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**Title: Re-defining the characteristics of environmental volunteering: creating a typology of community-scale green infrastructure**

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**Abstract**

One way to engage people with green infrastructure (GI) is as environmental volunteers. Previous studies explored the nature of such groups/projects in terms of the benefits they deliver such as their impact on levels of social capital within a pre-defined community. However, existing literature contributes little to our understanding of the composition, characteristics and mechanisms used to form and maintain these groups. As such, it is difficult to establish the influencing factors determining the capacity of a group to sustain its provision over time. This paper serves to offer a more nuanced understanding of local-scale environmental stewardship by outlining the diversity of volunteer-led GI activities observed at the community-scale. Evidence presented from a desk-based examination of observable activity within The Mersey area Forest in North-West England represents a re-conceptualisation of existing definitions of Community-Scale GI (CSGI). Using thematic criteria, the paper clusters characteristics into key classification affecting group dynamics, composition and objectives. Initial findings identified the following categories as being significant descriptors for community-scale green infrastructure: *status, location, timeframe, membership, activity focus, governance, resources and recognition,* and *communications.* Thus, we classify four distinct types of group engaged in voluntary activity contributing to local level GI creation and long-term management: ‘Formal Group (Active), Formal Group (Inactive), Formal Project and Informal Group. Creating a nuanced typology of CSGI provides further opportunities to analysis the creation and long-term management of GI at a site, neighbourhood and city-scale. In turn, this contributes to our understanding of how multiple actors remain engaged in the decision-making processes of GI management and maintenance.

**Key words:** Green Infrastructure, environmental stewardship, landscape management, participation, communities

**1. Introduction**

The range of benefits that green infrastructure can deliver has been widely discussed in the academic and practitioner literature (cf. Beatley, 2000; Benedict & McMahon, 2006; Natural England & Landuse Consultants, 2009). It provides societal benefits for health and social inclusion (Ward Thompson, Aspinall, & Bell, 2010), economically in terms of uplift in property values (Mell et al., 2013; Payne & Barker, 2016), and ecologically in terms of the development of biodiverse environments (Sadler et al., 2010). However, although we can identify a ‘global’ narrative of what green infrastructure *is* and *does,* meta-level discussions of green infrastructure value, as described by Mell (2016), often underestimate the complexity and inclusion of functionality and interactivity with ‘local-scale’ green spaces. Consequently, we posit that a dislocation exists between the overarching, and in many cases accepted definition of green infrastructure as ‘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 & McMahon, 2002:12), within the global-scale discourse which differ to the factors which facilitate engagement with, and the longer-term use of green infrastructure at the local (Hale & Sadler, 2012; Reid, Walker, & Salt, 2006). The following paper explores the intersection of these issues focussing on the growing research on Community-Scale Green Infrastructure (CSGI).

Within the paper ‘green infrastructure’ is framed as apposite for Nature-Based Solutions (NBS) illustrating the various socio-economic and ecological complexities of urban development. Community-Scale Green Infrastructure (CSGI) is defined as green infrastructure features which deliver multi-functionality and associated benefits at the local-level, through small-scale areas of land managed and maintained by groups of community volunteers. (Jerome, 2017b) Examples of CSGI include the activities of Friends groups who are actively engaged in land management of parks and woodlands; community garden volunteers engaged in food production; and voluntary participants engaged in health and wellbeing projects which create opportunities for people to spend time outdoors in nature for therapeutic benefits.

Moreover, whilst green infrastructure has been extensively defined (cf. Austin, 2014; Benedict & McMahon, 2006; Mell, 2016a; Sinnett, Smith, & Burgess, 2015), NBS are still evolving. NBS are considered by the European Union as approaches to urban management inspired and/or supported by nature-based ecological systems and resources (European Commission, 2015). However, other agencies including the IUCN define NBS as: ‘actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits’ by the IUCN (2016:xii). Thus, as with green infrastructure, NBS provide myriad approaches to investment (and management) that promote environmental, social and economic benefits enabling areas, and by extension decision-makers, to ‘build in’ ecological resilience (Kabisch et al., 2016). NBS, thus, provide options for landscape planners to invest in a diverse portfolio of ecologically inspired solutions to address a wide range of issues including climate change, social exclusion, and economic viability (Beatley, 2010).

NBS can thus be positioned as offering comparable benefits to green infrastructure, however, it has not, as yet, gained the same level of traction as a ‘go-to’ approach to urban landscape management (Ahern, Cilliers, & Niemelä, 2014). Moreover, green infrastructure commentators have explored the role that biodiverse locations hold in promoting sustainable places – a central principle of NBS - that are resilient to socio-economic and environmental stresses (Mell, 2009; Wolch, Byrne, & Newell, 2014). Unfortunately, the current global green infrastructure narrative, and the subsequent discussions of NBS are frequently focussed on city or landscape scale issues – the normative realm of city planners and local government. The local, and specifically the community-scale in green infrastructure and NBS discussions are afforded more limited space. Focussing on the ‘local’, and specifically how CSGI is conceptualised within community interactions with green space provides additional evidence supporting the extension of research into green infrastructure at a sub-city scale (**Allen, 2012; Campbell, 2009; Dempsey, Smith and Burton 2014; Young et al., 2014).**

Whilst clear links are made within the literature illustrating how the provision of green infrastructure and NBS can improve health, well-being and liveability at a city-scale (cf. CABE Space, 2005b; Kabisch et al., 2016), there is a more limited discussion of how engagement and environmental stewardship aids this process at the local level. Furthermore, whilst extensive research focussing on physical and mental health benefits associated with high quality, accessible and functional urban green infrastructure exists this same focus has not extended to evaluate aspects of social/communal resilience (Coutts, 2016; Lovell et al., 2014; Ward Thompson et al., 2010) Moreover, the links promoting communal resilience through stewardship of green spaces are less well defined. The specific role of community participation as part of the long-term management of green infrastructure has been brought into focus most recently in the conceptualisation of ‘place keeping’ (Dempsey, Smith and Burton: 2014) and environmental stewardship (Fisher, Svendsen, & Connolly, 2015). Where emphasis has been placed on the evolving dynamics between stakeholders from private, public, voluntary and community sectors to manage green infrastructure after the point of initial creation or enhancement. Moreover, the outcomes associated with partnership approaches to long-term management and maintenance foregrounded within the literature tend to highlight social capital and community capacity building as key outcomes (Glover, 2004; Kreutz, Dempsey, & Lindholst, 2014; Measham & Barnett, 2007; Wolch et al., 2014).

In response to this scalar disparity there are ongoing discussions within green infrastructure planning attempting to investigate the links between landscape resilience, environmental sustainability and communal interaction with green space to promote a more nuanced approach to urban greening (Ahern et al., 2014; Beatley & Newman, 2013). Our understanding of resilience as the ability of a system to find equilibrium following environmental or socio-economic stresses is therefore gaining traction as both a conceptual and as a practice-based conduit to improve the sustainability of places (Reid et al., 2006). Furthermore, discussions of resilience reflect upon the vulnerability to ecological stresses and propose communal and society-based solutions, i.e. local engagement and stewardship, as a key process in addressing environmental change (Ahern, 2013). Green infrastructure planning therefore attempts to utilise the conceptual understandings of resilience within policy-making, but asks how it acknowledges, and indeed responds to the needs of ‘communities’ (Fisher et al., 2015).

Green infrastructure, and more pertinently NBS, are thus presented within this paper as both conceptual and implementation anchors that act as signifiers of resilience and sustainability (Kabisch et al., 2016). The following examines the dislocation between how green infrastructure is discussed as an approach to landscape and urban planning, and the ways in which we understand notions of community participation/stewardship for local green spaces. This is presented as an evaluation of our understanding of *what* green infrastructure is and questions the complexities of *how*, *where* and *why* people engage with these resources. The main questions addressed in the paper focus on:

1. The conceptualisation of CSGI and its principles,
2. What influences, if any, green infrastructure and NBA have on the development of functional and resilient CSGI,
3. Are NBS a key influence on the creation of longer-term bonds with the natural elements of the built environment.

This is achieved through the presentation of a case study of CSGI projects in the Mersey Forest area of North-West of England, which utilises a qualitative analysis of local level engagement/volunteering with green infrastructure projects coupled with a quantitative evaluation of the characteristics of green space projects in The Mersey Forest area of Liverpool, Merseyside and Cheshire. This Mersey Forest area is used because as an organisation they have been at the forefront of small-scale green infrastructure projects in the north-west for over twenty-five years, and have delivered a range of community engagement programmes to establish better links between communities and their local landscapes. The Mersey Forest also have an extensive archive of material assessing the successes of community engagement work, which has been used to develop a conceptual framework for CSGI that identifies key factors which influence engagement, as well as how this can be characterised as a set of ‘project typologies’.

To achieve this the paper employs a synonymous and interchangeable use of green infrastructure and NBS. This is done as the core principles of both are comparable, and promotes a more flexible understanding in planning terms and the perceptions of communities as to how ‘nature’ can, and is, being integrated within development. Table 1 below outlines the similarities between these concepts, which is used to shape the following discussion of CSGI.

**<INSERT Table 1. Analysis of key Green infrastructure, NBS and CSGI principles, scales and stakeholders HERE>**

**2. Conceptualising Green Infrastructure**

Research over the proceeding decade has formulated a series of areas where green infrastructure can, and is being valued (Mell, 2016b). These discussions focus on a range of social, economic and ecological variables, institutional and legal characteristics, and variations in national and sub-national approaches to landscape planning. What is less well defined is how people, and specifically local-level interactions with green infrastructure are conceptualised and evaluated. This ‘gap’ highlights the complexity of integrating a global narrative of green infrastructure with examinations of contextually specific development at the local level (Mell, 2014). However, within the literature there is a wide ranging discussion of what constitutes *value* and *how* this should be debated (Roe & Taylor, 2014; Sutherland, 2012).

Aligned with the ongoing discussion of value is a narrative exploring what principles support the development of green infrastructure. As noted in the introduction connectivity has been highlighted drawing on the spatial configuration of the landscape ecology and greenways literature (Jongman & Pungetti, 2004). Moreover, access to nature has been illustrated as a key principle supporting the stewardship of landscape resources (Goode, 2014). These principles are framed though by an ongoing discussion of quality vs. quantity as key drivers of our understanding of green infrastructure. Both are deemed important as high quality environments can be biodiverse, visually attractive and provide varying socio-ecological benefits for people and wildlife (Beatley & Newman, 2013; Benedict & McMahon, 2006). Furthermore, the greater the proportion (i.e. m2 per person) of green infrastructure within a given area the more likely it is to support multiple users and uses simultaneously. However, as Mell (2010) argues planners should not automatically invest in large-scale projects when trying to meet local needs. Alternatively, Mell calls for a greater understanding of the cumulative value that local spaces, i.e. pocket parks, have for individuals and communities. Therefore, where a combination of a high quality landscape of an appropriate scale/size exists there are potentially greater opportunities to promote multi-functionality (CABE Space, 2005).

Establishing multi-functional landscapes, however, requires the integration of socio-economic and ecological factors, each of which influence the development of consensus of the value of green infrastructure at a local scale (Jerome, 2017a). Within this debate NBS are the most recent articulation of human-environmental affordances following on from greenways, green space planning and ecosystem services discussions (Little, 1990; Mell, 2016b). NBS also extend Louv’s (2005) promotion of landscape ‘affordances’ by using more cognate language, i.e. *nature*, that is accessible to wider range of stakeholders when compared to the more technical debates surrounding landscape ‘interactivity’ embedded within green infrastructure.

The value of green infrastructure can also be conceptualised as being associated with *proximity* (to homes, places of interest and business), *functions* (and the promotion of multi-functionality within and across landscapes) and the *time* spent in a given location (Jerome, 2017a). As a direct consequence of such complexity we see trade-offs being made in decision-making between location and functions, which lead to less time being spent questioning the need for investment in CSGI. Achieving an equilibrium between the delivery of appropriate, economically viable development and socio-culturally functional spaces is therefore an ongoing issue (Beatley, 2010). However, a consequence of good design, in proximate locations, is increased functionality promoting liveability and place-making, which in turn increases the length of time spent in, and the associated benefits derived from green infrastructure (CABE Space, 2005; Dempsey, Smith, & Burton, 2014; Swilling, 2011). Fisher, Svensden and Connolly (2015), Firth, Maye, & Pearson (2011) and Glover (2004) identified comparable findings indicating that increased engagement with local green spaces fosters both a greater sense of communal well-being and ownership. It is therefore important to examine whether consensus between different stakeholder groups can be established using green infrastructure or NBS as the contextual framing for consensus building.

**3. Policy-makers and LPAs engagement and valuation of green infrastructure**

As with the variation witnessed in how green infrastructure is conceptualised by stakeholders, there is an equally diverse set of approaches underpinning its use by decision-makers (Mell, 2010). Such variation impacts upon how green infrastructure is framed within national, regional and sub-regional policy explicitly influencing how stakeholders plan for it at a city or local level. For example, where a strong environmentally focussed policy-making arena exists, i.e. Denmark (Hansen et al., 2015; Werquin et al., 2005), the value of green infrastructure is promoted within government and by environment advocates. However, such a process is not universal. Variation provides insights into how different public, private, community and sectoral stakeholders rationalise the benefits of investing in green infrastructure. One of the few locations where policy is multi-faceted, with scaled investment that promotes socio-ecological values is in the UK, where from 2005 onwards a more human-environmental orientated approach to green infrastructure policy has been employed (Natural England & Landuse Consultants, 2009). Furthermore, although we can argue that green infrastructure respects a global set of principles it simultaneously attempts to retain a localised understanding of need within implementation (Mell, 2014).

NBS are extending this debate drawing on the principles of landscape/urban ecology to promote the socio-economic benefits that can be delivered within a biodiverse urban realm. NBS, however, are positioned at the interface of ecological design and planning, rather than in one discipline or policy (Eggermont et al., 2015). Thus, they can be viewed as moving away from existing institutional silos towards a more inclusive and integrated approach to development. Consequently, NBS have the ability to utilise ecological solutions as a central design tenant for investment (Beatley & Newman, 2013). We can therefore argue that the use of NBS within localised planning practices places emphasis on ‘nature’ which provide clarity for stakeholders attempting to engage with green infrastructure debates, compared to when such applications are presented in city, regional or national level policy (Connop et al., 2016). This implies a significant shift in thinking where ‘nature’ is utilised as a localised (spatially and thematically) presentation of green infrastructure that promotes ecologically focussed investment (Kabisch et al., 2016).

**4. Community participation with green infrastructure**

Although there has been an extensive discussion of participation in the design and delivery of green infrastructure, reflections on local-level environmental stewardship and volunteering has generated less debate (cf. Firth et al., 2011; Fisher et al., 2015; Glover, 2004), as arguably, volunteers provide an additional low-key mechanism to secure green infrastructure. This role has increased since 2011 following the UK government’s austerity measures which established extensive cuts to public sector funding; a process that has seen cuts to ‘discretionary’ services at the local-level including the management of greenspace (Kennett et al., 2015). The phenomena of voluntary contributions by community members to supplement, or in some cases, replace state-supported services, is thus becoming increasingly significant but is not, as yet, universal (Glover, 2004). It is therefore important to consider the motivating factors (and barriers) to participation in environmental stewardship, to examine the relationship between these issues and the ongoing promotion of NBS/green infrastructure planning (Jerome, 2017b).

The motivating factors for participation in environmental stewardship/volunteering are myriad meaning it has been difficult to identify consensus as to *why*, *how* or *when* people engage. Kreutz, Dempsey and Lindholst (2014:117) define volunteering as ‘a form of institutionalised unpaid helping behaviour that benefits other people, groups or organisations’; and moreover, they estimate the value of this ‘helping behaviour’ is approximately £39 billion in the UK. As such, developing a better understanding of what motivates individuals and/or groups to initiate and continue their voluntary activities potentially have a significant economically-focused underpinning. Additional research discussed the role of alternative variables in the characterisation of volunteering in the UK; focusing on population characteristics such as gender, ethnicity and socio-economic status (D’Souza et al., 2011); employment status (Benedict and McMahon, 2006: 232); and skill-level (Measham and Barnett, 2007). Addressing environmental volunteering specifically, Kreutz, Dempsey and Lindholst (2014) suggest that volunteers are motivated to engage in green infrastructure/NBS related activities because of their desire to work outdoors and increase their knowledge about the environment. ‘Nature’ could therefore be identified as a defining characteristic promoting engagement. Other studies, however, emphasise the social outcomes associated with participation, and the role of shared social values between volunteers, encapsulated as ‘civic pride’ by Fisher, Svensden and Connolly (2015:68). In addition, the production of social capital is foregrounded as a primary driver of environmental volunteering in many locations (cf. Blundell Jones, Petrescu, & Till, 2013; Glover, 2004; Measham & Barnett, 2007; Rydin & Pennington, 2000; Wolch et al., 2014). All of which illustrates the complexity associated with our understanding of why people engage with green infrastructure or NBS.

From this discussion, we can conceptualise a series of ‘push’ and ‘pull’ factors underpinning engagement in environmental stewardship. ‘Push’ factors include a sense of responsibility at the individual and community-level to participate in voluntary activity, which enhance the local environment, and the experience of living in a particular location. This is echoed by Benedict and McMahon who suggest that environmental stewardship can be understood as a response to three main drivers: *responsibility*, *care of the land*, and *management of the land for future generations* (2006: 200), factors reflected in Fisher, Svensden and Connolly’s conceptualization of ‘civic identity’ (2015: 104; 107). ‘Pull’ factors, in contrast, refer to perceived benefits (social, environmental, economic) of environmental stewardship, and may relate to an individual’s quality of life (Niemelä, 2014), psychological and spiritual benefits (Doick et al., 2013) or improved health and wellbeing (Bragg, Wood, & Barton, 2013).

Equally important to any evaluation of community participation is a consideration of what barriers exist to engagement (Dennis & James, 2016). Within landscape planning this includes the association of the negative impact of landscape design, which may impede usage by different user groups (Doick et al., 2013; Nordh & Østby, 2013). Connected to the issue of access is the discussion of the role played by distance as a barrier to engagement. Koppen, Sang, & Tveit (2014) offer a critique of standard approaches to determining optimal distances and proximity of different scales of green infrastructure, suggesting that different user groups may have varying ‘thresholds and critical distances’, and that green infrastructure should be designed in a more bespoke manner to address the accessibility needs of a particular neighbourhood, thus limiting the potential negative impacts on engagement.

A further identifiable theme is the role played by design and aesthetics in how green infrastructure is perceived. For example, Mårtensson et al's (2014:103) found that ‘settings with a mix of green and built elements in proximity to buildings are well-used’. Although Mårtensson et al. focused on school grounds, we can argue that their findings are equally applicable to other settings, principally community gardens characterised by their provision of space for social gathering and connected to residential/community buildings. Furthermore, Ward Thompson et al. (2012) report that smaller green infrastructure sites proximate to where people live/work play an important role in reducing levels of stress in individuals than larger sites at a further distance. Mell (2010) debated this issue arguing that size per se was not the defining characteristic of use or functionality. Alternatively he suggested that location and the ways in which a space responded to communal needs was more important.

It can also be argued that engagement needs to be focused more frequently on the capacity of the individuals involved, and include their motivations (D’Souza et al., 2011), time (Benedict & McMahon, 2006), and ability to learn new skills to ensure the long-term management of multi-functional green infrastructure (Schusler & Krasny, 2010). Castell (2013) makes a comparable argument highlighting the difficulties posed by ‘participative processes’ involved in managing and maintaining land, especially those which may have complex ownership and access arrangements. This all serves to contribute to the argument that CSGI represents a significant conceptual and practical mechanism to discuss the delivery, implementation and maintenance of green infrastructure at the local level, which is complementary in scale to more strategic green infrastructure planning. The diverse nature of CSGI debates also offers alternative routes for communities (and local government) to fund investment in a resource-deplete public sector (Dempsey, Smith and Burton, 2014; Hou, 2010; Fisher, Svensden and Connolly, 2015).

The following section explores these issues using the case study of The Mersey Forest can be used to illustrate coherency in terms of providing a context for exploring the characteristics of CSGI in light of the political, social, economic and environmental pressures facing the Liverpool City Region and neighbouring districts which make up the geographic area of The Mersey Forest (Mell, 2016a).

**5. Materials and methods**

To establish whether focussing on the ‘nature’ aspects of green infrastructure proposed in discussions of NBS can improve the relationship between people and CSGI an evaluation of urban green space projects in the North-West of England was undertaken. Using the Mersey Forest boundary as a spatial framing the following assesses the factors which influence engagement with CSGI projects, whether these functions can be categorised into distinct classifications, and how these categories address the perceived barriers to engagement discussed previously. The Mersey Forest area was used for the evaluation as they have twenty-five years of experience of delivering CSGI projects in the north-west, and have an archive of data regarding the successes and failures of securing long-term of community engagement.

The following sections evaluate what influences, if any, green infrastructure and NBS have on engagement with, and the development of functional and resilient CSGI. The paper thus proposes a novel methodology through which the role for green infrastructure/NBS can be evaluated to assess engagement with CSGI projects. The classifications presented are grounded in the research and evaluative practices of The Mersey Forest and is the first attempt to rationalise the spatial diversity of CSGI projects with a thematic analysis of their focus and application. Although the paper utilises a single case study to frame its discussion, the characteristics of each of the proposed categories are presented as translatable providing an additional spatial context to the conceptual understanding of participation with green infrastructure resources.

* 1. **Study Area – The Mersey Forest**

The Mersey Forest is an environmental charity established in 1991 by the Countryside Commission, as one of twelve regional community forest partnerships (see Fig.1) tasked with using urban/peri-urban forestry, and more recently green infrastructure to revalorise post-industrial landscapes in Merseyside, Cheshire and West Lancashire (Mersey Forest, 2013b). The Mersey Forest covers approximately 420 miles2 (see Fig. 2) but is conceptual in nature, as it constitutes a range of land parcels within a wider defined boundary; it is not a contiguous forest, although they have though planted over eight million trees in their twenty-five-year history. Working in post-industrial locations in the North-West of England has enabled The Mersey Forest to engage extensively with local communities, for example facilitating the creation of Friends groups to street tree planting groups, to address a range of socio-economic and ecological issues to facilitate improvements in communal health, well-being and social interactions (Mell, 2016c; Mersey Forest, 2013a; Ridgers & Sayers, 2010). They have also undertaken extensive research identifying areas of green infrastructure deprivation and addressing how, and if so, where these deficiencies align with areas of social, health and economic inequality (Mersey Forest, 2010). The CSGI categorisation was created as a bespoke tool to aid The Mersey Forest’s preparation and identification of projects that could address these issues.

**<INSERT Fig 1. Location of England’s Community Forest partnership HERE>**

**<INSERT Fig. 2. The Mersey Forest boundary HERE>**

* 1. **Data collection**

The definition of CSGI took the form of a classification exercise evaluating the characteristics that constituted different types of project (and the subsequent engagement with each project). A desk-based analysis was conducted, which involved identifying CSGI groups within the boundary of The Mersey Forest (utilising postcode data to validate entries), and recording a pre-determined range of data classification regarding individual and groups entries. This included:

* the name of the project or group;
* the location of the site/s;
* the type of activities engaged in by the group (e.g. nature conservation, health and wellbeing);
* constitutional arrangements;
* use of social media as a communicative tool;
* sources of funding and amounts

This data was collated as a ‘mastersheet’ of CSGI groups in The Mersey Forest area, which was subsequently used to identify entries with similar characteristics. This process identified four distinct categories of groups: *Formal Group (Active)*, *Formal Group (Inactive)*, *Formal Project* and *Informal Group*, that were all visible within The Mersey Forest. Each of the four categories were validated against a set of characteristics grounded in the academic/practitioner literature which included reflections on formal/informal structure, longevity, location (site vs. thematic CSGI projects), individuals, groups or projects. In addition, a desk-based analysis of secondary data was used to characterise the types of engagement and volunteering witnessed in The Mersey Forest area. The selection of criteria was an iterative process involving an extensive analysis of voluntary groups engaged in the delivery and long-term management/maintenance of local-level green infrastructure. Data was generated from an examination of The Mersey Forest archives, and included a Mersey Forest evaluation (Carding and Sayers, 2003) detailing the impact of the ‘Community Contracting Initiative’, a five-year community programme supporting Friends groups.

The approach outlined above was developed to align with the model created by England’s Forest Partnerships, which aimed to establish a standard approach to environmental stewardship, and conceptualised the key drivers of success in voluntary groups that sustain activity and optimise opportunities to deliver social, environmental and economic outcomes (Carding and Sayers, 2003). Additional data was incorporated from publically available projects and constituted friend’s groups, which had received funding and/or administrative/technical assistance during and/or after their commencement/completion published on local government websites. Date was collected from:

* the online environmental forum, ‘Project Dirt’, which invites peer-to-peer information sharing by environmentally-focused groups;
* local newspaper reports of CSGI activities;
* publicly available archives of funding bodies of voluntary groups and organisations engaged in environmental stewardship and volunteering, including national and local funding initiatives, for example the Heritage Lottery Fund.

Data was collected over a six-month period in 2013 capturing groups/projects established between 2008-2013, as well as groups and projects which had been inactive for no longer than five-years. The rationale for the data collection strategy reflects the findings of a review of the critical components of effective community action through environmental volunteering and stewardship proposed by Wood, Bragg and Barton (2013), which acknowledges the impact of grant funding on voluntary activity. In the period 2008-2013 a series of thematic grant awards were available to community groups engaged in CSGI activities, including Big Lottery Fund’s ‘Local Food’ programme launched in England in 2008, and ‘Natural Choices for Health and Wellbeing’ fund launched in Liverpool in 2011 (Mersey Forest, 2013a; Wood, Bragg and Barton, 2013). As such, groups/projects were included if they could be observed as being active from 2008 onwards. Data was evaluated against a set of five critical components for effective community action, identified through an extensive review of research/practitioner literature, and building on Benedict and McMahon’s (2006) discussion of effective leadership in green infrastructure planning. In the context of CSGI, the critical components for effective community action were:

* *governance* approaches to group structure and processes of decision-making;
* *membership -* whether a group has an open or closed approach to membership; and whether the CSGI activity reflects a ‘place-based’, ‘interest-based’ or ‘people-based’ community (Firth et al, 2011);
* *funding* approaches to securing the resources necessary to deliver and maintain CSGI;
* *support* - capacity to draw on local networks and access different forms of social capital; and
* *activity focus* relating to specific green infrastructure sites or groups.

The outcome was a thematic analysis of activity at the community-scale, defined by a group’s approach to both governance (i.e. Group or Project) and activity (i.e. conservation activities, health and wellbeing, environmental education). In this context, ‘Group’ describes examples of USGI activity where volunteers have established a group to coordinate their activities around a specific site or activity. ‘Project’ describes examples of green infrastructure activity where an established voluntary organisation whose core objectives do not focus on green infrastructure, but was established to engage volunteers in the creation and/or maintenance of green infrastructure.

 The desk-based analysis was not without its limitations. For example, it was not possible to collect information relating to all search fields in all cases. In part this was due to the nature of some Informal Groups whose methods of documenting their activities/information lacked consistency. In contrast, Formal Groups, such as constituted Friends groups, were more likely to keep records of their activities. The variability of evidence limits the utilisation of these findings to subsequent questions posed about *why* groups differ in their capacity to engage or to fully understand what motivates them to adopt certain approaches to the governance of USGI to achieve their environmental and social objectives. Consequently, the creation of a typology of CSGI promoted an examination of three distinct types of group within a framework for a in-depth exploration of environmental volunteering/stewardship.

**5.2.1. Data analysis – Typology creation**

The desk-study collated 244 unique examples of CSGI projects/groups which were organised using a set of descriptive fields representing thematic characteristics (See Table 3). All entries were analysed against: whether an entry related to a ‘Group’ or ‘Project’; whether they had a ‘Food’ or ‘Environmental stewardship and volunteering’ activity focus (or both) (e.g. nature conservation group); if they had a ‘Health and wellbeing’ (e.g. horticultural therapy group) or ‘Educational’ focus (e.g. Forest School group) (Table 2); and whether the focus of the group was the site of green infrastructure (‘site focus’) or the group itself (‘group’). Additional fields were recorded where online documentary/archival material was available, providing supplementary information about a group, including: type of site (park or woodland); year of formation; whether the group was affiliated with a residents association; any records of supporting organisations; whether the group was or had been a member of the Community Contracting Initiative; and if the group were ‘site’ focused, whether the site of green infrastructure had any habitat designations, and therefore restricting the nature of activity.

The initial categorisation of 357 entries was analysed for double-counting with 113 duplicate entries being identified and removed from the analysis; resulting in 244 unique entries. The large number of duplicates is indicative of the nature of green infrastructure activity at the community-scale, where the lack of a standardised approach to delivery and management within voluntary activity means groups are often described differently by different sources. Discounting was achieved through a process of cross-referencing data sources and geographical locations of site/projects.

 The categorisations were subsequently grouped thematically based on the types of group structure, types of activity, sources of funding and support mechanisms, and principal methods of communication. The outcome of which was the creation of six thematic categories:

* *status* (Group or Project);
* *governance* (Formal Group, Informal Group, Formal Project);
* *activity focus - broad* (environmental stewardship and volunteering-focus, food-focus, or both);
* *activity focus – detailed* (environmental stewardship and volunteering; food; health and wellbeing; education; and combinations therein);
* overlay of *activity focus* and *status*; and an
* overlay of *activity focus* and *governance*.

One limitation of the categorisation was the nature of Formal Groups (i.e. Friends groups) who are *constituted*, and Formal Projects who are *affiliated* with public bodies and voluntary organisations, which meant documentary evidence was more likely to be available relating to their activities. 50% of data points were defined as Formal Groups, and 38% as Formal Projects. The 12% described as ‘Informal Group’ may, however, not accurately capture the proportion of groups active in the sample area, as their activities are more informally managed, and ate not necessarily affiliated with established organisations or use formal governance structures.

**<INSERT Table 2: Activity focus of CSGI by typology of Group and Project HERE>**

**<INSERT Table 3: Typology of community-scale green infrastructure in The Mersey Forest area HERE>**

**6. Results**

The desk-based analysis focussed on The Mersey Forest area resulted in a clustering of characteristics around two main types of CSGI: Groups and Projects. This enabled the establishment of a ‘initial/formative typology’ to reflect the primary objectives relating to a group’s purpose and approach. *CSGI* *Groups* describe those groups which have been established by volunteers with the sole focus on the creation and maintenance of green infrastructure at the local level. *CSG*I *Projects* describe groups of volunteers who create and maintain green infrastructure through an affiliation with an existing voluntary organisation whose main objectives are not related to green infrastructure. Analysis suggests that *CSGI Projects* are often set up in response to identified needs within a place- or by an interest-based community, and that CSGI may contribute additional benefits but are not the primary value/aim of the project. In this way both CSGI Groups and Projects are concerned with the creation and maintenance of green infrastructure at the local-level but they differ in their approach to delivery.

The second component of the typology was to identify variation and/or continuity in approaches to *governance*. Two types governance were identified across the CSGI Groups, resulting in the definition of two types of Group:

* *Formal Group*, characterised by their formal approach to governance with a constitution and committee structure; and
* *Informal Group*, characterised by an ad hoc approach to organising activities often involving one-off or seasonal events to engage community members in green infrastructure activity.

As CSGI Projects represent a divergence from these two types in terms of approaches to governance (due to their affiliation with an established organisation and with their own governance structure), a third governance type was identified - *Formal Project.* Formal Projects are characterised by the support being made available to the group by in-kind contributions from members of the affiliated organisation who assist the group in terms of fundraising and communicating with external stakeholders.

A third component of the typology, which does not affect the ‘basic typology’, but is apparent in the variation across the three key types of Group/Project is activity focus. In terms of activity focus, variation can be identified within and between CSGI Groups and Projects. However, the majority of groups analysed (56%), were characterised as Formal Groups with a focus on ‘environmental stewardship and volunteering’. The next two largest categorisations were characterised as Formal Projects with a focus on ‘environmental stewardship and volunteering’ combined with ‘health and wellbeing’ and ‘food’ respectively. With regards to the remaining thematic criteria – *membership, funding*, and *support* –documentary analysis suggested there was less clarity as to their influence on a group’s capacity for effective leadership and community engagement. Discussion of the broader findings from the typology analysis sit outside the parameters of this paper.

**7. Discussion and Conclusion**

The creation of a typology of CSGI has significant implications for extending our understanding of the social, environmental and economic benefits attributable to green infrastructure activity at the local level. Furthermore, by defining CSGI as an approach to the governance, funding and management of green infrastructure, a reconceptualisation of environmental volunteering/stewardship as *CSGI* can be strengthened by its inclusion of a NBS framework. In contrast to more strategic interpretations of the function of green infrastructure at the international, national or city-region scale, this paper attempts to firstly define, and secondly locate the role of CSGI as an example of NBS delivering co-benefits in response to identified local needs, that utilises the agency of small groups of individuals (identified as projects or groups) at the neighbourhood scale (Jerome, 2017a; Wakefield et al., 2007).

In this sense, the role of decision-makers, i.e. local government, who utilise NBS to ‘build in’ ecological resilience (Kabisch et al., 2016) is extended to communities who can act as both agents and beneficiaries of change through environmental volunteering. Consequently, by more effectively defining nuances of use, understanding and engagement within community-scale management of small-scale green infrastructure, it may be possible to more effectively evaluate the contribution of community groups to landscape management. In recognition that NBS provide a diversity of approaches to investment and management, CSGI is proffered as one ‘piece in the jigsaw’ of sustainable landscape management where the historical reliance on public sector funding to support green infrastructure is uncertain (Eggermont et al., 2015; European Commission, 2015).

The variability presented in the CSGI typology supports a view discussed in the research literature (cf.Kingsley and Townsend, 2010; Firth, Maye and Pearson, 2011; Seaman, Jones and Ellaway, 2012; The Mersey Forest, 2016) that ‘groups’ may have greater capacity to respond more dynamically to gaps in green infrastructure provision close to residential areas or on sites lacking a definable economic terms, as they may live locally or can self-organise to create activities focussed on its use. This community-led approach to creating/managing green infrastructure reflects the discussions with the NBS literature, as it identifies the role of engagement with ecologically inspired solutions that address socio-economic issues at a local scale (Beatley, 2010). For example, Bragg, Wood & Barton (2013) report on the health, wellbeing and social capital benefits received from engagement with CSGI in their evaluation of the ‘Natural Choices for Health and Wellbeing’ initiative in Liverpool. In turn, this builds on the extensive literature highlighting the role food-growing initiatives can play in generating social capital (cf. Firth et al., 2011; Zoellner et al., 2012).

Defining what we consider CSGI to be, however, remains a complex process. As discussed previously the use of a categorisation process is one mechanism through which the variability of approach, location, focus and structure of projects can be rationalised. This highlights a number of the key difficulties that many green infrastructure commentators (Young et al., 2014; EC European Commission, 2012; Dunn, 2010) have found, for example the lack of consensus regarding what CSGI is supposed to be, how we plan for it, and what resources, projects or ideas people are willing to engage with. Therefore, it remains difficult to establish a grounded and consensual transposing of CSGI from the meta to the local-scale due to institutional, social-cultural and ecological variation in how green infrastructure is managed.

Attempts to establish consensus on what constitutes CSGI is further complicated because of the variability of spaces and projects, the fluidity of understanding by different stakeholders, and the ways in which alternative stakeholders engage with green infrastructure resources. This contrasts to the global narrative of green infrastructure, which identified a set of principles that are considered fundamental to its use (cf. Mell, 2016b). However, concerns remain that the dynamic characteristics of people, groups or agencies dealing with green infrastructure are less well informed when we move from conceptualisation to practice and to finally to evaluations of CSGI (Jerome, 2017b; Tzoulas & James, 2010). Within the categorisations discussed above we can identify such variation even within the relatively localised analysis of The Mersey Forest arguing that *status, location, timeframe, membership, activity focus, governance, resources and recognition,* and *communications* are all specific characteristics which influence engagement with green infrastructure, and not, as the literature proposes, supporting of a more conceptual engagement with the principles discussed by Austin (2014) or Hansen et al. (2015). Moreover, the four distinct ‘types’ of green infrastructure group: *Formal Group (Active)*, *Formal Group (Inactive)*, *Formal Project* and *Informal Group* do not map directly onto wider discussions of green infrastructure, partly because they are focussed on the characteristics of stakeholders engaged with CSGI and not the principles of green infrastructure as a concept.

It therefore appears critical to our understanding of CSGI that we can differentiate between the characteristics which support engagement with these spaces and the broader principles discussed in the green infrastructure and NBS literature (Austin, 2014; European Commission, 2015; Kabisch et al., 2016; Sinnett et al., 2015). Whilst there is significant overlap in terms of location, focus of a site/project, and the benefits that people (and nature) can accrue from engagement with green infrastructure, NBS and CSGI there remains a visible variation in how these terms are understood.

The principles of access to natural environments, connectivity and interactivity between people and local environments, and the promotion of multi-functionality are common to each concept (Beatley, 2000). Moreover, within such a debate NBS can be proposed as facilitating a more closely aligned narrative with CSGI as the focus on nature, access to resources, and an increased environmental awareness are increasingly prominent compared to mainstream green infrastructure discussions (Goode, 2014; Kabisch et al., 2016). NBS could therefore be positioned as the link between the conceptual definitions of green infrastructure and our understanding of CSGI. However, we contend that CSGI should place greater emphasis on the human-centred interactions between people, places and community engagement rather than simply repeating the accepted principles of green infrastructure regarding scale, access to landscape resources and strategic investment. Ongoing discussions of CSGI thus need to refocus the discussion of green infrastructure and NBS planning to facilitate a greater awareness of the benefits that can be delivered with a given local environment. Although working at such a discrete scale can limit the ability of local planning authorities, charities or communities to generate visibility (of funding) for local-scale greening projects it potentially facilitates greater buy-in if local communities can be engaged effectively.

The creation of a typology for CSGI is one mechanism through which greater awareness can be raised of the variation, value and functionality of green spaces at a local level. The typology discussed in this paper is proposed as a reflective tool providing a framework for categorising the multiplicity of approaches adopted by small groups (and individuals) who are brought together by a geographical areas or as a community of interest to create, enhance or manage green infrastructure resources; the aim of which is predominately to deliver co-benefits to the same community (Firth et al., 2011). In terms of overlaying group characteristics with a likelihood for longevity, the primary indicators of resilience are proposed as lines of governance (Formal and Informal) and group structure (Group or Project); with further distinctions addressing the activity of the group (i.e. food, environmental volunteering, health and wellbeing), which are suggested to hold a secondary importance as indicators of a group’s longevity. A robust evidence base has been created supporting these categories drawn from engagement with The Mersey Forest recorded over an extended period and cross-referenced with the research/practitioner literature. These categorisations also align closely with the range of classifications used by funding bodies including the Heritage Lottery Fund in the UK to differentiate between projects and eligible groups who apply for financial support (Dempsey et al., 2014).

Furthermore, if we review the characteristics of CSGI we can argue that locally contextualised engagement may only be tangentially connected to green infrastructure, in so much as it takes places in a green space; thus running counter to the evaluations presented by CABE Space (2005). The categorisations discussed above, as well as the proportion of The Mersey Forest sample considered to meet the location, function, people and groups/project characteristics may support a view that interactions with CSGI is the overarching reason why people engage, and it is not necessarily about the space itself or its proximity to people’s homes/places of work (cf. Jerome, 2017a; Firth, Maye and Pearson, 2011; Kingsley and Townsend, 2006 ). Again, this could be interpreted as green infrastructure offering a more overarching narrative to environmental awareness, which requires increased localised understanding to fully actualise its value (Austin, 2014; Mell, 2016b). Thus, the typology is proposed as an analytical framework for discussions of the localised factors affecting the longevity of CSGI, and potentially the resilience of a project in the long-term. This can be symbolised in the approaches to NBS, where the site and its functions are deemed central to building consensus around the value of a space for individuals and communities. Moreover, evaluating the types of CSGI along thematic lines: status, location, timeframe, membership, activity focus (see Table 2), governance, resources and recognition, and communications, provides additional characteristics that can be used to both identify complementarity between projects and to predict the longevity of a CSGI project. Conceptualising green infrastructure as a micro-scale activity or as a network of meaningful community spaces, where the value of the deliverables relating to social determinants such as health or social capital, and as a cost-effective approach to NBS may therefore have greater significance than ongoing discussions of the principles of green infrastructure. The significance of which to environmental volunteering is not only in the re-conceptualisation of green infrastructure and NBS as CSGI but also in recognising the breadth and diversity of activity observable at this scale.

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