



After All, What Is GI?

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Chapter 1

After All, What Is GI?



Ian Mell

Abstract Green Infrastructure is discussed to mean different things in alternative geographical, ecological and socio-economic contexts. However, the growing literature focussing on what Green Infrastructure is, what it does and how it should be delivered provides a baseline set of principles that help to situate the concept in academic and practice-based debates. The promotion of connected landscapes that are multi-functional that provide access to nature at the local, city and regional scale is central to Green Infrastructure thinking. Moreover, the need to integrate socio-economic and ecological perspectives into political decision-making has been repeatedly outlined as a key variable to successful policy creation and subsequent implementation. It is also important to align current Green Infrastructure thinking with the historical antecedents of greenspace planning to examine where complementarities can be identified between the past and the present. Overall, this introductory chapter sets out the principles and history of Green Infrastructure planning illustrating the nexus of people, policy and practice that permeates through the following chapters. It also outlines the broader parameters of the debates to come and grounds them in accepted principles of existing Green Infrastructure thinking.

Since the introduction of Green Infrastructure as a concept, many things have changed in how territories and city organisations use it within the context of planning. One of the remaining unresolved issues is its relationship with the landscape. To some extent, ‘landscape’ was the instrument that spatial planning used to introduce ecological elements that may otherwise have been difficult to embed within planning. When additional instruments emerged, such as Green Infrastructure, which was considered to be focussed on ecological issues, greater difficulties in

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implementation began. Through this paper, we will always capitalise both – ‘Green Infrastructure’ and ‘landscape’ – in order to use them as terms of reference, both to complement each other and to juxtapose them. It is understood that the expression Green Infrastructure also covers Blue Infrastructure, i.e. aquatic ecosystems.

Keywords Principles · Connectivity · Multi-functionality · Policy · Scale · Collaboration · Practice

1.1 Introduction

As governments around the world consider their responses to COVID-19 and the Intergovernmental Panel on Climate Change (IPCC) 2021 reports the role of Green Infrastructure (GI), urban greening and Nature-Based Solutions (NBS) have become increasingly mainstream discussion points (Rastandeh & Jarchow, 2020; Mell & Whitten, 2021). Central to these conversations is the view that as a society we cannot continue to ignore the anthropogenic impacts on the world’s climate. However, there remains a visible reluctance in many locations to promote systematic change in how we plan for, develop and maintain urban areas. Consequently, we can continue to identify failures in government to locate “environment” centrally in development narratives (Scott et al., 2018; Wamsler et al., 2020). The reaction to this continuing issue is critical to this compendium of essays. The following looks to the innovation embedded within GI thinking to illustrate where opportunities for built and natural environment specialists to work more collaboratively to secure a more sustainable future for everyone.

To contextualise these discussions, the following chapter will set out the arguments for the use of GI as a “go to” form of investment and management (Young, 2011; Cilliers et al., 2019). Through an outlining of the core principles associated with GI, and illustrating where their antecedents lie, the chapter introduces GI as a concept, a framework for investment and a set of elements that can be delivered. This will link the alternative ways in which GI policy and practice have been shaped by socio-economic, ecological and political factors (Mell, 2014). Moreover, it will highlight the influence of temporal, geographical, scalar and disciplinary variation in what GI is, what it should do and how it is delivered and managed (Mell & Clement, 2020; Matsler et al., 2021). These four framings are critical to understanding how GI is currently being reported in the academic and grey literature and how various stakeholders are using the terminology associated with GI to promote more attractive, functional and inclusive development (Beatley, 2012).

The discussions outlined in their introductory chapter will help situate the use of the concept in the remainder of the book. Each of the authors presented have a range of expertise in the use and understanding of GI in various geographical contexts (Nagendra & Gopal, 2010; Koc et al., 2017; du Toit et al., 2018). They expand on the discussion of the terminological diversity associated with GI, discuss its legitimacy or corruptible nature, as well as locating GI in terms of geographically or

culturally specific approaches to landscape and urban planning (Garmendia et al., 2016; Wang & Banzhaf, 2018). Several themes running through the chapters provide a set of golden threads for readers. These include appreciation of the role of water in GI practice; understanding nature as a tool for investment, design and management across the world; reflections of the inclusion of cultural interpretations of heritage and art; linking GI to complex socio-economic and economic issues at a number of scales; and the ongoing promotion of ecological design in place of more traditional urban design practices (Benedict & McMahon, 2006; Mell, 2016). What is apparent throughout though is the forward-thinking nature of the examples, discussions and propositions made. The authors are utilising GI as an opportunity to address significant issues in landscape and urban planning. They are arguing for a reorientation of planning towards more ecological or nature-based thinking but are doing so within the context of understanding the constraints placed upon practitioners by economics and political indifference (Matsler et al., 2021). This chapter, and those which follow, aim to provide evidence of global best practice that can be used to influence decision-making, delivery and management at several scales.

1.2 GI Principles

The core principles of GI focus on the development of connected and multi-functional places that deliver socio-economic and ecological benefits to society and the environment (Li et al., 2005; Davies & Laforteza, 2017). This is delivered within a holistic approach to investment that supports collaboration between stakeholders to ensure delivery of works at several scales. We also have to consider the ways in which alternative disciplines across the natural and built environment engage with the varied terminology and geography of GI. This includes its location with dominant landscape planning practices, as in Tojo and Lopez's discussion in Chap. 3, the debates presented by Sanchez et al. in Chap. 12 or Pellegrino and Ahern's analysis of designing with water in Chap. 4. These principles have been reported extensively by a range of academic and practice-based authors over a 15-year period illustrating the predominantly positive impact that the planning for, and use of, GI can have on society (Seiwert & Rößler, 2020).

1.3 Connectivity

The development of connective places is a core principle of GI. The creation of places that are linked via a network of links, hubs and nodes at a neighbourhood, city and regional scale has been key to aligning GI thinking with both landscape and urban planning (Fábos, 2004; Ahern, 2013). The use of GI to promote investment in linear features, i.e. greenways including the Atlanta BeltLine, large anchor sites including the Queen Elizabeth Olympic Park in London and smaller pocket parks

and urban green spaces as seen in Singapore, can all be considered as supporting the principles of connectivity (Palardy et al., 2018). This is of specific relevance when considered in terms of equitable access, mobility and size/distance metrics of available GI (Mell & Whitten, 2021). Designing GI that offers opportunities to engage with the landscape at several scales ensures that people and ecological species can navigate inter- and intra-urban/rural boundaries effectively.

1.4 Multi-functionality

The delivery of multiple socio-economic and ecological benefits in one location is a second key principle of GI planning. The ability of planners, designers and developers to consider the ways in which GI can be planned into new developments, as well as retrofitted into existing spaces, to enhance health and well-being, ecological functionality, mitigate climate change, promote economic prosperity and meet local and strategic needs, supports the view of GI being multi-functional (Ugolini et al., 2015; Vallecillo et al., 2018). Moreover, promoting multi-functionality enables advocates to utilise the breadth of GI typologies, i.e. street trees, urban forests, waterways, parks, green walls and meanwhile green spaces, at a number of scales. However, we also need to recognise that not investments in GI need to provide all socio-economic and ecological benefits (Lovell et al., 2020). This includes reflecting on the cultural ecosystem services that GI can support, i.e. heritage, as discussed by Báthoryné, Ildikó and Valánszki in Chap. 12, and to a lesser extent by Li and Mell in Chap. 9's discussion of historical approaches to landscape architecture in China and the UK. One significant benefit of taking a multi-functional approach is the ability to offer bespoke solutions to specific issues or problems. Therefore, as long as each element of a GI network provides benefits to the wider area (and by association society), it can be considered multi-functional.

1.5 Access to Nature

The COVID-19 pandemic highlighted to many the importance of access to nature. Linked to personal and communal health and well-being, discussions of access to nature are located within a wider dialogue focussing on quality, quantity and equity (Kordshakeri & Fazeli, 2020). In many cities there is an unequal distribution of GI due to the decisions taken historically by planners and politicians. Consequently, we can identify significant variation in the types of GI, the quantity of GI and quality of those resources depending on where you live (Nesbitt et al., 2019). Within the research and practice literature, a series of benchmarks and metrics have been used to assess the ways in which GI are seen to be accessible. These include the Accessible Natural Greenspace Standard (ANGSt) in the UK and ParkScore© in the USA,

which assess accessibility against specific criteria (Pauleit et al., 2003; Rigolon et al., 2018). However, these practices can underestimate the socio-economic, political or physical barriers to access created by planning. Effective GI investment therefore considers size, location, accessibility, functionality and ecological quality when examining how, where and what nature different communities can access. Thus, we should not simply consider more GI, in terms of m² or percentage per person (% pp) as a standalone approach to understanding access to nature, even though it may offer the most practical approach (University of Manchester et al., 2020).

1.6 Scaled Investment

The discussion of typologies, i.e. what GI is, also needs to consider at what scale investment should be located. As with considerations of connectivity and GI networks, scale draws explicitly on our understanding of systems (Hellmund & Smith, 2006). For example, water networks span geographical and administrative boundaries and need to be managed at both a catchment and a local scale. Likewise, habitats span scales from urban centres to national parks or over pan-national forests. Fabris and Li's discussion of GI development in Milan and Beijing in Chap. 10 support this view noting that considerations of connectivity and networks are critical to the creation of multi-functional landscapes. Within GI thinking an appreciation that policy, implementation and management need to be thought of at several scales is therefore implicit (Hale & Sadler, 2012; Che et al., 2014). In action this requires planners to consider what types of GI are implemented and where and how these investments link local and more strategic needs (Cambridgeshire Horizons, 2011). Moreover, as issues of climate change and health become central to discussions of GI provision, we can also examine how, and if so, whether local level action impacts upon landscape and urban functions at a different scale.

1.7 Multi-partner Approaches

To successfully deliver GI, there is a need to bring together practitioners from a range of disciplines. Planners, designers, environmental managers and hydrologists need to work with engineers, real estate specialists and health professionals to develop the most appropriate form of GI investment for a given location (Xing et al., 2017; Frantzeskaki, 2019). Sanchez et al. delve into the added value that effective collaborations can provide in their discussion of water management on the Arizona State University campus in Chap. 13. Historically though there has been a dislocation between disciplines within the natural and built environment leading to siloed practice (Mell & Clement, 2020). However, as GI has become increasingly mainstreamed, these disciplines have started to be more effectively aligned. This process

has been facilitated by advocates of GI who work in the middle ground between “natural, built and “grey” infrastructure provision providing knowledge and evidence in delivery and management (Finewood, 2016). Working from a multi-partner perspective provides a greater level of expertise to development that draws on working practices, methods and a longer-term appreciation of what works. We can also argue that working collaboratively enables policies and projects to address gaps in capacity or knowledge and install within GI investment a more nuanced appreciation of how built and environmental systems can work (Zmelik et al., 2011; Lennon et al., 2016; Pauleit et al., 2019).

1.8 Integrated and Holistic Policy

If GI can be located within a multi-disciplinary dialogue, it is also possible to achieve integrated and holistic policy. This means that GI is framed as engaging with or being embedded in thinking that covers several built and natural environment issues. In addition, GI may be used to consider the linking of local, city and regional or international policy mandates, as well as examine how scaled investment can deliver multi-functional benefits (Marcucci & Jordan, 2013; Jones & Somper, 2014). However, to facilitate a forum for holistic policy formation requires a high level of engagement from multiple stakeholders and leadership from an organisation or location to integrate GI within policy (New York City Environmental Protection, 2010; Philadelphia Water Department, 2011). We can identify a growing number of cities that are placing an implicit value on GI within policy as an aid to structure investment around climate change or resilience thinking (Mayor of London, 2021). Unfortunately, this remains a long-term process and one that needs to take into account the local political, socio-economic and environment context. Evidence suggests though that such a transition towards GI led planning is becoming increasingly mainstream in parts of Europe, North America and China (Mell, 2016).

1.9 The Antecedents of GI

The discussion of GI principles can be linked directly to the legacy of environmental thinking within landscape and urban planning. An extensive literature exists showcasing the links between greenway, garden city, sustainable communities, low-impact development, landscape ecology and ecosystem services, urban and community forestry, sponge cities and NBS. Within these discussions the principles of connectivity and multi-functionality are prominent. In addition, we can identify issues of scale and the alignment of complex socio-economic and ecological knowledge as signposts between GI and other concepts. Significantly, we can see a collective understanding of the evolution of GI thinking drawing on antecedents such as

greenways, to provide additional validity to the conceptualisation of GI practice (Benedict & McMahon, 2006; Walmsley, 2006). Herein lies the positives of these discussions – the promotion of a continuity of understanding between stakeholders in different geographical areas adhering to knowledge grounding in evidence (Austin, 2014; Firehock, 2015). For example, the role of stormwater management in GI development in the USA draws extensively on decades of research and practice to promote consensus between stakeholders (Hoover & Hopton, 2019; Zuniga-Teran et al., 2020). Moreover, in the UK the continuing influence of Ebenezer Howard's garden city principles within landscape and urban planning provides a level of reassurance for developers and decision-makers of the meanings attached to these concepts (Howard, 2009).

Temporally we can trace the principles integrated into GI from greenways with respect to the creation of connective landscapes allowing people to access nature and garden cities via the inclusion of scaled intervention in multi-functional environments open to all (Ahern, 1995; Town & Country Planning Association, 2012). These two approaches provide significant scaffolding for GI thinking and have allowed practitioners to draw on evidence from the mid-1800s onwards to take forward environmental enhancement work. Moreover, as environmental awareness increased following the 1960's environmental movement and the growth and landscape ecology thinking, we can identify a greater level of reflection by planners with ideas of connectivity (Pepper, 1996). Moving through the twenty-first century, we continue to see greenways and garden city principles used extensively in North American cities, Berlin and Singapore (Yuen, 1996; Lachmund, 2013). There is also a significant link between urban forestry in North America and community forestry in the UK in terms of shaping GI discourse (Konijnendijk, 2003; Conway & Urbani, 2007; England's Community Forests & Forestry Commission, 2012). In Canada and the USA, there is a wealth of evidence examining the role of urban trees and forests in delivering climatic, health and well-being and economic benefits to individuals and society more generally. By integrating additional evaluations of the socio-cultural benefits of trees urban forests, we have been able to provide additionality to the dominance of ecological approaches to urban forestry (Duinker & Greig, 2007; Conway, 2016). Community forestry in England differed as it was proposed as a mechanism to address landscape dereliction in post-industrial locations. Used as a regenerative tool, England's Community Forest partnerships worked with local government, developers and communities to reimagine the value of the landscape and used GI as a mechanism to promote investment (Blackman & Thackray, 2007; Kitchen, 2013). Greenways, garden cities and urban and community forestry have thus been instrumental in shaping the conceptual basis of GI and providing signposts to other forms of investment, i.e. low-impact development or landscape ecology principles.

In addition to these four key areas of influence, there have been a series of water and ecologically focussed concepts that have also helped to shape GI thinking (Li et al., 2005, 2020). The connective principles of links, hubs and nodes outlined in landscape ecology research have been a key driver of the spatial articulation of GI since its initial inception (Jongman & Pungetti, 2004). Moreover, the growth of

ecosystem services thinking (and more recently Natural Capital and Biodiversity Net Gain practices) within GI research has provided an increased level of technical expertise with regard to environmental systems (HM Government, 2018; etfec, Environmental Finance and Countryside, 2019). This has enabled GI advocates to consider the ways in which ecological functions work at different scales and what provisioning, regulating and supporting services, as well as the cultural benefits, they provide (Zuniga-Teran et al., 2020). However, the inclusion of detailed ecological perspectives has also been challenged as undermining the role of people and society in GI planning. Thus, a level of balance is needed to ensure that the four types of services and benefits noted above are met. Sustainable water management in the form of Water Sensitive Urban Design (WSUD), Sustainable Urban Drainage Systems (SUDS) and green stormwater management is also considered to hold a significant influence on the development of GI (Lashford et al., 2019). Although the most prominent focus of water-centric GI development lies in the USA, and more recently China, there is an appreciation that effectively managed water systems and the associated issues of provision and quality are core elements of GI practice. This has been critical to GI development in the USA, as it allowed advocates to generate funding via the delivery of the 1972 Clean Water Act. Similarly in China the central government mandate of sponge city development linked to urban sustainability and climate change mitigation has provided the framework (and associated funding) to deliver innovative GI in practice (Qiao et al., 2020).

In more contemporary GI research, there has been a visible increase in the use of alternative terminology to direct investment in environmental enhancement. However, the use of NBS, sponge city or blue-green infrastructure (B-GI) could all be considered to be derivations of GI as they draw on a comparable set of principles to direct investment (Wang & Banzhaf, 2018; Liao, 2019; O’Sullivan et al., 2020). This includes an increase in the size, diversity and accessibility of nature in urban settings, a consideration of environmental systems thinking and a promotion of multi-partner project teams to deliver multiple benefits to multiple stakeholders (Mell & Whitten, 2021). Current arguments for the use of ecosystem services or NBS as alternatives to GI may therefore be a matter of preference (Garmendia et al., 2016; Matsler et al., 2021). However, we could also propose that GI offers a more strategic oversight of development that draws on the principles noted above which are then delivered as NBS. Taking this idea further, we could suggest that NBS or sponge cities are the current elemental articulations of GI, whereas “GI” is the embedded knowledge, lineage and evidence base that enables stakeholders to deliver projects (Koc et al., 2017; Wang & Banzhaf, 2018).

1.10 The People, Policy and Practice Nexus

Central to the uptake of GI in mainstream landscape and urban planning has been the influence of strong advocate voices within policy and practice discussions (Mell & Clement, 2020). Organisations working with, and across, the natural and built

environment have spoken in favour of investment in GI to a broad set of audiences. These include receptive stakeholders within the environment sector but also those historically deemed to be reluctant to engage with ecologically focussed issues, especially where additional economic costs are visible (Mell, 2021). This has led GI advocates to engage in an ongoing dialogue with stakeholders to examine what factors are limiting their acceptance or use of GI. In several instances a lack of robust evidence has reduced use, whilst in others the need to embed additional knowledge into existing practices has been deemed undesirable. Moreover, a shift towards an inclusion of GI in praxis requires a level of flexibility within policy structures to allow new ideas to be debated and permeate into political thinking (Finewood et al., 2019; Meerow, 2020). This is not always present, especially in locations where the approach to environmental management is deemed to be effective, i.e., in Germany (Hansen et al., 2019). Over the last 15 years, though GI has successfully been integrated into policy mandates in many locations, for example, in the UK, however, reluctance related to the terminological, political or economic uncertainty of GI means this is not the universal case (Li et al., 2005; Landscape Institute, 2013; Liqueste et al., 2015).

Where success has been delivered, we can identify a greater level of understanding of the needs of a specific location, the options for development and the socio-economic and political context that a project lies within. Examples include the regenerative actions associated with landscape renewal in the Ruhr region and the delivery of the Landschaftspark Duisburg-Nord (Stilgenbauer, 2005; Cho, 2010; Mell, 2016).

Several of the chapters in this volume discuss the complexity of aligning policy and practice highlighting the potential limitations facing GI advocates as they attempt to embed the concept in localised thinking and action. However, there are also the thematic, spatial and political options open to practitioners, as they try to navigate these constraints. The chapter discussing the guiding of GI via a thematic framing of water management in Brazil by Pellegrino and Ahern is one example of this process. They, and others, examine the ways in which local practices can be shaped via the inclusion of additional evidence and best-practice guidance, although they and Sanchez et al. in their chapter in Arizona report on the effort, framing and negotiation needed to ensure that GI becomes a “go to” approach within planning.

Consequently, we must be considerate of the breadth of opinion related to what GI is, how it should be used and what issues it should address. This differs geographically, across disciplines and at various scales, all of which mean that advocates of GI need to be fluent in the linguistic gymnastics of practice in different places. The translation of meaning and application in Europe, North and Latin America and Asia, as discussed in the following chapters (e.g. Chap. 2 by Meredith Whitten), therefore requires careful consideration of what we mean when we use the language and terminology of GI and how this may present or limit opportunities for implementation and management.

1.11 Summary

The following chapters provide contemporary insights into the use of GI in a global context. They make links across terminology, disciplines, timeframes, scale and thematic approaches to investment and management and raise questions about best practice. What is common across all authors in this book is the depth of appreciation they provide to GI as a mechanism to address some of key issues facing landscape and urban planning in the twenty-first century, namely, ecological health, climate change and societal well-being. They do this by examining the ways in which GI, and its aligned concepts, are debated, framed and implemented in diverse locations around the world. Consequently, they provide a valuable addition to the research literature on GI and highlight opportunities for further research and practice. By exploring how GI differs between locations, how it has changed over time and how alternative users engage with the concept, each chapter supports the evolution of GI and its value in landscape and urban planning.

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