

Understanding green infrastructure: the development of a contested concept in England

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The idea of “green infrastructure” has experienced a quick emergence in planning policy with little opportunity to reflect on the meanings attached to the concept by different interests. This has contributed to confusion and discomfort with the “lack of understanding” among planning practitioners in England who argue that green infrastructure could be a “corruptible concept”. Here I respond to the resistance to multiple meanings of green infrastructure by critically examining it as a contested concept. Building on the literature that positions ambiguity as unavoidable, I argue that a single precise meaning of “green infrastructure” is problematic because the concept is evolving and divided between environmental theory and socio-economic policy. By doing this, I intend to better equip practitioners in England with an understanding of the meanings attached to green infrastructure and how its ambiguity is used, so that they may secure the environmental benefits that are at risk of being isolated in green infrastructure theory.

Keywords: green infrastructure; planning; ambiguity; contested concept

Introduction

The concept of “green infrastructure” is gaining political momentum and has made a quick materialisation in both planning theory and planning policy. The hurry to capitalise upon green infrastructure in planning policy has restricted opportunities to reflect holistically on the meanings attached to the concept and how those meanings might continue to develop.

In February 2010, planning practitioners were invited to the RTPI Green Infrastructure Conference in Leeds where professionals involved in green infrastructure in England presented the latest developments in green infrastructure policy discussions. The conference was not the first of its kind in England, and many of the practitioners present had attended similar events before. It was significant because, despite this, planning practitioners remained confused about what “green infrastructure” is or is not, beyond involving the ideas of connectivity, multifunctionality and “green” particularly as different interpretations of those ideas were conveyed in each presentation. There was growing discomfort with the ambiguity of the concept among practitioners at the conference who believed that the “lack of understanding” of green infrastructure led to it being a “corruptible concept”; that contestation would stimulate confusion and permit political agendas to take advantage of the

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concept, hindering practical application (Collinge 2010). The consensus among practitioners at the conference was to search for an explicitly defined meaning of “green infrastructure”, avoiding ambiguity in an attempt to secure the potential benefits of the concept in English planning practice.

This article responds to resistance against the ambiguity of green infrastructure by exploring the nature and politics of the concept. I argue that green infrastructure is ambiguous and essentially “a contested concept”. The concept has been given definitions, but is not yet explicitly “defined” as different interests attach different environmental, social and economic meanings to it. Crucially, green infrastructure is also contested between literature developing the green infrastructure concept (referred to as “theory” for the purpose of this analysis) which have an environmental focus, and policy writings contributing to the practical application of green infrastructure which are dominated by socio-economic concerns. Literature that contributes to both is identified by giving a more balanced consideration of each.

In the following pages, I develop the argument that resistance to the ambiguity of contested concepts is not productive and is based on a fundamental misunderstanding of their complex and political nature (Jacobs 1999) in relation to green infrastructure, and maintain that searching for a single fixed definition of “green infrastructure” is problematic because the concept is evolving, divided and gravitating toward socio-economic centres. Furthermore, I argue that in terms of securing the added benefits of green infrastructure that are set out in planning theory and policy, resistance to ambiguity is counterproductive. This article, therefore, does not propose to set limits for green infrastructure, but to help practitioners begin to understand the policy space around the concept in England and how this awareness can improve the potential to secure a wider range of green infrastructure benefits in practice by retaining environmental as well as socio-economic purposes as the green infrastructure concept continues to evolve and to be used by different interests.

The article has four sections. First an exploration of the evolving contested and divided nature of “green infrastructure”. Secondly an examination into the different interpretations of the concept and the factors contributing to the divide in theory and policy. Third, a discussion around the resistance to the ambiguity of green infrastructure drawing on wider debates around sustainable development. Finally the implications of explicitly defining green infrastructure given its evolving and contested nature will be critically examined, speculating on the future of the concept.

Lack of room inhibits full exploration of the debates involved and a comprehensive analysis of all the international contexts and uses of green infrastructure is not possible here, this contribution is therefore by no means definitive, but rather an attempt to provide a detached and holistic perspective on the question of “green infrastructure” in England and further open up what will undoubtedly be a vibrant and policy-relevant debate on the emergence and use of the concept in certain contexts.

What is “green infrastructure”?

Despite some practitioner perceptions, green infrastructure has not “come out of nowhere” (Thomas 2010). Although a new term, it is not a new idea; representing a long period of apparent convergence in theories and practices in different contexts (Benedict and McMahon 2006, Kambites and Owen 2006, Walmsley 2006, Mell 2008). The evolution of green infrastructure is far from linear and although we cannot conclusively recount the history of green infrastructure, it is interesting to note the narratives that have been attached to the concept and that are often replicated by other commentators. These

include Victorian parks, US greenways, Garden Cities and New Towns (Fabos 1995, Turner 1996, Benedict and McMahon 2002, 2006, Hebbert 2008, Mell 2008, McMahon 2009) and more recently the ecological city and sustainable urbanism (Ahern 2007).

The development of green infrastructure is gathering speed internationally in both theory and policy and there is a building consensus that green infrastructure provides an exciting opportunity for the delivery of significant environmental, social and economic benefits (Mell 2008). Since the beginning of the twenty-first century the use of the concept has grown in academia as discourses gain momentum under the same “umbrella” (see Markusen 2003) and actors recognise the value that the concept can add to their work (Mell 2008). The concept has also reached high levels of policy-making (see European Commission 2010). In England, it had taken just two years for green infrastructure to progress from a reference in planning policy (see DCLG 2008) to the basis of emerging national policy (see DCLG 2010). There has been significant regional and city regional activity in England and a growing number of local authorities in the UK are already developing strategies and delivering green infrastructure on the ground in front of policy (Comyn 2010; see for example TEP 2008, LDA Design 2010, Plymouth City Council 2010). Despite developments on the ground, the question of what green infrastructure means is nevertheless continuing in policy discussions. At the end of the first decade in the twenty-first century, it is clear that green infrastructure matters both as an idea and in practice.

The definition of green infrastructure is often the first line to be read in both academic articles and planning guidance. Definitions are, therefore, a useful starting point for analysis, carrying significant authority and to some degree expressing the values the author attaches to the concept. However, the definitions of green infrastructure are numerous and diverse (Benedict and McMahon 2006). Currently the term is being used loosely and there are broad and varied interpretations depending on the sector and context in which the concept have been developed, and critically a person’s involvement in either green infrastructure theory or green infrastructure policy (Table 1). This is evident in the different interpretations that have been developed in the USA and in England. The regulatory planning system in the USA has allowed greater certainty as to what development is permitted through the use of zoning, whereas the discretionary planning system in the UK is more pragmatic (Booth 1999). This combined with a sturdy and politically popular Green Belt policy has contributed to an English context for development pressure that is very different to the USA where urban sprawl has led to land consumption being three times the population growth (McMahon 2009), and green infrastructure has developed as a resource management tool for “smart conservation”. The green infrastructure concept has developed in response to different needs.

Furthermore, there is a lack of consistency in the wording of these definitions illustrated in Table 1 which appear to prioritise different environmental, social and economic focuses for green infrastructure. From this, we can see the complexity of the concept, as well as how actors struggle with its meaning. We can understand the significance of green infrastructure but not necessarily how this might translate into policy or practical measures. I argue that green infrastructure is inherently ambiguous.

The constructive and/or destructive nature of ambiguity in the planning system is a dynamic and extensive debate in academic literature (Beckerman 1994; Dobson 1999; Evans and Jones 2008). To understand how “green infrastructure” fits within this debate I will position it as a “contested concept” using Jacobs’ model (1999, p. 25). Within this model a contested concept is inherently complex, ambiguous and political, and has two levels of meaning. The first level is the “meaning of the concept”; this may have multiple

Table 1. Definitions of “green infrastructure”: varied lengths and wording exemplify difficulties with fixing green infrastructure beyond the three core ideas of connectivity, multifunctionality and “green” (*italicised*).

Source	Definition	
(Ahern 2007, p. 267)	“Green infrastructure is an emerging planning and design concept that is principally structured by a hybrid hydrological/drainage <i>network</i> , complementing and linking relict <i>green</i> areas with built infrastructure that provides ecological functions”.	Green infrastructure theory
(Benedict and McMahon 2002, p. 2)	“Our nation’s natural life support system – an <i>interconnected network</i> of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other spaces that support native species, maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life of America’s communities and people”.	
(DCLG 2008, p. 5, 2010, p. 25)	“‘Green infrastructure’ is a <i>network of multifunctional green</i> space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities”.	Green infrastructure policy
(Natural England 2009, p. 7)	“Green Infrastructure is a strategically planned and delivered <i>network</i> comprising the broadest range of high quality <i>green</i> spaces and other environmental features”	
(Kambites and Owen 2006, p. 484)	“Green infrastructure is taken … to encompass <i>connected networks of multifunctional</i> , predominantly unbuilt, space that supports both ecological and social activities and processes”.	Linking theory and policy

definitions but all will express a single collective set of core ideas. The second level is “what the concept means in practice”; this is usually the arena for political contest as to how the concept is operationalised. Jacobs (1999) applied this model to the concept of “sustainable development” (p. 26). Whereas sustainable development is not strictly defined, Jacobs argues that there are six core ideas at the first level of meaning (p. 26). These core ideas are generally agreed with (or are difficult to challenge) in principle. The contestation of the concept stems from varied interpretations of those ideas at the second level such as “dark green” sustainable development; “a commitment to living within the limits created by ‘carrying capacities’ of the biosphere”, and light green; “commitment where possible to protecting environmental resources and amenities” (Jacobs 1999, p. 31). Sustainable development should be acknowledged when an application compromises all six of these ideas (environmental-economy integration, futurity, environmental protection, equity, quality of life and participation) (Jacobs 1999, p. 26).

Although the definitions of green infrastructure are scattered, and include a number of different ideas (among those incorporated into Plymouth’s City Council’s (2010) Green Infrastructure Delivery Plan (p. 11) are low carbon solutions, sustainable transport, improving the quality of place, health and wellbeing), there are currently three broad and

interrelated core ideas (at the first level) which appear to lead consistently throughout the meaning of the concept: these are connectivity, multifunctionality, and “green” (see emphasis in definitions, Table 1). Connectivity and multifunctionality are often based on the idea that greater value is secured through establishing an interconnected network of environmental functions at different scales where natural processes work simultaneously (Ahern 2007). “Green” is a more implicit idea in definitions and usually represents the elements of green infrastructure that act as a basis for environmental improvement.

The core ideas of “green infrastructure” are comparatively narrower than those of more abstract concepts such as “sustainable development”. This can permit the use of fewer criteria needed to match the values of green infrastructure, allowing the concept a wider span over diverse disciplines and approaches as well as the concepts within them. Thus although there are fewer core ideas associated with green infrastructure, the scope of green infrastructure as a concept is actually broadened, aided by the greater number of possible combinations; interpreters have more flexibility in securing justifications of the uses of green infrastructure which apply to the three collective core ideas. Even at the first level of meaning, where Jacobs argues core ideas are acknowledged, one can see divisions (which would not be “allowed” in classic contested concepts such as sustainable development), this then multiplies the possible interpretations at the second level, highlighting initial indicators that green infrastructure continues to evolve as a contested concept as agendas are attached to these ideas. Thus, Mell (2008) stated “though both ecological and social agendas utilise a number of similar concepts to outline the proposed utility of green infrastructure, the main difference is the way that the research is framed” (p. 72). An example is the use of “green” which varies from the provision of assets that are green in colour (green space, wetlands, and woodlands (Benedict and McMahon 2002)) to the provision of more “environmentally friendly” infrastructure (renewable energy, public transport (DB Advisors 2008, Plymouth City Council 2010)). Here, we can see the contest around the second level of meaning, where the concept is interpreted and applied in practice. This contest and the frustrations arising from it, in terms of green infrastructure, are discussed in Section 3 of this paper. The core ideas chosen here are not to devalue others in green infrastructure literature, but to demonstrate the frequency in which they appear in planning theory and policy definitions.

Diverse interpretations of the core ideas of connectivity, multifunctionality and “green” are also evidenced (and in some cases disputed) by significant variations in the focus underlying definitions dependent on the discipline of the interpreter as well as the purpose for which that definition has been formed (Mell 2008), that is to say in the interpretation of the second level of meaning. The broader scope of green infrastructure, influenced by fewer core ideas, means that the proposed attributes of green infrastructure are also extended, often into different spheres and different geographical locations, for example, between the USA and England. These can be approximately identified as environmental, social and economic focuses of green infrastructure.

The environmental emphases of the concept have been said to be leading throughout the evolution of the concept in green infrastructure theory before it was named “green infrastructure” (Benedict and McMahon 2002, Walmsley 2006). Here we can see the core ideas of green infrastructure although they had not yet been given this label. Many understandings support the idea that green infrastructure is beneficial (and in some cases essential (see Ahern 2007)) for the protection and improvement of ecosystems (Tzoulas *et al.* 2007, McMahon 2009, European Commission 2010), for landscape connectivity enabling movement of wildlife and biodiversity (Fabos 1995, Dramstad *et al.* 1996, Leitão and Ahern 2002), and in some references for environmental protection and conservation (Benedict

and McMahon 2006, Natural England 2009). More recently functions have been extended further to climate change mitigation and adaptation both in theory (Ahern 2007, Gill *et al.* 2007) and policy (DB Advisors 2008) particularly as the planning system is now explicitly concerned with climate change (DCLG 2007). The purposes of green infrastructure therefore continue to evolve, including more technical environmental services such as storm water management and flood alleviation (Ahern 2007); a second example of the evolution of “green” as a core idea.

Social functions of green infrastructure have often been listed ahead of environmental considerations in planning policy (Table 1). As well as improving mental and physical health (TEP 2005, p. 1, Tzoulas *et al.* 2007, Northwest Green Infrastructure Think-Tank 2008, p. 3; Natural England and Campaign to Protect Rural England 2010, p. 7), the social benefits outlined in green infrastructure definitions include connectivity of urban and rural neighbourhoods, the provision of settings for culture, sport and recreation, and enhancing local distinctiveness, social inclusion, and sense of community (Environment Agency 2005, Kambites and Owen 2006, Ahern 2007). Green infrastructure has also been acknowledged for its potential in regeneration projects (North West Green Infrastructure Think-Tank 2008, Landscape Institute 2009, McMahon 2009, Natural England 2009).

A number of recent studies emphasise the economic focus of green infrastructure, including the benefit of providing an “enhanced environmental backdrop” using green infrastructure to inspire economic growth through attracting skilled workers and tourists to cities (Environment Agency 2005, TEP 2005, ECOTEC 2006), and increasing land and property values (CABE Space 2005, NWDA 2008, McMahon 2009, Collinge 2010). In addition, reduced costs associated with mitigating climate change, flood management and improving health and wellbeing are highlighted (CABE Space 2005, NWDA 2008, Collinge 2010). Other indirect economic justifications relate to labour productivity, products from the land and recreation and leisure (NWDA 2008).

The differences in definitions may therefore be “symptomatic of the differences in views on what green infrastructures are and what they should constitute” (Mell 2008, p. 73). The concept of green infrastructure is fluid and has progressed rapidly since it was first introduced in the policy realm (see Mell 2008, p. 76), this evolution continues with the gradual development of its core ideas. This is significant as the apparent focuses of “green infrastructure” have altered throughout its varied progressions; from design-based green space interpretations (Williamson 2003, Pincetl and Gearin 2005) to landscape ecology and environmental (Davies *et al.* 2006, Ahern 2007, Tzoulas *et al.* 2007) to socio-economic focuses (Environment Agency 2005, Benedict and McMahon 2006, North West Green Infrastructure Think-Tank 2008, Landscape Institute 2009, Natural England and the Campaign to Protect Rural England 2010). This has not been a neat transformation; there has been a layering of focuses rather than displacement of those that went before, which may have been underlined by, and/or support, different agendas and actors.

As a relatively new term, it is not surprising that the green infrastructure concept is susceptible to change as planning theory and practice develop, and it is beneficial that green infrastructure has evolved into wider socio-economic benefits. The problem arises when green infrastructure is frozen by a fixed definition while in an evolving state. Crucially, not only are the core ideas of “green infrastructure” contested when interpreted into policy or practical measures, but this contest of priorities and the development of the concept appear to be split between environmental theory and socio-economic policy which are currently evolving through parallel rather than converging dialogues. This too is not a neat division, especially as theory and policy are not easily separated, and there are some exceptions to this pattern such as Benedict and McMahon’s (2006) more

socio-economic approach in theory. The point here is that significantly this divide represents a fundamental gravitation in the emphases of green infrastructure that is potentially detrimental to the meaning of the concept given the resistance to this contestation for which negotiation between researchers and practitioners is on-going (see Mell 2008). This will be discussed further in Section 3. In the next section, I will examine the factors influencing the interpretations and thus the divide in the second level of meaning of green infrastructure according to Jacobs (1999) model of contested concepts in order to highlight features of ambiguity and meaning contestation.

An examination of the apparent divide

In order to draw attention to the process of interpretation and how this can influence the divide between more or less environmental or socio-economic green infrastructure, it is useful to examine a case study of current policy discussions. The following paragraphs describe an example of green infrastructure as presented at the RTPI Green Infrastructure Conference in Leeds, specifically the competing agendas of different actors in the process of development, which will be referred to throughout the remainder of the paper.

Presentations on the benefits of green infrastructure resulted in a lively debate at the RTPI Green Infrastructure Conference as to the interpretations and use of green infrastructure. A private consultancy had been commissioned to produce a city regional green infrastructure strategy. The main actors involved were therefore the public sector at the city region level with a strong economic competitiveness agenda, as well as the private consultancy itself, who needed to outline an efficient planning strategy to deliver green infrastructure improvements on the ground. It was argued that green infrastructure was too broad to be feasibly delivered, and the objectives of the concept had been reduced to four as a result; economic development and population growth, biodiversity, health and wellbeing, and climate change. These interpretations of green infrastructure were viewed as “drivers of investment”. Where consultation had been carried out with local authorities, it was found that every element of the concept had to correspond to economic development and/or health and wellbeing. The more environmental objectives were argued to be secured “where possible” when investment could be fed down following this hierarchy of priorities. During the conference, this was challenged by an actor with a more environmental focus who argued that there were in fact eleven benefits of green infrastructure to be secured; economic growth and investment, land and property values, labour productivity, tourism, products from the land, health and wellbeing, recreation and leisure, quality of place, land and biodiversity, flood alleviation and management, and climate change adaptation and mitigation (see Natural Economy Northwest 2011, n.p.). It was claimed that consolidating these environmental benefits reduced the possibility for different types of investment in those benefits, and that focusing green infrastructure development solely on economic development and health and wellbeing could lead to detrimental trade-offs in terms of which environmental benefits could be secured, and which would be more convenient for private interests to deliver.

This example illustrates the contestation between different interests in different contexts as they interpret green infrastructure and raise issues around the trade-offs which may lead to the separation of socio-economic factors. There is a distinct awareness here of the apparent contestation between desirable environmental outcomes and the necessity to satisfy those able to invest in green infrastructure on the ground. We can also see the significance in terminology and interpretation to appeal to these interests. The actors involved in this example appear to make an impact on the way that they interpret the core ideas of green infrastructure.

The interpretations of “green infrastructure”, or parts of those interpretations, that are adopted by actors cannot be explained by chance, but reflect different interests and power relations; this concerns branding, politics and the “strategic selectivity” of the state. The branding of the ideas of connectivity, multifunctionality and “green” as “green infrastructure” has been explained as an attempt to shift the concept from something that is an “amenity” to something that is a “necessity” (Benedict and McMahon 2006, Walmsley 2006). This appears to have had a significant impact on the popularity of the concept, allowing it to be sufficiently ambiguous and non-technical to appeal to a wider audience. Ambiguity can facilitate the formation of “umbrella” concepts under which typically conflicting interests find synergies through the use of a common language where a dialogue had not been apparent previously (see Markusen 2003, Harding 2008). This has been identified as a characteristic of sustainable development as a contested concept, uniting different agendas where “not long ago, environmental policy and politics was a battlefield not just for sharply conflicting interests and world views ... but correspondingly for competing vocabularies” (Jacobs 1999, p. 21). Kambites and Owen (2006) have supported this perspective of green infrastructure, suggesting that its varied focus can provide broader ranging benefits to environmental, social and economic interests. More actors can contribute to this shared area, and a more rounded focus for planning is created. This is exemplified in the diverse benefits identified in different spheres in the Plymouth Green Infrastructure Delivery Plan (among others); CO₂ reduction, inward investment, education, biodiversity enhancement, sustainable transport, climate change adaptation, health and wellbeing, quality of place, food production and increased activity (Plymouth City Council 2010, p. 11).

The concept of “ecosystem services” has become popular in planning policy because of its emphasis on the human benefits of ecological functions (see Haines-Young and Potschin 2007). Similarly, “green infrastructure” is implicitly socio-economic, identified as a tool to deliver “ecosystem services” in planning policy (DCLG 2010). This use of “infrastructure” has assisted the green infrastructure concept in being more relatable to socio-economic interests which have picked it up in policy. This is exemplified in the coining of Benedict and McMahon’s (2006) socio-economic approach to “green infrastructure”; Edward T McMahon was dubbed “the founding father of the concept of green infrastructure” by CABE after his appearance at the Park City Green Infrastructure Conference in 2009 (Minton 2009, n.p.). This US definition has, therefore, become important in England, albeit produced in a context with different needs for green infrastructure. Although there may be a link between green infrastructure theory and green infrastructure policy in England through the joint use of this definition, it should be recognised that McMahon’s development of the concept is distinctively less environmental and more socio-economic than most other “theoretical” writings as the development of the concept becomes integrated between both environmental and socio-economic focuses. The emergence of city regional works, which primarily aims to increase economic competitiveness (see TEP 2008) could suggest that it may in fact be the socio-economic refocus of green infrastructure that is popular.

Contested concepts are inherently political. The idea of “green infrastructure” as a “shared territory” (Evans and Jones 2008) implies the involvement of equal actors; however, in reality interests compete for the dominance of those interests within the concept. Although there appears to be an integration of environmental and socio-economic green infrastructure ideas, some interpretations have more discursive influence. The result may be that the cooperation of interests gives only the appearance of a common ground where actors have different objectives and often outcomes, but the concept is labelled the same, as Torgerson (1995) argues has occurred in respect to sustainable development.

This is significant for green infrastructure as there is a greater number of, often more powerful, socio-economic interests than environmental interests acting in the policy arena. For example, in the city-region case study it can be reasoned that pro-development agendas may benefit from the delivery of green infrastructure on the ground. The concept has been situated as a tool for securing sustainable development in planning policy (see Deeney 2008) which can translate into sustainable economic growth. This tool may be subject to the interpretation that new economic development, benefiting from an “enhanced environmental backdrop” in green space areas, can be facilitated in terms of planning permissions given that it meets the broad criteria of connectivity, multifunctionality and “green” (which are again subject to interpretation). This is relevant in consideration of the need to secure investment capital. Economic interests, therefore, carry significant weight for the implementation of green infrastructure, especially in uncertain economic conditions when the state must facilitate economic growth and meet housing pressures. On the surface green infrastructure appears to benefit everyone; however, it may benefit socio-economic interests more than environmental in practice. This raises questions as to whether green infrastructure alters the objectives of economic development, or whether economic objectives remain unchanged under the label of green infrastructure.

Powerful interests are also reinforced by the “strategic selectivity” of the state as it attempts to reconcile the interests of different groups, reflecting the changing balance of socio-economic forces (Jessop 2002). This is significant as “[state] capacities … always depend for their effectiveness on links to forces and powers that exist and operate beyond the states formal boundaries” (Jessop 2002, p. 40).

The need to meet the expectations of private interests may have affected the focus of green infrastructure on the grounds of efficiency in the planning process and certainty in planning policy. Efficiency in the planning system has long been a pressing objective for the state (see Dobry 1975, Barker 2006, Killian Pretty Review 2008). Critiques of the planning system argue that regulation hinders development through increasing “delay” and therefore risk (see Booth 2002). The state requires growth to be facilitated quickly. Similarly to the way that green infrastructure has provided the “umbrella” for disciplines to unite, it has also provided the regulatory context to streamline planning policy and tailor that policy to current contextual needs (see DCLG 2010). This has helped to establish the integration of sectors such as those given as drivers of investment for our City Region example; economic development and population growth, biodiversity, health and wellbeing, and climate change adaptation and mitigation. However, the discussion between the different interests in this case study highlight that there will inevitably be a hierarchy within that integration (see Homer 2010). Here we see signs that some policies can be prioritised over others combined under “green infrastructure” and the suggestion that it may be environmental focuses that lose out in the trade-off when defined (see Wilmers 2010).

Furthermore, immediate time pressures placed on practitioners by the requirement of developers to secure a degree of certainty in a discretionary planning system may have also pushed “green infrastructure” into a more socio-economic focus. Because green infrastructure strategies are being produced alongside policy discussions (TEP 2008), there has been little time for practitioners to realise the full extent of green infrastructure policy applications, or the will to reflect on the meaning of “green infrastructure” other than what is given in the policy guidance. Prematurely produced strategies exclude the expansion of green infrastructure functions as they emerge and the concept evolves, restricting the potential to incorporate more environmental green infrastructure theory as these dialogues develop; an option suggested by the private consultancy in the City Region case study

once economic needs have been satisfied. There is a risk that planning policy may, in this scenario, retain the same objectives labelled as green infrastructure.

Here, we can make links to some reasons why socio-economic interpretations of green infrastructure (and its core ideas) are benefitting from ambiguity, while environmental interpretations are arguably losing out, influencing the divide. This is not to say that the grouping of environmental and socio-economic interpretations of green infrastructure is not useful. It can be argued that there has been some necessary integration in terms of funding, for example, to ground green infrastructure in economic viability. However, there are priorities within that combination of environmental and socio-economic interests which are not assumed equal weight. Not only does the concept continue to evolve, but the divide may continue to expand subject to powerful socio-economic interests and practical circumstances. In a similar fashion to sustainable development, there are now “strong” and “weak” versions of the concept (see Jacobs 1999, Connelly 2007) evident in the respective environmental and socio-economic forms of “green infrastructure”. Ecological modernisation has been viewed as a liberal political policy response to conceptualise urban environmental problems, which some have argued has reduced these issues to a condition for social regulation through environmental policy (Hajer 1995, Jonas *et al.* 2004). What we could be seeing is “green infrastructure” as parallel to, or a subset of, ecological modernisation.

The divide in planning theory and policy is particularly pertinent, given the responses to the different interpretations of green infrastructure. In the next section, I will examine how the existence of different interpretations, and to some extent the divide itself, have provoked frustrated responses to green infrastructure and the call for a single fixed definition.

Responses to “green infrastructure”

Ambiguity can allow political actors to “proceed without having to agree also on what exactly to do” (Torgerson 1995, p. 11), however, this leaves the problem with practitioners. At the RTPI Green Infrastructure Conference in Leeds, practitioners in attendance felt that the “lack of understanding” of the meaning of “green infrastructure” was both a weakness and a threat for its potential applications. This frustration with the green infrastructure concept is essentially resistance against its ambiguity and resulted in an insistence by planning practitioners that the concept should be defined in order to ensure it is used in the “right” way. Following the debate after the given city region case study at the RTPI Green Infrastructure Conference, it was argued that practitioners should find a common language of green infrastructure taking the explanation beyond the meaning in practice and fixing the meaning of the core ideas (Collinge 2010, Wilmers 2010). This response to ambiguity reflects a common debate around “sustainable development”.

The argument around what green infrastructure means in practice in relation to the lack of clarity around what green infrastructure means conceptually, is crucial. Although Jacobs (1999) argued that contested concepts have two levels of meaning, in reality there are far more, the boundaries of which are fuzzy. “Green infrastructure” has been described as a physical thing to be delivered (Sandstrom 2002, Environment Agency 2005). It has since developed into a number of forms: a model for “sustainable development” (TEP 2005), an approach to working (see Kambites and Owen 2006), a planning and design concept (Ahern 2007) as well as environmental assets and functions on the ground; natural areas, conservation lands, working farms, ranches and forests, and wilderness (Benedict and McMahon 2002). Practitioners do not know whether green infrastructure is a philosophy or a tree, when in effect it could be both of these things. Here we see the blurring of the two levels of meaning in Jacobs (1999) model, highlighting issues when considering the

will to define the concept at either or both levels of meaning. In relation to sustainable development as a contested concept, two main justifications of this response are given.

The technocratic response to ambiguity argues that concepts can only be constructively operationalised if they have a single precise meaning (Jacobs 1999, Markusen 2003), so that a set of measurable criteria can be used to determine effective implementation (Harvey Brooks in Beckerman 1994). Practitioners at the RTPI Green Infrastructure Conference reasoned that “green infrastructure” has expanded into a solution for too big a problem; with so many interpretable elements to consider, implementation becomes less feasible (Homer 2010). There is also perhaps an element of risk-aversion around this response; a reluctance to implement green infrastructure when uncertain about what is expected of practitioners and without clear guidance on the approach that should be taken. Under pressure to work quickly (see Booth 2002), planning practitioners are unwilling to reflect on the meaning themselves, leaving interpretation at a higher level of governance. This concern may have contributed to the separate treatment of green infrastructure and existing Green Belt treatment (Government office for Yorkshire and the Humber 2008) as opposed to integrating them in practice as part of the same normative idea as discussed at the RTPI conference in terms of competing or complementary interpretations of each agenda (Comyn 2010, Thomas 2010). This is important in terms of the potential for practitioner negotiation to secure environmental benefits, particularly at a smaller scale to meet local needs.

The comparatively narrow core of “green infrastructure”, with arguably half the number of core ideas as other contested concepts such as sustainable development, provides the ambiguity to be more interpretable and, therefore, the power to transform the way that different agendas are emphasised granting justification to all approaches (Evans and Jones 2008). Some arguments associate ambiguity with camouflage for powerful interests and political agendas (see Jacobs 1999). There was concern at the RTPI Green Infrastructure Conference that green infrastructure was a “corruptible concept” which may be hijacked by these interests to “green” their objectives (Collinge 2010). As discussed in the case study, the objectives of private interests could remain unchanged while benefiting from a “greener” outer shell; because “green infrastructure” has been positioned as a framework for sustainable economic growth (Walmsley 2006), development in the Green Belt may be justified if it does not disconnect the multifunctional “green” (Thomas 2010). Similar arguments have been made with regard to sustainable development (Lélé 1991, Richardson 1997). Potentially some environmental damage could be justified by other environmental benefits.

Benedict and McMahon (2006) have gone beyond response to a call for action in the USA. They attempt to put boundaries on what the green infrastructure concept is not, concerned that it should not become a “panacea”; “like any planning effort, green infrastructure requires tradeoffs among priorities to be made” (Benedict and McMahon 2006, p. 15). This suggests that the ambiguity of “green infrastructure” is undesirable and avoidable (see Harding 2008) and implies that the concept has a “true” meaning. In the next section, I will argue that this response is based on a misguided assumption of ambiguity and is particularly problematic for the development of “green infrastructure”.

Implications of defining “green infrastructure”

There is “a longstanding, though always minority, tradition that sees conceptual ambiguity and ensuing contestation as inevitable and explicable” (Connelly 2007, p. 259).

The implications that I discuss in this section are based on my own normative position on “green infrastructure”; that environmental focuses of the concept are fundamental for the

broad range of opportunities that green infrastructure presents to be secured in practice. In addition, that the environmental interpretations of the core ideas of connectivity, multifunctionality and green should remain a significant part of the concepts development. I position myself among those who believe ambiguity is unavoidable. The pursuit of a precise meaning of a concept is neither possible nor productive and is based on a mistaken view of contested concepts (Jacobs 1999, Mittler 2001, Connally 2007).

The problems of defining green infrastructure as it stands today is a risk, given the imbalance between socio-economic and environmental interpretations. An attempt to fix the meaning of “green infrastructure” as a developing concept, as well as its current position, is problematic as it disregards the fluid nature of the concept. Ambiguity has been an attribute in that it allows the concept to adapt to the varied requirements of different spatial and temporal situations. Any definition of “green infrastructure” in its current state would be restricting freedom in its interpretations and applications, compromising the valuable development of the concept. Rather than securing the environmental benefits of the concept this may cause green infrastructure practices to become obsolete in a short time period and the significance of “green infrastructure” may be compromised. A single fixed definition would stifle the adoption of future progression in the green infrastructure concept as has been noted in recent developments of green infrastructure in relation to climate change (LDA Design 2010).

There is a danger that the meaning of “green infrastructure” is also divided between theory and policy; both continue to transform, but in parallel to one another. If a definition of “green infrastructure” was fixed tomorrow (if this was indeed possible), the opportunity of combining these dialogues would be ruled out. Rather than streamlining planning policy, a definition is likely to separate green infrastructure theory and green infrastructure policy further and moreover, impose an additional divide between green infrastructure policy and practice. It could be argued that “green infrastructure” has gone past the point of environmental considerations in planning policy, however there is a possibility that because the concept now has socio-economic justifications, these elements can be integrated and environmental benefits can be secured more easily.

The meaning and integrity of “green infrastructure” may also be compromised. Discarding environmental functions in theory is crucial for the delivery of those functions as the concept itself is rarely central to the process of implementation (Harding 2008). It is unlikely that meanings other than those specified in planning policy will be considered as delivery attempts to follow the most convenient and efficient route (subject to political pressures). In addition, as this article has discussed, the implementation of green infrastructure functions depends on their ability to be quantified in order to secure investment (Collinge 2010). Although there is a general consensus that environmental improvements can reduce costs (CABE Space 2005), practitioners may choose to deliver those functions which provide greater certainty of economic return and environmental functions drop out of the equation.

Here it is not argued that ambiguity itself is a negative thing, quite the opposite when giving recognition to the way in which ambiguity has allowed the green infrastructure concept to become more relevant and potentially more deliverable as broader socio-economic and environmental functions come forward. However, what is problematic in regard to ambiguity is the unease and resistance that it has provoked. It is important that the resistance to ambiguity is alleviated, particularly as ambiguity is inevitably present within contested concepts. If green infrastructure were purely socio-economic, it would leave the concept open to criticisms of a hollow rhetoric. Many of the supporters of strong “sustainable development” have dismissed its weaker counterpart; Richardson (1997) viewed socio-economic

interpretations of sustainable development as an unacceptable political pretence. There is considerable risk that in practice, green infrastructure may only be an “enhanced environmental backdrop” amounting to the attractive greening of cities through design with little environmental value. Sustainable development has been heavily criticised because of its ambiguity (Richardson 1997) and “green infrastructure” is in danger of heading for a similar fate.

Importantly, the argument that “green infrastructure” should have a precise meaning assumes that there are those with the authority and the will to define the concept. It is likely that the broad interpretations of “green infrastructure” would cause any single definition to be disputed. The reluctance to explicitly define “green infrastructure” suggests that it may be consensus agreement that shapes the development of green infrastructure rather than an optimal expert definition. However, the political nature of contested concepts means that interests compete to fill up the concept. What appears to be a “consensus” may in fact represent those interests that have organised themselves sufficiently to secure their interests (Jacobs 1999). The discomfort with powerful interests, using ambiguity might be replicated here, building further resistance to “green infrastructure”. If practitioners require the concept to be used in the “right” way it may be more beneficial for it to remain without a singular meaning. Moreover, national planning policy has remained fairly broad in its interpretation of green infrastructure to date. Although guidelines may outline some limits of what green infrastructure is and/or is not, it would appear that higher level interests find it more beneficial to retain a widely applicable and ambiguous green infrastructure concept.

Conclusions

To those who *understand* the green infrastructure concept, and its promise, the need and opportunity to apply it in the pursuit of sustainability are quite profound. (Ahern 2007, p. 282 [emphasis added])

Increasingly, simply rejecting ambiguity is seen as deconstructive; a number of academics now determine ambiguity as unavoidable (Connelly 2007). In addition, putting aside the various successes and failures of the concept in practice, the fact that some actors have rejected “sustainable development” has not prevented its dominance in planning policy. There are a number of interests who can benefit from green infrastructure and those interests can be expected to increase as the green infrastructure concept and green infrastructure developments continue to evolve. It is unlikely that the concepts of high level popularity will diminish as a result of practitioner frustration. Once a concept is accepted as inherently contested, there is greater opportunity to understand how it is used and what it might look like in practice (Jacobs 1999). Connelly (2007) suggested that by mapping the “terrain of struggle” created by ambiguity actors can better identify their position in relation to other interests. This understanding reduces the confusion often caused by ambiguity. Practitioners should not limit what “green infrastructure” means to a definition, but take a different approach to how it could achieve more comfortable meanings in the planning perspective. By choosing to address or ignore the exercise of political power in the planning process, planners can make that process more democratic or less, more technocratic or less, more dominated by powers or less (Forester 1989). It is crucial for practitioners to understand “green infrastructure” and how it is used and shaped in practice in order to enhance the potential of the concept through negotiation. This may also open up opportunities to gain positive impacts of ambiguity such as “creative outcomes” and “joined up” thinking (Evans and Jones 2008).

Consensus can be a positive and productive tool for securing green infrastructure delivery. However, what we should seek is not a “consensus” based on a single definition of green infrastructure, but the consensus that green infrastructure as a contested concept presents an exciting opportunity for delivering environmental, social and economic benefits in different theory and policy spheres as well as on the ground. In reviewing the concept I have joined this consensus, but with caution. The way that “green infrastructure” is currently evolving must be considered in order to ensure a policy-relevant future for green infrastructure. Socio-economic functions are greatly beneficial and will inevitably be placed above environmental considerations (Ahern 2007); however, they should not be pursued to the point where the environmental benefits of “green infrastructure” fall out of the equation. If others will continue to use green infrastructure to secure socio-economic benefits, it is also important that practitioners use it to secure environmental benefits too. Emerging studies that attempt to bridge the gap between green infrastructure theory and green infrastructure policy have tended to move into more socio-economic interpretations, prioritising the core ideas of connectivity and multifunctionality over “green” (see Kambites and Owen 2006). A position favouring environmental applications would give green infrastructure a normative goal to work towards while beginning to reconcile the void between theory and policy. Using this approach, practitioners may be better equipped to secure more of the benefits that green infrastructure offers in practice, and integrate as opposed to merely combining the socio-economic and environmental benefits of green infrastructure.

The correlations identified between the ambiguous, complex and political nature of “green infrastructure” and the divide between green infrastructure theory and policy in this article are significant, but not exclusively so, particularly as the meanings of the concept evolve in England and in other international contexts. It will, therefore, be interesting to see how the green infrastructure contested concept continues to develop who benefits from national planning policy developments and who may therefore benefit in the future as a result of green infrastructure delivery.

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