factors to support their preferences and, in doing so, showed a cross-section of characteristics where

⁶⁶ Differences in the interpretation of videos and on-site visits are discussed in Chapter 5 and include examinations of how colour, light, depth, and sensory interpretations affect perceptions when compared to the use of photographic images in preference surveys.

these areas interact. In relation to green infrastructure development, the preference survey was used to assess whether the form or function of a specific location was the key factor underpinning its value. A review of the role that ecological, psychological and social interpretations hold in assessing landscapes also highlights how natural or social interpretations impact on preferences. These results suggested that both ecological elements and psychological interpretations of areas were important in the perceptions of each image as respondents noted that both of these categories informed their evaluations. However, respondents showed preferences for ecological elements as the primary reason behind their value statement. These preferences were then supported by views of the social features visible in an image. There also seemed to be a preference in negative perceptions relating to the psychological interpretations of a space, which were referred to more frequently than social or natural elements. Consequently, when people were asked to explain why they disliked an image, they would firstly refer to psychological reasons (e.g. fear of crime) before reviewing the actual components of the image.

In terms of green infrastructure planning, these findings hold an important value for planners and developers. Form and function of a landscape were discussed in Chapters 2 and 4 as being important in our understanding of the landscape and it is also relevant here. The responses reported in this chapter placed the form and composition of the landscape at the centre of positive perceptions; consequently, it is important to acknowledge that the interpretation of the form of a green infrastructure is linked firstly to its natural or ecological composition and then its social meaning. Furthermore, the design and management of a space needs to assess how the ecological components of that space will be interpreted by users. Where respondents provided negative interpretations of the landscape, they were based on ideas of dereliction, overgrown spaces and poor management. Thus, although green infrastructure needs to fulfil an ecological function, it must also conform to certain social constructions of what a functional and useful space must be. Although respondents noted more frequently that ecological elements influenced their perceptions, social interpretations were also considered to be important. In regard to green infrastructure, social constructions of a space are a way of assessing the processes people use to value landscapes. Reviewing crime, landscape functionality, and management alongside the notions of memory, experience and nostalgia, therefore, provides a platform for respondents to assess how these ideas interact.

When these ideas of socially constructed interpretations of the landscape are debated in terms of specific green infrastructure resources, respondents in this survey also thought about childhood, Christmas or picnics. Respondents therefore appear to review each image through a set of very personal interpretations. This can also work for negative perceptions where ideas of crime (personal or developed by the media) can provide signposts that people use to ground their interpretations in the real world. It can, therefore, be suggested that social interpretations play a central role in our understanding of how people view the landscape. Landscape managers and green infrastructure developers must therefore be increasingly aware that looking at a space is just one way of perceiving it as there are a number of other layers people use to interpret what they see and value. The role of green infrastructure developers is therefore to interpret and understand how personal experiences shape perceptions of a landscape and needs to be considered in the design stages of a development.

Respondents also noted how their experiences in childhood influenced their perceptions and consequently the relationships they have with the landscape, an idea explained extensively in the work on children, the landscape, and Nature Deficit Disorder. Good access, alongside connective and functional spaces that allow different demographic groups to use a space, may therefore be a vital component in providing children and young people with a positive relationship with the landscape that can be taken into adulthood. Evidence of this relationship is presented in the responses gathered from this survey that supports research developed by CABI Space (2005c), who proposed the intrinsic link between early year use of the landscape and a long-term understanding of its value.

The role of natural, psychological and social interpretations is potentially a very difficult area for landscape managers to plan for. Any attempts to interpret psychological and social interpretations of a space are fraught with an endless number of personal, communal and national interpretations. However, certain elements of the research and practitioner literature highlight that open, managed, well-lit and functional green infrastructure are viewed more positively than derelict, dark or degraded space. This is an important area of discussion, especially in terms of public space developments where the perceptions of a green infrastructure development can make a substantial difference to the proposed value of a space (Sibley, 1995; Minton, 2006). It is also a view presented in this chapter. Landscape managers must therefore be aware that the use of green infrastructure can be a layered experience that draws on personal experiences or cultural understandings, as well as aesthetic qualities. The design and management of new green infrastructure must therefore take into account that people view⁶⁷ ecological elements in preference to social ones and that spaces imbued with negative values will be viewed most frequently in psychological terms.

7.8. Summary: environmental perceptions and green infrastructure

The perceptions survey presented in this chapter discussed a number of ideas related to the interpretations of the landscape and its relationship with green infrastructure development. These ideas have been presented to review how different respondent groups interpret specific landscape elements and assess how these relate to green infrastructure thinking. A number of different ways of presenting and interpreting the landscape have been proposed that underpin this process and outline the complex nature that interpretations and perceptions take.

The survey assessed how and why perceptions of landscape differ. By outlining whether being asked to define positive or negative aspects of landscape affected responses, this survey provided a number of interesting outcomes. Respondents most frequently associated positive values with ecological components, whilst they attributed negative values to psychological and social aspects. These responses suggest that how people perceive landscapes can be influenced by what respondents are being asked to look for. In terms of green infrastructure, it is possible to review how perceptions differ in each of the respondent groups and suggest that perceptions of a landscape are developed through a series of natural, psychological and social interpretations in a multi-layered process of understanding. The implication of this is that respondents appear to assess specific ecological and

⁶⁷ This includes contemporary and historical understandings of the landscape and its functions.

social elements or experiences and then layer them in the descriptions presented in their responses. Therefore, experience may precede senses of awe or danger in how people respond. Likewise, the scale or specific elements may form the initial basis for discussions. Each interpretation or perception is, however, overlaid with different understandings and influences. In relation to positive interpretations, people appear to note that landscape form is important and attribute values to ecological elements. However, when asked to attribute negative values, people review the form and function of a space and its social context in a multi-dimensional way.

Consequently, interpretations of a given space are influenced by a number of different features and can be based on visual quality but also personal experiences, knowledge and social values. Green infrastructure also generally appears to be viewed in these terms. This suggests that spaces which are deemed to be dangerous, unsuccessful or negative are assessed at a number of levels through a greater number of criteria than positive interpretations, whereas those that people like are being viewed in terms of what they look like. An understanding of the interpretations of landscapes and green infrastructure, therefore, depend on a number of key ideas:

1. What people are asked to view or value affects their judgement of a landscape.
2. Landscapes are viewed in terms of a number of different influences (experience, memory, knowledge). Consequently, although specific elements may be frequently highlighted as valuable, there will always be a level of diversity as respondents have different interpretations of what a landscape shows or means.
3. Positive perceptions are linked most frequently with visual or aesthetic interpretations of ecological resources. Negative perceptions appear to be generated through a deeper process of valuation that places more importance on psychological or social interpretations of a landscape.
4. Green infrastructure developers and managers have to understand how ecological, psychological and social interpretations of the landscape affect the success of developments as functional and useful spaces.
5. Landscapes should always be reviewed in terms of their ecological and social contexts if an effective or through evaluation of its value is to be made.

Consequently, by reviewing both the positive and negative elements of a landscape, it is easier to assess how different factors impact directly on perceptions and interpretations. These ideas support the research literature where the processes of seeing, interpretation, and response have been discussed extensively (Gow, 1995; Rodaway, 1994; Valentine, 2001). Therefore, the use of a visual preference survey provides a way of explaining the social context of interpretations (e.g. how people view spaces as dangerous or dark) alongside its physical or ecological context as perceptions of a site are developed and based on an understanding of the immediate, and the wider, landscape. This can be seen in the discussions of which images were most frequently chosen as being the most or least popular and the descriptions that supported these choices.

The valuation of the landscape as noted by Kaplan and Kaplan (1989) and discussed in terms of how people have developed ways of perceiving landscape value needs to be understood in its social and ecological context. This is supported by the research of Ingold (2000), who noted that the reviews of

ecological, economic and social factors that people base their landscape values on can be understood in most interpretations of the landscape. In terms of the ideas proposed in this chapter, the notion of landscape value based on experience and understanding also appears to be supported. The results also suggested a scaled or layered approach to interpretation, such as the one outlined by Jeans (1974) in Chapter 3 in which personal perceptions and how people view the landscape depends on what they are being asked. Consequently, green infrastructure needs to be considered as a resource and as a concept that can be perceived in a myriad of contexts depending on the focus of the questions being investigated. Green infrastructure resources and developments, therefore, must be carefully considered in terms of their form and actual functions if they are to meet the needs of the population and promote the implementation of positive of useful spaces.

Chapter 8.0. Results and Analysis: Spatial planning, policy and practice, and the future of green infrastructure planning

8.1. Introduction

This final Results and Analysis chapter reviews the current use of green infrastructure in planning policy and landscape management. It outlines how different environmental organisations in the UK and North America have interpreted green infrastructure and promoted its use in their work programmes. This analysis highlights whether there has been a progression of green infrastructure thinking (since its first use in the 1990s) within different landscape planning sectors (e.g. state or ENGOs) and assesses how this progression is articulated in planning policies, strategies, and guides.

This chapter presents two types of data to review the use of green infrastructure; firstly, an examination of current planning documents is made discussing how green infrastructure is being incorporated into strategic planning documents and also at a regional and sub-regional scale. This review includes an analysis of the latest draft Regional Spatial Strategies (RSS), Examinations in Public (EIPs), Scoping Studies and Green Infrastructure Guides for England. A timeframe has been placed on these documents and no document published after December 2007⁶⁸ is included.⁶⁹ This analysis uses the green infrastructure principles presented in Chapters 2 and 5 as a basis for these discussions and presents the results in Table 8.2. The second area presents empirical data collected from interviews with environmental organisations or green infrastructure practitioners examining how different organisations are currently using green infrastructure. These responses assess the use of green infrastructure and compare it with interviews conducted with academics to highlight how their views or translation of green infrastructure into policy differ from that of practitioners. Throughout, this chapter explores areas of contrast and commonality within and between planning organisations, green infrastructure thinking, and the actual implementation of the concept by landscape professionals. This review examines the current gaps in green infrastructure thinking and the mechanisms or processes that need to be developed to address these needs. This chapter, therefore, provides a counter-point to the conceptual discussions proposed in Chapter 6 by outlining how green infrastructure principles or characteristics are actually being delivered. Moreover, both Chapter 6 and 8 can be viewed collectively, showing where successes in green infrastructure development can be seen and where opportunities for further development lie.

8.2. Planning Documents

A number of planning documents have used the green infrastructure concept in the UK since the President's Council on Sustainable Development first adopted it in 1999 (PCSD, 1999). At present, these include government policy agendas, RSS, Green Infrastructure scoping studies and planning guides. There are also a number of documents relating to the use of green infrastructure focussing on

⁶⁸ There is one exception, the North West Final RSS, which was published in January 2008. This document has been included despite it falling outside this timeframe by one month. See Chapter 3 for an explanation of why a timeframe is being used.

⁶⁹ Only English documents were discussed due to their availability and relative ease of assessment and cross-referencing with other documents in the public domain developed by Natural England and the Community Forest Partnerships. The English system of planning policy publication also follows a linear model of production and implementation based on a top-down system. This makes the review of documentation more approachable as all regions in England have used the same system to develop their RSS documents.

community forestry or the creation of sustainable communities. Each document reviewed in this chapter outlines a number of green infrastructure characteristics and were produced to present the potential benefits of the concept to different potential user groups. The following section outlines the main themes proposed in these documents, assessing the ideas they promote and how these compare to the ideas being developed by other green infrastructure researchers. This review supports the view presented by Kambites and Owen who stated that:

To remain consistent with statutory development plan policies, green infrastructure planning itself would need to be subject to continual review. In integrating green infrastructure planning with the statutory planning process careful attention would need to be paid from the outset to the potential problems involved in the timing and coordination of the constituent elements of the process.

Kambites & Owen (2007:492)

Kambites and Owen warn against complacency in the inclusion of green infrastructure into planning strategies without a proper period of consultation, reflection and discussion. This following section outlines how the current debates relating to green infrastructure development are being articulated in the discussions of regional and local level environmental organisations. Within this debate, a reflection of the different actors and audiences of these documents is presented to contextualise the arguments made against a wider discussion of green infrastructure development. Although this section only uses UK examples, other documents can be found that propose similar discussions in the literature of the Conservation Fund, Maryland DNR, the Heritage Conservancy or the New York Parks & Gardens website.

Table 8.1. RSS and EIP references to green infrastructure⁷⁰

RSS	GI mentioned		EIP	GI mentioned	
		No. of ref			No. of ref
East of England	Y	10	East of England	Y	19
East Midlands	Y	11	East Midlands	Y	27
London	N	-	London	Y	12
North East	Y	4	North East	Y	40
North West	Y	24	North West	Y	21
South East	Y	16	South East	Y	61
South West	Y	15	South West	Y	41
West Midlands	Y	1	West Midlands	Y	5
Yorkshire and Humber	N	-	Yorkshire and Humber	Y	33

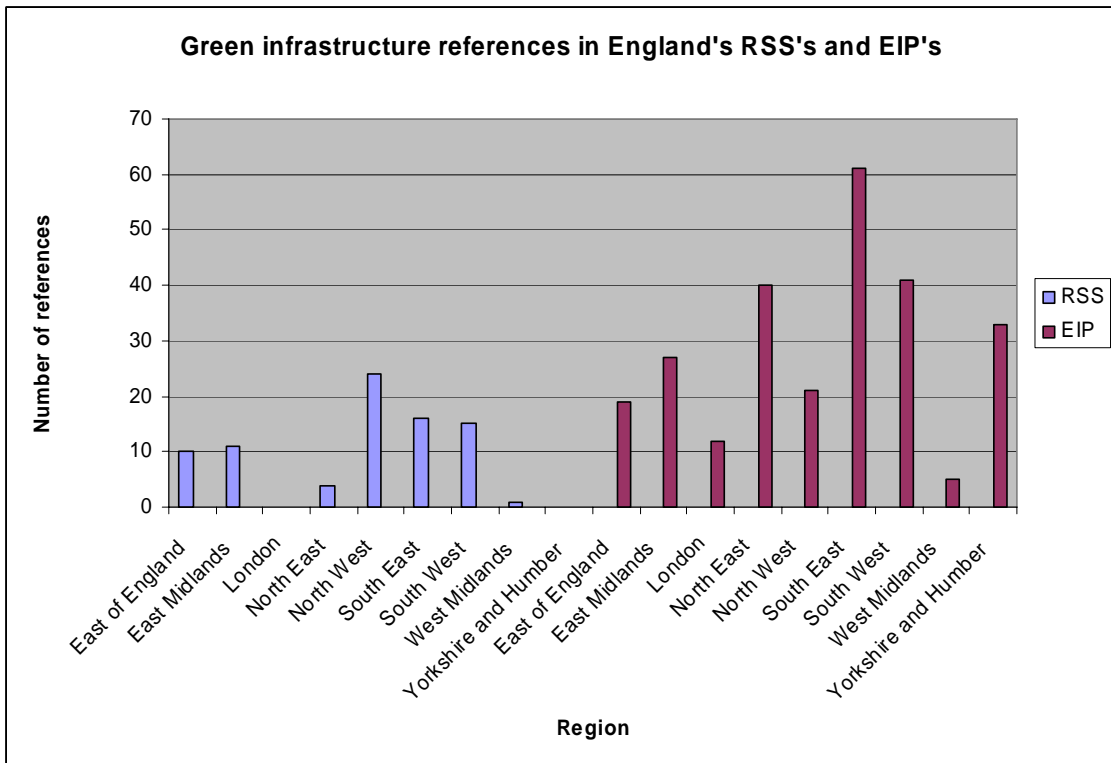
8.3. Regional Spatial Strategies (RSS) and Examination in Public (EIPs)

Each English region produces a Regional Spatial Strategy (RSS) outlining the future of regional spatial planning in that area. Within the latest round of RSS production, a range of planning issues are discussed including the use and development of green infrastructure. The following section reviews how each of the nine RSS (eight regions plus the London Development Agency) present and discuss green infrastructure, examining how, and in what context, the concept is discussed. The total number of references to green infrastructure in the RSS and EIPs are shown in Table 8.1. This table highlights that the majority of the RDAs increased their discussions of green infrastructure in the EIP consultations (compared to the RSS) with the exception of the North West, where there is a slight

⁷⁰ Each of the RSSs and EIPs were reviewed through a document content analysis assessing the use and the context of green infrastructure terminology and principles.

decrease. This suggests that discussions of green infrastructure are starting to be potentially valued and become an important issue relevant to strategic regional planning.

Chart 8.1. Green infrastructure references in England's RSS and EIPs



However, this may also imply that there is an inherent weakness in the production of strategic or spatially diverse documents as the broad focus of the consultation process may not reflect an increase in the use of a specific term or concept. Consequently, the assessments of green infrastructure use in the RSS and subsequent EIPs are presented separately. This allows a distinction to be made between the documents and lowers the presumption that there is a causal relationship between the information presented in RSS and EIP documents. Changes in green infrastructure use (i.e. number of references and discussions) is therefore proposed as being based on the progression in the evidence base presented by practitioners and planners and does not propose a direct uptake of ideas from an RSS into an EIP report. The data gathered, though, does suggest that the green infrastructure targets or policies being discussed in the development of RSS reports have started to be integrated into regional guidance, i.e. the Cambridgeshire Green Infrastructure Strategy, which was a response to issues raised in the RSS consultation process.

The discussions of RSS and EIPs presented in this chapter are not descriptions of green infrastructure characteristics but examinations of each region's use of green infrastructure thinking. Presenting the documents individually thus allows an analysis of each to be made that can then be drawn together synoptically to outline the main characteristics identified across them all (see Table 8.2). The following two sections, 8.3 and 8.4, outline the RSS and EIP discussions, highlighting where the use of green infrastructure can be seen in a progressive manner in each region.

8.3.1. East of England RSS (2004)

The East of England RDA uses green infrastructure in a varied manner. The RDA writes that green infrastructure should be promoted as a strong delivery mechanism at a regional and sub-regional scale in order to raise the standard of living in the region, and suggests that this can be achieved by labelling green infrastructure as a strategic priority. This, they say, would increase the proportion of high quality green infrastructure and note that further provision should extend and enhance infrastructure, thus creating coherent networks of green space across the sub-region delivering sustainable communities. However, this is a very idealistic view and the RSS process does not take into account the wider financial and political structures associated with sympathetic growth. The RSS does, however, state that this process is particularly important if the region is to meet the Sustainable Communities Plan for growth areas and support Growth Area Funding and Housing Growth targets. The RDA, therefore, promotes green infrastructure use to meet local needs and targets proposed by central government policy. They also outline a hierarchal system of functional space classifications as an essential element of strategic planning where location, form and function are integral to the development of social cohesion and regional regeneration. The theme of landscape sustainability (physical and social) is therefore at the centre of this document.

8.3.2. East Midlands RSS (2005)

The East Midlands region reviews green infrastructure in terms of spatial and strategic values, its broad benefits, and its utility in promoting the region's economic and social development. In terms of strategic thinking, green infrastructure is proposed as a way of meeting the challenges of developing high quality and liveable landscapes. The document also clearly proposes that green infrastructure needs to be developed at a strategic level if it is to meet growth needs and should be prioritised or supersede existing infrastructure priorities. This includes the development of a higher proportion of green infrastructure in and around urban areas to provide a wide range of benefits. A number of references are also made to the benefits that green infrastructure can deliver, including the enhancement and maintenance of ecological assets which provide recreational provision. This is discussed specifically in terms of the Nene Valley, where the RSS notes that the physical landscape provides opportunities for sport and informal recreation which contribute to green infrastructure networks promoting sustainable communities. Again, the role of sustainability and strategic planning are proposed as important elements in green infrastructure development at a regional scale.

8.3.3. North East Draft RSS (2005)

The North East Draft RSS presents only four references to green infrastructure but, despite the small number, the RSS does outline clearly the value of green infrastructure. Green infrastructure is used to discuss how large proportions of the region's resources are connected forming a network of linked multi-functional spaces. It also discusses how the landscape plays a crucial role in supporting the economic growth of the region by promoting the development of high quality physical and social landscapes. Green infrastructure is also proposed to support Policy 2 - Sustainable Development, as the RSS states that the RDA should promote the concept of green infrastructure as a network of linked, multi-functional green spaces in and around the region's towns and cities (see pg.18). The RSS use of green infrastructure, therefore, shows similarities to the wider role proposed for the concept in

the planning literature (physical and social landscape connectivity, economic growth and developing multi-functionality).

8.3.4. North West Draft RSS (2006) and Final Version (2008)

The North West RSS outlines a range of areas where green infrastructure could benefit the region. The document also proposes a green infrastructure policy (Policy EM3 - Green Infrastructure) which states that plans and strategies should identify, promote and deliver multi-purpose networks of greenspace or green infrastructure, particularly where there is limited access to natural greenspace or where connectivity is poor. It goes on to state that green infrastructure should also be integrated within existing and new development and especially within major development and regeneration schemes (pg. 97). The document also makes a number of references to the relationship between the promotion of ecological, economic and social benefits and green infrastructure. Here, the RDA notes that this process will develop if the concept is integrated into regional strategic thinking, working across administrative and physical boundaries. The document goes on to state that the RSS should be focussed to meet the needs of future development that emphasises green infrastructure as a base for providing a strategic and long-term view of the concept. The RSS also proposes that green infrastructure can be seen to promote alternative transport infrastructure, stating that walking and cycling networks can provide important elements of green infrastructure use that can be developed across physical boundaries. The document therefore outlines an articulation and varied use of green infrastructure that links its development to sustainable landscape development and the delivery of green space at a local and sub-regional level.

8.3.5. South East RSS (2006)

The South East RSS uses green infrastructure in three ways to promote a) strategic use, b) appropriate provision, c) and effective management. The first is discussed, suggesting that green infrastructure should be attributed equal importance to other infrastructure developments to aid economic growth and improve the quality of life. The RSS also proposes the use of green infrastructure within the strategic spatial planning of the region. These ideas are discussed further when the document notes that both urban development and sustainable urban extensions should be planned to maintain or extend green infrastructure and ensure that these issues do not impact on landscape character, whilst the coalescence of settlements are addressed. Thus, green infrastructure is discussed in terms of its appropriateness for development and landscape management. This is developed further, as the RSS notes that adequate environmental protection mechanisms or guidelines are needed to manage and maintain the region's green infrastructure resources. One further aspect noted in the document is that it presents a definition of what green infrastructure is, which draws heavily on the work of TEP (2005) and the RTPI (2005). The role of green infrastructure in developing strategic policy and appropriate development is therefore central to the RSS use of the concept.

8.3.6. South West Draft RSS (2006)

The South West Draft RSS identifies a number of areas where green infrastructure planning could benefit the region's spatial development. The document discusses how green infrastructure can be

developed within new and existing infrastructure in conjunction with commercial, residential and other infrastructure. There are also discussions of the ecological and social value of developing appropriate green infrastructure, which reflect the importance of design and support (financial and political) in this process. The South West RDA also discusses how green infrastructure should provide an increase in the critical mass of greenspace resources and supports the need for strategic and sustainable developments in urban and urban-fringe landscapes. There are also discussions of how green infrastructure can meet the social needs of the region by supporting the region's economy to improve the quality of life and help to build better and more sustainable communities. The Draft RSS states that, by using green infrastructure, 'local authorities and partners will: a) build existing expertise and initiatives to identify priorities and partnerships for GI, b) incorporate GI policies by setting out broad locations for GI appropriate to the extent and distribution of development proposed, co-ordinated across administrative boundaries as appropriate, and c) develop a GI plan with a delivery programme to support GI policies' (pg. 153). To underline the region's support of green infrastructure, the RDA also present two partial definitions of the concept.⁷¹

8.3.7. West Midlands RSS (2008)

The West Midlands RSS only provides one reference to green infrastructure in discussing how the West Midlands' Green Infrastructure approach can be used to deliver an integrated network of open spaces, waterways and canals, and to protect and enhance topographical, biodiversity and historic assets and promote walking and cycling.

8.3.8. London (2004), and Yorkshire and Humber (2006) RSS

Neither the London or Yorkshire and Humber RSS refer to green infrastructure. They do, however, discuss the concept in their subsequent Examination in Public (EIP) Report, which suggests that at the time of their development little attention had been given to the concept. Its inclusion in the EIP suggests that there has been an increase in the discussions and evidence has been presented to the RDA and planning inspectorate which was not presented in the original RSS consultations.

8.3.9. Summary of RSS use of green infrastructure

Each of the RSS discussed presented different views of what green infrastructure is and its use in each region. Seven of the nine RSS presented discussions of the concept and a number of the characteristics attributed to green infrastructure in Chapter 2 and 6, the London and Yorkshire & Humber RSS being the exception. There are, however, commonalities in the use of green infrastructure principles across a number of the documents. Table 8.2 outlines these similarities, suggesting that the role of strategic development that supports sustainable living is important in the promotion of green infrastructure. Linking the capacity of a resource base to deliver broad benefits is also noted, as is the need to provide the most appropriate development for a region. These themes are discussed against the need to promote the use of networks to provide a physical and social structure for development and its associated benefits.

⁷¹ These definitions have been developed further in the final RSS released in 2009, where the characteristics outlined in Chapters 2 and 6 are strongly emphasised.

A review of the RSS was conducted as a way of assessing the extent that the principles of green infrastructure have been discussed and developed at a regional planning scale. Much of the research and practitioner literature focuses on the regional level (e.g. TEP, 2005) and consequently it is important to review the extent to which these findings have been incorporated into spatial planning policy. Where green infrastructure is discussed in each RSS, it appears to be drawn from the research undertaken by organisations like Natural England and the Environment Agency. In a later section, this chapter evidence from ENGOs, i.e. Natural England, will be presented highlighting how different organisations have engaged with the process of green infrastructure development seen in the RSS.

It is clear that there are differences in how each RDA attributes various values to green infrastructure. A number of the RSS present green infrastructure policies (East of England, North East, North West, and the South West), whilst a number of the RDAs assess future green infrastructure development against existing regional or city plans (East of England, North West, and the West Midlands). Consequently, a number of the RDAs locate their green infrastructure thinking within the broader spatial planning of their regions. However, although the use and discussion of green infrastructure is a positive sign that the concept is being discussed, there still appears to be great variations in approaches to delivery.

In each RSS reviewed, the scale of green infrastructure planning (local, city, regional) and the proposed benefits of these developments differ drastically (see Table 8.2). Discussions are made in several of the RSS locating the value of green infrastructure planning at a micro or urban scale. Others present a metropolitan approach to planning and there are specific discussions locating development at a regional level. Consequently, the focus of green infrastructure planning may become diluted due to the diverse focus that each RDA places on its development. However, this may not be such an important issue as the different scales at which green infrastructure is discussed still resides within an overarching strategic framework for its development. Although it may not propose specific sites, the ideas and focus of green infrastructure development are embedded within these strategic documents, with the strategic Manchester green infrastructure work in the North-West and the Cambridgeshire green infrastructure work in the East of England being two good examples of this process.

Table 8.2. Main green infrastructure focus of each draft RSS

Region	Main GI focus	Expanded reasoning of GI focus
East of England	Strategic Hierarchy Growth (ecological, economic and social) Opportunities and needs	<ul style="list-style-type: none"> ▪ Label GI as a priority in strategic documents ▪ Increase provision of GI resources across the sub-region ▪ Meet regional growth targets ▪ Propose a hierarchy of GI based of form, function and meeting the needs of the area
East Midlands	Strategic Growth and infrastructure development Multi-scale Benefits and opportunities	<ul style="list-style-type: none"> ▪ Develop GI as high quality resources within a number of strategic documents ▪ Meet the economic growth needs of a region and support (financially and politically) new infrastructure development ▪ View GI as a multi-scaled, cross-boundary resource ▪ Promote diverse benefits and needs
London	N/A	N/A
North East	Networks Economic growth Multi-functionality	<ul style="list-style-type: none"> ▪ Promote GI as a network that promotes multi-functionality ▪ GI should be developed to support the economic

		prosperity of the region
North West	GI policy Opportunities and needs Strategic Sustainable landuse	<ul style="list-style-type: none"> ▪ A regional GI policy should be developed ▪ The relationship of ecological, economic and social benefits should be integrated with GI ▪ Develop GI strategically and across-different administrative borders ▪ Promote GI as an appropriate alternative landuse use approach delivering sustainable development
South East	Strategic Appropriate provision Effective management	<ul style="list-style-type: none"> ▪ Provide a strategic focus for GI discussions ▪ Develop Gin appropriately and with equal importance to other infrastructure types ▪ Promote more effective and appropriate landscape management practices ▪ Use baseline research and data to underpin GI development
South West	Appropriate development Support development plans Diverse values Critical resources Development and support	<ul style="list-style-type: none"> ▪ Develop GI with an appropriate focus ▪ Support development plans and promote diverse ecological, economic and social benefits ▪ Support diverse values and needs ▪ Increase the critical mass at a strategic level ▪ Promote the extension of GI research and foster further support for development
West Midlands	Network Diverse needs	<ul style="list-style-type: none"> ▪ Develop GI as a network of spaces ▪ Promote GI as a way of meeting diverse needs in different locations
Yorkshire & Humber	N/A	N/A

The main focus of green infrastructure outlined in Table 8.2 supports the characteristics and themes outlined in Chapter 2. The themes of strategic development and appropriateness appear to be universally embedded in each RSS and show that key messages are being delivered from each region. The notion of sustainable landscape planning is also prominent and potentially highlights the mainstreaming of these ideas into all areas of landscape planning. However, Table 8.2 does highlight that the delivery of these ideas is varied and there does not appear to be a specific process or mechanism for development. This suggests that levels of funding and political motivation to develop green infrastructure are still varied and was a notion that was discussed in Chapter 6. Therefore, whilst complementarities can be seen within the discussions and use of green infrastructure, there are still issues relating to delivering these ideas in planning policies and programmes, an idea that this study will return to in later sections.

8.4. Examination in Public breakdowns; themes and areas of reference

Following the release of each RSS, an extensive period of consultation was held resulting in the release of the Examination in Public (EIP) Reports. These reports outlined the responses of planning and practitioner organisations to the draft RSS, highlighting the planning inspectorate recommendations for changes. As a relatively new concept, green infrastructure was discussed in most RSS but was referred to more frequently in the EIP reports. The higher proportion of green infrastructure references in the EIP documents could be attributed to a number of factors, including the level of additional data and evidence that was presented to the planning inspectorate. References to green infrastructure also benefited from the additional research and use of the concept in the interim period between the draft RSS and consequent EIP being published. A review of the EIPs does, however, provide a level of insight into how green infrastructure was discussed in this interim period. It

can therefore be suggested that progress is being made in the understanding and use of green infrastructure by the RDAs and regional planners.

8.4.1. East of England EIP (2006)

The East of England EIP suggests that green infrastructure should be supported and promoted throughout the region with the development of a better knowledge and evidence base that practitioners can refer to when planning green space resources. The EIP notes that if this is to be achieved then strong links between green infrastructure, urban development and sustainable communities must be emphasised. The EIP also proposes that green infrastructure should be attributed the same value as other infrastructures and that it could hold a key strategic role in meeting diverse ecological, economic and social needs. This is outlined in the revisions to Policy ENV1, which states that:

Areas and networks of green infrastructure will be identified, protected, created, extended, enhanced, managed and maintained throughout the region to ensure that an improved and healthy environment is available for the benefit of present and future communities. This will be particularly important in those areas identified to accommodate the largest amounts of growth in the region, whether or not officially recognised as such in the Sustainable Communities Plan.

(2006: pg. 167)

Policy ENV1 suggests that green infrastructure should be discussed in a holistic manner acknowledging its diverse antecedents and values. The implementation of green infrastructure is identified at multiple scales that need to work across urban and urban-fringe landscapes if it is to meet the needs of the growth areas targets in the region.⁷² Specific examples of this process in action can be seen in the proposed expansion of the Cambridgeshire sub-region, the London Arch in Essex, and around the market towns of Suffolk and Norfolk. The EIP also emphasises the ecological role of green infrastructure in maintaining the principles of 'green wedges' in urban landscapes (e.g. around Norwich and Chelmsford); to protect and maintain wildlife sites and promote urban biodiversity (e.g. Wicken Fen and Cambridge City); and contribute visually to the enhanced character and setting of urban locations (e.g. East Anglia's market towns). One critique of the EIPs reporting of green infrastructure is that the development or creation of spaces is clustered around three or four main urban settlements such as Cambridge. As a consequence, it can be argued that the strategic value of the East's Fenland landscape is given less prominence and the EIP does not focus readily enough on the whole landscape, instead choosing to focus more frequently on the primary urban (and economic) centres.

8.4.2 East Midlands EIP (2007)

The discussions within the EIP focus most frequently to the role green infrastructure should play in the strategic and integrated planning of the region's resources. This is emphasised as the EIP states that, in conjunction with strategic local green infrastructure planning, it should also be promoted to meet regional, national and international agendas (ecological and social). Whilst this idea provides green infrastructure with a broad set of characteristics, the EIP also states that Local Authorities and LDFs must play a key role in delivering this strategic development. The EIP thus notes that green

⁷² The Growth Area targets include promoting economic development, increasing and improving housing provision, promoting employment and attracting investment into the region.

infrastructure should be attributed with the same values as economic and social infrastructure, but should also promote the notion that green infrastructure needs to view the landscape holistically and include developments of 'blue' infrastructure. The EIP, however, fails to outline how, or who, should lead this process and presents a rather idealistic vision for development with no framework for delivery.

8.4.3. London EIP (2007)

In the London EIP, green infrastructure is used in terms of clarification of its meanings and terminology. Where it is used it is linked to planning of the region's ecological resources; however, it is suggested that the concept could be developed further. There are also discussions of how green infrastructure could be used as the overarching green space definition or terminology because of the breadth of focus in its thinking. The use of green infrastructure is, therefore, shallow compared to some of the other reports as it offers only a basic view of the concept and how it may potentially be of value to the Greater London area. This is especially unusual as the East of England and South-East EIPs show extensive areas where links with London could be integrated to promote a better and more sustainable use of green infrastructure. These relationships are not, however, developed within the London EIP.

8.4.4. North East EIP (2006)

The North East EIP heavily emphasises the need to develop the green infrastructure resource base in a strategic way. The report suggests that green infrastructure is essential ecological, economic and social infrastructure that supports the economic and social development of the region. Throughout the EIP it refers to green infrastructure, proposing the need to develop strategic resources within existing and new development plans at local and sub-regional scales. This is emphasised further where environmental organisations like Natural England or the Environment Agency state that additional support, financial and political, should be given to allow planners and developers to fully understand the differences between strategic and non-strategic green infrastructure.

The utility of green infrastructure is discussed further where commentators state that green infrastructure needs to be embedded in specific regional policies; examples include Policy EN.03, EN.04, and EN.05, where some of the broader issues facing planning, notably climate change and regeneration, can be addressed. Finally, the EIP notes that, although discussions are helpful in promoting green infrastructure, the resource base of the region needs to be mapped in more depth to allow different practitioner groups to visualise the resources that the region holds. The comments presented in the EIP therefore suggest that green infrastructure needs further support from regional delivery bodies. Moreover, a process of up-skilling and knowledge expansion of green infrastructure could be developed to apply its delivery within the diverse ecological, economic and social contexts of the region. Again, the North-East EIP argues that the development of green infrastructure should be focussed at a strategic level. It does not, however, outline how these strategic targets are to be implemented and, although it can be implied that regional partners are to lead on promoting green infrastructure development, this is not actually stated. Consequently, the questions of financing

development are not discussed and therefore an analysis of the implications for landscape change is not outlined.

8.4.5. North West EIP (2007)

There is an extensive debate within the North West EIP of how green infrastructure should be developed. Although there are specific sections promoting the values of green infrastructure, there are also comments questioning its value, especially at this stage in the concept's development. The EIP states that there is a need to embed green infrastructure in regional spatial plans but, without a national policy or an evidence base, this process will be slow. The commentators in the EIP note that there is value in green infrastructure but without further support the concept will not be given the prominence its supporters feel it is worth. Consequently, the policies proposed in the region's RSS referring to green infrastructure may need to be updated to include more directed use of the concept (e.g. where and what form development should take). However, the values of green infrastructure are discussed throughout the EIP promoting the idea of a more inclusive and holistic use of the concept. This is attributed as being a key mechanism in the delivery of high quality landscapes. Duly, commentators have suggested that green infrastructure can be adapted into all levels of planning and highlight this process using Local Authorities:

...local authorities should adopt a cross disciplinary approach to the identification of green infrastructure. There is a need for the planning system to work in tandem with bodies responsible for leisure, countryside and environmental management in order to deliver wider benefits. LDF policy should identify and protect existing green infrastructure and seek to deliver improvements where possible.
(2007: Pg. 190)

Thus, although the concept is noted as being able to bring multiple benefits to the region, there are some organisations which feel that the current developments in green infrastructure do not justify specific policy or funding. Subsequently, although the region proposes that green infrastructure could support ecological, economic and social development, there is potentially too little evidence to support its use within the RSS. The EIP therefore presents both a positive promotion of green infrastructure but outlines concerns towards over-enthusiastic support or delivery of a relatively new, and therefore untested, concept, potentially lacking a robust evidence base. However, the concept does appear to be attributed with more positive values than negative and development of green infrastructure is promoted at a strategic scale but with a number of caveats attached.

8.4.6. South East EIP (2007)

The South East EIP reports green infrastructure development primarily in terms of the strategic development of the region's resource base. Within this, the EIP discusses the specific cross-cutting role green infrastructure holds in supporting diverse planning issues (e.g. climate change and social inclusion). It also notes that this process is dependent on the use of green infrastructure by practitioners, an improved knowledge base, and the availability of data. It goes on to outline that development must fit within the wider sustainable ideals of the region and green infrastructure planning must be developed with minimal negative impacts. This process is achievable if the values of the concept are presented clearly in strategic documents that can be translated to a sub-regional or local scale.

Although the document presents a number of positive references to green infrastructure, there are also notes of caution. The EIP states that green infrastructure will remain secondary to other infrastructure developments (e.g. transport) as these are deemed as being more essential to the region's growth. There are also discussions as to whether the proportion of green infrastructure in the region needs to be increased. This is raised as the current level of green space provision is viewed by some commentators as being able to sufficiently support the growth in the region.⁷³ References are also made to the need for a clearer definition of green infrastructure to be proposed to provide practitioners with a clear understanding of what they are planning. Although these comments highlight a number of possible hindrances, the overarching sense is that the South East is showing good progress in its thinking and strategic development of green infrastructure resources. Further evidence and engagement are, however, needed to fully explain the values of green infrastructure to all ENGOS and infrastructure developers in the region.

8.4.7. South West EIP (2007)

The South West EIP presents a very positive discussion of how green infrastructure should be developed. This includes its role in meeting sustainable development targets and its ability to deliver economic and social initiatives. There are also discussions of best practice for conserving, protecting, and managing existing and new green infrastructure developments across the region. Within the EIP, these ideas are formulated to promote green infrastructure as a facilitator of strategic and cross-boundary development that combine with other infrastructure to improve the quality of life of the region's population. There is, however, a note of caution as the EIP states that the development of green infrastructure has to fit within current planning and development guidelines. The South West, therefore, proposes that an integrated green infrastructure approach to planning is the best way to achieve this and sets out their views in the following policy:

Policy GI1 Green Infrastructure

Development of networks of Green Infrastructure (GI) will be required to enhance quality of life in the region and support the successful accommodation of change. GI networks will comprise multifunctional, accessible, connected assets, planned around existing environmental characteristics. This may take the form of protection, enhancement or extension of existing resources or the provision of new or replacement facilities. When planning the proposed distribution of development, opportunity should be taken to extend the network. GI is required as an integral part of development, with provision for a network incorporated in the masterplan. Local authorities and partners will:

- Build upon existing expertise and initiatives to identify priorities and partnerships for GI
- Incorporate GI policies setting out broad locations for GI appropriate to the extent and distribution of development proposed, co-ordinated across administrative boundaries as appropriate.
- Develop a GI Plan with a delivery programme to support GI policies.

(2007: p. C35)

⁷³ The South-East, like the East of England, is a location for a number of government growth targets and as a consequence the level of development is again focussing on housing, employment and economic development.

The South West thus synthesised the responses in the EIP into a coherent policy for green infrastructure. They have also emphasised its value as a strategic green space planning tool, a view supported in both the research and practitioner literature on green infrastructure. By proposing a policy for green infrastructure the South-West present a positive view of the concept, addressing the questions querying the value of it and outline how they expect these resources to be developed.

8.4.8. West Midlands EIP (2007)

The West Midlands presents its use of green infrastructure in a concise manner compared to the other EIP documents. Whilst the value of green infrastructure is acknowledged, there are queries about the implementation of the concept throughout the region. The EIP states that their concerns can be counterbalanced by a better presentation of green infrastructure in terms of definitions, principles and evidence. However, the EIP does outline that green infrastructure can meet a number of different social and ecological agendas that promote the region's landscape resources at a strategic level.

8.4.9. Yorkshire and Humber EIP (2007)

Although the Yorkshire and Humber EIP discusses the value of green infrastructure in terms of developing the region's landscapes, there are also a number of negative references questioning its value. Discussions state that the diversity of green infrastructure detracts organisations from the concept's implementation value. The EIP also notes that the region may have sufficient green infrastructure resources (e.g. National Parks) and that there is no reason to develop further green spaces. Consequently, responses state that the concept needs to be presented in a uniform manner to allow it to be developed further within the final RSS. Green infrastructure is also presented as needing to be discussed in terms of current planning policy if it is to be implemented. However, in contrast to the negative comments made, there are also a number that promote the concept's use. Several references are made stating that green infrastructure needs to be developed strategically across the region at local, sub-regional and regional scales. This is supported with the view that there is a need for the development of specific green infrastructure policies such as those developed in other regions (e.g. South-West). Furthermore, green infrastructure is also discussed as an essential element in meeting the needs of the changing ecological and social landscape. Yorkshire and Humber, therefore, outline that although green infrastructure is gaining prominence there are still some practitioners who state that the concept may already have been promoted in other ways or terminology.

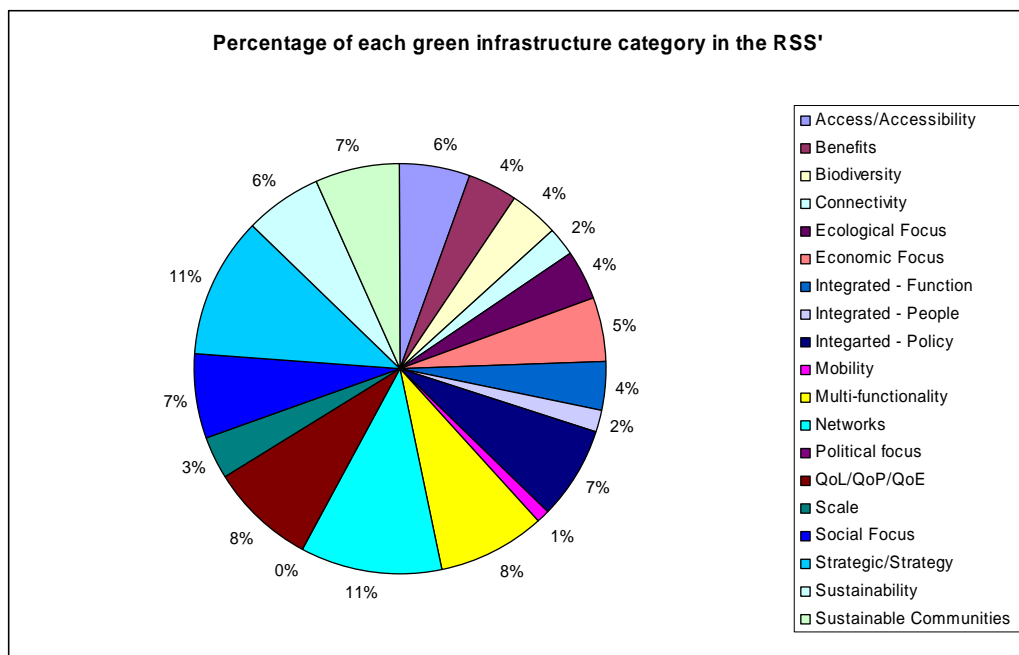
8.4.10 Summary of EIP use of green infrastructure

Each EIP, like the RSS, showed great variation in its use and discussion of green infrastructure. These discussions most frequently built on those ideas reported in the RSS but provided greater detail of the values different organisations attributed to the concept. The EIPs also proposed that, although there are differences in what green infrastructure principles are valued, the concept is beginning to be viewed as a valuable landscape management process. The diversity, levels of support, and use of the concept has manifested itself in the production of green infrastructure policy (e.g. South-West EIP) based on the evidence presented at the EIP consultations. This suggests that the value of green infrastructure is growing. However, the diversity of discussions of each EIP shows that further

progress is still possible. There are also discussions that further evidence and data is needed to support the calls for green infrastructure development. Consequently, although progress in the acceptance of green infrastructure is clear, there are still areas where development in its principles, funding and support need to be improved. Through these processes a better level of consensus between planners and green infrastructure advocates may be achievable. However, the discussions outlined in Chapter 6 may argue that creating consensus is not actually viable and in some cases is not the best process for future development.

Despite the predominately positive use of green infrastructure in each of the EIPs, a number of areas were presented that could be interpreted as promoting an idealistic view of its development. Further evidence and a framework of delivery (funding streams and agency responsibilities) would therefore have been a useful addition to the EIP documents to allow a better level of understanding and engagement to occur. The importance of focus is also noted extensively throughout. What green infrastructure is supposed to deliver is, therefore, an important question that most, but not all, of the EIPs addressed. This is especially pertinent when discussing funding and those areas identified as government growth regions, e.g. South-East and East of England, presented more details regarding these issues. There is also an issue with the urban-rural focus of some EIPs. Clustering of development principles around major urban centres to some extent lowers the landscape scale value of green infrastructure and should be addressed. The East of England in particular followed this route, identifying development opportunities around Cambridge, Norwich and Thames Estuary but not to the same extent in rural areas. The value of green infrastructure to a *given region* is therefore an important notion to consider and should not be down-played in return for promoting urban development. Overall, however, the EIPs showed a good level of discussion and understanding of green infrastructure. A more focussed use of these debates is now needed to translate these discussions into delivery programmes.

Chart 8.2a. Percentage of responses for each green infrastructure categories (RSS)



8.5. Green infrastructure references and categories

Within each RSS and EIP a number of criteria were used to assess the discussions of green infrastructure. Drawing on a review of the green infrastructure literature, a set of characteristics was used to assess the principles used to discuss green infrastructure and how it was used in planning practice (see Chapter 5 for more details). The results of this analysis can be seen in Chart 8.2 (a & b), 8.3 (a & b) and in Table 8.5. A review of Table 8.5 highlights that a small number of green infrastructure characteristics were referred to most frequently compared to the whole range. The most frequently mentioned characteristics were:

- i) Ecological and social focus;
- ii) Network and connectivity;
- iii) Integrated policy;
- iv) Scale;
- v) Strategic focus.

This suggests that throughout England the organisations responsible for developing regional planning policy have begun to develop an idea of what they believe the most important principles of green infrastructure are. These five main themes show that throughout England values have been attributed to green infrastructure that may promote a comparable set of characteristics for the concept. Consequently, a collective acknowledgement of the value of green infrastructure at local, metropolitan, regional and the national scale could follow. If this occurs, then there is greater potential for additional funding to be obtained which, in turn, could be used to develop baseline green infrastructure work. This process could also aid the development of a larger evidence base that can feed back into regional planning policy and the next round of RSS development.

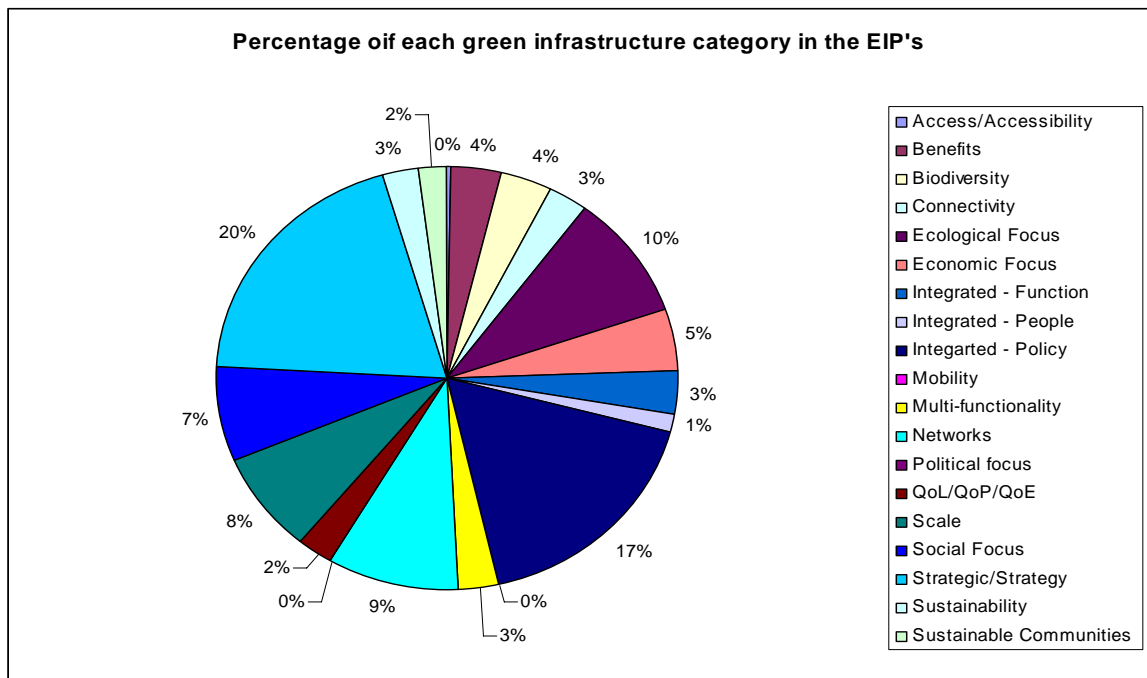
The discussion of such a wide range of principles within the RSS and EIP documents also allows a thorough analysis of the current understanding of green infrastructure to be made. Chart 8.2 (a & b) and 8.3 (a & b) show that there are a number of categories which are most frequently identified. These characteristics are then supported with the use of a wide range of others. From a review of the green infrastructure references made, there are a proportionally higher number of references made referring to:

- i) Supporting biodiversity and conservation of the landscape;
- ii) Sustainability and the need for sustainable development of the landscape and communities;
- iii) Improvements to quality of life, place and the environment;
- iv) Improved access and connectivity between green infrastructure resources;
- v) Strategic development and implementation.

These principles are supported by the research literature and in the academic and practitioner interviews discussed in Chapter 6. Consequently, these principles have been used to support the development of green infrastructure by providing either contextual or supporting evidence for its creation and discussion. The use of these other principles also suggests that a green infrastructure approach to planning is grounded in green infrastructure theory, and an assessment of what can actually be planned for.

A review of Table 8.5 suggests that there is greater variation in discussions of green infrastructure within the EIP's compared to the RSS. This could relate to a number of factors but is most likely linked with the depth of green infrastructure information or evidence presented within the EIP. The draft RSS as a policy document set out visions for the spatial planning of a region whilst the discussions held for an EIP provide a discussion of greater variation in the consultation process. The role of the EIP's as a peer review process therefore provides a forum for discussions and the subsequent changes to regional spatial policy. Consequently the range of ideas stated in the EIP is potentially (and appears to be proportionally) greater than for the draft RSS because of this. EIP's are therefore a forum for organisations to outline their support or objections to the use of green infrastructure and different organisations therefore bring a wider range of knowledge, expertise and organisational focus to these discussions. This then proposes that different approaches to green infrastructure planning are discussed more extensively as the EIP provides a platform for the more specific ideas or targets to be discussed. This also suggests that the evidence presented in the RSS was discussed in greater detail during the EIP process. The increased reference to green infrastructure terminology does not, however, necessarily mean that there has been a greater uptake or understanding of the values of green infrastructure in the EIP. It does though imply that a higher level of discussion was made that examines a broader range of green infrastructure principles.

Chart 8.2b. Percentage of responses for each green infrastructure categories (EIP)

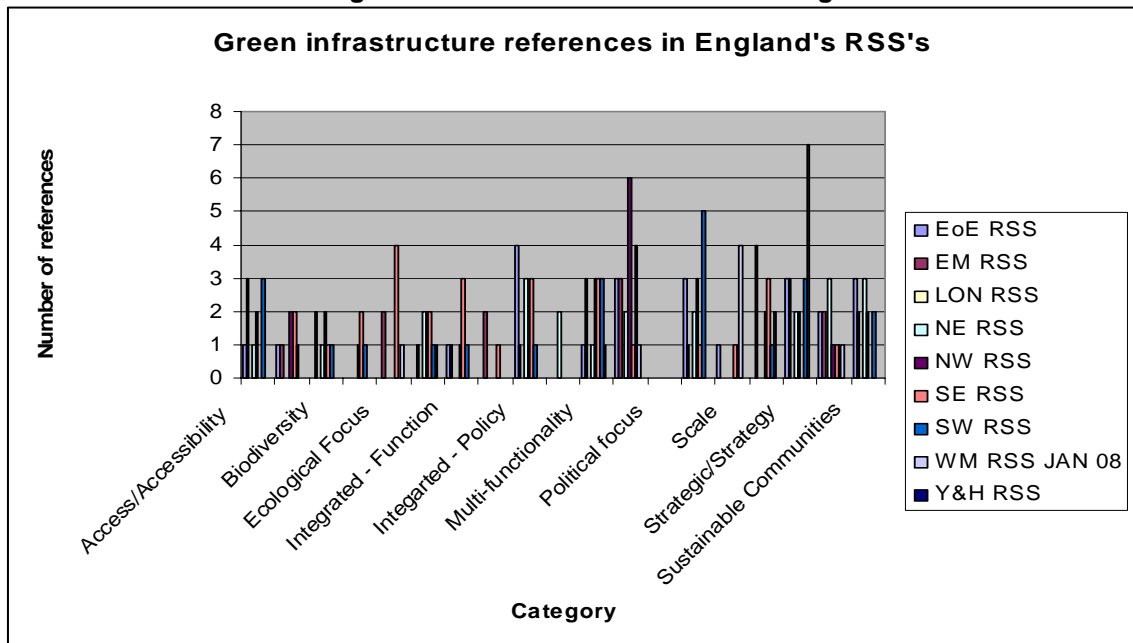


8.5.1. Summary

The role of the EIP as an arena for green infrastructure discussions provides these documents with a broader sense of what it can deliver within regional spatial planning. However, although there are variations in both the number of references, and the focus of these references in the latest RSS and EIPs, the use of green infrastructure is a positive sign that the benefits are starting to be noted. The use and discussion of green infrastructure principles has a number of important implications that will drive the development. Firstly, the use of green infrastructure thinking is a positive sign that

practitioners are starting to value the ideas that support the concept. Secondly, the discussions of green infrastructure in the RSS and EIPs potentially show that the concept can be incorporated into regional planning policy and become a statutory component of the planning system. This is a key element in its development as, with increased use and an acknowledgement of the available evidence, the concept will gain greater value in implementation and planning terms. Thirdly, the use of such a diverse range of categories (see Charts 8.3a and 8.3b) and the promotion of access, connectivity, and strategic development related to green infrastructure is an important component of its promotion. The varied focus of its use, therefore, implies that planners and practitioners view the concept as fitting within a range of planning contexts that enable it to be supported by local, regional and national organisations that benefit from using it to meet different spatial, ecological, economic or social needs.

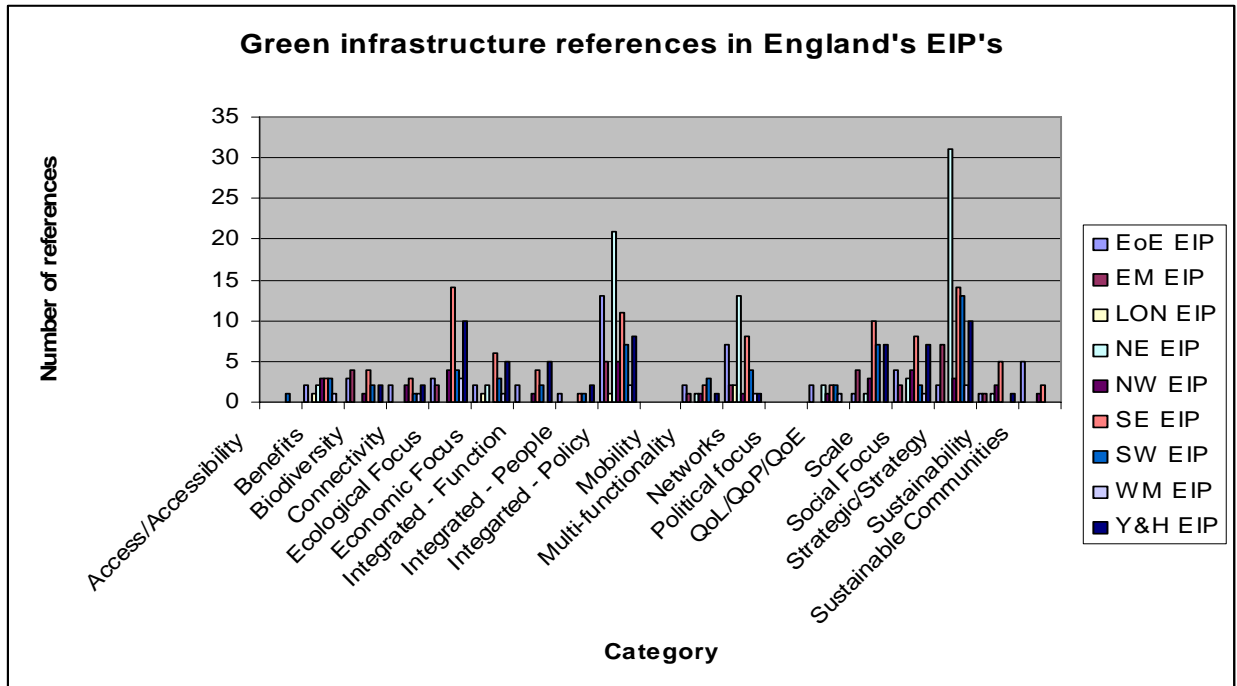
Chart 8.3a. Total green infrastructure references in England's RSS



The presentation of evidence is therefore a clear area where each of the RSS and EIPs could develop their use of green infrastructure further. Stated simply, evidence influences the development of policy, policy which in turn can attract funding for green infrastructure creation. The identification of growth point allocations in the East of England and the South-East support this process by highlighting how government funding can be directly linked to strategic targets. There is also a need for further depth in the discussions of green infrastructure. Although this chapter has already stated that there is not a causal relationship between the level of discussions between the RSS and EIPs, the level of detail outlined in the EIPs, especially in the North-East and South-East, suggest that a greater level of detail is being presented with the EIP process. Again, however, detailed information needs to be presented if funding is to be allocated to green infrastructure and transferred from other infrastructure developments, an issue that the East Midlands and the South-West EIPs discuss. Despite the progression in discussions of green infrastructure, some regions are still questioning the value of the concept to landscape planning. Yorkshire and Humber state that further evidence is needed to allocate funds towards green infrastructure; however, without funding the research can not be developed. Therefore, whilst other EIPs, i.e. South-West or North-West, have allocated funds to

develop an evidence base, the Yorkshire and Humber region appear less willing to undertake such a process. Consequently, the nature of green infrastructure discussions varies in the EIP reports. However, there does appear to be a positive progression in its use and uptake despite the need for a number of areas to be improved further. This process will potentially increase as further evidence is developed and fed to the RDAs.

Chart 8.3b. Total green infrastructure references in England's EIPs



8.6. Green Infrastructure planning documents

The following section assesses a number of documents focussing on the planning of green infrastructure. This includes reviews of planning guides (where and what can be developed), scoping studies (what is there and where are the opportunities), and strategies for implementation. Each is reviewed, highlighting the differences in green infrastructure thinking in a number of implementation and visioning locations and from different organisations. This process also provides a snapshot of how green infrastructure is being developed and builds upon the discussions presented in Chapter 2 and 4 where the conceptual and planning theory were outlined.

The following review and analysis assesses the ideas underpinning green infrastructure development and the processes that support them. The planning guides reviewed are the Leeds Metropolitan University-CUDEM planning guide (CUDEM, 2006), the Milton Keynes & South Midlands planning guide (Milton Keynes & South Midlands Environment and Quality of Life sub Group, 2005) and the North East Community Forests planning guide (Davies *et al.*, 2006). These documents were selected because they were readily available (electronically and in hard copy) and fitted the timeframe of this study. Other documents have subsequently been released which do not fulfil both of these criteria. The documents used also provided geographical variations in terms of landscape resources and their different links with government growth areas or policy initiatives.

8.6.1. Leeds Metropolitan University: Centre for Urban Development and Environmental Management (CUDEM) (2006)

The CUDEM report was produced for the Countryside Agency and provides a description of how open space should be planned and proposes a process through which resources can be developed. It also outlines a number of stages for green infrastructure development. The document may also aid communities by providing an assessment framework for development and planning.⁷⁴ These stages, listed below, range from the use and understanding of relevant development theory to the development of a vision and plan for green infrastructure development:

- Stage 1 - Acknowledging the local context of a potential development
- Stage 2 - Sustainable Development theory
- Stage 3 - Engaging with practitioners, the public and delivery agents
- Stage 4 - Developing the evidence base
- Stage 5 - The visioning process
- Stage 6 - Turning the vision into a plan and developing the economic of the environment

CUDEM proposes the use of sustainable development theory as the basis for green infrastructure development. In Stage 1, it notes the complexity of the world where increased attention needs to be made to what resources people use and the long-term availability of such resources. The report proposes that such an acknowledgement can be used to promote ownership over a landscape and allow people to review the processes, technologies and actions that take place there. CUDEM do, however, state that this type of planning must draw on an established and robust evidence base linking knowledge and experience. Stage 2 develops these ideas, but notes that development must be discussed within a sustainability framework if decision-makers are to be provided with sufficient background information to make informed decisions. Stage 3, in turn, discusses the role of engagement and creating dialogues between planners, developers and the public, and discusses the role of scale in developing green infrastructure, noting that no single ideal can be developed to fit all development.

Stages 2 and 3 set out the administration of green infrastructure development. Stage 4 promotes the role of evidence in providing available data on resource location and composition, their function, and assessing what value they hold in relation to sustainable development principles. Stage 5 states that green infrastructure visions should be developed through a process of decision-making and consultation based on the previous four sections. The final stages, Stages 6 and 7, focus on actual green infrastructure implementation at different scales, within and across, the landscape.

CUDEM outlined that green infrastructure planning needs to work through a needs and opportunities assessment in terms of resources, scales and delivery before moving onto the visioning and implementation process. However, throughout the document the roles of sustainable development, participation and co-operation are discussed as essential elements underpinning effective green infrastructure development. This document, therefore, presents a very pragmatic staged approach to

⁷⁴ The document looks at the spatial dynamics of implementing the Countryside in and Around Towns agenda and describes the pressures currently impacting placed upon urban-fringe areas.

green infrastructure development, which takes a number of principles from participatory planning to provide the broadest scope for dialogue and negotiations. The process is, however, not new as each of these stages is a re-articulation of the existing framework used in landscape planning. The CUDEM report appears to have refocused this process solely to promote green infrastructure, despite the fundamental process being unchanged.

8.6.2. Milton Keynes & South Midlands Environment & Quality of Life Sub Group (2005)

In contrast with CUDEM, the Milton Keynes & South Midlands Environment & Quality of Life Sub Group (MK & SM EQOL) document focuses more readily on implementation rather than the process. The MK & SM EQOL proposes that their guide be used as a checklist for categorising green infrastructure elements, outlining good practice and suggests a process for the implementing of green infrastructure strategically. The guide also discusses its antecedents, stating that it was produced to meet the environment needs of the increasing population in the sub-region. It was also developed to meet the need to provide access to, create, and manage high quality green infrastructure of different classifications or landuse⁷⁵. The guide sets out a number of statements that have been utilised in other green infrastructure documents, most noticeably that:

- Green infrastructure should be developed as an integrated approach to planning, design and development.
- Green infrastructure provides a new way of working across spatial boundaries and also at different or larger landscape scales.
- Green infrastructure thinking may provide a mechanism for attracting capital funding and can be viewed as a valuable adaptive planning (learning by doing) process.
- Green infrastructure offers a strategic approach to planning across boundaries and can integrate a number of different planning policies within local LDFs.

Each of these comments provides an indication of the values placed upon green infrastructure by the MK & SM EQOL sub group. The guide also provides a wider discussion of what constitutes green infrastructure, how these ideas fit within the planning process, and how best green infrastructure can be implemented at different spatial scales. Two of the most prominent recurring themes are the need for balance in the development of green infrastructure projects and the integration of different stakeholder ideas. Balance is therefore discussed as being central to green infrastructure development as it offers a way of co-ordinating the different foci, themes, priorities or hierarchies of planners, delivery agents, other stakeholders and the public. This is deemed central to the guide as, without a balanced and co-ordinated approach, the focus and implementation of schemes may fail to achieve the widest range of possible benefits. Table 8.3 shows how the MK & SM EQOL sub group view green infrastructure as an integrated approach to the design, management and strategic planning of the landscape. This view supports the guide's promotion of strategic green infrastructure resources and connective routes as a way of planning for long-term sustainability across administrative boundaries. The overarching themes outlined in Table 8.3 also provide the guide with a number of clear links to the research literature. The guide thus provides a good example of how the ideas underpinning green infrastructure can be contextualised within a document with an implementation

⁷⁵ The growth point targets outlined by DCLG are therefore increasingly important in this process.

focus. To support this further, the guide goes on to discuss the importance of a strategic approach to green infrastructure and its role in attracting funding for future green infrastructure development.

The purpose of this review is therefore to suggest how best to develop future guidance. By providing links between discussions of what green infrastructure is and how these principles can be implemented, this document goes a stage further than the CUDEM report. This is due to the fact that this document takes the process proposed by CUDEM and develops explicit guidance notes, explaining how this process should be undertaken by planners and developers at a sub-regional level.

**Table 8.3. Milton Keynes & South Midlands Environment & Quality of Life (EQOL)
Sub Group (2005) main themes**

Important themes	Characteristics
Landscape character	Assessments of available data, integration, multi-partner, innovative design in urban environment, GI inclusion as a mandatory planning policy
Historic Environment	Protection of landscapes especially within existing GI networks, restoration for multi-functionality, further investment, recognition of landscape value and context
Biodiversity	Biodiversity as an integral part of urban design and delivery, decrease damage or negative impacts, implement policy (BAPs), decreased fragmentation, increase connectivity/habitat creation, baseline data
Woodlands	Core of GI resource, enhancement and creation of spaces, meeting the needs of local populations, Quality of Life, place and environment, access and recreation
Sports & recreation	Protect and enhance spaces, improve health, meet future needs, improve baseline data, develop multi-functionality
Natural processes and environmental systems	Appropriate methods of linking systems, using sustainable development ideas, feed into policy frameworks, contribute to systems functions/processes, integration into delivery
Managing urban greenspace	Funding and management, integrate all functions and uses, acknowledge value and work accordingly, develop provision or opportunities, improve public participation
Design	Sense of place, improve quality of life, environment and place, adapt sustainable development and environmental design principles, integrate with landscape management, improve best practice, promote inclusion, safety and social cohesion
Community involvement	Improve social inclusion, promote health and education, increase well-being, promote opportunities for involvement and foster support and investment

8.6.3. North East Community Forests, Newcastle University and Northumbria University (2006)

In contrast to the CUDEM and MK & SM EQOL guides, the North East Community Forests, Newcastle University and Northumbria University (hereafter Davies *et al.*, 2006) guide provides both a review of green infrastructure development and an approach to decision-making for green infrastructure projects. Although the Davies *et al.* guide presents a narrative of these two areas, a number of the ideas supporting green infrastructure use are similar to those outlined by CUDEM and the MK and SM EQOL.

One of the main ideas that the guide discusses relates to the effective management of the landscape. The guide notes that spatial delivery must take into account landscape change and scale if ecological

and social activities are to be promoted or protected. The guide acknowledges that landscapes are in a constant state of change and that green infrastructure planning has to meet this challenge. This is further supported with the view that green space management has to understand the diverse values placed on a landscape in terms of its diversity, form, function, and quality. Through an acknowledgement of these ideas, the strategic value of a space can be assessed and planned for. The strategic roles of management and communication are also discussed highlighting how policy makers and practitioners hold an important role in developing and designing appropriate management plans. By linking these ideas, the guide offers a process that decision-makers can use to assess the values of green infrastructure within a system of interpretations and landscape analysis.

The actual process proposed for green infrastructure development is more pragmatic. Presented in stages, like the CUDEM report, the planning guide proposes a systematic GIS approach through which planners and developers can make informed discussions. The Davies *et al.* planning guide also assumes a certain level of proficiency in data manipulation, as the process relies heavily on the use of GIS to test and interpret a variety of development scenarios based on an initial set of development criteria. The guide thus outlines how GIS can be used to develop proposed green infrastructure maps at a number of scales. The mapping work produced can then be used to locate opportunities for new green infrastructure development and provide much needed evidence for regional bodies to promote future landscape planning activities.

Each of these documents highlights different areas of green infrastructure that are being discussed but appear to be based on a comparable set of characteristics. The variation in focus (i.e. conceptual and implementation) of each document suggests that a set of criteria can be developed that underpins green infrastructure and can subsequently be utilised by different practitioners in diverse locations. This process should include an understanding of the planning system, links between theory and practice, and the best methods of translating development ideas into evidence that can influence actual implementation.

8.7. Green Infrastructure Scoping Studies

Three scoping studies were reviewed: East Midlands Green Infrastructure Scoping Study, Green Infrastructure Planning in the Swindon Urban-Fringe, and Planning Sustainable Communities: A Green Infrastructure Guide for Milton Keynes & the South Midlands. Each document was commissioned by different local authorities and statutory agencies and has the varied focus of partnership working.⁷⁶ These documents also provide a forum in order to translate the conceptual and practitioner research into a clear vision that assesses, articulates and strategically outlines opportunities for green infrastructure development. These documents are analysed as they highlight how the principles of green infrastructure have been developed through a combination of academic discussion and practitioner research, presenting a progression of green infrastructure thinking from discussions to the generation of principles and implementation plans.

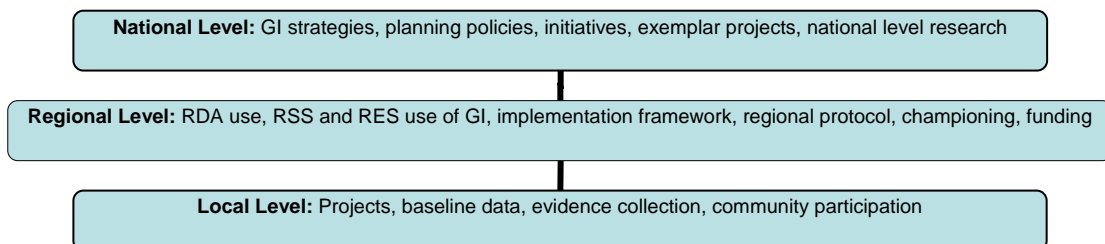
⁷⁶ Each document was guided by a steering group of sub-regional and regional partners drawn from across the planning and environmental field to provide expertise, knowledge and political backing to these studies.

8.7.1. East Midlands Green Infrastructure Scoping Study (2006)

The East Midlands scoping study (EMSS) outlines as one of its main points the benefits that can accrue from green infrastructure planning. Throughout it uses, these benefits are seen as a way of justifying the role and funding of green infrastructure, linking the proposed benefits of the concept with wider policy initiatives (e.g. Quality of Life and Growth Funding). The policies underpinning the document refer to those that have been used in the research literature on green infrastructure (e.g. CIAT, Sustainable Communities or Urban Renaissance). The study does, however, review these policies in terms of the installation of a framework for the strategic development of green infrastructure based on connectivity, environmental stewardship, partnership, and lowering the fragmented nature of green space planning. Consequently, by providing planners with a framework to adapt the fundamental ideas of green infrastructure at different scales rather than using administrative boundaries, the EMSS provides alternative possibilities for decision-making. The EMSS thus proposes that the delivery of green infrastructure can be achieved through a process of holistic and comprehensive planning at the landscape scale. It also states that this can be achieved through co-ordinated partnerships, active participation and the up-skilling of people to effectively promote ecological, economic and social needs.

The EMSS also outlines a set of implementation recommendations to support green infrastructure development. These recommendations range from local level ideas to regional and national policy initiatives that EMSS feel need to be developed. Firstly, the study states that a far greater level of baseline data is needed for planners to make informed decisions. Secondly, the region needs to develop a framework for assessing the public benefits that green infrastructure can deliver at a strategic level. This is supported by two further recommendations, which suggest regional stakeholders must help develop the concept, provide stewardship, funding and management opportunities in support of green infrastructure. This is to be achieved by providing a framework for the RDAs where regional and national strategies or policies can work within a multi-layered vertical framework of expertise and understanding (Figure 8.1). Within this system, information and good practice can be used to inform each level or scale and provides scope for a two-way reporting process to be developed.

Figure 8.1. Integration of green infrastructure within East Midlands Scoping Study recommendations



The EMSS thus outlines a well-defined process that the authors believe green infrastructure should be developed through. It shows how and where green infrastructure thinking or planning can fit within planning frameworks and proposes a number of processes through which the concept can develop.

Moreover, the documents role as a scoping study heavily emphasises the use of green infrastructure as a beneficial planning process to meet a region's development or growth targets. This focus may be expected because of the funding of the document, and its spatial focus on one of the UK government's growth regions. However, despite this, the document positively acknowledges the use of green infrastructure and outlines a set of evidence to support its use.

8.7.2. Green Infrastructure Planning in the Swindon Urban-Fringe (2006)

The scoping study for Swindon's urban-fringe outlines three main areas supporting its approach to green infrastructure planning. Firstly, it identifies key green infrastructure principles that support its planning in the region. This is followed by placing the study in context of the region itself; thirdly, reviewing it against the ecological, economic, political and social background of the area. The study therefore addresses what green infrastructure is, how it fits with the local landscape, and the wider landscape context of the region.

The key principles that the document outlines relate closely to the wider green infrastructure literature and the CIAT agenda. Ideas of access, connectivity, and multi-functionality are discussed alongside the need to protect the ecological, economic and social landscapes of the region. The document also outlines the role of scale in terms of what benefits green infrastructure can deliver locally, regionally and even nationally. Although the document does not expand the literature, it does provide a good discussion of green infrastructure ideas. These ideas provide a firm foundation for the study based on an understanding of what green infrastructure is and how it can be developed. This is unfortunately though a basic discussion that does not progress the research of scoping ideas presented in other documents.

The use of connectivity as a way of linking different elements and implementation provides the document with a clear focus of how the area envisages green infrastructure planning developing. Connectivity highlights that there are links between the work programmes of different actors and the document outlines how people and the environment need to interact in order to promote ecological and social values. It also reviews how different boundaries in planning (e.g. administrative, ecological, political, and social) need to be integrated if appropriate plans are to be developed. The document thus contextualises green infrastructure development conceptually but also reviews possible developments in terms of the physical, political and social landscape of the Swindon region.

The second section of the document outlines why the study was developed and the framework created to promote the use of green infrastructure. The study itself was designed to provide information on how, and whether, green infrastructure can be developed in the Swindon area. This reviewed the ecological and political context of the area and investigated how dialogues could be initiated between local planners and developers. It therefore outlines a number of stages that could be used to communicate the ideas of green infrastructure (see Box 8.1). These stages offer a logical flow of ideas from inception to implementation, providing the document with a foundation to begin developing green infrastructure plans.

Box 8.1. Principles outlined in the Swindon Urban-Fringe green infrastructure document

1. Comprehensive planning
2. Information collation and analysis (baseline data)
3. Holistic approach (a. geographical, b. political and c. functionally)
4. Promote linkage and connectivity
5. Community involvement
6. Plan for recreational needs
7. Promote preservation and conservation
8. Appropriate design and respect for the site
9. Develop and preserve local distinctiveness
10. Obtain sources of sustainable funding

The principles outlined also show clear comparisons to a number of the other documents reviewed in this chapter, whereby a set of principles show a clear understanding of the literature promoting ecological, economic and social needs within a holistic and comprehensive planning framework. The principles outlined provide a clear process through which planners and developers can work to develop appropriate green infrastructure developments. They also provide more detailed discussions of how specific green infrastructure objectives can be achieved.

8.7.2 Planning Sustainable Communities: A Green Infrastructure Guide for Milton Keynes & the South Midlands (2005)

This guide was produced as a response to the high levels of projected growth in the Milton Keynes and South Midlands (MK & SM) area and brings together organisations focussed on protecting and enhancing the environmental assets of the sub-region. The document itself outlines a set of principles and standards that will ensure there is consistency and co-ordination in the delivery of green infrastructure promoting quality of life initiatives. The document itself is based on eight principles, which focus on the benefits that green infrastructure can deliver rather than outlining a process for implementation. This focus, however, is proposed as a set of ideas that can be developed further in other planning and implementation documents.

The principles outlined in the document relate to a number of the fundamental areas of green infrastructure set out in Chapters 2 and 6. They are also split into three distinct areas: ecological, social and sustainable development. The first, ecological, suggests that green infrastructure should contribute to the management and conservation of local landscapes by maintaining and enhancing the biodiversity of the region. This is developed further as the document states that green infrastructure should also protect and conserve the historic (ecological and social) environment. It goes on to propose that more specific ecological elements need to be integrated into better landscape management processes, using woodlands as an example of this process. In contrast, the document also presents social factors promoting the need to develop a better quality of life, place and environment for the sub-region. It notes that, in order to achieve this, recreational facilities should be developed to provide access and connectivity across urban and urban-fringe boundaries.

The role of connectivity is therefore emphasised as the document acknowledges the role green infrastructure can play in promoting social inclusion, community participation and lifelong learning.

These ecological and social principles are brought together to aid the development of multi-functional green spaces that support current and future landscape use. The level of detail in this document is, however, relatively weak compared to the other scoping studies and it therefore fails to provide a clear framework for implementation. Where the benefits of green infrastructure are noted they provide a sound regional context for the study, but there is little detailed information in where and how these resources can be developed.

8.8 Green Infrastructure strategies

The final part of this section reviews two green infrastructure implementation strategies: Cambridgeshire, and Bedfordshire and Luton, and assesses whether and how these documents differ from the scoping studies and guides reviewed above. The documents outline how the themes discussed in the other documents have been articulated into implementation strategies that promote sustainable green infrastructure development. They were also analysed as they present insights into how green infrastructure is being discussed in two of England's growth regions, areas where multi-functional green space provision has been promoted as needing to act as a balancing infrastructure against the more traditional development of transport or housing development.

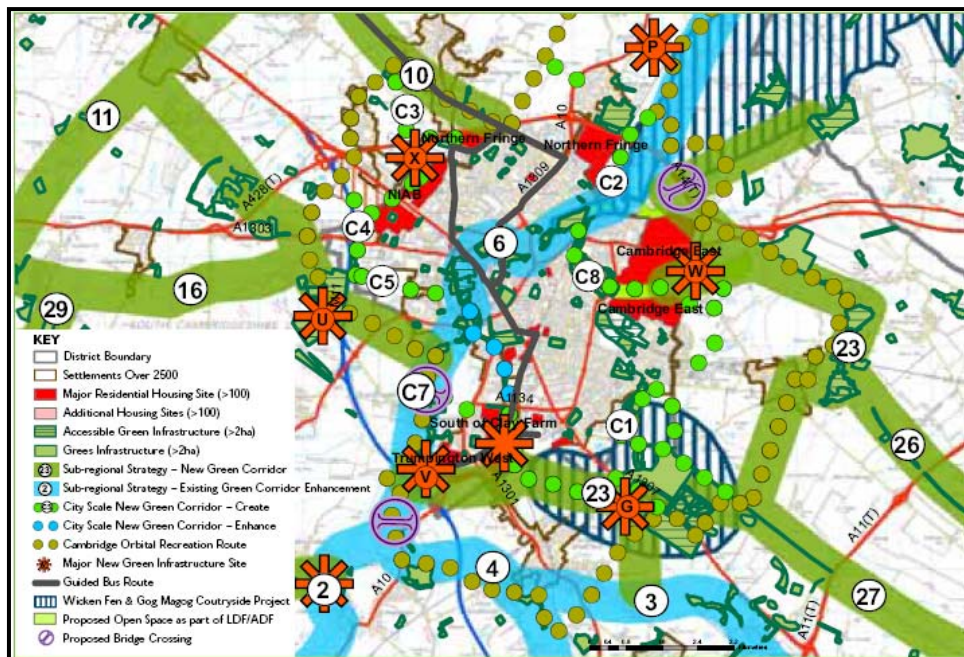
8.8.1. Cambridgeshire Horizons - Quality of Life Programme: Cambridgeshire Green Infrastructure Strategy (2006)

The Cambridgeshire strategy outlines a number of areas the authors feel support green infrastructure development. These assessments are made following discussions relating to the ecological, political and social contexts of the Cambridgeshire region. A review of the current extent of the region's green infrastructure resource is made from which needs and opportunities have been identified for future development, e.g. in the Northstowe urban expansion. In their reviews, the ecological components, landscape character, biodiversity and water resources are all discussed highlighting the current state of the region's ecological resource. These assessments are then compared to the historic and built environment in terms of housing, recreation and service provision. This process goes on to build a profile of the resources base and where gaps are in these networks. Following the presentation of this information, broader planning issues are discussed assessing how best to develop the region. These areas discuss the role of strategic transport corridors and the built environment as key grey infrastructure within the wider green infrastructure network. Issues of climate change, scale and strategic development are also outlined, providing the document with a review of the sustainability concepts that support green infrastructure thinking.

The central aim of the strategy was to outline where opportunities lie in the Cambridgeshire region for green infrastructure development. Through a series of assessments and discussions these areas have been identified (see Plate 8.1). What is apparent is that a number of overarching themes were embedded into the document to provide a conceptual structure for the proposed green infrastructure strategy. The roles of connectivity and access are heavily emphasised and GIS mapping shows the strategic nature of these linkages. Coupled with the promotion of linkages across different landscape scales, multi-functionality is also discussed as one of the main benefits that green infrastructure can deliver. Within the document, multi-functionality keys into ideas of access, recreation, ecological

diversity and social inclusion and is used to promote ecological, economic and social regeneration. Proposed green infrastructure developments also link with the region's expansive economic vision. By using a green infrastructure approach, landmark projects, e.g. Wicken Fen or centres of historical value such as Ely or Newmarket, have embedded into the strategy by Cambridgeshire Horizons, providing the region with a firm financial basis for future development. The document's overall stance is one of development within appropriate parameters, be they ecological, economic or social. Basing its strategic visions on a series of ecological and social assessments allows the document to highlight where the most appropriate areas for development lie and contextualise these against the wider landscape of the region.

Map 8.1 Green infrastructure opportunity areas in Cambridgeshire
(source Cambridgeshire Horizons, 2006)



However, the document has been discussed as having failed to promote an appropriate and workable mechanism for development. Despite outlining a number of key infrastructure sites, it does not suggest a framework for delivering these projects. Consequently, although the Cambridgeshire green infrastructure work does provide directed thinking for development, it does not present an appropriate implementation plan or framework.⁷⁷

8.8.2. Bedfordshire and Luton Green Infrastructure Consortium - Bedfordshire and Luton Strategic Green Infrastructure Plan (2007)

The Bedfordshire and Luton (B&L) green infrastructure plan, like Cambridgeshire, provides a thorough analysis of the region's resources and where gaps in the resource-base of green infrastructure lie. The plan centres on five main themes that permeate the document and contextualise the current state of the region's resources. The main themes, shown below, relate to six issues raised in the document's opening chapters (Box 8.2).

⁷⁷ As a response to this situation, LDA Design were commissioned to undertake a review of the strategy and develop an implementation strategy based on strategic projects, area frameworks, and investment opportunities.

Box 8.2. Main themes of Bedfordshire and Luton Green Strategic Green Infrastructure Plan

- Local and sub-regional focus for delivery
- Builds on recent work conducted in the region
- Spatial vision to develop a strategic framework for GI creation to support Sustainable Communities ideas
- Support in the production of baseline data and analysis
- Resource to help planners and developers
- Links to local, regional and national policy initiatives

Each area provides the document with an understanding of the region's ecological, financial and social structures and gives the document scope for delivering focussed green infrastructure within the sub-region. This suggests that, although green infrastructure can meet a number of multi-functional needs, it can also be proposed as meeting a specific need in one location. This is reiterated in its proposal that the strategy is intended to present a strategic framework for green infrastructure development with a:

- Local delivery focus
- Present of a strategic delivery framework to promote green infrastructure
- Provide the strategic framework for the production of green infrastructure plans at the district and community level which identify local green infrastructure frameworks and any associated investment or funding plans.

The document also states that it is not an implementation plan for green infrastructure development but is a strategic assessment of where development should be located. The key opportunity areas outlined in the plan are therefore linked with the region's growth targets, i.e. housing and economic growth, and provide a spatial opportunities plan rather than a delivery plan.

The plan also outlines a number of objectives that have been identified as being crucial to green infrastructure development (see Box 8.2). These objectives show balance with some of the of the areas covered previously, highlighting the partnership focus on developing strategic green infrastructure resources through an identification and assessment exercise held with sub-regional practitioners. The document acknowledges that this will only be possible if information on existing strategic landscapes, the historic environment, biodiversity, accessible green space and access routes are reviewed at a sub-regional scale. The document therefore proposes integrating and discussing these strategic elements within a wider consultation process. With such a period of consultation, the document suggests that specific regional resources can be reviewed alongside broader strategic goals to outline where opportunities for development lie. This whole process is supported through a system of assessments, analysis, and communication that suggest proposals for development that meet the multi-functional targets outlined above.

Finally, the strategy sets out a number of aspirations for green infrastructure development in the Bedfordshire and Luton region. The first promotes the ideas that green infrastructure can be an essential environmental foundation and support system for ecological, economic and social development. Secondly, it wants to create a healthy and rich environment that supports attractive places to live, work, and recreate. The document therefore looks at the strategic implementation of

green infrastructure ideas alongside the final objective of promoting a sustainable future as key goals for development. It also offers a good example of how partnerships can develop achievable and appropriate goals for landscape development. By relating their green infrastructure thinking to a small number of ideas, the document focuses its conceptual thinking well alongside the overarching strategic nature of the document. Subsequently, the final assessment and maps provided within the document present a scaled (local, sub-regional, regional) insight into what is appropriate for the region and how these development visions fit with the broader development needs of the area.

8.8.3. Summary

Each of the documents discussed provides an insight into how green infrastructure is beginning to be planned for at a sub-regional scale. A number of areas were explored which describe the processes being developed that translate the visions of green infrastructure presented in Chapter 6 into practice. The range of each document's focus is one area where it is clear that the main principles of green infrastructure are being debated. Although each document presents a different use of these principles, overall there is a clear use of the fundamental ideas that support green infrastructure development. The main criticisms regarding these documents, however, relates to the depth of these discussions. A number of the documents (CUDEM and Milton Keynes & South Midlands) present basic discussions of how theory can be expressed in practice. As a consequence of this, the level of detail varies dramatically across the documents and affects their scope and usefulness. Other documents, e.g. Cambridgeshire and Bedfordshire & Luton, present more extensive discussions but, again, issues of how best to translate these targets into a working mechanism for development are still varied. The transition from visions to implementation therefore appears fraught with difficulties, a notion that is also expressed in the RSS and EIP discussions. Work is, however, progressing and development of a number of the strategic projects outlined are being achieved, Wicken Fen and the Ely Country Park in East Cambridgeshire being two notable examples of this process. Further progress, however, is needed to relay the value of visions into practice and to focus the breadth of green infrastructure discussions into deliverable programmes of sub-regional and regional development. Further research also needs to be undertaken in order to identify sustainable sources of funding as current avenues, e.g. Growth Area Funding will continue to decrease. The combination of translating green infrastructure visions based on strategic maps and obtaining funding are therefore two areas where its development may be hindered in the long-term. However, the production of each of these documents suggests that the political will to engage with green infrastructure is beginning to develop and could lead to issues of funding and strategic projects being negated.

8.9. Interview data - organisational use of green infrastructure

The role of green infrastructure in different environmental organisations, like their definitions, differs according to the focus of their work programmes and policy focus. Consequently, it can be expected that the specific uses of green infrastructure will complement the role of the organisation, e.g. the Maryland Department of Natural Resources (DNR) potentially focus their research most frequently on conservation. The following discussion presents an analysis of the role green infrastructure has for Community Forestry in England, UK environmental organisation Natural England, North American State Authorities (e.g. Maryland) and North American environmental and planning organisations. This

analysis is presented to assess how different geographical areas or planning systems affect the focus and use of green infrastructure. It also highlights how interview data can offer a greater level of interpretation and focus than green infrastructure documents because of the increased scope for discussion. The main objective of this process was to examine how the principles discussed in the planning documents analysed earlier in this chapter are being used by different organisations to develop landscape planning practices or programmes. The range of interviews presented provides a multi-region (and scale) depth to this analysis that enables an understanding of the mechanism associated with the development of green infrastructure to be made. The following sections, therefore, outline a number of commonalities and differences in the use and thinking of different organisations in terms of green infrastructure planning. These differences are important as they propose potential areas of future research and discussion for green infrastructure, and support the view that, although a number of key principles have been developed for the concept, variation in its delivery is still apparent.

8.9.1 England's Community Forests

England's Community Forests differ in their approaches to green infrastructure planning for a number of reasons: location (e.g. being within growth areas), funding and the drive of their staff. Three of the most vocal supporters of the concept's development have been the North East Community Forest (NECF) Partnership, The Mersey Forest and The Marston Vale Community Forest. Although the other nine Community Forests utilise green infrastructure, these three have been at the fore of landscape planning, incorporating green infrastructure within the changing role of Community Forestry. However, these three Community Forests differ in their use of the concept. Murphy (NECF) notes that green infrastructure is used predominately to maintain and improve the integrity of local green spaces and ensure the highest capacity for its use (socially and ecologically). McGloin (The Mersey Forest), however, states that green infrastructures should be used as routes and as a justification for increased tree and woodland cover. Both, however, promote a view that Community Forestry planning should incorporate green infrastructure as a way of justifying funding for the expansion of high quality environments that meet local social and ecological needs. This idea is supported by Nolan and Gill (The Mersey Forest) who also support linking the expansion of green infrastructure with specific planning policy at all regional and sub-regional levels. Nolan states that appropriate and strategic planning are essential components in the long-term sustainability of green infrastructure development. This view can be seen in The Mersey Forest's work as they are partners in research and the subsequent development of green infrastructure in St Helens and in the Liverpool Green Infrastructure Plan, alongside Government Office North-West, a number of local authorities and other statutory agencies. The Mersey Forest has also been successful in using their role as a green infrastructure facilitator to provide workshops and educational materials for local authorities to develop its green space resource base at a more local level.

The need to integrate green infrastructure thinking with policy agendas is also clear in research conducted by NECF. Davies *et al.* (2006) developed a green infrastructure planning guide to aid landscape practitioner delivery of high quality landscape management. Murphy describes this role as one the primary functions of green infrastructure if it is to bring together local partners in order to develop a better understanding of the benefits that green infrastructure can deliver. NECF, along with

English Nature, utilised this position to influence the inclusion of green infrastructure within the North-East RSS. This is a view the McGloin also notes, saying that green infrastructure needs 'to be treated holistically rather than as individual elements' if spaces are to provide multi-functional benefits. Both Murphy and McGloin thus promote a number of similar ideals to Nolan, who contextualises these stating:

...if the policy people say ecosystem services are the big thing (i.e. the water framework directive) or if its about a real push for the adaptation of towns and cities for climate change...and we're saying these are the sorts of things you should be doing and we've got the knowledge and skills to help you implement these things but you need the resources to make them happen on the ground.

Paul Nolan, 03/01/2007

Nolan therefore argues that the Community Forestry has to meet the needs and targets outlined in national planning policy. Consequently, one of the roles of green infrastructure within Community Forestry is to adapt their work programmes to meet the objectives proposed in urban-fringe policy initiatives like CIAT. The Mersey Forest has once again proved successful in positioning itself well in this process. Using their role within the North-West Think Tank, they have become a pivotal agency promoting positive landscape change in the North-West. David Hopkins of Bedfordshire County Council and the Marston Vale Community Forests has taken this idea and used it to aid the production of the Bedfordshire & Luton Strategic Green Infrastructure Plan (Bedfordshire Country Council, 2007). Hopkins notes in reference to UK landscape change and climate in the summer of 2007 that:

Green infrastructure is where we need to go given the pressure with growth, the space we've got, and climate change. The weather in the last few weeks really brings it home that this is an important issue and we need to get the right green infrastructure in place to enable the communities to work, and for houses to work and not be flooded.

David Hopkins, 31/07/2007

Hopkins suggests, in relation to the Bedfordshire and Luton Green Infrastructure Strategy, that the development of the strategic plan heavily emphasised the role of co-operation between different partners. Using a five-area classification system, they highlighted the roles of 'landscape character, the historic environment, biodiversity, accessible greenspace and access routes' as key resources in their green infrastructure visioning.

Another idea Hopkins outlined was the role of four hierarchal levels of greenspace that his team used to discuss green infrastructure. These levels (sub-regional strategic or county level sites, neighbourhood, local, and street level) were identified to support their green infrastructure plan at a strategic sub-regional scale, but highlighted the need for green infrastructure to be reviewed and implemented at all scales. NECF and The Mersey Forest have also taken this view on board in their green exercise (i.e. Darlington), street tree, country parks (i.e. Sunderland) and forest mobility schemes. Consequently, although the views of the different Community Forests do not present a singular use, they highlight how green infrastructure planning can, and is, being developed in different ways. The Community Forests have been able, as Nolan argues, to use green infrastructure to educate and inform people about Community Forestry. This in turn raises their profile and allows for the further development of their green infrastructure research.

England's Community Forest Partnership has provided a key testing ground for the development of green infrastructure principles and its creation. The Community Forests network has had one of the longest associations with the concept and as such has been able to develop their resource base and work programmes accordingly. This process has varied in its success within England, but The Marston Vale Community Forest and NECF have shown partially successful uses of the concept. The Mersey Forest, however, appear to be, along with Natural England, one of the most influential agencies in the North-West in promoting green infrastructure. The value of an analysis for Community Forestry's use of green infrastructure is in its longevity and their role is pivotal in the sub-regional development of the concept and appropriate landscape management. The relative success of these three organisations provides a mirror to how other ENGOs and local authorities have approached their use of green infrastructure and the subsequent successes or failures.

8.9.2. UK Environmental Non-Governmental Organisations (ENGOs)

In contrast to England's Community Forests, Natural England have a greater strategic role in the development of green infrastructure. Charlton (Planning and Advocacy-Natural England) presents a view which situates green infrastructure in a policy rather than a delivery context. Charlton outlines Natural England's role as a facilitator for green infrastructure planning in relation to the delivery of the CIAT and DCLG growth area remits. He states that, although regional initiatives and green infrastructure programmes allow different agencies to promote the concept's use, this process will only become mainstream if a national policy acknowledgement is developed. Charlton expressed the view that he felt that national level support needs to identify the necessary funding streams and promote a wider level of political motivation to fully disseminate the benefits of green infrastructure to local authorities and planners. Charlton also noted that local and regional research must contribute evidence and include a strategic understanding of how green infrastructure could be planned at different scales if it is to be successful at a regional and sub-regional level.

Hall (Natural England) promotes a view that supports Charlton's by stating that green infrastructure needs to develop through:

...regional level development with a considerable degree of harmony and commonalities of approach in so far as the Countryside Agency/Natural England have come from different backgrounds in what they want to achieve. By bringing together the two agendas under the umbrella of green infrastructure we can achieve what we want and other things as well.

Richard Hall, 10/01/2007

Clingan develops this idea, stating that closer ties between different planning scales and research are essential if commonalities in approach and working partnerships are to be developed. Both Clingan and Hall also discuss how the changes in landscape policy and the current structural and financial reorganisations in the environmental sector have hindered green infrastructure development. However, Clingan states that green infrastructure has an inherent suitability in approach and focus

when discussed alongside the strategic objectives of Natural England⁷⁸ and will continue to be funded. He does, though, note that the uptake of green infrastructures in Natural England and other environmental organisations policy is still uncertain. Again, he suggests that there is a need to provide evidence (empirical research and analysis) of green infrastructures benefits if it is to be embraced. The overarching theme that Charlton, Clingan and Hall present is, therefore, that green infrastructure has the opportunity to be incorporated at the centre of Natural England's development frameworks. This is especially true at a strategic level if it fulfils a cross-section of policy objectives, evidence of which can be seen in the creation of specialist regional Green Infrastructure Officer positions and the development of green infrastructure as a central pillar of Natural England's London Futures Team.

8.9.3. UK and European academics

Where England's Community Forests and ENGOs focussed on implementing green infrastructure, UK and European academics have simultaneously attempted to develop the concept within planning theory. The role of academic discussions has, therefore, been seen as linking theory with the practice of development and implementation at different policy scales, both horizontally and vertically.⁷⁹ Although UK and European academics and practitioners work within different spatial planning systems, the focus of green infrastructure is still based on similar concepts. Different researchers, however, present views that are withdrawn from the actual implementation of green infrastructure undertaken by local authorities, Natural England or the Community Forests. Even where people like Littlewood (CUDEM) have worked in conjunction with the Countryside Agency, the outcomes presented still highlight the distance between academic discussions and green infrastructure delivery. Academic discussions have, therefore, focussed more frequently on embedding green infrastructure into contemporary planning policy rather than on best practice or implementation.

Selman (25/07/2007) outlined in his discussions that 'one of the dangers of [GI] is that people will see it as a specialism...and try to bolt it together' rather than plan it appropriately or strategically. He goes on to state:

...in essence the focus of GI is that it is multi-functional, it is integrated and interactive and works as a living interconnected system. I would like to believe that there will be a growing acceptance simply because it is necessary. It's an essential part of the future city. It isn't just an optional extra it's an integral part of the design.

Paul Selman, 25/07/2007

Selman proposes that green infrastructure is an essential component of contemporary planning and suggests that it is 'part and parcel of planning, people [shouldn't] see it as an option or extra. It's got to be integrated across the whole thing and I think that's where GI will be seen'. Selman therefore argues that green infrastructure needs to be supported by different government departments and ENGOs if it is to gain credibility and be embedded in planning policy. He elaborates this by stating:

⁷⁸ These objectives are: a) having a healthy natural environment, b) people's enjoyment of the natural environment, c) sustainable use of our natural resources and d) a secure environmental future.

⁷⁹ Vertical thinking refers to the different scales of green infrastructure planning (local, sub-regional, regional and national). Horizontal thinking refers to cross-sectoral ideas that are discussed at a given scale.

I don't think people have the joined up vision of it, it may take something like these debates to get people to think seriously about [GI]. In a sense urban regeneration was like that twenty or thirty years ago. It's at a kind of set piece stage at the moment where you're kind of hoping that you'll the occasional sympathetic [planning] inspector who'll agree to a particular policy. But it has yet to get to the stage where [GI] is a major driver of urban change.

Paul Selman, 25/07/2007

Within this quote, Selman outlines the historical timeframe that new ideas take to become accepted practice. He acknowledges that, at present, green infrastructure still needs to gain greater prominence if it is to reach this stage. Littlewood outlines a similar view when discussing green infrastructure, noting that certain parameters already exist within planning policies and suggests that green infrastructure currently is not one of them. In discussions of the urban planning, Littlewood states that he is not against sets of criteria to define success but does not view these lists as actually defining successful places. He uses green infrastructure as an example, suggesting that:

Part of the problem is that green infrastructure doesn't have boundaries as such [and that] money tends to follow areas that need regenerating. Part of the difficulty is that people don't understand that actually putting some resources into maintaining things that aren't in the green and leafy suburbs can actually have a wider value than simply putting money into middle class areas. We may understand the benefits of green infrastructure to some extent but we're only going to resource it in a particular area. You need to somehow develop this concept of developing the whole.

Once [green infrastructure] is in the planning process it starts to guide the process, you start to bring in other sectors whereby if developers want to develop then they have to address the issue of green infrastructure. Once you've got it into your core mainstream planning system, which is fundamental to getting this done links between land use and development planning and development control – at a certain point it will have its own impetus.

Steve Littlewood, 04/01/2007

To highlight this process, Littlewood discusses the role of the RSS in mainstreaming green infrastructure planning. Littlewood states that RSS are increasingly significant and influential, especially in terms of regional social and economic development, a view also supported by Selman. Both Littlewood and Selman argue that, at present, green infrastructure thinking is in a transitional state. It has started to be valued by academic researchers and practitioners who are reviewing how best to embed the concept into planning practices. Littlewood proposes using the RSS as the primary method of implementing green infrastructure within regional policy, whilst Selman supports this, noting that a period of development, evidence collection, and analysis is needed prior to any uptake or new policy formation. Green infrastructure is, therefore, currently in this transitional stage where funding, project focus, and policy and political backing are all developed.

In contrast to the work of Selman and Littlewood, current research being undertaken in Europe differs in terms of the spatial planning context and their development of the concept as the historical role of planning in North-West Europe (Denmark, Germany and The Netherlands) differs from that of the UK. Consequently, this has influenced the ways in which green infrastructure has been developed and managed. In The Netherlands, Konijnendijk states that:

I think, if I look at the Netherlands, [GI] is not used so much. Green structure is a term [and has been] ever since the 1980's and we've seen and used green structure plans which are still being developed. But green infrastructure I think is not used yet. I think it's still confined to Anglo-Saxon areas, maybe the concept is not so well known in Holland...

Cecil Konijnendijk, 08/08/2007

In The Netherlands, the use of the term 'green infrastructure' appears to be less well developed than in the UK. Konijnendijk states that some of the same themes and principles are however still apparent. He suggests that using the prefix 'infra' for green infrastructures promotes its use because it is linguistically similar to other infrastructure developments and, as such, may be attributed with the same value. Konijnendijk then proposes that the uptake of green infrastructure could depend on being given the same priority politically as with other infrastructures. Pauleit (08/08/2007) outlines a similar view in reference to the German planning system:

I don't think [green infrastructure is] used in Germany as we have a very elaborate planning system and have always had the term of 'landscape' plan, an instrument of landscape plans. So we have general land use plans which are for zoning of the area then we have coupled to this a landscape plan which talks about the ecological goals or the general goals for the green spaces and the landscape and the different ways of how this is integrated into the landscape plan.

Stephan Pauleit, 08/08/2007 - emphasis added

Despite the lack of a functional use of green infrastructure, Pauleit outlines a critique of German planning that may provide an insight into this situation where he examines the proposed static nature of the planning system. He states that, due to the static nature of these regulations, the needs of contemporary planning are not reviewed to the extent that they have been elsewhere. Thus, Pauleit suggests that there are potential issues in the German planning system. However, more recent policy developments have started to address these problems and provide mitigation options for them. Oppermann (08/08/2007) also outlines this view by stating that, in the 1980s, an alternative green space planning typology was developed in Munich that was closer to the themes of green infrastructure. This typology stated that green space needed to be integrated into residential areas and should be combined with other infrastructure to provide spaces no more than five minutes walk from a person's home.⁸⁰ The use of this typology in Munich provided German planners with an alternative view of infrastructure development that allowed greenspace planning to be discussed outside the normal restraints of planning policy. Pauleit also discusses this, stating that, by using an alternative process for greenspace planning, Munich was able to highlight the value of its resource base and improve its provision of connective networks of green space. In essence, both Pauleit and Oppermann note that Munich's planners were promoting and developing what is now known as green infrastructure under a pseudonym of contemporary urban planning.

From the responses gained from Konijnendijk, Oppermann and Pauleit, there does not seem to be a clear use of green infrastructure in Germany or The Netherlands. However, the principles proposed for green infrastructure do appear to form the basis of a number of planning strategies in these countries. Subsequently, it is possible to argue that, although green infrastructure as a concept may not be

⁸⁰ Similarities to the UK's promotion of the CIAT and ANGSt agendas are apparent in this process.

readily used by planners, the fundamental ideas of the concept are already discussed using different terminology. Consequently, if green infrastructure is to become mainstream policy agenda in Germany or The Netherlands, planners and researchers need to explicitly promote the concept as a beneficial synthesis of other concepts or greenspace terminology. Research in Copenhagen has approached this issue by exploring the mechanisms supporting the city's green space network and its benefits.

Randrup (08/08/2007) outlined the approach of Copenhagen to the management of its green space resource. Randrup noted that, like other Scandinavian countries, Denmark has a history of progressive or alternative landscape management within city and national planning agendas.⁸¹ Randrup explained that the city's main green infrastructure resources are managed by three separate organisations: the Royal Palaces, the City of Copenhagen, and Copenhagen University. However, because of the differences in land ownership, there is little management co-ordination between the three. Consequently, cross-organisational strategic management of the city's green infrastructure is poorly developed in direct contrast the role of partnership and co-operation outlined previously in this chapter. This has had the effect of lowering the flow of funding for management and means that most spaces are managed as isolated pockets rather than as connected networks. Despite the lack of a co-ordinated city green infrastructure plan, Copenhagen does have a set of management principles that protect the city's resources and Randrup describes this as being based on traditional Scandinavian modernist approaches.

The approach of Copenhagen may seem too fragmented to achieve effective green infrastructure development; however, this does not appear to be the case. To support Randrup's claim that Copenhagen is a progressive green infrastructure manager, he uses the Greater Copenhagen 'Finger Plan' as an example where greenspaces form the city's distinctive spatial outline. The lack of a grounded policy on green infrastructure, or indeed a formal policy for the finger plan, allowed Randrup to make the following observations, relating how politics plays an important role in both the development of the landscape and the funding of green infrastructure projects:

...the City of Copenhagen has a formalised park policy - it's a nice little manifest that is being acknowledged by the politicians. It's very general, it's not very specific because it's difficult in a political situation to have a specific policy on green spaces as it's of interest and its relevant but its not very important in a political setting. That's one of the things that we're working with to improve the importance and discuss the importance of greenspace.

Thomas Randrup, 08/08/2007

Randrup states that political will is essential if green infrastructure is to gain the necessary value to be planned as a statutory requirement. Randrup outlines similar ideas to Pauleit and Oppermann by stating that, although the social and ecological values of green infrastructure are noted at a city level, the value of green infrastructure still needs to be supported politically, and not just be an ecological or social idea. Levels of co-operation and funding were once again noted as hindering the development of green infrastructure. When discussed in relation to the different planning systems of Denmark,

⁸¹ Similar examples of innovative or progressive greenspace planning in urban areas can be seen in Helsinki (Finland), Stockholm (Sweden) and Malmö (Sweden).

Germany and The Netherlands, these differences become even more apparent. Change though, as Oppermann states, is starting to occur and greenspace planning is beginning to be placed at the centre of the planning process. Other European cities do, however, appear to have successfully negotiating these issues with Utrecht and Den Haag in The Netherlands and Freiburg in Germany, being noted by Konijnendijk as exemplar city's promoting green infrastructure planning principles. A review of UK and European academics researching green infrastructure appears to highlight a number of diverse views concerning its use and current value. These debates are based on the ecological, economic, political and social constructions and highlight the difficulties in developing a coherent focus for the concept across a spatial diverse area. These are also difficulties that can also be seen in the development of green infrastructure in the USA.

8.9.4. United States Environmental Organisations

The Conservation Fund is one of the most prominent and visible supporters of green infrastructure in the USA. Ted Weber (Strategic analyst) has been at the forefront of their green infrastructure research, especially in relation to protection and assessment of Chesapeake Bay and the Delaware Ecological Network analysis. Weber stated that, as a strategic conservation planner, green infrastructure is used primarily as a framework for ecological data collection. His work with the Delaware Ecological Network noted that green infrastructure should be used as a basis for conservation priorities. Weber's research on environmental resource assessments is, however, only one element of the Conservation Fund's green infrastructure programme.

Will Allen, also of the Conservation Fund, strongly promotes their role in educating other organisations about green infrastructure planning and research. Allen explains that the educational role of the Conservation Fund is of equal importance as their research. He states that educational workshops provide a forum for practitioners to learn about green infrastructure, and then take away fundamental messages and apply them to their management programmes. Educational workshops therefore promote the strategic role of green infrastructure and the benefits it can bring to practitioners. Consequently, the Conservation Fund's role is deemed central in disseminating the practical applications of green infrastructure planning because they have one of the highest profiles amongst ENGOs in the USA.

Like Natural England (UK), the American Planning Association (APA) has used green infrastructure as a part of its 'overall land-use planning strategy' but state that they appreciate the fact that planner's work at different scales (municipal, county, regional or state) and consequently should plan accordingly. Lewis (APA) stated that the APA also has an advisory role in offering planning, research and evaluation advice for planners. She also outlines the framework the APA promotes, which includes the circulation and inclusion of information and data in strategic planning documents. This, Lewis suggests, allows the development of a dialogue between partners that aids the planning of green infrastructure at different scales. The role of the APA, like the Conservation Fund, thus provides a platform for the development of research and implementation guidelines. Furthermore, by developing a set of guiding principles that support a strategic approach to landscape planning, green

infrastructure creation can be translated more readily by City or State agencies (e.g. the Maryland DNR or by New York's Manhattan Greenway project).

The effects of this process can be seen in Maryland where the States Department of Natural Resources (DNR) has used green infrastructure to promote strategic conservation assessments. Conn (Maryland DNR) promotes the ideas discussed by the APA as enabling the DNR to conduct and analyse state-wide conservation opportunities. Within this assessment, green infrastructure is used to target the restoration of gaps in the wider networks and includes the creation and restoration of habitats and wetlands. These assessments are subsequently used by a number of agencies in Maryland and have been noted as an important tool in the planning of transportation infrastructure.⁸² Although Conn herself utilises green infrastructure as an application to locate external funding for technical innovation, she states that green infrastructure planning is now one of the main processes through which the Maryland DNR conduct their research.

In contrast to the national and state level use, Williamson (Heritage Conservancy) promotes green infrastructure planning most frequently at a county or municipal level. Through public education and outreach activities, Williamson states that the Heritage Conservancy supports the use of green infrastructure as part of a collaborative process, conserving land in environmentally sensitive areas, including New Jersey's Musconetcong River and the Churchville to Playwicki Greenway. To achieve this, Heritage Conservancy promote three main service areas:

- Providing land use planning assistance to municipalities
- Protecting natural and historical resources through land acquisition or conservation easements
- Using current land stewardship practices to manage properties that they own.

Williamson also notes that the Heritage Conservancy's aim for infrastructure is to protect and promote 'lasting landscapes'. This is explained as a way of protecting landscapes of ecological and cultural significance by developing partnerships of shared values that support these visions. Through these partnerships, Williamson states that the momentum needed to protect valuable landscapes can be created using green infrastructure as the driver promoting shared ideals.

From the above discussions it is suggested that green infrastructure is starting to be embedded in the research of a number of US practitioner organisations. The Conservation Fund and the APA are state-level organisations promoting green infrastructure as a strategic landscape management practice, whilst the Maryland DNR and the Heritage Conservancy are developing green infrastructure projects at a regional and local level. It is, however, clear that although these organisations differ in their focus, each draws on the different policy ideas, processes of integration, and education in promoting green infrastructure use at all planning scales. They also acknowledge the value of green infrastructure to local level management practice in order to meet localised needs. State-level organisations are, however, currently planning green infrastructure more strategically using baseline data developed by

⁸² The specific form that the DNR's green infrastructure work takes, therefore, also appears to promote benefits outside their core remit of ecological conservation.

organisations such as Heritage Conservancy to underpin their work. Overall, there is a positive sense that green infrastructure appears to be working allowing local, regional and national level organisations to feed into the use, and further development, of the green infrastructure concept.

8.10. Summary

The difference in spatial location and the planning systems of the UK, Europe and the USA have been highlighted within each of the interviews discussed above, especially where the top-down approach to landscape planning in the UK differs to the fragmented approach outlined for Maryland. ENGOs also appear to hold different roles and promote a wide range of green infrastructure principles which appear to be somewhat spatially specific. One of the most apparent differences, however, appears in the structural organisation of green infrastructure planning and its focus. The holistic approach of the UK does not appear to be mirrored by the conservation-led green infrastructure approach of the Conservation Fund or the APA. The European examples also seem more static in their more traditional planning framework, which incorporates both despite being flexible towards the ideas of a green infrastructure approach to planning. The wide range of interpretations of green infrastructure planning, therefore, provides scope to meet ecological and social needs and some of the examples shown (e.g. Maryland) suggest that this range can, and is, attracting funding.

One of the main issues that appear to exist between the different locations is the translation of the principles outlined in the research literature into actually deliverable actions. The Community Forests differed from Natural England's use of green infrastructure and, although the Conservation Fund and Heritage Conservancy may have similar goals, the focus of their work is quite different. Once again the focus and lack of a clear consensus between different practitioners appears to present a problem for focussing project work, the scale of implementation, funding and the long-term use or viability of green infrastructure as an approach to landscape planning.

However, positive statements are made suggesting that the values and principles of green infrastructure are starting to be embedded into planning practice. The range of projects proposed by the Community Forests provide a good indication of the progress and, with further evidence, a continued use of green infrastructure may be assured. References to the fragmented and sometimes static nature of the planning systems in the USA and Germany also provide opportunities for local level or regional partnerships to lead on development projects. In the UK, regional bodies in the East of England and the South-East have highlighted the achievable nature of this process and the evidence of success can be translated to other areas. Therefore, although scope still exists for a more focussed use of green infrastructure across spatial boundaries, lessons and evidence are beginning to be shared and a more holistic and cohesive view of green infrastructure is being developed.

8.11. Green infrastructure in practice: lessons learned

The overarching view from the above discussions is that green infrastructure is becoming increasingly valued but there is a still need to develop a broader evidence base to support its use. This needs to take place at all planning policy levels if political support for the process is to develop and subsequently become a mainstream planning process. However, at present, the diverse nature of the

concept in terms of form and function means that there is not a coherent view of green infrastructure. These differences in approaches to green infrastructure policy and practice have also been discussed in this chapter in terms of policy implementation. What these discussions suggest is that green infrastructure is gaining widespread acknowledgement from UK, Europe and North America; however, acknowledgements of its value are not enough to support its use by different planning and development organisations. From the discussions outlined in this chapter, the following areas have been repeatedly noted as being needed to further the use of green infrastructure in landscape planning. These areas are:

- Need for a clearer focus of the use of green infrastructure i.e. to promote a more holistic use of green infrastructure between the Conservation Fund, APA and state or local agencies
- Further agreement on the principles of green infrastructure - i.e. North-West Green Infrastructure Think Tank and The Mersey Forest
- Development and dissemination of evidence - i.e. Maryland DNR and Conservation Funds promotion of green infrastructure in the Chesapeake Bay area
- Mainstreaming of knowledge through dissemination and educational programmes - i.e. Conservation Fund educational programmes and workshops
- Further integration of knowledge, more focussed interactions, and a partnership approach to green infrastructure planning - i.e. Natural England's work with Cambridgeshire Horizons and other local authorities to develop the Cambridgeshire Green Infrastructure Strategy
- A sustainable approach to green infrastructure development is needed - i.e. Heritage Conservancy's development of the Churchville to Playwicki Greenway, which promoted sustainable construction methods and conservation principles simultaneously
- Locating and obtaining funding is a key factor in successful green infrastructure development - i.e. The Mersey Forests and Natural England role in attracting funding for the Warrington, Liverpool and Manchester green infrastructure plans from Government Office North West
- Assessment of green infrastructure project success will be a long-term process – i.e. the biodiversity and climate change value of the Wicken Fen developments in East Cambridgeshire will need to be assessed over fifty to one hundred years.

Although there is inherent diversity in how different researchers and practitioners discuss green infrastructure, a number of themes were consistently outlined. These included principles that were discussed in Chapter 6 and in this chapter a similar process of discussion and value attribution was used, especially in respect to the analysis for the green infrastructure scoping studies, guides, plans and toolkits. Owing to the nature of the concept, these documents proposed a number of 'buy-in' factors which allow different organisations to use the concept to support specific planning policies or practices. The principles of an ecological focus, connectivity, and access to high quality spaces was highlighted in each of the documents reviewed as being essential to effective green infrastructure planning. Issues of scale, cross-boundary implementation, and the need for a strategic overview have also been referenced in each document. These principles promote the role of green infrastructure within a process of sustainable planning aiding the adaptation of landscapes to meet current and future ecological, economic and social needs. The principles of sustainable development must also not be overlooked. Within each document and interview the principles of sustainability were central to a green infrastructure approach to planning. These principles also addressed the issue of balance and

the need to develop or work within a progressive and co-ordinated planning system that integrates green infrastructure principles.

Reviewing the most recent RSS provides a litmus test of this process and shows how far green infrastructure has developed over the last five years. Since its first use, UK discussions of its value have increased significantly as the Community Forest Partnership and Natural England have embraced the concept. Consequently, the concept's inclusion in the majority of RSSs and all the EIPs suggest progress has been made. The rise in discussions of green infrastructure in policy documents therefore highlights the will of organisations such as English Nature to develop evidence emphasising the value of the concept. This role is especially relevant in the regions where the RSSs and EIPs recommend actual green infrastructure policies (i.e. North West and South-West) in their spatial plans. The development of the concept within these strategies proposes that green infrastructure thinking has started to effectively locate itself in the consciousness of planners and policy makers. As such, policies have been developed that legislate for green infrastructure development over the next ten to twenty years.

The other planning documents and interviews discussed also place an emphasis on how green infrastructure can be promoted in policy. By promoting connective landscape features, biodiversity enhancement, conservation principles, and alternative transport infrastructures, green infrastructure has been proposed as a concept that offers planners and developers alternatives. These choices may therefore focus on ideas of ecological, economic and social longevity to provide opportunities to plan in a more sustainable or holistic manner. Linking green infrastructure with sustainability ideas potentially places the concept at the centre of the planning process in the same way as linking it with climate change debates. The perceived focus of policy, be it sustainability or climate change, is therefore a prominent issue in planning and within these debates a green infrastructure approach to planning has been positioned effectively to be used in the future.

The development of green infrastructure can also be traced within the guides, toolkits, and strategic plans being produced. The indication from these documents is that a green infrastructure approach to landscape planning is starting to be taken seriously, as NECF showed with their facilitating role in the North-East RSS and its green infrastructure Guide. The principles of green infrastructure have therefore been articulated through the document-scoping process to highlighting how green infrastructure plans can meet the needs or focus of different environments. If reviewed alongside UK government policy, then these scoping studies provide a clear indication that green infrastructure can support the needs of an ever-changing urban, urban-fringe and rural landscape. In terms of planning guides and 'toolkits', these documents also provide an insight into the progress made in linking green infrastructure thinking with practice. These guides synthesised the broad conceptual ideas of green infrastructure and formulated processes allowing for the implantation of these ideas. The development of logical decision-support systems, like that proposed by NECF, therefore supports a progressive shift towards appropriate and sustainable green infrastructure creation. By developing systems that offer a logical question-query/construction-answer system, planners and developers can undertake cost-benefit or stated preference analysis for a green infrastructure project prior to development. Moreover,

the cumulative values of green infrastructure can be discussed against a pragmatic framework of empirical analysis. The evidence produced by the North-West Green Infrastructure Think Tank for the Liverpool green infrastructure assessment is a good example of this process. Sustrans were also noted as being extremely knowledgeable in conducting cost-benefit analysis of new alternative transport routes and attracting funding for them.

The increase in green infrastructure discussions made in each RSS, EIP and scoping or planning guides mirror the debates developed in academia where similar arguments for and against green infrastructure have been made. In the UK and Europe, a holistic approach to green infrastructure planning has been proposed, assessing the ecological, economic and social needs of a landscape collectively. In contrast, research undertaken by North American academics and organisations has proposed a primarily ecological value for assessment. This approach is, however, changing with more recent work by the Conservation Fund, the APA, and Ahern supporting a broader focus of green infrastructure that prioritises a holistic discussion of ecology, finance and society to inform the development of project work. The Conservation Fund's continuing work with the Maryland DNR in the Chesapeake Bay area has also begun to acknowledge the social implications of landscape management alongside their previously stated conservation priorities.

Consequently, developments of green infrastructure can be seen that reflect how different academics review the future of the concept. Some researchers (e.g. Selman or Ahern) see green infrastructure as a way of meeting the challenges of an ever-changing environment. Conn sees green infrastructure research as a way of promoting spatially-diverse assessments supporting sustainability agendas. What is apparent, however, is that although there are differences in focus, green infrastructure discussions are developing the conceptual ideas and an implementation focus for the concept. A range of examples from the UK (Community Forestry), Europe (city planning) and North America (Conservation Fund) have highlighted this, arguing that the roles of funding, education, focus, and additional research are all needed to further the concept's progression. The links between policy and implementation may, therefore, become clearer as the role, and knowledge, of green infrastructure increases.

Further examples also include Randrup's review of green infrastructure in Copenhagen where he notes that the value of the city's green infrastructure resources are acknowledged, but there is low political will to fund or support its development. In the UK, the Community Forest Partnerships have used green infrastructure as a way of diversifying their core activities, attracting funding, and re-contextualising their visions to meet the changing needs of the communities they serve. Duly, the diverse nature of green infrastructure planning has only been partially successful in development terms and there are still areas to be addressed. Again the role of funding, focus, needs assessments and political will are important aspects of this process. However, through the promotion of green infrastructure as a sustainable planning process, statutory agencies like Natural England have been able to more effectively manage landscape resources. There still remains an issue with attracting sustainable funding if they are to develop green infrastructure in the long-term and meet the needs and opportunities of the ever-changing landscape. The Maryland DNR and Conservation Fund have

also developed country, metropolitan and state green infrastructure assessments, which have been used to report to government agencies to fund development projects. The Conservation Fund as well as academic institutions like the University of Massachusetts (USA) has also developed educational programmes and seminars teaching green infrastructure concepts, values and processes as central elements of sustainable landscape planning.

Each of these areas will be discussed further in the following chapters to draw together the main themes outlined in planning policy, guidance and practitioner interviews. This will be examined against the meanings and debates presented in Chapter 6 to assess the success of translating the principles of green infrastructure into practice and explore the role of perceptions of the landscape in promoting sustainable and functional spaces. The interpretation of all three Results & Analysis chapters will provide insights into the progress made in green infrastructure development to date and suggest avenues for future research. Moreover, the need to balance the findings of these three chapters will be debated to show how theory and practice can be used to develop appropriate landscape planning mechanisms and assess the role of form, function, and context (aesthetic, ecological or psychological) in developing attractive and useable spaces.

Table 8.5 Categories and number of references to green infrastructure in each RSS and EIP

	EoE RSS	EoE EIP	EM RSS	EM EIP	LON RSS	LON EIP	NE RSS	NE EIP	NW RSS	NW EIP	SE RSS	SE EIP	SW RSS	SW EIP	WM RSS	WM EIP	Y&H RSS	Y&H EIP	Tot.
Access/Accessibility	1	0	3	0	0	0	1	0	2	0	0	0	3	1	0	0	0	0	11
Benefits	1	2	1	0	0	1	0	2	2	3	2	3	1	3	0	1	0	0	22
Biodiversity	0	3	2	4	0	0	1	0	2	1	1	4	1	2	0	0	0	2	23
Connectivity	0	2	0	0	0	0	0	0	1	2	2	3	1	1	0	1	0	2	15
Ecological Focus	0	3	2	2	0	0	0	0	0	4	4	14	0	4	1	3	0	10	47
Economic Focus	0	2	1	0	0	1	2	2	2	0	2	6	1	3	1	1	0	5	29
Integrated - Function	1	2	1	0	0	0	0	0	1	1	3	4	1	2	0	0	0	5	21
Integrated - People	0	1	2	0	0	0	0	0	0	0	1	1	0	1	0	0	0	2	8
Integrated - Policy	4	13	1	5	0	1	3	21	1	5	3	11	1	7	0	2	0	8	86
Mobility	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Multi-functionality	1	2	3	1	0	0	1	1	3	1	3	2	3	3	1	0	0	1	26
Networks	3	7	3	2	0	2	2	13	6	1	1	8	4	4	1	1	0	1	59
Political focus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
QoL/QoP/QoE	3	2	1	0	0	0	2	2	3	1	1	2	5	2	0	1	0	0	25
Scale	1	1	0	4	0	0	0	1	0	3	1	10	0	7	4	0	0	7	39
Social Focus	0	4	4	2	0	0	0	3	2	4	3	8	1	2	2	1	0	7	43
Strategic/Strategy	3	2	3	7	0	0	2	31	2	3	0	14	3	13	7	2	0	10	102
Sustainability	2	1	2	1	0	0	3	1	1	2	1	5	1	0	1	0	0	1	22
Sustainable Communities	3	5	2	0	0	0	3	0	2	1	0	2	2	0	0	0	0	0	20

Chapter 9.0. Discussion: Is the green light really on?⁸³

9.1. Introduction and synopsis

The previous three chapters examined the empirical evidence gathered for this thesis. They outlined how the three main areas of study, namely green infrastructure, environmental perception, and spatial planning, have supported a better understanding of the development and use in planning practice of green infrastructure. The following chapter and Chapter 10 discuss these results and contextualise them against the research questions and objectives outlined in Chapter 1. This addresses the current level of growth seen in green infrastructure thinking, highlighting where opportunities for further development lie. At the conclusion of this chapter and in Chapter 10, recommendations will be made addressing how these challenges should be met.

'The green light is on' was how Dapolito Dunn and Stoner described the economic and environmental viability of green infrastructure development in the USA (Dapolito Dunn and Stoner, 2007:iv). Their review of green infrastructure suggests that effective green space planning proposed a way of harmonising the impacts of city living with a natural systems approach to environmental planning. Dapolito Dunn and Stoner argued that green infrastructure could manifest itself into effective and sustainable landuse planning practices by addressing the inputs and outcomes of this process.

The relevance of Dapolito Dunn and Stoner's work is that it proposes, at least for the USA, a national scale acknowledgment of the values attributed to green infrastructure. Commissioned by the Environmental Protection Agency (EPA), Dapolito Dunn and Stoner suggest that the EPA appear to be promoting green infrastructure at a national level and, alongside the Conservation Fund, is one of the first organisations to undertake such a course of action. In this thesis, and in other current research into green infrastructure, researchers have examined whether, and how, the green light is on in two ways. Firstly, support for green infrastructure growth conceptually and in practice has been explained whilst, secondly, a positive response to national level endorsements of the concept in the USA have been visible within state and national policy. A green infrastructure approach to planning, therefore, appears to have gained credibility in what Ahern (2007) noted in Chapter 8 as a historically fragmented system.

The EPA's acknowledgement of green infrastructure as an economically and environmentally viable landscape planning process also suggests that they associate a number of valuable characteristics with the concept. Dapolito Dunn and Stoner thus propose a number of areas where green infrastructure thinking can benefit decision-makers and planners in urban and urban-fringe locations. They highlight the role of evidence collection and analysis, appropriate funding, and the use of green infrastructure to integrate policy and practice as valuable components in this value attribution system. This work identifies that the principles of green infrastructure are beginning to be located within the planning policy-making process. This process is referred to throughout this chapter as one of the most

⁸³ The title of this chapter is taken from a conference paper presented at the 2008 Association of American Geographers Conference entitled '*Is the green light really on? Has Green Infrastructure Planning started to provide cross-cutting benefits for urban and urban-fringe areas?*'

crucial factors in translating the values of green infrastructure into actual policy and implementation programmes. Dapolito Dunn and Stoner's review of green infrastructure development therefore provides a good platform to begin the discussions within this chapter. Their work suggests that green infrastructure thinking has progressed extensively, conceptually and in policy and practice terms since 1998, a process mirrored in the responses of England's Community Forests. Furthermore, this chapter reviews how these ideas have been presented within the broader questions relating to green infrastructure and will examine the following in response to the research questions proposed in Chapter 1:

- This chapter presents a synthesis of the previous literature and analysis chapters and propose recommendations to address the following: What green infrastructure is, how is it being used, and what the future holds for green infrastructure planning?
- The chapter brings together the narratives discussed within this thesis and outlines where commonalities and differences are located in the research, focussing on green infrastructure, environmental perception, and spatial planning. This discusses the development of green infrastructure, the role perception plays in understanding the landscape and its attributed values, and how green infrastructure is being developed by decision-makers, developers and practitioners.
- An assessment is made outlining where gaps in green infrastructure thinking appear and where opportunities lie to fill the gaps in the research and practitioner literature.
- This chapter also addresses an understanding of whether the landscape plays a role in the lives of the research groups examined and assesses how this affects their use and understanding of green infrastructure.
- Finally, this chapter proposes a number of recommendations assessing best practice strategies for translating green infrastructure research into effective and appropriate planning policy.

In Chapter 1, a number of primary and supplementary research questions were outlined, each of which investigated a particular facet of green infrastructure thinking. The empirical data collected was analysed and discussed in Chapters 6, 7 and 8 exploring how different respondent groups examined their understanding of green infrastructure. However, it is also important to return to these questions to place the discussions presented in this chapter in context with the main themes of this thesis. The aims of the research can be found in the eleven questions below outlining the three main areas of study: *green infrastructure*, *environmental perception*, and *spatial planning*. Each of these themes supports the objectives of this thesis to explore the contemporary concept of green infrastructure and examine its development, its use, interpretations of green infrastructure resources, and what the future held for the concept. The first trio of questions investigated the different ideas and views that underpin the use of the green infrastructure concept and explored whether the definitions and use of it differed between different planning sectors, academic disciplines and geographical areas. These were:

1. What is Green Infrastructure?
2. Is Green Infrastructure viewed differently by different user groups, academics and landscape practitioners?
3. Are there differences found in the definitions of Green Infrastructure culturally generated?

The next set of questions reviewed the perceptions and interpretations of green infrastructure resources. These questions addressed how different respondents and groups viewed specific elements of the landscape and how these perceptions affect their use of the landscape and green infrastructure resources. By reviewing these processes, this research highlighted the factors proposed as supporting positive and negative interpretations of green infrastructure. They also presented themes planners and landscape architects could use to design more socially and ecologically sustainable places as follows:

1. How is Green Infrastructure being used as part of people's everyday lives?
2. What influences a person or group's perception of Green Infrastructure?
3. How do these factors influence the choice and use of Green Infrastructure?
4. What landscape or specific site elements encourage people to utilise Green Infrastructure resources?

The final area of questioning assessed the broad range of factors that influence the development and use of green infrastructure in both planning policy and practice. By examining the use of green infrastructure in different planning documents, these questions enabled an analysis of the broader influences to be made. These questions explored the gaps in current green infrastructure planning practice and proposed processes that can address these issues:

1. Who influences the development of Green Infrastructure – planners, statutory bodies, the public or individuals?
2. Who decides whether Green Infrastructure is developed as a concept and in reality?
3. How is Green Infrastructure being developed and implemented in the real world?
4. Can Green Infrastructure meet the broader ecological, financial and social needs of a constantly changing society?

In this thesis, these three areas of questioning have been used throughout to highlight the progress made in green infrastructure thinking but have also highlighted the gaps in current research. They have, therefore, been used as a starting point for broader discussions of the values of green infrastructure and have promoted a better understanding of the processes that have supported its development to date. Previous chapters discussed how different definitions have been attributed to green infrastructure and how these have, in turn, affected its use in policy and subsequently in implementation. Each of these discussions has been based on one of the research questions outlined above. Consequently, these discussions revolved around how different researchers or practitioners view the main principles of green infrastructure. There are, however, also supplementary issues relating to temporal and spatial differences in the development of green infrastructure. These include: What are the best ways to extend and implement the concept? Can green infrastructures be used successfully in all locations and scales? Should they be selectively integrated into urban, urban-fringe or rural landscapes? These issues have also been discussed, highlighting the temporality of the landscape and how the field of green infrastructure research has expanded in spatial terms and will be examined further in this chapter.

Temporal change is, therefore, at the centre of Gill *et al.*'s suggestion that 'given the long time of building, from 20 to over 100 years...it is critical to take opportunities for creating [green infrastructure]

as they arise' (2007:127). Ahern maintained a similar view in that space has a critical value and, when reviewed against the ever-changing landscapes of redevelopment, regeneration and renewal, green infrastructure should hold an integral place in these changes. Thus, although constant changes can be seen in time and space, both can be viewed as being elements in a cyclical process. Anna Stranton's work is applicable here as she stated that 'each element can itself be a system; and each system can be an element in a larger system' (2006:404). Therefore, where time and space have been viewed as abstract concepts (e.g. Lefebvre, 1991), it is relevant that interpretations of space and time should be based on physical spaces and the subsequent perceptions attributed to them. Green infrastructure thus holds the potential to fulfil this pivotal position as people view spaces as physical materials and, consequently, their understanding is based on an interpretation of those materials. Interpretations of spatial and temporal norms naturally evolve as personal and communal perceptions change. Moreover, when viewed as a part of a systems approach, time and space are components of the continual cycle of change and, in terms of green infrastructure, can adapt the landscape to changing ecological and social circumstances. These ideas are discussed within this chapter to assess the future potential of green infrastructure approach to landscape planning.

9.2. Green infrastructure definitions

The work undertaken in this thesis developed through a cyclical process of discussion, analysis and understanding. By examining different definitions and uses of green infrastructure, this thesis has presented a debate proposing what the principle values attributed to this concept are proposed to be. This process examined the ideas that underpin green infrastructure thinking and have provided this thesis with both theoretical and practical characteristics of what elements constitute the concept. The Cambridgeshire Green Infrastructure Strategy provided a clear example of how this cycle of interpretation can be acknowledged. The vision of the Cambridgeshire Green Infrastructure Strategy summarised green infrastructure planning as attempting:

To create a comprehensive and sustainable network of green corridors and sites that: enhance the diversity of landscape character, connect and enrich biodiversity habitats and extend access and recreation opportunities.

Cambridgeshire Horizons (2005:15)

This statement is used in trying to define what green Infrastructure is and proposes it as a way of improving the quality of life, quality of place and the quality of the environment. The focus of these improvements has, therefore, been placed upon individual ecological, economic and social principles as suggested in Chapter 6. Those authors and organisations that have supported green infrastructure have done so by establishing these principles as underpinning the concept (Ahern, 2007; TCPA, 2004; Benedict and McMahon, 2006). A number of these principles can now also be seen in policy (e.g. RSS) and practice (e.g. green infrastructure planning guides) with differing success. However, those authors who feel that green infrastructure is a semantic manipulation of other planning terms (e.g. Brown's discussions of green space planning) may need to reassess their positions as the concept continues to develop further prominence.

The debates presented in Chapter 6 outlined a number of diverse academic and practitioner definitions for green infrastructure. Each suggested a number of complementary and contrasting elements proposed in the research literature (e.g. access, scale, strategic thinking) which allowed each author to discuss their specific interpretation of these characteristics in support of their use of the term. However, a number of principles were more frequently identified as being central to the concept. Access, connectivity, different landscape elements, scale, and the strategic focus of planning were all noted consistently in what practitioner and academic defined green infrastructure as.

Due to the diversity of responses in Chapters 6 and 8, the production of a definitive green infrastructure definition could benefit future discussions of the concept. However, it was suggested that this process may not be necessary as long as projects and landscape managers are still promoting the concept positively. Whether or not a definition of green infrastructure is developed may therefore depend on academic will, but also practitioner or policy-maker needs. However, a dualism can be presented within this view. If green infrastructure thinking is to develop a definitive definition, this would provide the concept with a clear set of grounded principles; as a result, some researchers may cease their use of the concept as it becomes too restrictive. The links between what characterises green infrastructure may therefore be a more appropriate way of discussing the concept and this allows a broader range of researchers to continue utilising the concept. However, it may not be necessary to resolve this issue as long as the ideas of green infrastructure are still being discussed in relevant forums. The development of Natural England's Green Infrastructure Guidance (2009) emphasised this dilemma by proposing that an understanding of its principles were the most important factor affecting development.

Despite this dilemma, the review presented in Chapter 6 proposed a synthesis of the overarching principles used to promote the production of a working definition of green infrastructure. This definition summarises a number of key concepts including the roles of sustainable landuse and the need to sustainably maintain the resource base, maintaining the integrity of green infrastructure resources and aiding the development of resilient spaces across different landscape boundaries. The definition presented below, and in Chapter 2, promotes the ideas of sustainability, connectivity, conservation, scale, and meeting diverse ecological, economic and social needs, each of which was discussed in the responses presented in Chapter 6. This analysis, therefore, supports the use of the working definition of green infrastructure which proposes it as:

...resilient landscapes that support ecological, economic, and human interests by maintaining the integrity of, and promoting landscape connectivity, whilst enhancing the quality of life, place and the environment across different landscape boundaries.

This definition thus integrates a range of ideas outlined in Chapters 2 and 6. It does not, however, outline specific green infrastructure elements, although they are acknowledged as being of equal importance. This is because a broader review of the landscape is proposed as being more important than identifying specific elements in promoting the principles that green infrastructure encompasses at

a number of different scales. Consequently, by providing a broader scope for the inclusion of different landscape elements alongside a number of primary principles, this allows different disciplines and practitioners to utilise elements of green infrastructure in their research. However, if a list of green infrastructure components is developed, it would include specific landscape elements but also approximations of size or scale, design principles, and more conceptual ideas (e.g. soft and hard landscapes). An attempt at such a categorisation is shown in Table 9.1. A list of this nature also suggests that the role of both terrestrial (green) and water (blue) infrastructure elements are potentially of equal importance. This diversification can be divided further into public and private spaces, agricultural land, forests and woodlands, parks and gardens, urban and urban-fringe green spaces, thus noting the diversity of spaces that people note as constituting green infrastructure. This also presents one of the issues raised relating to any attempt to add specific landscape elements to a definition, as it becomes difficult to address all elements and thus requires a hierarchy of value to be prepared.

Table 9.1. Proposed elements, scales and initiatives of green infrastructure

Element of green infrastructure	Scale/Size of green infrastructure resources	Initiatives or conceptual ideas supporting green infrastructure
Forests, wetlands, floodplain, streams, all green spaces, open spaces, water resources, parks, nature, reserves, greenbelts, working landscapes, rivers, lakes, wellhead recharge, green roofs, sustainable transport routes, waterways, street trees, open countryside, semi-natural and natural landscapes, community forests, city farms, woodlands, grass, flora and fauna, green walls, gardens, school yards	At least 250 acres(approx 1km ²) for hubs, 1100ft (approx 335 metres) wide for corridors, core areas and wider connected landscapes, interconnected systems approach, urban, urban-fringe, rural,	Smart Growth, soft vs. hard landscapes, sustainable transport, finger plans and green seaming, connectivity, public vs. private land

The role of defining green infrastructure and what it constitutes has therefore been aided by the development of a set of green infrastructure principles in Chapter 6, which proved comparable to those outlined in Chapter 2. The principles discussed in Chapters 6 and 8, and within this chapter, propose a number of characteristics that have been argued as being fundamental to green infrastructure. The continued use and discussion of these principles provides a firm foundation for green infrastructure utilising notions of sustainability, scale, strategic planning, but also access, connectivity and quality of life indicators. The presentation of the working definition proposed in this chapter is one stage in developing this process and consequently promotes the diversity in practitioner and academic thinking and its values for green infrastructure in different landscape management organisations.

9.3. Is there a consensus in green infrastructure thinking?

Whether there is a consensus regarding what green infrastructure means is still somewhat unclear. A number of respondents discussed commonalities and characteristics they believed underpinned green infrastructure in Chapter 6. However these differed between respondents. Where commonalities were found a number of the common principles were presented and it appears that, where green infrastructure is developing a clear focus, it is based on a number of specific principles. This is perhaps to be expected as respondents who expressed positive signs of a consensus have been at the forefront of green infrastructure development. However, where differences or a lack of a consensus were noted a broader range of ideas, including discussions of green infrastructure elements, its conceptual underpinnings, and how it should be developed, were suggested addressing the concept's diversity and lack of a clear vision. Respondents also noted the contrasting views of the basic elements of green infrastructure, e.g. hard vs. soft landscapes and green vs. grey infrastructure. By discussing these different interpretations, respondents, including Bob Brown, outlined that they felt that there was still uncertainty relating to what green infrastructure is. Discussions were also made relating to the concept's actual value in planning theory because of the range of other green space planning concepts already in use. This poses an interesting question of whether there is actually a need for consensus and whether such a consensus for green infrastructure is achievable or desirable. This argument is still open to debate.

In contrast to the respondents who were unsure if a consensus will develop, those who do used a number of the same arguments to support their views. Using the notions of soft vs. hard and green vs. grey, respondents such as Paul Selman highlighted that the differences in characteristics actually promote the inclusion of a broader number of principles. Respondents noted that this variation in thinking may lead to the production of a more coherent understanding of green infrastructure. By comparing elements and ideas, these differences may mean that researchers and practitioners have to find the links between these characteristics which allow them to develop a clearer vision of what green infrastructure is. Consequently, through a continued discussion this proposes that a level of consensus is achievable as the basic elements of the concept become established. The production of a set of criteria or characteristics that explain what green infrastructure is would therefore provide a firm platform that researchers could utilise to support their future research. The production of a new definition and an outline of its supporting elements presented in Table 9.1 therefore attempts to address this need.

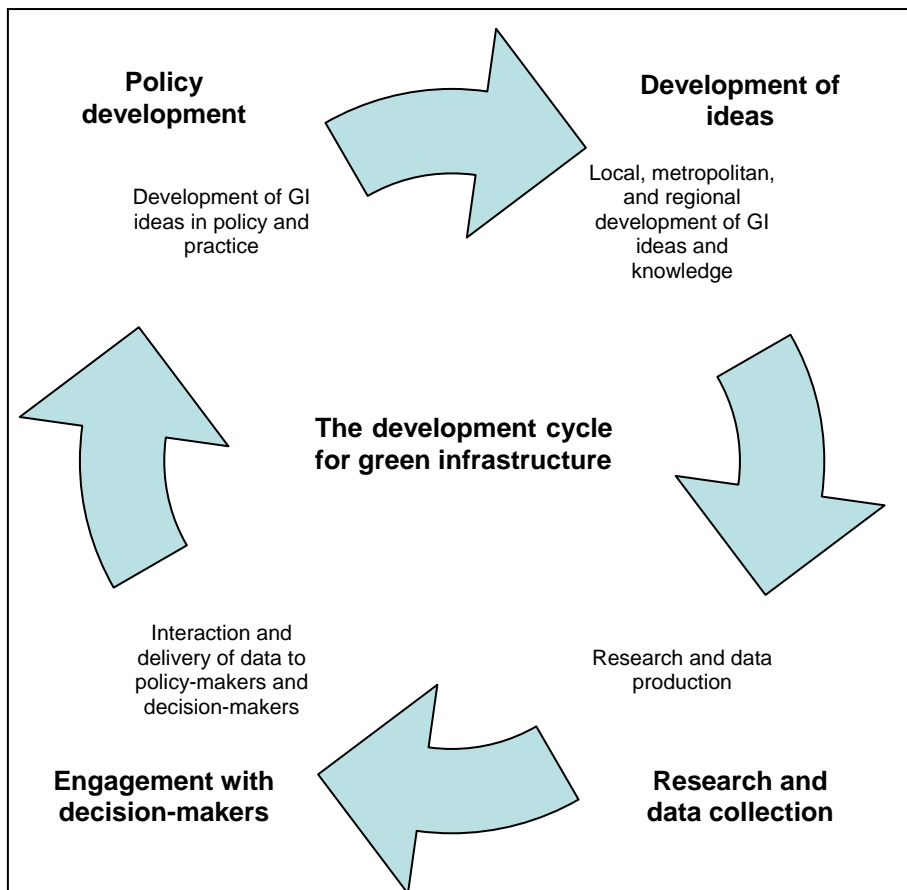
A set of criteria would also provide clear links between the theories that underpin green infrastructure (e.g. landscape ecology) that could be used to promote future inter-disciplinary research. The continued discussion of green infrastructure in academic, practitioner and policy forums suggests that a consensus between decision-makers and researchers is achievable (Natural England, 2009). This may also address some of the problems currently facing the concept, most notably the diversity in focus and fragmentation in use (Kambites and Owen, 2007). Further development of these core principles could support a broader acceptance of its values and promote its use to a far greater extent in both the generation of theory and in planning practice (Mell, 2009). This process may lead to wider uniformity in green infrastructure thinking and proposes a continued development of the concept but

also advocates further research and policy initiatives. This thesis, therefore, argues that it is desirable to achieve such a state of consensus to promote a set of characteristics that stand up to the rigors of academic and practitioner debates. Viewing green infrastructure as a dynamic concept that is still evolving is therefore an important acknowledgement made by this thesis. As green infrastructure is currently being expressed in a number of ways, it becomes more apparent that a grounded set of principles is needed if the widest audience is to be reached. Consequently, continuing variation makes it harder to integrate these audiences because of the lack of clear guidance for green infrastructure development (Natural England, 2009; Landscape Institute, 2009).

9.4. The role of green infrastructure champions

To achieve this consensus, green infrastructure must develop into a broad inter-disciplinary research field. However, this development has been heavily dependent on a small number of organisations and academic researchers who have promoted its values. The role of environmental organisations, including the Community Forests Partnerships and Natural England in the UK and the Conservation Fund in the USA, has been able to provide important research developing the concept's key principles and helped to establish a supplementary evidence base supporting their views. These organisations have also played a role in promoting the concept by acting as intermediaries between evidence collection and the reporting of information to the national structures of planning decision-making. Advocacy of green infrastructure as an appropriate landscape management process has therefore been a primary role of these organisations and is an essential component of green infrastructure development (Kambites and Owen, 2007).

Figure 9.1. The green infrastructure development cycle



With the continued support of organisations including Natural England (UK) and the Conservation Fund (USA), the evidence base supporting green infrastructure continues to grow and become debated within relevant research and practitioner forums (e.g. RSS or state green infrastructure programmes, Weber *et al.*, 2006). The role of such organisations in lobbying national organisations has therefore been crucial in the development of green infrastructures to date. The latest RSS have been a good example of this process, highlighting how strategic policy at a regional scale is influenced by green infrastructure research. By obtaining project funding for green infrastructure development, a number of values have been proposed, supported and subsequently integrated into the focus of strategic core documents and implemented by Natural England. This process needs to continue as, although the Conservation Fund and Natural England have positioned themselves at the confluence of policy development and practical implementation, further evidence is still needed to highlight economic and social value of green infrastructures to policy makers. The green infrastructure plans developed in Stockton, St Edmundsbury, Cambridgeshire and Harlow all present examples of this process in practice with varying levels of success.

The role of these champions has been to develop links between the conceptual ideas of green infrastructure and its uptake into planning policy and subsequent implementation plans. England's Community Forest, Natural England, and the Conservation Fund have all promoted a range of values they believe green infrastructure provides for development based on the principles outlined in Chapter 6. Access, connectivity, conservation, and social and economic development are all discussed providing a number of characteristics for inclusion in the development of green infrastructure implementation. These organisations have also provided a forum for evidence collection, analysis and knowledge exchange, reinforcing the call for further green infrastructure growth. A cursory review of the Conservation Fund's website emphasises this view and, by examining the scope of project variety supported by this organisation, it is clear that green infrastructure can and is being developed at all scales and in diverse locations.

This advocacy role should therefore not be underestimated as, although there has been a joint development of green infrastructure in academic and practitioner research, practice-led research is proposed as potentially holding a greater ability to influence and engage the governance structures of planning policy (i.e. Figure 9.1). Consequently, academic research may hold a primary position in developing the conceptual principles of green infrastructure in order to promote specific characteristics that can then be developed by environmental organisations to influence planning practice.

9.5. Green infrastructure and Community Forestry

Advocacy of green infrastructure in practice has been discussed in relation to community forestry throughout this work. Over the last five years (2004-2009), several of the Community Forests have developed green infrastructure as part of their core functions as a way of meeting changing ecological, economic and social agendas. These changes have seen their land management options decrease and their role as advocates develop. Blackman and Thackray's (2007) review of community forestry's use of green infrastructure outlines a number of areas where the concept has been successfully integrated into landscape management practices. This work promoted the links between

green infrastructure principles and community forest planning presented in Chapter 8, discussing how England's Community Forests are in an almost unique position of being able to *test* the development of multi-scaled and diverse landscape benefits using green infrastructure.

In the future, this relationship will potentially evolve to include a wider range of landscape management processes. Consequently, the core activities of the community forests are adapting to ensure green infrastructure is brought to the fore of their work in order to attract funding and promote their influence to RDAs. The focus that England's Community Forests have taken has, however, been both informative and innovative to the wider debates on the concept. As a result, the position of community forestry as one of the main delivery agents of urban-fringe green infrastructure project work has provided them with a number of options for establishing effective landscape management techniques. By combining the new terminology of 'green infrastructure' with an already varied portfolio of projects, they have been able to diversify both their focus and knowledge accordingly to the contemporary challenges in landscape planning. This contrasts with the more direct advocacy roles of statutory bodies in the UK. Natural England may have a smaller delivery role but have a proportionally higher influence on the formation of policy and implementation plans at a regional and local scale. Community forestry is, therefore, an attempt to integrate their advocacy of green infrastructure with appropriate developments of resources. It may therefore be suggested that the Community Forest Partnerships have been exceeding expectations in their capacity to deliver green infrastructure (conceptually and in delivery terms) when compared to the organisational structures and financial backing of Natural England or CABI Space.

However, the work of NECF and the Mersey Forest discussed within this thesis has been prominent in the development of green infrastructure in the UK. The NECF and the Mersey Forest have each produced research highlighting the multi-functional nature of green infrastructure planning (Davies *et al.*, 2006; Gill *et al.*, 2007), providing a structured set of options and evidence relating to green infrastructure development. Although the ideas behind the NECF planning guide may not have been revolutionary, its development was one of the first examples examining the relevance of green infrastructure to local and regional planning policy. The latest round of RSS reports also highlighted this approach and England's Community Forests were prominent alongside Natural England in leading the call for green infrastructure to be included. The Community Forest Partnerships achieved this advocacy position by developing evidence from green infrastructure projects and delivering these benefits on the ground. The development of evidence that can be integrated into planning policy and achieved in practice has been strongly emphasised in the research literature, providing each Community Forest with both conceptual and practitioner support for their work (Kambites and Owen, 2007; Blackman and Thackray, 2007).

Further evidence supporting the role of the Community Forests is located in the innovative use of green infrastructure, which they have viewed as being both multi-functional and multi-scaled. This has meant that the Community Forest Partnerships have been able to apply its principles of green infrastructure to a number of their activities, from tree planting and green exercise programmes to wider landscape management projects. All of these activities have enabled green infrastructure to be

debated and planned for as multi-functional green spaces but also, and perhaps more importantly, as green spaces that can be developed in a range of landscape planning scenarios.

Green infrastructure has therefore been used as a way of refocusing community forest activities in terms of their landscape management priorities, the scope of their work programmes, and the accessibility of funding. This process has allowed the Community Forest partnership to be placed in a similar category to Natural England as one of the most prominent voices in UK green infrastructure development. Moreover, this position has allowed the Community Forest Partnerships to influence planning policy at a regional level whilst delivering green infrastructure with a local and occasional regional focus. However, although green infrastructure development has focussed on a broad range of ideas, subsequent research has been developed focussing more directly on specific issues in contemporary planning, e.g. climate change or health and well-being.

9.6. Health: opportunities, motivation, access, support

The health benefits of green infrastructure have already been elicited in this thesis (Chapter 7), showing the importance of the links between access to green space, physical and psychological well-being, and the role of connective green infrastructure networks. The links between the landscape and health have been reported in a range of literature, stating that access to green space and the motivations to use these spaces support improved and prolonged personal health (Grahn and Stigsdotter, 2003; Maas *et al.*, 2006; Florgård and Forsberg; 2006; Erkip, 1997). Examples are also available that review the restorative value of physical space (Ulrich, 1986), green infrastructure as a motivator to use spaces (Sibley, 1995), and green infrastructure as a facilitator of greener lifestyles (Nielson and Hansen, 2007). Research examining green exercise is one area where green infrastructure is seen as encouraging these links, suggesting that there is a correlation between the availability and access to space and the motivations to use them. This is a view also presented by the NHS and PCTs in the UK (DoH, 2004). Green exercise programmes, therefore, promote the links between access and motivation enabling people to utilise green spaces for a variety of physical and psychological functions. Green infrastructure, therefore, has the potential to meet the Department of Health targets for improving physical and mental health by emphasising the value of personal interactions with the landscape compared to the use of medication (DoH, 2004; Mell, 2007).

It can therefore be argued that green infrastructure provides an approach to planning practice that supports the notion of 'liveability' and its influence on the value of a location. Liveability has been defined as the way in which a landscape fulfils the wants and needs of a given population whilst simultaneously providing opportunities for economic investment and development. Bischoff (1995) approaches the view from an aesthetic perspective, stating that natural settings, e.g. trees and attractive plantings, can actually mask industrial or commercial properties and increase the aesthetic quality of a landscape, thus promoting a wider use of that space despite its underlying built infrastructure. Similarly, Ulrich (1986) proposed that green space was an aid to health and post-operative recovery, a view that formed the basis of recent holistic and restorative approaches to post-operative recovery (DoH, 2004). Both Ulrich and Bischoff argue that the nature or composition of the physical environment affects social interactions and human health responses to it. Research by Sibley

(1995), Burgess *et al.* (1988) and Gilroy (1987) also highlights this process, noting that the physical landscapes directly influence the way in which people use and interact with their environments.

Green infrastructure could therefore be used to aid the development of a greater proportion of high quality spaces. In achieving this, a number of the UK government's health, social mobility, and enterprise targets could be met. Investment in the landscape may therefore present one of the most cost-effective methods of lowering public expenditure on health and social regeneration. However, any green infrastructure development needs to be aware that perceptions of the landscape are reviewed through a number of layered interpretations. Spaces thus need to entice, encourage and motivate people to use them in order to aid personal or communal (physical and psychological) well-being. However, although the conceptual development of green infrastructure is being addressed in academic and practitioner discussions, there is still a need to assess how people view green spaces in order to understand how best to develop it. This is addressed in the following section.

9.7. Perceptions and interpretations of green infrastructure: integrity, vision, voices

Chapter 7 outlined how perceptions of green infrastructure affect the use and interpretations of the landscape. It was suggested within this discussion that perceptions were based on a complex interaction between stimuli, e.g. personal experience (childhood) and the physical landscapes around people (composition and location). These factors influence an individual's ability to build a catalogue of experiences, memories and values that can be used to interpret what people see around them. Consequently, this process focuses interpretations of a space in conceptual or relative terms, a distinction which was discussed in Chapter 7. The results outlined in Chapter 7 also suggest that perceptions of a space are based on an interpretation of that space's function, its location, and its composition. However, there are also a number of factors why people label or identify spaces as exclusionary, dangerous or less valuable. Consequently, the combined role of form, function and location need to be considered carefully if a better understanding of green space perception is to be made.

This therefore suggests that interpretations of green infrastructure can be developed through a dual-layered system of perceptions. These layers allow people to either a) review the immediate stimuli solely in its current context, or b) take longer to assess the situation, reviewing it in terms of previous experience or knowledge. A process of understanding based on immediate vs. consulted interpretation is therefore being proposed here. This system links with the work of Lefebvre (1991) who discussed spaces of immediate experience and spaces of more considered representation. The implications of these two processes are that one offers a snapshot of the immediate influences of interpretation compared to a more in-depth analysis of a longer interpretation. In terms of the discussions presented in Chapter 7, this thesis proposes a link between what people value and what people do not and the subsequent interpretation of the landscape. Reviewing what people value in a landscape suggests that people predominately propose ecological features as being valuable. These are landscape elements that are easily identifiable and thus promote the use of an immediate system of perception.

When these ideas are compared to negative responses of the landscape there are marked contrasts. People most frequently expressed psychological or social interpretations of a landscape as the reason for not liking a space. These interpretations are based on a system of more in-depth interpretation that take into account past experience, knowledge, and a conceived understanding of a space. The difference is that what is being seen is identified and interpreted through a much wider set of criteria than with immediate interpretation. Criteria are therefore assessed to produce a relative interpretation of the space being viewed rather than an immediate one. A relative interpretation proposes that other factors are being examined (e.g. fear, freedom, happiness) that are added to the physical characteristics of an image or space (Rodaway, 1994; Valentine, 2001). Consequently, any review of a space using a representational viewpoint will be imbued with a much deeper level of analysis than that of an immediate interpretation of the landscape (Green, 1995; Kaplan and Kaplan, 1989).

Figure 9.3. Different elements of perception and interpretation

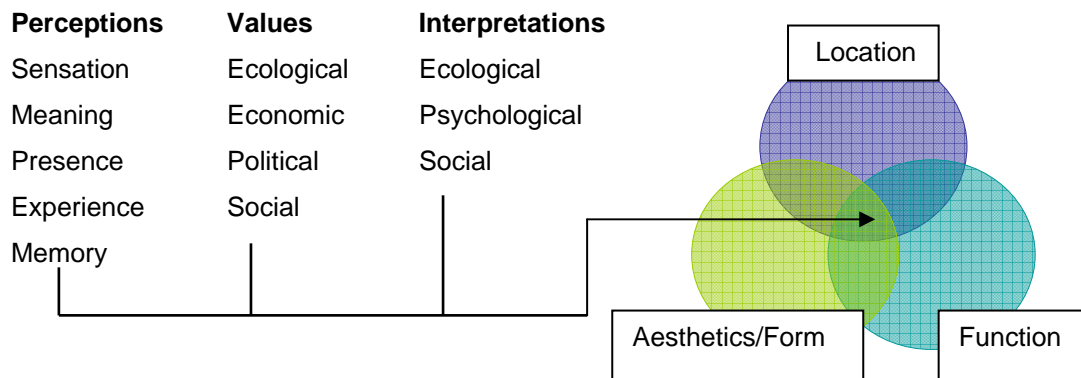


Figure 9.3 shows a number of the areas that influence perceptions of the landscape. Each element was identified in Chapter 7 as holding a value in the interpretations of a given landscape. By including a number of psychological and social ideas, perception can be viewed as a complex organisation of knowledge, experience, and sensation. In terms of the physical landscape, these do not necessarily elicit a high number of responses but can be elements used to interpret social understandings of it. Therefore, a continuous process of interpretation and negotiation between a person's immediate review of a space and their deeper understanding of its values and meanings is taking place. Ideas of spatial interpretation and recognition, therefore, propose a number of links between the use of a space and our interpretations of different landscapes (Ingold, 2000). Thus a constant review of a site's ecological context, location and function, and our own experiences, underlie patterns of interpretations and perceptual trends. Furthermore, a combination of spatial and personal perceptions is used to assess the value of a green space. This highlights the way in which different ecological, psychological and social elements interact in order to inform a person's judgements. Subsequently, although there are specific differences noted in the literature, this thesis suggests that it may be prudent to argue for the use of a simultaneous approach to interpretation and representation rather than splitting these areas into actual (immediate) and perceived (considered) interpretations of space. Thus, as Harvey stated:

The space and times...that envelop and surround us as we go about our daily lives likewise affect both our direct experiences and the way we interpret and understand representation [of space].

(Harvey, 2006:131-132)

Moreover, the ways in which we view the landscape can be broken down into component elements that are collectively more valuable than their individual parts. When reviewed together, the role of ecological, physical and social factors provide a deeper view of a landscape, examining each component and its relationship to the world around us. Thus, in Chapter 7, physical, psychological and social influences were presented as the reasons why people valued a space. This supported the view that the value of a space is developed through a series of interpretations of how people negotiate the physical world against their preconceived notions of psychological and social value. This discussion promotes a view that the interpretation of green infrastructure (like green space and the landscape) is based on a number of factors reviewed simultaneously. Interpretations therefore involve the processing of information and propose a didactic process of understanding (Nassauer, 1997; Appleton, 1995). The value of personal interpretation may, however, be of use to planners and landscape architects as an understanding of the landscape may benefit the development of new green infrastructure resources. Subsequently, the exchange of knowledge and education is needed to relate the value of the concept to a wide audience if an acknowledgment of green infrastructure value is to be achieved.

In terms of value to planning policy, landscape perceptions offer planners and landscape managers insights into how people assess the environments around them. Although the data discussed in Chapter 7 outlined the role of ecological factors on positive perceptions and psychological or social factors on negative ones, this relationship is not straightforward. Both the physical landscape and the interpretations of these green spaces are important components of its use. Landscape managers and planners, therefore, have to be aware of the context, be it social or physical, of a green space and acknowledge that these spaces are complex amalgams of elements and experiences. Landscape policy may therefore benefit from an inclusion of such ideas in the form of public participation or consultation. Through a discussion of landscape perceptions, landscape managers can develop criteria and implementation practices that lower the negative associations of landscapes and promote positive perceptions of inclusivity, safety and multi-functionality in their place.

9.8. Green infrastructure, education and awareness

Raising educational awareness of green infrastructure was also identified in the discussions of perceptions as being important to our understanding of the landscape. Chapters 6 and 8 outlined the role of education supported by Natural England or the Conservation Fund in developing the green infrastructure concept. A number of respondents noted how the dissemination of green infrastructure and its research will underpin its uptake in academia and in practitioner implementation. Consequently, a process of continual green infrastructure education is proposed within academic, practitioner and policy spheres to allow current research and analysis to be discussed in the most appropriate forums (Williamson, 2003; Countryside Agency, 2006). This dissemination could take the form of teaching within academia, the reporting of the key green infrastructure messages in

conference papers and journal articles, and additional practitioner education through workshop and seminars, but also in planning policy through an increased dialogue between researchers, planners and decision-makers. In the UK, Natural England is an example of this as they have been successful in promoting workshops, policy guidance and officer advocacy in order to improve practitioner understandings of green infrastructure. Likewise, the Conservation Fund has performed a parallel role in the USA.

At present there appears to have been a progressive dissemination of the values of green infrastructure in the research of a range of academics and practitioners, each of whom have presented evidence in the form of education or awareness, raising reports of the values associated with the concept (Kambites and Owen, 2006). However, Jack Ahern and Paul Selman both argued that this process needs to be supported by a clear strategy of how the concept should be disseminated within the key areas of academic and practitioner education. Therefore, the development of a clear understanding of what green infrastructure is, an evidence base to support these statements, and the reporting of this information are key aspects of its potential success. Signposting or emphasising the development of these processes is therefore crucial to assessing the value and uptake of the ideas being presented. This process may benefit from the development of a set of guiding principles for green infrastructure which outline future opportunities for green infrastructure planning. It will also gain credence through increasing discussions in international forums (e.g. the Fábos Symposium) or in national guidance (Natural England, 2009).

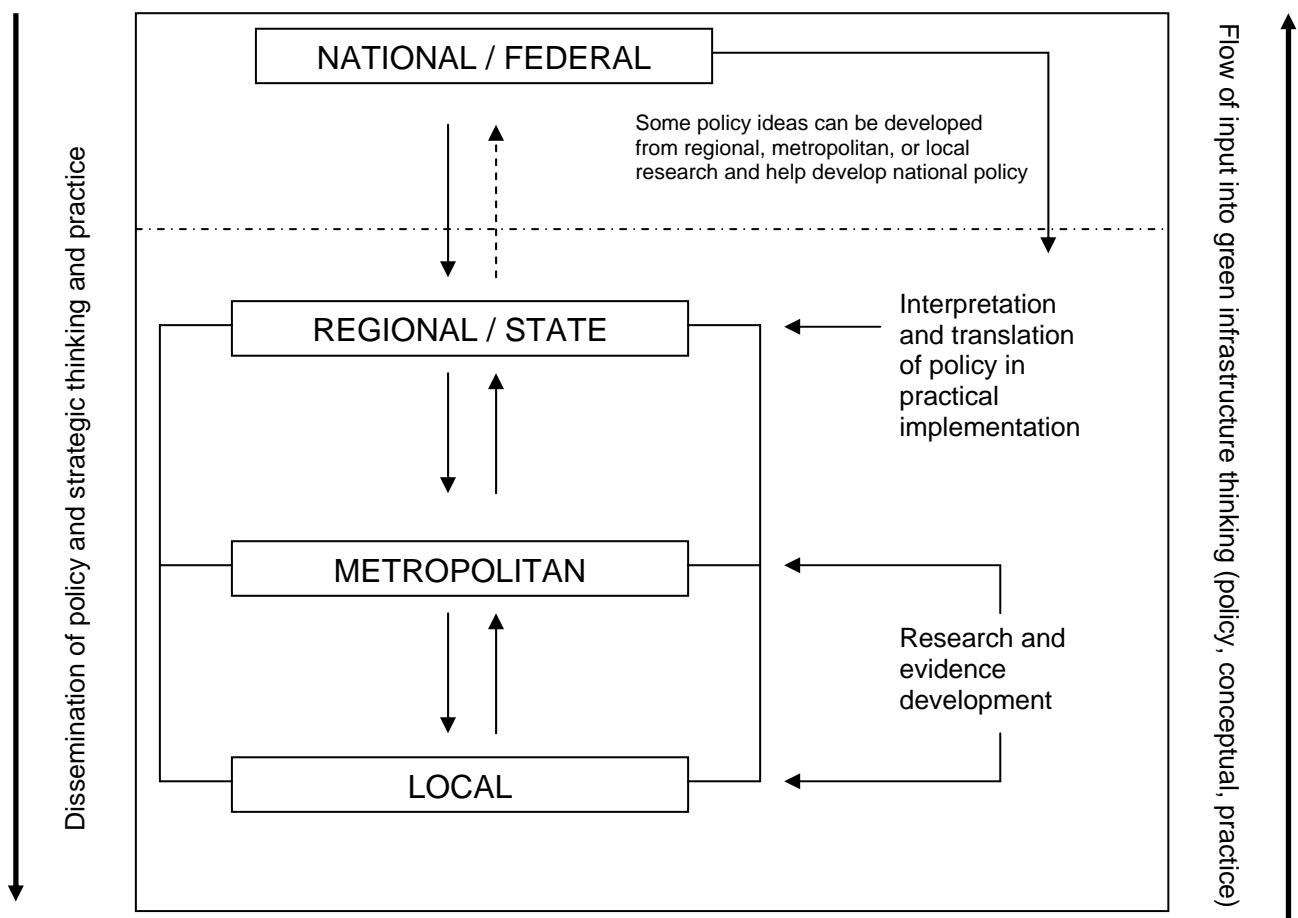
This process could take the form of expert teaching and educational programmes such as those discussed by Will Allen of the Conservation Fund or in the work of the Community Forests. However, although there is scope to develop such programmes, financial and political support for green infrastructure also needs to occur if these programmes are to be successful. Events or programmes of this nature may also benefit from a clear outline of what green infrastructure is and where opportunities for development lie, issues that have been addressed in Chapters 6 and 8. Thus, a clear research agenda, a definition, and a comprehensive set of case studies should be developed to support such programmes. If this process succeeds then a greater integration of green ideas may be seen in practitioner and academic programmes. Evidence from the Conservation Fund's education programme suggests that this is being achieved and is allowing the values of green infrastructure to be disseminated to a wide audience of environmental practitioners. This point will also be outlined in the recommendations made in the following chapter.

9.9. Integration, interaction, and multi-functionality (*matrix of ideas, advocacy, engagement*)

At the outset of this research the terms, integration, interaction and multi-functionality were noted as key components in developing a green infrastructure approach to planning. Over the course of writing this thesis, these terms have become increasingly relevant to the ongoing development of green infrastructure, a view that is supported in the expanding research literature. The international Fábos Symposium (March 2007) held at the University of Massachusetts is one such example where green infrastructure has been proposed as being potentially one of the most significant processes supporting

sustainable landscape management (Mell and Roe, 2007; Rottle, 2007). Extensive references were also made calling for the need to integrate green infrastructure policy with implementation plans to improve the dialogues between planners, the public and developers. In the current climate, where liability for planning sustainable spaces is placed on the developer or planner, the use of these processes are becoming more prominent (DCLG, 2009). Installing a framework that integrates a green infrastructure approach, which supports interactions between powerful actors, would therefore appear, in theory, to improve the quality of green space planning. In essence, integration and interaction could be viewed as co-operation and support within planning circles, areas that have been proposed as major components of an effective and transparent system of planning (Cullingworth and Nadin, 2006; Kambites and Owen, 2007).

Figure 9.4 Development of green infrastructure thinking



Reviewing the research literature alongside the responses outlined in Chapters 6 and 8 show that this process is beginning to take shape. Subsequently, the values attributed to green infrastructure and the forums where it is being discussed are providing it with a greater level of exposure. This in turn has allowed decision-makers at local and regional levels to integrate a number of green infrastructure ideas into their strategic policy and implementation (i.e. LDFs or RSS). It can, therefore, be argued that a positive process of interaction between practitioners, decision-makers and researchers has started to develop. This process has allowed a greater depth of thinking that reviews the spatial

distribution of green infrastructure and its value in terms of developing sustainable places (DETR, 2000), Green Urbanism (Beatley, 2009) or Sustainable Communities (ODPM, 2005).

The integration of green infrastructure thinking into policy has relied relatively heavily on the development of evidence and data to support its use. Here, regional champions like Natural England and the Community Forests have played a pivotal role in acting as conduits providing sufficient and appropriate data for analysis (Countryside Agency, 2006; Blackman and Thackray, 2007). These organisations have been able to consistently discuss the role of green infrastructure as a mechanism for delivering improved landscape functionality and support sustainable landscape management. The development of an integrated process for research in conjunction with appropriate decision-making structures has therefore been an important factor in the development of green infrastructure planning. Alongside the development of a number of underlying principles, the development of a green infrastructure approach to planning which proposes diversity in landscape function has also been important. However, the interaction between environmental organisations and the integration of appropriate data still requires support from other regional and local actors if green infrastructure is to continue to grow as a central component of landscape planning.

Figure 9.4 outlines such a framework, proposing that there is potentially a far higher level of integration between local, metropolitan and regional planning structures that could effectively be used to promote green infrastructure. In contrast, the ability to translate this evidence and analyse to a national level appears to show a lower level of integration. This supports the views of Selman and Littlewood in Chapter 8, where they noted that a local or regional scale focus for planning appears to work more effectively because of the greater links between the two compared with translating national policy to the regional scale.

Figure 9.5. Green infrastructure planning and the statutory planning system

(Source: http://www.greeninfrastructurenw.co.uk/resources/GI_for_the_Liverpool_&_Manchester_city-regions.pdf)

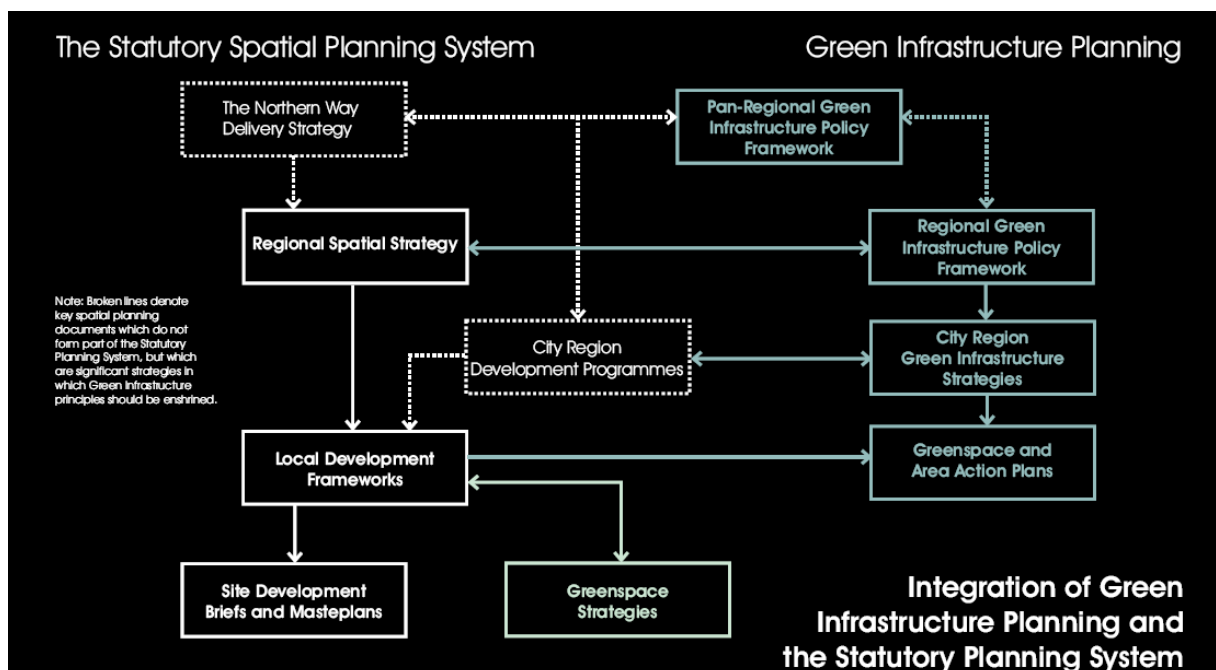
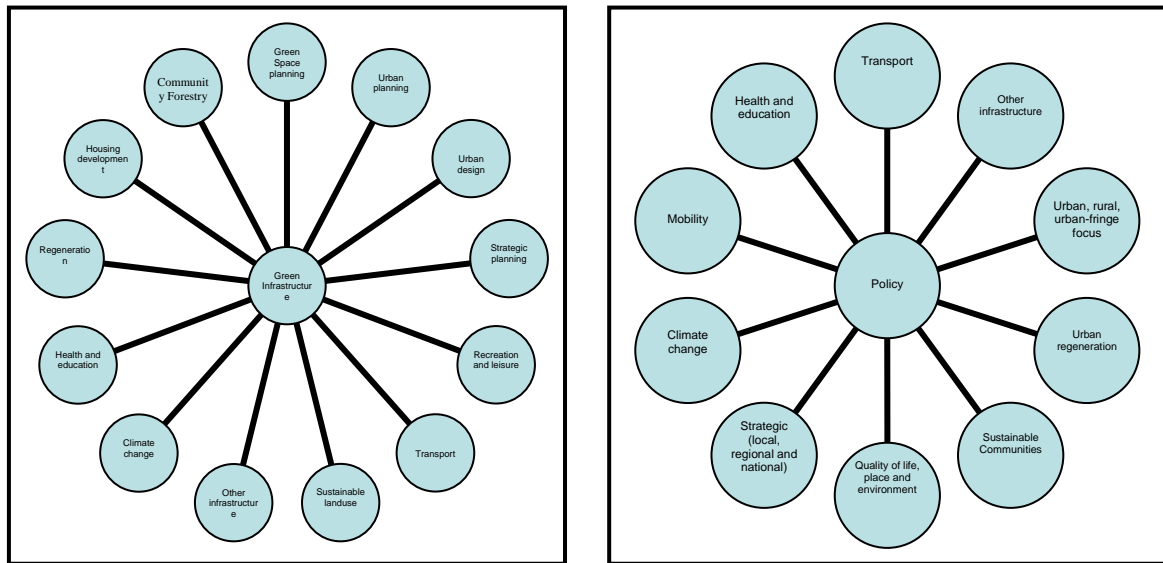


Figure 9.4, however, highlights a very idealistic view of the feedback mechanisms between central government, regional and local planning policy. It suggests that there should always be a flow of ideas, evidence and policy between each of these four levels. This process, however, is not necessarily always followed. Consequently, the relationships between policy-makers in central government may propose and outline new policy ideas which metropolitan or local level planners may feel are inappropriate. The evidence presented by the Conservation Fund in the USA emphasised this dislocation, as did Ahern who also stated that there is a fragmented system of reporting and policy making between regional and state bodies. However, this process is not reciprocal, as central government may find that local interpretations of planning policy fail to meet their strategic objectives. Therefore, although Figure 9.4 portrays an idealised view of the transition of policy, practice, and evidence collection, it does infer that the system of policy translating to practice is relatively static. However, because green infrastructure can be discussed at a number of scales and by a number of different actors, it can be classified as a dynamic or flexible approach to planning that infers change and development rather than the static system noted above. This view was described in the feedback from regional green infrastructure champions in Chapter 8, who noted that interactions have to be developed and nurtured to achieve the most appropriate feedback.

Figure 9.6. Conceptual and disciplinary elements of green infrastructure ⁸⁴



The discussions presented in Chapters 6 and 8 both noted that green infrastructure policy is being developed at each of the scales shown in Figure 9.4. Subsequently, there appears to have been a flow of ideas both towards the centre of government policy formation and also to a more localised use of these ideas. Green infrastructure, therefore, appears to hold a key position in translating policy between these two areas and fosters an increased dialogue between planners, developers, and policy-makers. This relationship is, however, also a dynamic process and consequently green infrastructure has to constantly evolve to meet the changing objectives of these planning scales if it is to continue being discussed and debated. The changes seen in PPS1 and its SPD highlight how policy formation can, and does, change over time as new evidence is integrated into existing

⁸⁴ Both of these radial diagrams were developed as mind mapping exercises to outline where green infrastructure and its associated research areas could be located.

legislation. Green infrastructure planning can thus be said to be undertaking the initial stages of this process.

If Figure 9.4 highlights an idealised view of green infrastructure planning and the planning system, then Figure 9.5 proposes an interpretation of this process drawn from the North-West of England. Figure 9.5 highlights the current statutory policy components, i.e. LDFs and RSS, but also outlines where green infrastructure plans can be integrated into this system. It suggests that the system of interaction can work at different scales and green infrastructure can be viewed as being a suitable approach to planning at each. Figure 9.5 does not, however, show the links between regional and local planning processes and those at the national level compared to Figure 9.4. Therefore, although it highlights a number of inputs for green infrastructure, the translation of these ideas is not shown.

A combined discussion of Figure 9.4 and 9.5 thus suggests that green infrastructure planning can be developed at a number of scales. However, this should be viewed as a dynamic system of inputs, evidence development and reporting from local and regional levels to a national scale. Any subsequent national level policy would then be based on grounded evidence which can be expressed in planning policy and fed back into the planning system at a lower level. The system outlined in 9.4 can therefore be used as a basis for this process.

9.10. Policy: geographical, administrative, spatial connectivity

The role of integrating green infrastructure research and practice is still viewed as a somewhat fragmented process. The work of Kambites and Owen (2006) highlighted this issue and outlined a number of areas where green infrastructure was proposed as an essential element of landscape planning (see Fig. 9.6). Their work suggested that green infrastructure should be developed specifically around the idea of connectivity as they propose that connectivity be discussed in terms of spatiality, administration, and policy integration to support successful green infrastructure development. In Chapters 6 and 8, the role of connectivity was discussed, examining the complex relationships between different elements of green infrastructure thinking and its translation into implementation. The two figures outlined in Figure 9.6 show how different concepts can be connected to green infrastructure, proposing that the concept does not rely on one area for its evidence and can therefore meet a diverse range of challenges.

Figure 9.6 also shows the conceptual connectivity between disciplines and policy areas which support current and future green infrastructure thinking. If these areas are reviewed in terms of Kambites and Owen's work, then these are the ideas that advocate their five categories of connectivity⁸⁵ and promote the integration of policies and implementation tools with green infrastructure principles. This proposed level of inter-connectivity, therefore, suggests that green infrastructure can provide a focus for inter-disciplinary research. Health and education have already been discussed (Ulrich, 1986; Randrup, 2006) but urban planning, housing or sustainable engineering could also all be debated as

⁸⁵ a) spatial connectivity, b) connectivity between social and ecological functions, c) connectivity between different human users, d) administrative connectivity, and e) connectivity between different parts of the organisational structure of local authorities.

supporting these links (Ferguson, 2002; Luymes and Tamminga, 1995). These areas also support a process outlined by Ahern (2007), who noted that green infrastructure should be developed through the following five stages:

- a) Articulated spatially.
- b) Strategically planned.
- c) Developed as a process of greening infrastructure.
- d) Planned for multiple use.
- e) Developed as a system of learning by doing.

Ahern (2007:274-275)

Ahern repeats some of the principles of green infrastructure discussed in Chapters 6 and 8, proposing the development of a series of green infrastructure planning characteristics. Ahern's process complements Kambites and Owen's view of green infrastructure in linking the strategic thinking of a green infrastructure approach to planning and implementation. They go to propose five additional stages in green infrastructure development:

- a) Connectivity is an essential attribute to GI planning.
- b) The development of an indicative process for GI planning.
- c) The need to embed GI planning in statutory planning systems.
- d) The need to involve the community throughout the GI planning process.
- e) The importance of a partnership approach to GI planning.

Kambites and Owen (2006: 489-490)

Ahern and Kambites and Owen both suggest that a number of priorities for green infrastructure planning can be used as a basis for effective and appropriate development. These ideas were reviewed in the analysis in Chapters 6 and 8, suggesting a clear set of guidance notes for green infrastructure planning based on a number of strategic objectives that different organisations can also discuss to aid green space development.

This raises the question of whether focussing green infrastructure on the five main principles⁸⁶ as outlined in this thesis presents the most useful approach for development. The frequency of responses outlining the use of these principles would suggest this is a worthwhile starting point. There is, however, still a need to integrate green infrastructure concepts further into deliverable planning policy. To develop green infrastructure further, specific policy initiatives or directives that advocate its role as a fundamental component of planning and development is needed, especially in terms of establishing statutory support for these processes. To successfully accomplish this, reference to green infrastructure needs to be made in policies relating to education, health, economic regeneration, housing renewal and climate change. Furthermore, planning regulations could also be adapted to provide a clearer understanding of green infrastructure in the development process. Recently, England's RSS and EIP reports have shown support for the green infrastructure concept in this way. Assessments of the green infrastructure strategies developed for the East of London (green grid) and

⁸⁶ a) Green infrastructure being developed with a joint ecological and social focus, b) green infrastructure should be developed at the appropriate scale, c) access to and connectivity between green infrastructures are essential to their use, d) green infrastructure should be thought of as a strategic process of landscape management, and e) green infrastructure should be integrated into all levels of landscape policy.

the South-West and for the Cambridgeshire growth points have all been identified as highlighting this process.

The next stage in this process would be to translate these ideas into specific or statutory policy to provide a framework for planners and developers to invest in green infrastructure as a standard component of development rather than as a supplementary process. Consequently, although the planning system is currently contributing positively to green infrastructure development (e.g. in Cambridgeshire and Harlow) a review of the most recent RSSs and EIPs suggests that there is still no universal acceptance of green infrastructure. The process of discussion and value attribution must therefore continue to acknowledge the benefits of green infrastructure. To aid the promotion of green infrastructure into planning practice, researchers and practitioners need to engage fully with the structures of planning policy-making. This should include an understanding of the evidence needed to support policy-making decisions and the development of SPDs, DPDs, and core strategy documents. At present, however, organisations like Natural England and the Community Forest network have been at the fore of delivering evidence to regional and national level policy makers (Countryside Agency, 2006; England's Community Forests, 2004).

Table 9.2. Areas for UK green infrastructure planning, policy, and implementation

SCALE	FOCUS	POLICY	IMPLEMENTATION (who)
National	Health, regeneration, education, housing, sustainable communities, climate change, transport, water, waste, health, green space	Sustainable Communities, Urban Renaissance, PPG, PPS, Sustainable Development, Transport, Climate Change, Water, Waste	DCLG, DEFRA, DCMS, DoH, DoT, DCSF, Natural England, Environment Agency, English Partnerships, Community Forests, Forestry Commission,
Regional	Health, regeneration, education, housing, sustainable communities, climate change, transport, water, waste, health, green space	Integrated Regional Framework, RSS, RES, RDS, LSA, Environment Strategies	RDAs, LAs, DCLG, Natural England, Environment Agency, Community Forests, PCTs, Water Authorities, Groundwork, Highways Commission, Forestry Commission, GI think tanks (e.g. NW, Northamptonshire)
Metropolitan	Health, regeneration, education, housing, sustainable communities, climate change, transport, water, waste, health, green space	City Plans, Community Forest Plans, MAAs, City Region, LAAs,	RDAs, LAs, city councils, councillors, Natural England, PCT's, Environment Agency, water agencies
Local	Community participation, sustainable communities, health, education	Neighbourhood plans, LAAs, Green Gym/Exercise, Street Trees,	LAs, Community Forests, Parish Council, Community groups, schools, outreach workers, parks and gardens managers

Natural England has also discussed the role of scale and strategic thinking in green infrastructure planning outlining its role in developing sustainable landscapes. CABE Space (2003) has been one organisation who had been seen to promote the function of green infrastructure in developing better places to live, work, and recreate. In Table 9.2, a number of areas within national, regional, and local planning are articulated where opportunities for future green infrastructure development exist. Again, this table shows the diversity that green infrastructure planning can address and proposes a number

of policy areas (e.g. RSS, LAAs, Community Forest Plans) where this process may be successful. Current policy making in Cambridgeshire highlights how regional and sub-regional policy can be supported with the development of a robust evidence base that can be used to facilitate strategic policy and identify appropriate green infrastructure development sites. Figure 9.4 also outlines a complementary process but highlights the linkages between different levels of planning.

In Figure 9.4, the interactions between the four levels of planning policy most frequently discussed in Chapter 8 and in the research literature (TCPA, 2005) are shown as interacting in different ways. In terms of the development of green infrastructure thinking, Ahern and Selman argue that it fits within each level of planning. The interactions proposed at the local, metropolitan, and regional level are policy translations into implementation plans but they also support research and evidence building. Within these three levels, green infrastructure thinking could aid the development of new evidence through which future policy can be influenced. Developing positive working relationships between ENGOs, RDAs and statutory bodies is therefore crucial if this process is to succeed. When compared to engaging policy makers at a national level, it appears that it may be easier to form consensus and policy at a regional, metropolitan and local level. Due to the structure of the delivery frameworks at this level, the Mersey Forest have highlighted mechanisms to develop this relationship.

Figure 9.4 shows that the distance between national and the other three policy levels is proportionally greater than the gaps between the delivery or dialogue of the other three policy levels. Owing to the system of data collection, debate, negotiations and timeframes that inform policy at a national level, it may be difficult for ideas from the other levels to quickly influence national policy. Figure 9.4 may also be interpreted as a network of dynamic interactions between different planning scales. Consequently, although Figure 9.4 appears to show a static system of influence, the flow of ideas and policy supports a dynamic process of interaction, co-operation, and integration. This also includes an understanding of both the perceived nature of the planning system (static or top-down) and the view of several respondents who note that planning is an evolutionary process of adaptation and change aimed at achieving equilibrium.

The development of planning policy is, however, a two-way process. Ideas and evidence submitted to national policy makers allows planners at a regional or local scale to engage with national debates. This process, however, needs to be supported by sufficient and appropriate evidence from local, metropolitan and regional decision-makers if focussed research is to be relayed most effectively to the national level. Figure 9.4, therefore, shows that there is effectively a two-tiered policy network associated with green infrastructure planning: a national level planning system that produces and disseminates policy, and a regional, metropolitan, and local system that translates and implements these initiatives. The proposed PPS on Eco-Towns and PPS12 are examples of this, whilst the green infrastructure city-region strategies produced for Leeds highlight the later process.

There are scenarios where the lower tier can, and has, influenced the upper tier: green infrastructure being an example. In terms of green infrastructure, this approach allows researchers in this lower tier the opportunity to deliver evidence and policy recommendations to national decision-makers, e.g. in

the development of the Natural England (2009) or Landscape Institute (2009) guidance on green - making expertise that can be used to engage national policy making. However, this is a continual process for infrastructure planning. Therefore, the system outlined in Figure 9.4 coupled with the areas of planning, suggested for further research in Table 9.2, provide an effective conceptual framework of evidence and decision that relies on the progressive development of green infrastructure and its use in implementation plans at local, regional and national levels. Suggestions are that this interaction between national and regional policy is becoming stronger because of the greater input of sub-regional and regional evidence into national planning policy guidance (DCLG, 2009).

9.11.1. Where next for green infrastructure? Shaping the ground to deliver the future

Although a progression can be seen in green infrastructure thinking, gaps are still apparent in its use in planning practice and policy that need be addressed (see 9.11.1-3). The latest round of RSSs showed that green infrastructure is now being discussed as a primary component in regional spatial planning, progression that now needs to be translated into a national level policy. This can be achieved through an active engagement with decision-makers at a regional and national level, as a robust evidence base examining the value of green infrastructure along with a number of regionally or nationally important empirical studies outlining similar values have been developed over the last five years (e.g. research developed by the North West Green Infrastructure Think Tank or Natural England).

This evidence may benefit from being translated into a regional policy framework to promote green infrastructure as a delivery mechanism focussing on the creation of multi-functional landscapes. Thus, green infrastructure can be said to support economic development, social mobility, and ecological conservation within local authority, sub-regional and regional documents. In terms of policy development, the work presented in this thesis argues that there are progressive links between green infrastructure and the visions of the Urban Renaissance (DETR, 2000), the CIAT agenda (Countryside Agency and Groundwork, 2005) and the development of Sustainable Communities (ODPM, 2005) and in meeting effects of climate change (Goode, 2008). By utilising components from each of these agendas, a green infrastructure approach to planning is proposed as a multi-faceted process that meets diverse ecological, economic and social needs. A specific planning policy for green infrastructure drawing on green space policy initiatives would therefore consolidate existing research or evidence and provide scope for policy makers to develop more focussed policy.

Whilst some may question the need for specific green infrastructure policy, there is clear scope for its inclusion into existing green space policy. PPG17, the supplementary elements of PPS1, as well as the Sustainable Communities and Growth Area initiatives, are areas of policy where green infrastructure can support their objectives. The latest RSS have shown there is scope to integrate green infrastructure into regional level planning policy and outlined a wide range of references to green infrastructure. What these all highlight most frequently is the need to provide green infrastructure with an ecological and social focus and to develop accessible and connective spaces that are grounded in financially stable and integrated policy. The RSS also promote the role of scale and strategic thinking in the development of green infrastructure. Each of these areas can be viewed

as supporting the links between current policy guidance and proposes that green infrastructure can be developed by effectively embedding it within statutory policy initiatives alongside the five main principles identified within this thesis. This would subsequently provide the conceptual and delivery elements needed to effectively support policy proposals.

A further value of green infrastructure is that it holds the potential to be applied to other policy areas. A large research literature exists linking health, education, regeneration, transport, inclusion and green infrastructure (i.e. Gobster and Westphal, 2004; Harrison *et al.*, 1995; Schönfelder and Axhausen, 2003; Fjørtoft and Sageie, 2000). Each of these policy areas has been discussed within this thesis, examining the links between the composition of green infrastructure and its value to human interactions with the landscape.

Figures from the UK Department of Health suggest that an overall increase in exercise would lead to better public health, thus saving the NHS over £500 million per year (DoH, 2004). Green infrastructure could therefore be used to meet social (and health) needs whilst also providing an alternative and economically viable system of primary health care. In terms of education, Scandinavian research has reviewed the value of outdoor exercise and teaching for the physical health and academic progression of children (Fjørtoft and Sageie, 2000), work that has been replicated by the Community Forest Partnerships. This research also explores the potential benefits to educational achievement associated with wider engagement with green infrastructure. English Heritage and the Heritage Lottery Fund have both examined this view, stating that the role of landscape in the teaching of local history is a functional and effective way in which to engage a range of demographic groups (English Heritage, 2002; HLF, 2005). Consequently, the links between social well-being and the landscapes are being promoted and reinforced as alternative ways of engaging the public with health and educational programmes. The promotion of these programmes may also enable people at local, city or regional scales to learn about the landscape and gain from the associated health and educational benefits. In economic terms, using natural resources provides local authorities with an opportunity to programme a wider range of appropriate programmes that can lower revenue costs in the long-term.

Regeneration targets have also been linked with green infrastructure planning. The CIAT agenda explicitly reviewed how the landscape could be used to aid regeneration of local and regional economies (Countryside Agency and Groundwork, 2005). This view has been expanded by CABI Space (2005d), who assessed the increases in property prices and the development of local business located within green infrastructure projects. CABI Space proposed that attractive spaces provide inclusionary spaces (social and economic), which translate into economic development and regeneration. Economic development and social well-being have therefore been discussed as equally important in the development of sustainable communities (ODPM, 2005). However, translating the economic potential of green infrastructure into implementation strategies is not an easy process. The development of green infrastructure policy needs to assess the form and function of a landscape (e.g. its utility) as well as review its management (revenue or on costs). Thus, by acknowledging the value of different functions, decision makers may be able to meet the challenges of changing ecological, economic, and social landscapes using green infrastructure as a basis for development. Natural

England have outlined this process in their national guidance and this practice has been assessed successfully in the North-West of England.

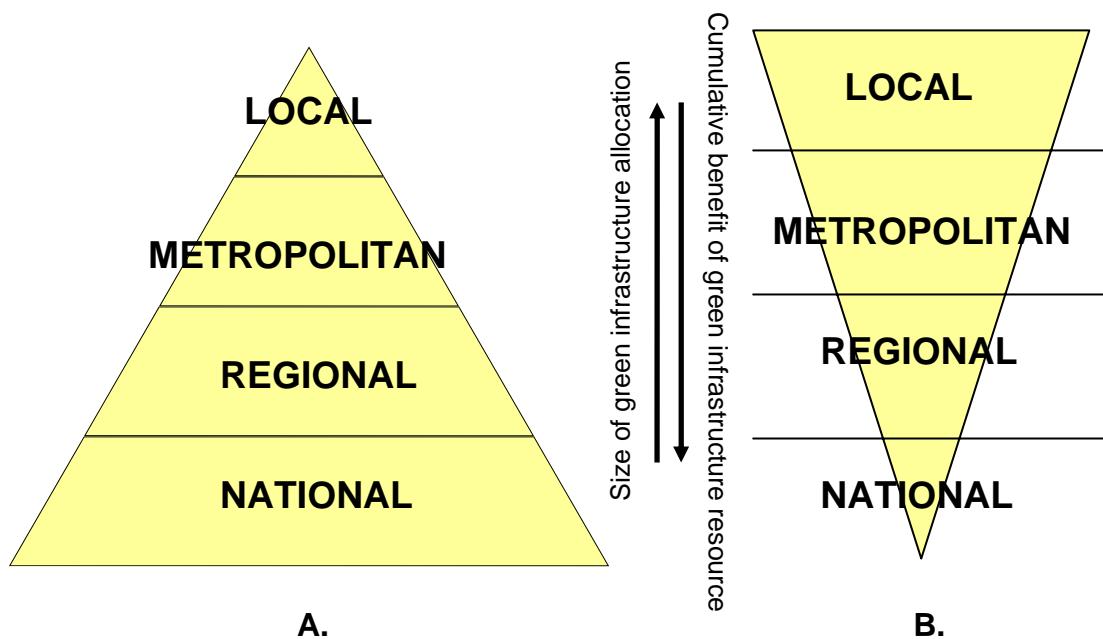
There also appears to be the potential to use European and North American exemplar green projects to promote green infrastructure in the UK. In Copenhagen, Helsinki, Boston, and to a lesser extent Toronto and New York, the development of connective green infrastructure networks has been at the heart of regeneration and successful use of space (Beatley, 2000; Fábos, 2004, De Sousa, 2003; Hobden *et al.*, 2004). These green infrastructure networks lie within urban landscapes but provide additional connective links between urban and urban-fringe areas. Their role as functional and connective elements thus encourages multiple uses by human populations and promotes more effective habitat conservation. Multi-functionality can thus be achieved but must not be preferred if the capacity of a location to undertake its core function is lost. Green infrastructure planning may therefore benefit from developments that mirror the historical creation of '*stepping stones*', '*green seams*', or '*greenscapes*' within new developments to provide a higher proportion of green space to otherwise urban landscapes (Dapolito Dunn and Stoner, 2007; ODPM, 2005).

The planning of large scale projects in urban areas may, however, prove problematic due to issues of land ownership and economic viability. Thus, the process of creating connective stepping stones (hubs, links, and nodes) may be the most practical way of delivering benefits to the widest population. This also supports the long-term value of green infrastructure development which, over time, can link smaller parcels of land promote a larger cumulative value. Consequently, ideas can be drawn from European compact city designs where the greening of high density urban landscapes has forced a reassessment of traditional green space (Beatley, 2000; Barton, 2000; Benton-Short and Rennie Short, 2008). In these proposed multi-functional cities (e.g. Stockholm), high density developments have sought to incorporate green infrastructure as a fundamental element to avoid or lower the level of disconnection between people and the landscapes around them (Sandström, 2008). Examples of this process can also be seen in Manhattan (New York) and the Thames Gateway. Figure 9.7 outlines how the process of valuing green infrastructure resources and locations could function where scale and function can be disproportionate to the value of a space.

This thesis, therefore, proposes that the values of green infrastructure are not only dependent on proximity to an area of need, but there may also be other influences such as uniqueness which provides a resource with a high value regardless of where it is located. In Figure 9.7, in Pyramid A, as you move further towards the peak the green infrastructure resource (size) proportionally decreases to fit with the size of local landscapes (i.e. increased urbanity). Therefore, at a national level there will be a greater proportion of green infrastructure resources because of the land available for classification. In contrast, the actual value of green infrastructure resources will increase and become more beneficial to the individual as the move away from the peak in Pyramid B as green infrastructure values become more concentrated in the areas of need. Consequently, although nationally important green infrastructure has a higher overall benefit to the nation, this is potentially smaller proportionally than the benefits of a green infrastructure at a local level to an individual. This difference highlights that, although green infrastructure developments and policy can work at a number of scales, the

benefits vary depending on location and the needs of the population. Thus, there is a view that increasing the proportion (%) of green infrastructure through incremental steps could be an effective way of increasing the overall size of these resources. Developments in The Netherlands, i.e. Rotterdam or Utrecht, are examples of how small connected stepping stones of green infrastructure have benefits (ecologically and socially) that are perceived as being greater than the actual size of that space (Fainstein, 2008; Beatley, 2000; Benton-Short and Rennie Short, 2008). The value of green infrastructure, therefore, allows these resources to increase simultaneously depending on the person or groups using or assessing it.

Figure 9.7. Proportional green infrastructure values



Although this chapter has outlined a number of areas where the development of green infrastructure promotes ecological, economic and social well-being, there are areas that have been examined to a lesser extent. The role of green infrastructure as a facilitator of climate change adaptation, as a promoter of sustainable water or drainage systems, and as an aid in developing engaging urban landscapes, have been touched on but not explicitly discussed. The following sections will outline how these areas can contribute positively to green infrastructure debates by outlining their utility. Although these areas are acknowledged as holding important insights into the development of green infrastructure benefits, the scope of this thesis did not allow a fuller discussion of these issues.

9.11.2. Green infrastructure and climate change

The role green infrastructure can play in adapting landscapes in terms of climate control is still somewhat under-researched but it is growing. However, the value of landscape adaptation is widely acknowledged (i.e. Benedict and McMahon, 2002, 2006; Williamson, 2003) and suggests that the inclusion of a green infrastructure approach is potentially a positive step in tackling climate change. Within climate change debates, the issues of focus and scale in landscape management are seen as paramount issues in the successful adaptation of the landscape to the changing climate. Consequently, a range of techniques and processes must be developed including green infrastructure

planning, i.e. in the form of habitat banking, to meet the needs of these changes. Successfully integrating green infrastructure into climate change adaptation strategies may therefore be an important and effective avenue in the development of the concept. Handley *et al.* (2007) articulated this process, stating that:

Greenspace or green infrastructure strategies will require a suite of complementary measures to realise the full adaptation potential of green infrastructure, particularly in relation to climate related functions such as interception, flood conveyance and storage, infiltration, evaporative cooling and shading. (Handley *et al.*, 2007:50)

Consequently, the long-term viability of landscape prosperity needs to focus not only on current development pressures but also on the processes that allow landscapes to adapt successfully to changing climatic conditions. Green infrastructure planning therefore provides a process that can sustain natural resources (e.g. natural capitals) and promote the sustainable use of these resources. The new definition of green infrastructure outlined in this chapter supports this concept in being able to meet these challenges. This view becomes increasingly relevant when green infrastructure is associated with the notion that a large percentage of landscapes will need be re-developed in the next one hundred years (see Ahern's comments in Chapter 8). In this scenario, the perception that natural resources need to be carefully managed as '...within urban centres greenspace therefore constitute critical environmental capital that, once developed, is difficult to replace' becomes more apparent (Gill *et al.*, 2007:127). Green infrastructure therefore encourages the development of an approach to landscape management that prioritises ecologically and socially important processes and advocates more sustainable landscape management. Green infrastructure may also increase the overall proportion of ecological resources. Subsequently, areas can be 'future proofed' to improve the resilience of a landscape to change. However, any underestimation of the complexity of green space management and its links with ecological systems could undermine the value of the space itself and hinder its function (CABE Space, 2003; 2005a).

Consequently, a strategic approach is proposed as an effective mechanism promoting a better understanding of the role that green infrastructure can play with the ecological interactions and functions of any given landscape.⁸⁷ With an understanding of these systems and processes, green infrastructure planning may be used to develop mitigation and adaptation strategies including habitat banking (Bean *et al.*, 2008). By meeting the needs of the landscape at different scales, the development of green infrastructure could raise the quality of landscape resources, thus meeting climate adaptation and broader ecological, economic and social needs. Landscape designations and classifications can also play a part in this process. In support of Handley *et al.* and CABE Space research, the BESEECH project led by Ekins (2007) stated that there is a need to develop new scenarios to provide insights examining the capacity of landscape systems to adapt to climate change, i.e. their *adaptive capacity* (Ekins, 2007:14). By meeting these needs, new sustainable landscape management techniques can aid the development of landscapes that are 'recognised as functional green infrastructure, [providing] a wide range of potential benefits from healthy recreation,

⁸⁷ A systems approach to green infrastructure is proposed based on theories drawn from Landscape Ecology, Green Urbanism and environmental systems literature.

to wildlife protection and enhancement, to flood risk management' ODPM (2005:5). It also has the potential to provide equally important benefits at local, regional, national and international scales through the use of appropriate management techniques.

9.11.3. Green infrastructure and sustainable urban development

Although green infrastructure as a component of sustainable urban development has been discussed at various points within this thesis, it has not been explored as a primary research area. Sustainable urban development as proposed by Beatley is a complex relationship where green infrastructure, high density urban landscapes, connective and functional transport networks and economic development all need to be discussed collectively (Beatley, 2000; 2009). In this sense, green infrastructure planning offers a process that can help integrate these factors in urban landscapes as it is not wholly dependent on the size or form of the landscape. What green infrastructure brings to this equation is a diversity in size, form and function which can be used to address issues of capacity or open space provision (CABE Space, 2003). Consequently, the Sustainable Communities, Growth Area initiatives and latterly World Class Places (DCLG, 2009) initiatives have benefited from the use of green infrastructure principles. By promoting connectivity between urban locations, access to high quality spaces, the provision of multi-functional spaces and long-term sustainable development can balance the social needs of an urban area with its ecological capacity to cope with change (Thwaites *et al.*, 2007; Farr, 2008; Ahern, 2007).

Promoting places that function within their ecological, economic and social limits that can be maintained with minimal inputs from wider sources of capitals is therefore an objective green infrastructure can strive to meet. Places that facilitate a more sustainable way of living and offer a high quality of life have therefore started to be examined within a green infrastructure approach to planning (Beatley, 2000; Farr, 2008). Green infrastructure planning thus has the potential to allow planners to develop a more holistic approach to integrated planning. A number of cases were presented to support of this view in the COST Action C11, outlining how various European cities have used green infrastructure positively to counterbalance the proposed negative effects of urban development (Werquin *et al.*, 2005). By placing an emphasis on the functions that green structures can provide in meeting changing ecological and social needs, COST Action C11 highlighted the need to promote a green ethos in planning. Like Beatley, COST Action C11 outlines how issues of focus, scale and utility all hold an important role in developing sustainable places and in promoting green infrastructure as an effective facilitator of this process. Continued research investigating the development of urban spaces with a green infrastructure focus would provide further evidence of its utility in meeting the changing needs of urban landscapes. Furthermore, Natural England, the APA and authors like Beatley (2009) have all provided case studies supporting this process in the last two years.

9.11.4. Green infrastructure and Sustainable Urban Drainage Systems (SUDS)

Like its use in terms of sustainable urban development, the value of green infrastructure to Sustainable Urban Drainage Systems (SUDS) developments support a similar notion. By effectively integrating human activities with natural landscape systems, SUDS aim to harmonise this somewhat distorted relationship. Using a number of innovative techniques (bioswales, porous or permeable

pavements, habitat banking) green infrastructure designed and implemented as SUDS can provide a range of ecosystem services supporting soil management, reduce pollutants, improved irrigation, and controlled run-off/release events (Rodie and Feehanm, 2008; Ferguson, 2002; Kloss and Calarusse, 2006). Each of these functions provides green infrastructure with a useful ecological function and helps to mitigate the adverse effects of the changing environment. They also provide a more cost-effective and less intrusive process of engineering than traditional structural building works. However, SUDS can also be used to control the additional resources needed to cater for urban expansion by being able to retain a greater proportion of household grey water and rainfall for reuse. Bioswales and tiered drainage systems can therefore remove waste and pollutants, returning potable water into the system. In terms of this research, although SUDS (blue infrastructure) and green infrastructure have not been discussed explicitly, their value has been elicited to in a number of the responses in Chapters 6 and 8. The value of SUDS systems therefore lies in their ability to control the level and quality of water in a given system and promote a sustainable use of these resources. More research, however, is needed to review in greater depth the value of SUDS within a green infrastructure approach to planning (Landscape Institute, 2009).

9.12. Summary

Over the course of this chapter and throughout this thesis, a number of key green infrastructure principles have been discussed. In the following section, a number of recommendations are made examining where the potential options for future green infrastructure development lie. This section examines how such research could benefit both the conceptual development of green infrastructure and its use in actual planning. Research in the UK, Europe and North America has shown that green infrastructure has the potential to be a successful approach to planning and landscape management. This view has been supported in the conceptual thinking and the diversity of projects, assessing the various functions of green infrastructure. Consequently, the role of green infrastructure as an umbrella term for green space and other planning agendas (e.g. CIAT) has enabled a number of organisations in the UK and the USA to develop an evidence base promoting its use. However, this research must continue to engage policy makers if green infrastructure is to gain further acceptance in planning practice and policy. This process must also be aware that locating appropriate funding to support the development of evidence-based data collection and analysis across a number of spatial locations is an important process to consider.

With the projected increase in land values in the UK, Europe and the USA, the use of optimum economic designs for development will also become more pertinent. Green infrastructure, therefore, has a role to play here in providing an appropriate approach to developing economically and environmentally sustainable landscapes (CABE Space, 2005). Furthermore, green infrastructure planning promotes a process that can support ecological resources and landscape functionality, whilst balancing the financial costs of development. This view is proposed by Dapolito Dunn and Stoner (2007) who argue that the capital costs of green infrastructure are actually lower than other grey infrastructure as they do not have the same level of revenue (maintenance) costs. A second positive area promoting the economic viability of green infrastructure is its capacity to be adjusted or fitted within a greater range of spaces than traditional grey infrastructure. Green infrastructure is, therefore,

proposed as a positive mechanism for retro-fitting a higher proportion of multi-functional space into either new or redeveloped landscapes (Countryside Agency, 2006; Ahern, 2007).

Consequently, an increased proportion of green infrastructure located in high density areas can promote a more innovative use of land for housing whilst promoting more intelligent designs. The use of urban green space, cycleways or SUDS are just three examples of this process. Developers therefore may not require greater quantities of land if they can build effectively within smaller spaces using connective green infrastructures which do not minimise the economic incentives to develop. The current development of the Community Infrastructure Levy (CIL) and Infrastructure Investment Strategies (IIS) at a sub-regional and District level in England are attempting to facilitate this process by developing financial costs that can be levied against all projects to deliver green infrastructure.

Green infrastructure is, therefore, in an almost unique position. The rate of urban and urban-fringe reconstruction will potentially continue exponentially over the coming century. As a result, the rate of development and re-development will also rise. It has been argued (i.e. Gill *et al.*, 2007; Ekins, 2007) that it is difficult to recover green infrastructure once it is developed. However, during this period of reconstruction planners, developers and landscape architects could be presented with a platform for integrating a greater proportion of multi-functional green spaces in developments that meet ecological, economic and social needs found in green infrastructure principles. As a multi-faceted approach to landscape management, green infrastructure could therefore be adapted to meet the environmental challenges of urban and urban-fringe development over the next fifty years by providing an appropriate framework for planners and developers based on grounded principles.

The opportunities currently available to landscape planners provide them with a reasonably blank canvass onto which 'green' or sustainable issues can be integrated. Furthermore, there is a great responsibility for planners and developers to acknowledge the value of green infrastructure as a set of appropriate landscape management options. As Ahern (2007) argues, in the coming years most of what we see in the built environment will be new. Consequently, we are in a position where the planning profession can influence the practices that ensure long-term social, economic and ecological sustainability (DCLG, 2009). This process can be achieved through a cumulative approach that integrates green infrastructure principles into the mainstream of planning policy. An approach of this nature would therefore meet the challenges outlined by Battle who suggests that planning has reached a confluence of ideas and that 'green is the new way of living [and provides the] sustainable solution are our goal' (Battle, 2008:392). A green infrastructure approach to planning is, then, positioning itself at the forefront of this challenge to lead the charge and meets Battle's call to arms.

However, there are still those authors who believe that the values attributed to green infrastructure are over-stated. Detractors will need to be shown through project success and the reinforcement of key green infrastructure messages that the concept offers a valuable approach to planning that can meet a range of strategic objectives simultaneously. Moreover, only through a strong review of green infrastructure practice will the concept be fully accepted into mainstream landscape management practice. In terms of more specific academic and practitioner agendas, green infrastructure has been

proposed within this chapter to meet an ever-expanding number of remits. Due to the diversity of the concept, a number of different agendas can be seen to benefit from green infrastructure directly (i.e. immediate responses) and indirectly (long-term sustainability). This includes research, reviewing the integration of sustainable design into urban planning, its value in adapting landscapes to climate change, and the role green infrastructure can play in developing spaces that promote social inclusion or social history. These areas may appear to be too disparate for direct comparison, but they all utilise the principles underpinning green infrastructure proposed in this thesis as a way of developing more sustainable and understandable places. In the final chapter, the key themes discussed in this and the previous eight chapters will be presented in order to propose a set of conclusions, recommendations and areas for future green infrastructure research drawn from data collected and presented in this thesis.

Chapter 10.0. Conclusion: What lies ahead for green infrastructure thinking?

10.1. Introduction

Throughout this thesis a number of questions have been explored examining the development of green infrastructure. References have been made to the development of the concept's principles, its meaning, and its future. Green infrastructure has been discussed in terms of landscape perceptions and outlines a framework through which people can access the values of places in order to enhance their quality of life (Lindsey *et al.*, 2001). This discussion has also been contextualised in terms of current landscape planning policy relating to green space and green infrastructure proposing where potential opportunities for development lie. This final chapter draws together the data and literature examined in the previous nine chapters and proposes a number of recommendations for green infrastructure development and its future.

This chapter outlines the key findings of this thesis and examines how these conclusions can be taken forward in the form of green infrastructure planning recommendations. The chapter also reviews how the research questions outlined in Chapter 1 and the methodological framework proposed in Chapter 5 determined the shape of the research. The aim of this concluding chapter is to discuss whether the research questions asked have been answered and how the approaches used to answer them were successful. The following four sections present the main conclusions drawn from this thesis and address the value of green infrastructure in terms of its meanings, its focus in strategic planning policy, and its use in landscape planning. These four sections highlight the contribution to knowledge that this thesis makes by arguing how it has progressed the thinking on green infrastructure planning.

10.1.1. Key conclusions: green infrastructure definitions

- The diversity in the focus and principles of green infrastructure is a useful base for its use. An acknowledgement of the overarching principles, though, needs to continue to develop the concept further.
- Green infrastructure thinking has to focus on the utility of the concept and its use in landscape planning.
- Increases in green infrastructure thinking are occurring but further developments are still needed.

Many of the responses reviewed in this work presented definitions that outline a number of interesting and occasionally contrasting ideas of what green infrastructure is. However, although areas of consensus exist there is still diversity in the approach, focus, and meaning of these different definitions. An analysis of these discussions proposed a number of areas that have been consistently promoted (i.e. connectivity, access, and strategic thinking) which support the new working definition of green infrastructure as outlined below:

Green infrastructure are the resilient landscapes that support ecological, economic, and human interests by maintaining the integrity of, and promoting landscape connectivity, whilst enhancing the quality of life, place and the environment across different landscape boundaries.

10.0. Conclusion: What lies ahead for green infrastructure thinking?

This definition incorporates the principles outlined in the analysis presented in Chapter 6 promoting access, connectivity, quality of life, scale and the sustainable development of the landscape to meet current and future uses. Although it does not address specific ecological, economic or social elements of the landscape, these influences are inferred and described in relation to the sustainability agenda outlined in Chapter 9 (see Table 9.1). However, such a definition can still be interpreted through a number of ecological, economic and social perspectives. Consequently, ENGOs and planning policy or decision makers can utilise the underlying principles of green infrastructure outlined in Chapter 6 and the definition above to meet their needs. This allows the proposed definition scope not to be hindered by one specific economic or social approach, meaning that the focus of the researcher can be incorporated directly into a green infrastructure approach to planning.

Although this definition outlines a number of the most frequently used principles, it inevitably retains a level of diversity in order to promote green infrastructure in different areas of planning. Although this definition presents a cohesive notion of what the concept means, there is innate scope to bring together ecological, economic and social agendas and move towards a more holistic or adaptive use of green infrastructure in planning processes. Consequently, although there appears to be a broad consensus of what green infrastructure is, an acceptance of a new definition will not inevitably lead to the development of a universal consensus. This, however, is not a significant problem as the definition proposed can be utilised within a range of conceptual or planning parameters. Thus, although a range of interpretations relating to green infrastructure still exist, this thesis outlines a set of grounded principles which propose that there is scope to integrate a number of key elements into future green infrastructure research.

This integrated process can also be seen in the discussions of green infrastructure variability in terms of form and function. As a consequence, the concept will continue to hold the ability to be planned and developed in a number of diverse planning scenarios. Diversity, thus, allows green infrastructure to offer practical solutions meeting the changing needs of landscape managers in the UK, Europe and North America. This process can be seen in the USA where the PCSD and the former Maryland State Governor, Paris Glendenning, led the call for the development of a network of green infrastructure planners across the United States to synthesise their research and support the concept at county, metropolitan and state levels. Although this network has yet to truly embed itself in the national consciousness, it has highlighted the progressive uptake of a green infrastructure approach to planning. A co-ordinated approach could also be developed in the UK if national and regional level environmental organisations can develop a more expansive evidence base to promote green infrastructure planning in local, city and regional forums.

10.1.2. Key conclusions: scale and strategic green infrastructure planning

- Green infrastructure offers a multi-faceted and multi-functional approach to landscape planning
- The strategic nature of green infrastructure thinking can promote its uses at all levels of planning and in a number of diverse landscape scenarios
- Policy and practice need to support each other in the development and maintenance of a green infrastructure approach to landscape planning

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In the current climate, where landscapes are discussed as needing to meet a number of development criteria (i.e. multi-functionality, housing or economic growth), green infrastructure provides a mechanism for negotiating sustainable or appropriate land use. Its role as a diverse and multi-scaled management process provides developers and decision-makers with a number of options through which better places to live, work and recreate can be developed. Evidence presented in the latest RSS and regional green infrastructure plans are examples of this success. Green infrastructure planners, therefore, need to be aware of the issues associated with strategic thinking if it is to be developed. Landscape scale and focus are crucial elements in the successful development of functional landscapes and green infrastructure offers an approach that can meet different local, regional, and even national landscape management targets simultaneously. Thus, landscape scale issues (e.g. climate change) can be addressed by planning larger scale, cross-boundary or multi-purpose green infrastructure projects. Local level access or conservation targets can be met concurrently by planning at local or neighbourhood levels. Local level projects also have the potential to add to the cumulative value of larger landscape scales projects, i.e. the Thames Gateway. Green infrastructure thinking may therefore provide planners and decision-makers with a number of management tools with which to develop appropriately scaled and focussed projects. Consequently, the benefits of access, connectivity and multi-functionality can be developed across physical and social landscape boundaries.

The development of a strategic use for green infrastructure planning has been another of the main themes discussed in this thesis. The role of strategic thinking is now being outlined at the centre of green infrastructure planning to support the overarching principles developed in this thesis. As a result, RSS, Community Forest plans, and green infrastructure strategies developed for Growth Area like Cambridgeshire can be focal forums for multi-scaled or strategic green infrastructure development. With an increasing acknowledgement within strategic documents, the value of green infrastructure can be disseminated further and can be mandated within statutory planning policy. A further inclusion of green infrastructure could therefore be the natural progression of its value from these conceptual discussions to realised implementation plans.

10.1.3. Key conclusions: Dissemination, evidence and funding of green infrastructure

- Appropriate education of key policy makers and practitioners regarding the value of green infrastructure use is central to its dissemination and uptake
- Further evidence is needed to attract sustainable funding streams
- An active approach to engagement and the marketing of green infrastructure is a key process in sustaining its use.

Whilst the development of green infrastructure research has increased extensively since its use by the PCSD (PCSD, 1998), there is still scope for further awareness. This can take the form of research, workshops, or teaching, all of which can be used to promote green infrastructure to a number of audiences. Dissemination through research and literature can be used to engage academic and practitioner audiences; a review of the 2008 Association of American Geographers or the 2007 Fábos Symposium highlights this interaction. Meanwhile, professional workshops and seminars have been shown to encourage practitioners and decision makers to engage with green infrastructure and

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develop it within their work programmes. The teaching of green infrastructure therefore engages an ever-expanding audience depending on where, in what format and to whom it is being taught.

Education was noted in Chapters 6 and 8 as being vitally important in disseminating green infrastructure research. Through the continued promotion of green infrastructure, its benefits and principles can and will be discussed by a wider audience. Although marketing does not necessarily promote use, it does increase the debates, positive and negative, surrounding green infrastructure. The current level of engagement in practitioner and academic research is therefore a good sign that green infrastructure education is increasing. However, there is still some distance to go to embed the concept into planning practices and education is one area where this process could be achievable. It has also been suggested in Chapter 8 that the education of professionals could help develop a stronger knowledge base from which new practices can be influenced.

Although the process of educating practitioners is important, the collection of appropriate evidence also needs to be addressed. Evidence collection has increased dramatically over the last five years but there are still gaps in the available evidence base, especially concerning green infrastructure and economic development or climate change. This research has debated the variation in responses proposed by different research groups providing this thesis with a range of conceptual and empirical themes for discussion. However, if green infrastructure continues to develop, the gaps in current data will diminish as research increases. This process may also be seen as a central objective for green infrastructure projects. At present, funding is being made available for discreet projects at local and regional levels. With the development of an appropriate evidence base, securing additional funds could be achievable and support a broader portfolio of practice-led research at a landscape scale. The Conservation Fund and some RDAs (e.g. GO East) are currently attempting to address this issues by funding projects like the Great Fen Project in Cambridgeshire, Huntingdonshire, and Bedfordshire. By meeting these gaps, evidence can be produced which can feed into planning policy recommendations being delivered from local and regional organisations.

10.1.4. Key conclusions: Integration and policy

The integration of green infrastructure into planning policy can only progress so far with the support of academic and practitioner research. To promote the successful transition of green infrastructure thinking into planning practice, support within policy is needed. By promoting the principles outlined in this thesis, underpinning green infrastructure policy could be developed to meet a broad range of ecological, economic and social needs. Throughout this thesis, a number of conceptual and practical approaches have been explored highlighting the value of green infrastructure in landscape planning. If these ideas are reviewed in terms of meeting landscape management issues associated with scale, promoting multi-functionality, and addressing a range of planning needs, the value of green infrastructure can be supported within a robust and strategic planning framework. Thus, by providing a framework that can be developed at a number of scales, green infrastructure offers a management approach that can be implemented by a borough, local or regional planning bodies. Consequently, local, regional and national bodies may be able to integrate green infrastructure into their policies more effectively. This process has already been seen in RSS development and in a number of Local

Authority plans (e.g. Harlow or Tees Valley). The next stage in this process is the formation of government guidance for green infrastructure that proposes its use as a mandatory element of planning. If green infrastructure planning is to become a mainstream process it needs to be promoted as a way of bringing together the following areas:

- Firstly, green infrastructure should provide the basic foundation on which development can be delivered. Moreover, there is a need to acknowledge the value of 'green' infrastructure in terms of its ecological, economic and social value. Only with such an acknowledgement can an appropriate approach to landscape management be developed.
- Secondly, green infrastructure needs to be thought of spatially. The differences associated with landscape scale and variations in its function means that each landscape is a unique amalgamation of size, composition and its utility. A working knowledge of how these systems work independently and collectively is therefore vital if the spatial component of green infrastructure is to be understood. Green infrastructure planning should therefore be viewed as a mechanism for integrating ideas of scale and spatial variation into a coherent process that is adaptable to different locations and planning scenarios.
- Thirdly, green infrastructure needs to be developed with a collaborative focus. Much of the research conducted to date on green infrastructure has highlighted that there is scope for an increased dialogue between planners, government agencies, developers and the public. Co-operation between different planning actors thus promotes the role of policy and practice integration and supporting the role of partnerships in delivery.
- Finally, as an appropriate mechanism for delivering better places, green infrastructures should not be viewed as a quick-fix solution but should be seen as a component of a longer term process. Designed appropriately, and developed with ecological, economic and social factors in mind, green infrastructure can be a valuable component of successful landscape renewal. In the same manner that ICT, housing or transport infrastructures cannot develop better places to live individually, collectively this is possible. Green infrastructure should therefore be identified as being as equally important as other infrastructures.

With an encouragement for green infrastructure planning at different political levels, this process offers a potential mechanism for breaking down the physical, administrative, and psychological landscape boundaries that can be present in the minds of policy makers and planners. Consequently, if green infrastructure is viewed as the resilient landscapes that support ecological, economic and human interests by maintaining the integrity and promoting connectivity, policy can be developed that articulates these ideas into practical implementation practices. Green infrastructure research can therefore be viewed as a process of policy integration interpreted or articulated alongside planning practices to support appropriate landscape developments.

10.2. Review of the methodological structure

The methodological structure developed for this project outlined in Chapter 5 provided a number of informative avenues for data collection. The methods used and the line of questioning developed enabled this thesis to examine the research questions outlined in Chapter 1, but also provided this research with a clear understanding of the complex ecological, economic, and social interactions that underpin the development of green infrastructure. The focus used, therefore, provided a robust baseline of meanings, interpretations and an assessment of the current use of green infrastructure.

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This structure therefore allowed the thesis to investigate the objectives of what green infrastructure is defined as, how different interpretations of green infrastructure are constructed, and how perceptions can be defined and used on planning policy. The analysis presented in Chapters 6, 7 and 8 suggest a better understanding of each of these areas in providing a breadth of information that can be fed into green infrastructure debates.

The use of a multi-method approach enabled disparate sources of data to be collected, thus providing insightful discussions of the development and use of green infrastructure. The complementary roles of primary and secondary data sources also enabled this thesis to compare data from practitioners and policy makers from different geographical regions with respondent discussions to review the value of green infrastructure alongside its planning and implementation. The thesis may, however, have benefited from a greater level of participatory research in some areas, especially in relation to the environmental perceptions data assessed in Chapter 7. Unfortunately, time and access constraints limited the level of participatory research that could be undertaken. The data, however, provided a number of interesting themes for discussion which helped to integrate some of the debates outlined in this thesis. Consequently, further data sources could have been explored and a greater number of green infrastructure project case studies could have been examined. Unfortunately, time constraints limited this process. However, this thesis acknowledges that a greater depth of case study analysis could have provided further data for interpretation, which would have aided the discussion made in Chapter 7.

Overall, the multi-method approach used within this thesis provided a depth of data that enabled the research questions outlined in Chapter 1 to be analysed. Where issues occurred with time constraints and the sampling sizes, these issues were acknowledged and alternative methods and sources of data were reviewed. I feel that the approaches utilised in this thesis have enabled a clear and insightful discussion of the main debates proposed in relation to green infrastructure to be made. Where improvements could be made, these issues have been acknowledged and the drawbacks noted. However, to obtain the level of data gathered for this research, a wide range of sources needed to be targeted, thus the broad nature of the research and the multi-method approach were deemed the most appropriate method to collect this data.

10.3. ESRC CASE Studentship Award

The ESRC CASE studentship award supported the research undertaken for this thesis and provided it was a number of avenues through which to examine the development of green infrastructure. The involvement of an ENGOs in the development of green infrastructure provided evidence and a forum examining a range of planning issues which enabled this research to translate its analysis into policy and practice recommendations. Researching alongside the NECF also placed the development of an academic thesis in sharp contrast to the use of green infrastructure by land managers. Consequently, the diversity of opinion in Chapters 6 and 8 outlined the variation between academic research and practitioner use of green infrastructure. An understanding of this relationship has been a crucial component of this research supporting the evidence collection, analysis and my own understanding of green infrastructure in practice throughout. Holding an ESRC CASE Award has therefore proved to be

a beneficial experience and heavily influenced the research and analysis undertaken in this thesis. One caveat, however, is that the relationship between the research undertaken on behalf of the CASE sponsor and the development of a thesis need to be managed effectively and boundaries should be proposed in terms of time and output commitments. Apart from managing this relationship, I found the role of the CASE sponsor, NECF, to be informative, helpful, and a positive contributor to the recommendations of this thesis.

10.4. Contribution to knowledge

This thesis is one of the first narratives to assess the breadth of green infrastructure. By assessing its development in context of historical green space research against the more contemporary policy and practitioner uses of the concept, this thesis provides an understanding of green infrastructure built upon a history of research. The breadth of discussions relating to the meaning of green infrastructure and our understanding of it in different geographical contexts has also only been touched upon previously. This thesis, therefore, brings together a number of global green infrastructure leaders and presents a detailed analysis of their conceptual understandings and their delivery of multi-functional and strategic green infrastructure projects.

By linking the understanding of green infrastructure perceptions with planning practice, this thesis also provides recommendations which can be taken forward by policy-makers, planners and landscape architects. Furthermore, by assessing these issues in relation to the definition and principles proposed for green infrastructure, this thesis provides a framework of conceptual meanings, perceptual understandings, and planning mechanisms that can support the development of new green infrastructure resources. This thesis, therefore, presents one of the first collective articulations of these factors which can be applied to further academic research and to practitioner-based green infrastructure development.

10.5. Recommendations: green infrastructure development

Current green infrastructure research appears to have developed a set of principles, although consensus of these principles is as yet not universal. However, there is scope for a more defined green infrastructure agenda to be developed providing a framework for future research and discussions. This process may be achievable if the following recommendations are addressed:

1. Green infrastructure has the potential to be developed further in both conceptual and implementation terms in the UK, Europe and North America. The current progress in green infrastructure thinking shows signs of an increasing understanding and acknowledgement of the concept, but further support is needed to fully embed the concept in landscape management practices and policy.
2. Although a consensus has not been reached, a number of overarching principles underpinning green infrastructure have been developed that promote its use by different academic and implementation organisations. Whether a universal consensus is necessary is still therefore open for debate for, as long as a set of guiding principles are developed, then the concept can be utilised in a number of academic and practitioner fields.
3. The main principles proposed for green infrastructure discuss how green infrastructure is being developed with a joint ecological and social focus, green infrastructure should be developed at the appropriate scale, access to and connectivity between green

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infrastructure is essential to its use, green infrastructure should be thought of as a strategic process of landscape management, and green infrastructure should be integrated into all levels of landscape policy.

4. This research proposes a new green infrastructure definition that defines it as the *resilient landscapes that support ecological, economic and human interests by maintaining the integrity of, and promoting landscape connectivity, whilst enhancing the quality of life, place and the environment across different landscape boundaries*. This definition along with further debates could therefore promote further consensus building.
5. The debates and research focussing on green infrastructure needs to continue to develop principles, uses, and an evidence base of the concept. This process also needs to engage a number of different research areas (e.g. climate change) to fully explore the variation of green infrastructure thinking and its values.

10.6. Recommendations: interpretation and perceptions of landscape values

The perceptions and interpretations of the landscape are also vital components in our understanding of green infrastructure. Without a thorough knowledge of how the landscape is viewed different planners, designers, and decision-makers may be unable to develop appropriately designed and managed spaces. The following recommendations should therefore be viewed as a set of criteria that can be described to decision-makers, outlining how different interpretations of green infrastructure affect the use and longevity of a space:

1. Planners, developers, and landscape managers need to be aware that there are varying levels of integration between ecological, psychological and social elements that support positive and negative interpretations of the landscape.
2. Green infrastructure research acknowledges that the interpretations of a given landscape are developed through a complex interaction of stimuli, experience and knowledge. Spaces, therefore, need to be viewed as constructions of their physical composition but also in terms of the psychological and social contexts.
3. Positive landscape interpretations are based on immediate interpretations of the landscape. Negative associations however appear to be discussed from on a deeper psychological and social interpretation of the landscape context and function. Both of these views therefore need to be taken into account in the design and management of spaces.
4. Attractive and functional landscapes encourage use but it is important to understand that the form of a space and its location interacts to influence the level and longevity of use. Consequently, green infrastructure can be viewed as a way of creating functional and viable routes within urban, urban-fringe and rural areas by providing locations and opportunities that promote, attract and engage users.
5. Community engagement, personal investment (time, money and emotions), and motivations to use green infrastructure are dependent on a wide range of factors that do not necessarily follow traditional ethnic or gender views of a given landscape. Green infrastructure must therefore provide opportunities for a broad range of activities to be undertaken at a location if people are to be encouraged and motivated to use it.
6. Attractive and functional spaces may be used as a facilitator encouraging a more active lifestyle. Where green infrastructure resources are viewed as offering a number of benefits at a lower personal cost (time or financial) people may be more likely to engage with them and improve their personal well-being.

10.7. Recommendations: green infrastructure planning policy

Finally, the future of green infrastructure development is dependent on its inclusion in relevant planning policy. It is crucial for the structures underpinning policy development to be engaged with by green infrastructure developers if the evidence supporting it is to be translated into planning and

implementation policies. Planning policy also needs to take into account the ways in which individuals actually interpret the landscape if they are to produce policy that aids the development of appropriate and functional spaces.

1. There is scope to develop specific green infrastructure policy at local, regional and national levels, building on the work conducted by the Community Forests, Natural England and England's RDAs. The role of these organisations is therefore to act as facilitator for green infrastructure policy development using evidence and engagement to influence policy.
2. Amendments to current planning policy statements or guidance (i.e. PPS1, PPS12 or PPG17) could be used to embed green infrastructure into statutory policy. Alternatively, new policy guidance could be developed specifically for green infrastructure such as the proposed PPS on Eco-Towns which uses green infrastructure as a basis for its development principles.
3. The process of policy development will only occur if evidence is presented to decision and policy makers to engage with green infrastructure within the governance structures of policy development. This process must be addressed at all planning scales to promote green infrastructure principles and can inform the debates undertaken within neighbourhood panels, LAA, LSP policies, and in RSS.
4. Green infrastructure must be developed as a planning process that brings together inter-disciplinary teams of decision-makers, planners, developers and the public to engage a range of knowledge and experience in order to create appropriate and sustainable landscapes. Local Authorities and statutory bodies therefore may have the capacity to provide this support and, if not, funding should be provided to aid this transition.
5. Green infrastructure has the capacity to meet a number of diverse ecological, economic and social needs and should be viewed as one of the most appropriate approaches to landscape management to meet these challenges. This is especially important if we accept that the landscape is in a constant state of change and will require redevelopment over the next century.
6. Green infrastructure has the potential to contribute data and guidance on a number of contemporary planning issues including social inclusion, mobility, and landscape adaptations to climate change. Other areas where green infrastructure may be beneficial include sustainable transport networks, the development of sustainable communities, developing broader landscape scale projects, and the UK government's health agenda.
7. By developing green infrastructure within appropriate planning frameworks, a greater number of multi-partner projects could be developed. Boundaries associated with administrative and financial capacity may therefore be lowered if partnerships can be effectively developed.
8. Due to the diversity in green infrastructure form and function, the concept is able to meet the planning objectives of different geographical locations. Although the research presented in this thesis has focussed most frequently on the UK, Europe and North America green infrastructure, principles can also be applied to Asian, Africa and Latin American locations (e.g. research in China and the Gulf States). Consequently, there is scope for green principles to be utilised globally in spatial planning regardless of location as long as the motivation and encouragement is there to use these ideas.

10.8. Future green infrastructure research

A number of diverse areas of research have been presented and analysed within this thesis. It does not, however, purport to have addressed all avenues of possible green infrastructure research. Outlined below are a numbers of areas where further green infrastructure research would provide further data to support its development conceptually and in practice.

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- A more detailed and focussed assessment of the utility of green infrastructure in meeting the challenges of climate change would be beneficial. This could focus on local, regional, national or international climate change objectives and could be fed into policy and practice at all levels. Specific focus could be placed on understanding the value of green-blue infrastructure and the role of heat mitigation in urban areas.
- The development of a stated-preference analysis of green infrastructure, assessing how the perceptions of the landscape and specific project visions interact to provide an understanding of what people will actually fund and use. This is of use in developing an economic baseline for green infrastructure development, which could be used to assess the cost-benefit of future urban and urban-fringe developments.
- An analysis of 'habitat banking' techniques could be developed to assess how green infrastructure can provide ecological, economic and social benefits in tackling climate change.
- A more in-depth study of the potential role of green infrastructure in promoting sustainable building codes and more sustainable urban landforms in the shape of greenway, SUDS, or urban greening projects. This could be focussed at a household level or at a city level.
- Further analysis could be undertaken assessing the role of statutory agencies in the development of green infrastructure. This could provide a more in-depth study of the role of Natural England and the Community Forests' hold in promoting green infrastructure and examine whether the delivery arms of these organisations is working in tandem with their policy teams.

10.9. Summary and conclusion

In conclusion, the progress made in developing an evidence base for future green infrastructure development means that the green light does appear to be on. Progress has been made in the development of a number of overarching green infrastructure principles that can be translated into planning policy at a number of scales. However, for progress to continue, political and financial support needs to increase at a local, regional and national level. The available evidence base also needs to be promoted if green infrastructure is to be embedded in current and new planning policy. Furthermore, the inclusion of green infrastructure references and principles in current policy and strategic thinking highlights the progression already made and a review of the current research debates suggests this process will continue. Green infrastructure planning may therefore be seen as an approach, bringing together a range of ideas and practices and promoting a set of best practice landscape management techniques. Consequently, as a way of meeting the challenges of development, green infrastructure offers a dynamic or fluid process for shaping the landscape and meeting the future needs and opportunities of different urban and urban-fringe landscapes. Finally, by proposing that green infrastructure are the resilient landscapes that support ecological, economic, and human interests that maintain the integrity of the landscape, promotes landscape connectivity and enhances quality of life, place and the environment, green infrastructure can meet the complex needs of our ever-changing landscapes and promote a more holistic approach to landscape management.

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Appendix 1. Visual preference survey images.

Image 1 - West Jesmond Cemetery



Image 2 - Leazes Park, Newcastle



Image 3 - Marsden Bay

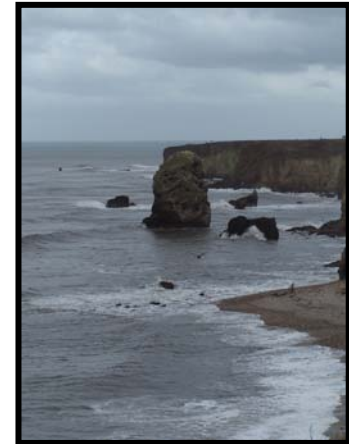


Image 4 - Calthorpe Project, London



Image 5 - West Park, South Shields



Image 6 - Wardley Manor, South Tyneside



Appendices

Image 7 - Misterton, North Lincs



Image 8 - Herrington Country Park



Image 9 - Hadrian's Wall at Steel Rigg



Image 10 - Coram's Field, London

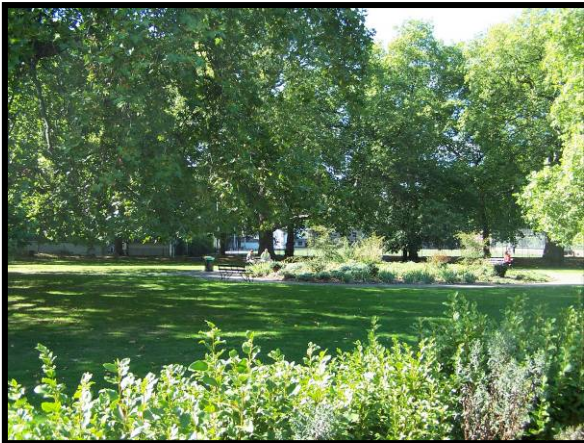


Image 11 - Bede's World, South Tyneside



Image 12 - Ouseburn Valley, Newcastle



Appendix 2: Visual preference surveys category breakdowns.

	Natural features	Social features	Psychological features
<p>University of Massachusetts, Amherst</p> <p>UMass</p> <p>Why do you like this image? What features do you like within this image?</p>	<p>Grass (2) Trees Ocean/Seaside/Waterways (3) Cliffs Waves (2) Non-cultural elements (2) Landscape patterns (2) Plants Snow Light Bushes</p>	<p>Accessibility Social landscape patterns (2) Historical links (2) Wall Arty (3) Tea-walking</p>	<p>Bright-sunny Warm Fore/Middle/Background/depth (4) Focus Big/powerful Colourful Safety Man-made vs. natural (2)</p>
<p>UMass</p> <p>What do you think is the most important part of the image?</p>	<p>Waves Cliffs Nature (2) Trees Shrubs Space Snow Greenery Light</p>	<p>Enjoyment Wall (2) Painting Bridge</p>	<p>Subordination to nature (2) Space</p>
<p>UMass</p> <p>Why you not like this image? What features do you not like within this image?</p>	<p>Overcast Water (2) Windy Mon-culture grass Bushes Trees</p>	<p>Messy Doesn't fit Lack of beauty Too much human control Not accessible for all</p>	<p>Dark Cold Not interesting (2) Dull Too large Doesn't celebrate life Sterile (2) Lack of protection/safety Lack of organisation Lack of Beauty Lack of prospect/refuge Un-inviting (2) Colour Enclosed space</p>
<p>UMass</p> <p>What do you think makes this image less important or likeable than the other images?</p>	<p>Grass Sky Landscape type (2) Landscape values Water Openness</p>	<p>Aesthetics Gloomy Utility/pylons lines Possible landuse i.e. dumping Spatial definition Painting Building</p>	<p>Unpleasant feeling Do not want to be there (2) Nothing stands out Aesthetics Gloomy Uninspiring Uninviting No real landscape classifications Lack of value Lack of spatial definition Openness Boring (2) Man-made landscape</p>

Appendices

University of Northumbria			
<p>UNN</p> <p>Why do you like this image? What features do you like within this image?</p>	<p>Ocean (2) Shoreline (3) Marsden Rock/Stacks (2) Waves (3) Wildlife (3) Weathering process Open space (3) Trees (5) Snow (6) Bushes Natural (5) Lake Scenery Countryside Cliffs Seasonal Change Rugged</p>	<p>Childhood (2) Holidays Christmas (4) Picket fencing Bridge Wall Agriculture Tourism Footpath Styles</p>	<p>Natural (5) Seasonal change Pleasant feeling (3) Sounds Crisp/clean (3) Childhood Calm Tranquil/quiet (3) Christmas (3) Nostalgia Rugged Peaceful (3) A nice place to visit Foreground/background Attractive Green</p>
<p>UNN</p> <p>What do you think is the most important part of the image?</p>	<p>Waves (4) Landforms Green areas Shoreline (5) Natural (3) Snow (2) Cliffs Ducks and swans Marsden Rock/Stack (2) Wildlife Trees (2) Hills Fields Countryside Sky</p>	<p>Amenities Steps Fences Bridge Styles Gate Accessibility Wall (3) History/ancient civilisation</p>	<p>Peaceful Clean Human influence over nature Angle and lighting</p>
<p>UNN</p> <p>Why you not like this image? What features do you not like within this image?</p>	<p>Leafless trees No trees (2) Grass Not natural (2) Overgrown Sky</p>	<p>Industrial look (3) School/hospital/buildings (2) Paved areas Painted walls Gravestones/graveyards Road Landfill site (3) Derelict Pollution</p>	<p>Bland (9) Uninteresting Could be anywhere Dark Polluted Lifeless Not attractive No colour/beauty Desolate (2) Smoggy Scary Uncomfortable Looks managed Ugly Depressing 'Too perfect' Cheap/tacky</p>
<p>UNN</p>	<p>No grass (2) No trees (2) Weather (2)</p>	<p>Industrial landscapes (2) Wall Derelict</p>	<p>Dullness (3) Boring (3) Image itself</p>

Appendices

What do you think makes this image less important or likeable than the other images?	Landscape type Water	Landfill	Not personal (2) Could be anywhere (3) Not attractive (5) Landscape type Lifeless Capitalism Ugly Rubbish Lack of colour Death/sadness Don't like it Managed
Gateshead Conservation Volunteers			
GCV Why do you like this image? What features do you like within this image?	Beach (1) Birds (1) Grass (4) Landscape (3) Natural (7) Natural (7) Open space (4) Patchwork (1) Sea (1) Snowy (2) Stormy/rain (3) Sunny (6) Vegetation (2) Wildlife (2) Woods (5)	Activity (1) Background-foreground (2) Bandstand (1) Childhood (2) Management (3) Wall (5)	Colour (5) Freedom (1) Life (4) Lushness (1) Peaceful (5) Security (3) Sustainability (1)
GCV What do you think is the most important part of the image?	Beach (1) Brook (1) Grassland (1) Landscape (2) Natural (3) Sea (2) Sun (2) Trees (1) Wildlife (2)	Amenity (1) Background-foreground (6) Bandstand (1) Life-Death (1) Man-made (2) Pathways (3) People (1) Sunbathing (1) Wall (1)	Colour (1)
GCV Why you not like this image? What features do you not like within this image?	Sky (1) Winter (2)	Background-foreground (2) Bridge (1) Litter (3) Urban (1) Van (1)	Claustrophobic (1) Clutter (6) Cold (1) Colour (1) Depressing (4) Graffiti (1) Man-made (8) Poor form (1) Slippery (1) Too neat and tidy (2) Unattractive (1) Uninviting-uninteresting (9)
GCV What do you think makes this image	Grass (1) No leaves (1) Sky (1) Winter (1)	Buildings (2) Government policy (1) Litter (1) Managed (6)	Bland (3) Clutter (2) Emotionless (1) Lack of colour (1)

Appendices

less important or likeable than the other images?		Pathways (1) Sink estate (esque) (1)	Oppressive (1) Ordinary (5) Uncared for (3) Unclear (1) Uninviting-uninteresting (7)
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Appendices 3: Interview schedules

a. Interviews with Green Infrastructure academics.

Definition

- 1a. What do you understand the term Green Infrastructure to mean?
- 1b. What elements constitute Green Infrastructure?
- 1c. What does not constitute Green Infrastructure?

Placing Green Infrastructure

- 2a. How would you describe Green Infrastructure (i.e. a concept, a process or a delivery mechanism?)
- 2b. Would you place Green Infrastructure into a specific discipline, school of thought or context?
- 2c. If not how best can Green Infrastructure be described? (i.e. by its component parts, its theoretical background, its function?).
- 3a. Do you feel that there is a consensus as to what constitutes Green Infrastructure?
- 3b. If not why do you think that there are differences in how different groups define Green Infrastructure?

Development of Green Infrastructure

- 4a. What is your understanding of the historical development of Green Infrastructure?
- 5a. How would you describe the development of the Green Infrastructure concept i.e. stages, processes?
- 5b. What are the main processes involved in developing Green Infrastructure?
- 5c. Are there any conflicts between different groups interested in the development of Green Infrastructure?
- 5d. How could these different interests be negotiated to better develop Green Infrastructure?
- 5e. How should Green Infrastructure be developed?
- 5f. What scale should Green Infrastructure be developed at?

Future of Green Infrastructure

- 6a. What do you envisage the future developments of Green Infrastructure to be?
- 6b. Do you feel there will be a longevity to the development of Green Infrastructure?
- 6c. How do you see Green Infrastructure being developed within an academic context?
- 6d. Does this differ from how you see Green infrastructure developing in other sectors i.e. landscape management or public sector landuse and development?

b. Interviews with Green Infrastructure practitioners.

Definition

- 1a. What do you understand the term Green Infrastructure to mean?
- 1b. What elements constitute Green Infrastructure?
- 1c. What does not constitute Green Infrastructure?
- 2a. Do you feel that there is a consensus as to what constitutes Green Infrastructure?
- 2b. If not why do you think that there are differences in how different groups define Green Infrastructure?

Development of Green Infrastructure

- 3a. What is your understanding of the historical development of Green Infrastructure?
- 4a. How would you describe the development of the Green Infrastructure concept i.e. stages, processes?
- 4b. What are the main processes involved in developing Green Infrastructure?
- 4c. Are there any conflicts between different groups interested in the development of Green Infrastructure?
- 4d. How could these different interests be negotiated to better develop Green Infrastructure?
- 4e. How should Green Infrastructure be developed?
- 4f. What scale should Green Infrastructure be developed at?

Organisational Green Infrastructure use

- 5a. How was Green Infrastructure introduced to your organisation?
- 5b. What is the focus of your organisations use of Green Infrastructure?
- 5c. How do you use Green Infrastructure within your work?
- 5d. What areas of your work does Green Infrastructure fit within?
- 5e. What level of integration has Green Infrastructure has within your work?

Appendices

5f. How does your organisation deal with the different uses/definitions of Green Infrastructure?

5g. Are there any difficulties with working with this landscape assessment/management technique?

Future developments for Green Infrastructure

6a. What do you envisage the future developments of Green Infrastructure to be?

6b. Do you feel there will be a longevity to the development of Green Infrastructure?

6c. How does your organisation see Green Infrastructure being used in the future?

6d. Does this differ from how you see Green infrastructure developing in other sectors i.e. landscape management or public sector land use and development?