Examining the role of community engagement in nature-based solutions

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Master of Philosophy by Sophie Preston

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Abstract

Nature-based solutions have been proposed as a family of approaches that can help society adapt to climate change and mitigate its impacts. NBS are guided by the principles of harnessing natural processes to enhance ecosystem services; in turn producing a number of societal co-benefits. A key aspect to consider is their aim to solve societal problems, holistically addressing both the social and ecological dimensions of the system, enhancing the biophysical environment as well as addressing social issues. Despite this commitment to social issues, most research to date has focused on proving the biophysical efficacy of NBS. As a result, NBS are increasingly viewed as a panacea for a host of contemporary environmental and social problems in cities, but evidence in the latter domain is weak. Although the social imperative to engage communities are stressed in policy, there is as yet little published research exploring this in the cities trialling NBS. In order to explore this gap, this thesis examines the benefits and potential contribution of citizen participation to co-produce knowledge for the creation of locally-attuned NBS interventions. This is hypothesised to engender political support for NBS, enhance benefits delivered to local communities and help inform NBS planning and policy. This research into citizen engagement with NBS was carried out over the course of one year using the case study of URBAN GreenUP, Liverpool a private-public partnership between Liverpool City Council, the University of Liverpool and the Mersey Forest which has been primarily funded by the Europen Commission as part of Horizon 2020 research. This research found that although there was evidence of a variety of methods employed to perform ‘community engagement’ in line with project aims, there was a significant lack of opportunities for what might be termed as meaningful participation with URBAN GreenUP. Findings reflected that citizen stakeholders were frustrated by the lack of depth of engagement and its timing within the project timeline. This suggests that engagement activities should feature as early in the project as possible, and should endeavour to improve outcomes such as co-production which tends to occur in relation to in-depth engagement from an early stage.

Abbreviations

EbA	Ecosystem-based Adaptation
ES	Ecosystem Services
GI	Green Infrastructure
NBS	Nature Based Solutions
PGIS	Participatory Geographic Information Systems
SES	Social Ecological System(s)
UGI	Urban Green Infrastructure
UHI(E)	Urban Heat Island (Effect)

1 Chapter 1: Introduction

This research aims to examine citizen participation in the context of nature-based solutions (NBS), using the Liverpool URBAN GreenUP project as a case study. 'Nature-based solutions' is a term that describes interventions inspired by and using natural processes to combat societal problems (Faivre *et al.,* 2017). This emerging topic in environmental planning and management has largely been framed as a series of approaches to support climate change adaptation and mitigation at the local scale, simultaneously offering the promise of a plethora of social co-benefits. There is evidence to support the biophysical effectiveness of NBS, but social co-benefits and implications for policy have been under-studied to date (Frantzeskaki, 2019). Many NBS case studies have drawn attention to examples of co-creation with citizens on single interventions, but there is limited evidence of this process particularly for larger projects involving multiple interventions (Frantzeskaki, 2019; Ambrose-Oji *et al.,* 2017; Mendes *et al.,* 2020). Citizen engagement with NBS is important because citizens are the primary end-users of NBS are therefore a key stakeholder in collaboratively governed NBS projects (Stout and Love, 2018). Engagement with NBS is purported to offer a host of benefits to the project and to citizens including empowerment, improving services provided to end-users and place-making (Gulsrud *et al.,* 2018).

1.1 Problem framing

Cities worldwide are currently facing multiple overlapping sustainability challenges including climate change, improving air quality, improving biodiversity and halting its loss – described as 'super wicked problems' to highlight their complexity (Levin *et al.,* 2012). Their complexity results from the combined issues of considering time pressures, lack of policy direction and weak governance (Levin *et al.,* 2012). In light of growing public awareness in recent years, pressure is mounting for the British government to take action on sustainability issues in UK cities. However, progress has been slow, following a decade of austerity measures and years of protracted Brexit negotiations which has further reduced the capacity of politicians to make progress on UK climate change policy (Keating, 2019; North, et al.,

2017). The UK is struggling to make the changes necessary to meet their commitments to reducing carbon emissions under these political and economic conditions.

NBS have been proposed as a potential approach to meeting super wicked problems associated with climate change. The term NBS draws on interrelated concepts that have evolved over the end of the 20th and beginning of the 21st century, including green infrastructure, ecosystem-based adaptation and ecosystem services (Dick *et al.,* 2019). NBS is in part an umbrella term for these other approaches, but the way the concept is framed is slightly different and focuses on providing **solutions** to societal **challenges**. They may offer a cost-effective, novel and locally-based method to address sustainability challenges faced by governing bodies to improve society (Pauleit *et al.,* 2017). According to the European Commission, NBS are:

"solutions that ***are inspired and supported by nature****, which are* ***cost-effective, simultaneously provide environmental, social and economic benefits*** *and help* ***build resilience.*** *Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through* ***locally adapted, resource-efficient and systemic interventions****."* (Faivre *et al.,* 2017, p. 510)

The IUCN's forthcoming guidelines go further in specifying that NBS are intended to provide specific solutions to defined societal problems, such as adapting to climate change with the additional benefit of delivering a suite of co-benefits alongside meeting the associated challenges of a rapidly changing social-ecological system (IUCN, 2020).Although the term only came into mainstream scientific use in the mid-2000s, the theoretical basis has quickly mounted (Potschin *et al.,* 2015). However to date, research into NBS has primarily focused on efficacy of ecological functions whilst governance, policy and planning of NBS remains underexplored (Mendes *et al.,* 2020). Unsurprisingly, a review of this emerging body of literature revealed that the long list of concrete actions that constitute NBS is not matched by a similar list of practical, concrete recommendations for institutionalising NBS and incorporating them into planning and policy (Mendes *et al.,* 2020). These new guidelines from the IUCN begin to outline key governance criteria which could help to improve NBS as an approach to climate change (IUCN, 2020).

It is important understand the governance, policy and planning aspects of NBS as they ultimately determine the quality of solutions that can be delivered to municipalities. The mechanisms underlying purported social co-benefits also remain unclear; these additional co-benefits that supposedly occur in the process of addressing specific challenges are central to the appeal of NBS in comparison to other solutions, and therefore understanding these mechanisms is essential. Furthermore, whilst NBS act as a local, place-based intervention for climate change adaptation, NBS have been studied with a view from

nowhere which has impeded exploration of the benefits of locally-adapted solutions (Gulsrud *et al.,* 2018). This is particularly important considering that a central tenet of the European Commission's definition is that NBS are locally adapted, and the forthcoming global standard on NBS from IUCN explicitly incorporates this in its critera and indicators (Faivre *et al.,* 2017; IUCN, 2020). Further research is required to fully understand NBS policy which determines effectiveness of interventions from all perspectives; environmental, social and economic and how appropriate governance approach may help to facilitate a locally-adapted strategy for NBS.

1.2 Community engagement with NBS

In particular, this research will examine the role of community engagement because citizens are considered a key stakeholder in collaboratively governed NBS projects, as the people who will be affected by implementation of NBS (Baptista *et al.,* 2019; IUCN, 2020). The NBS literature to date and IUCN guidelines stipulate the importance of meaningful participation of citizens as central to good governance of NBS (Frantzeskaki, 2019; IUCN, 2020). This stems from a longer history of engaging affected citizens in planning and policy, particularly for those decisions which affect the environment. However there has been little critical engagement with the reasons why community engagement might be beneficial for the governance of NBS beyond its presumed role as an inherent benefit, rather than considering the value of citizen involvement with NBS in enhancing the multiple co-benefits they have the potential to deliver to society (Norström *et al.,* 2020).

Outlining basic principles for participation of the public in NBS such as those addressed by the IUCN guidelines has led to NBS generally attempting to incorporate participation in some way. However variation exists across a number of factors including the stakeholders involved, funding sources and capacity of citizens to contribute their time to the NBS project. This reflects the importance of considering community engagement with NBS on a case by case basis. For instance, a grassroots project may have an intentional community focus whereas a municipal authority-led greening strategy may include aspects of community engagement but have competing aims and objectives and limited discretion to act on community aspirations, which limits the value of community involvement to some degree (Ansell, 2011). In the UK, it would be unlikely for an NBS project to lack any sort of community engagement due to statutory planning requirements for consulting the general public, but participation literature tends to be highly critical of relegating community involvement to 'consultation', which is considered to be a relatively low bar (Healey, 1998).

This is because at best, consultation may miss key opportunities to innovate with communities and ensure NBS are appropriately adapted for the local context, maximising solutions and co-benefits delivered and increasing their effectiveness (Percy-Smith, 2006). Limiting participation to consultation may even have negative consequences for NBS projects. For example, the way in which consultation is conducted typically does little to include marginalised voices and instead favours special interest groups and reproduces extant power dynamics in society; this may limit the ability of NBS to meet the unique needs of the local community because of the prioritisation of the requests of one powerful individual or group (Healey, 1998). Furthermore, consultation asks for the input of citizens too late in the process, limitng any substantive input on designs of NBS interventions. This is perceived to be tokenistic, having the appearance of taking public views on board but having little real impact on predetermined designs (Arnstein, 1969). This unfortunate side-effect of the process has become widely understood by the general public, which acts as a further deterrent to participate (Wondolleck and Yaffee, 2000). Instead, the participation literature tends to advocate for citizens being equipped with skills and power for decision-making on projects for which they are considered to be a key stakeholder (Baptista *et al.,* 2019).

1.3 Approach

This research examined URBAN Green UP in Liverpool, UK as a case study of NBS that are currently being implemented. Through on-ground demonstration sites in Europe and beyond, URBAN GreenUP aims to demonstrate the environmental and socio-economic benefits of NBS as well as develop a transferrable method for “re-naturing” cities globally, with aspirations to strengthen NBS policy and planning at the national, European and international levels. This is indeed, an ambitious goal of the project that I studied as an independent researcher. My research specifically examined community engagement to better understand its role in designing and implementing NBS and how it may contribute to delivering locally attuned NBS interventions and help improve service delivery by NBS, particularly within Horizon 2020 alligned projects. Horizon 2020 NBS projects tend to be small-scale NBS interventions implemented in urban settings, such as street trees and green walls mounted onto buildings (Faivre *et al.,* 2017). Horizon 2020 formulated the EKLIPSE framework for guidelines on their NBS projects, which has a sustained focus on climate change adaptation rather than IUCN guidelines which have a greater focus on governance, planning and policy (IUCN, 2020). Although the European Commission may use the phrasing ‘locally-adapted’ in their definition of NBS, the IUCN’s guidelines may better

facilitate a local approach compared to EKLIPSE through a more sustained focus on implementing the governance measures to allow for locally adapted NBS (IUCN, 2020).

URBAN Green UP is a European Commission, Horizon 2020-funded project that began in 2017. The project has been led by 3 frontrunner cities: Liverpool, UK, Valladolid, Spain and Izmir, Turkey. URBAN Green UP in Liverpool was the focus of study where it is being governed as a collaborative partnership between Liverpool City Council, The Mersey Forest and University of Liverpool. The project partners are working together with public sector, private sector and third sector organisations to deliver a range of NBS in three demonstration areas in the city.

Figure 1: Map of Liverpool within the Liverpool City Region and its location in the UK (URBAN GreenUP, 2017a)

The work began in 2017, and at the time of writing the project has completed the pre-implementation phase and is mid-way through implementation of the interventions. Baseline monitoring has been conducted to compare against the post-implementation phase in order to be able to evaluate the impact of NBS on Liverpool (URBAN GreenUP, 2018c). NBS will be implemented and then monitored until 2022 and hopefully beyond to assess how effective they have been in addressing various environmental, economic and social challenges faced by the city of Liverpool. The monitoring and evaluation aspects of URBAN Green UP are essential to the project's overarching aim – to demonstrate the efficacy of NBS and strengthen NBS policy (URBAN GreenUP, 2018c). URBAN GreenUP is a Horizon 2020 funded project, which means rather than solely focusing on delivering NBS to the city, the project will act as a research exercise. This will ultimately allow the frontrunner cities of Liverpool, Valladolid and Izmir to provide a blueprint to follower cities involved and beyond for their own NBS programme, ensuring the growth and sustainability of NBS in urban planning (URBAN GreenUP, 2017b).

1.4 EKLIPSE assessment framework outline

Like all Horizon 2020 projects, URBAN Green UP is required to use the EKLIPSE Framework as a guide for planning and assessing the project outcomes. Although the EKLIPSE report was based on a time-limited scoping exercise and was not intended to be used as a framework, in the first year of URBAN GreenUP, the European Commission introduced a requirement for all Horizon 2020 projects to use the report as a monitoring framework. It allows NBS in Europe to be compared using standardised requirements, which is important for setting expectations for performance of NBS (Raymond *et al.,* 2017). Therefore, all NBS interventions implemented within URBAN GreenUP, as a Horizon 2020 project, will be assessed on their performance across a range of key performance indicators; and although there was some scope to identify locally-relevant indicators, the requirement to use EKLIPSE does limit the scope of each city to identify and monitor those aspects deemed most important by researchers, partners, and the local communities who are affected by and can benefit from NBS. EKLIPSE outlines the impacts nature-based solutions may have in 10 identified challenge areas that span the environment, economy and social factors – reflecting the holistic nature of NBS (Raymond *et al.,* 2017).

Table 1: Summary of EKLIPSE framework Challenge Arenas

Challenge	Description
1: Contribution of NBS to Climate Resilience	How NBS impacts both mitigation and adaptation to climate change Carbon storage and sequestration and improving local microclimate through cooling and shading
2: Water Management	Improving sustainable urban water management Increasing infiltration, evapotranspiration, storing rainwater and removing pollutants Preventing flooding
3: Coastal Resilience	Protect against coastal storms and sea level rises Maintain or restore coastal ecosystems and biodiversity
4:Green Space Management	Creating, enlarging, connecting and improving green spaces as a sociocultural asset Improving biodiversity in existing NBS areas
5: Air Quality	Using NBS to remove pollutants from air, reduce GHGs and reduce air temperature to regulate production of secondary pollutants
6: Urban Regeneration	Using NBS to improve the economic, physical social and environmental conditions of vulnerable areas that have been subject to decline
7: Participatory Planning and Governance	Ensuring planning and governance procedures for NBS that promote collaboration to maximise potential for creative, adaptive design Supporting community-based NBS projects; and ensuring accessibility to these spaces Supporting processes that restore ecological memory Knowledge co-production processes for transparency, openness and bring legitimacy for knowledge from civil society
8: Social Justice and Social Cohesion	NBS that recognises the diverse social groups in society, prioritising the needs of marginalised people

	Promoting inclusiveness and fairness to enable vulnerable social groups to feel comfortable in their living environment
9: Public Health and Well-being	Using NBS to promote ecosystem services that improve public healh For example protecting people from temperature extremes and air pollution
10: Potential for Economic Opportunities and Green Jobs	Opportunity to create jobs directly related to NBS and create an environment that nurtures 'green business'

Out of the 10 challenges arenas, 5 are socioeconomic; reflecting that EKLIPSE places high value on both biophysical impacts and social impacts of NBS. EKLIPSE will allow URBAN Green UP partners to prioritise KPIs that match up to the Challenge Arenas, complementing the Liverpool City Council Local Plan for Green Infrastructure.

This research will mainly focus on topics collated under *Challenge 7: Governance and Participatory Planning* in relation to community engagement with URBAN GreenUP. It is also worth noting, that themes explored in this research overlap with Challenges 1, 4 6 and 8 (see Table 1). Challenge 7 has been selected as a focal point due to the centrality of planning and governance in affecting the service delivery by NBS to society that ultimately reflect the success of URBAN GreenUP. Furthermore, despite clear efforts of the EKLIPSE working group to strike a balance between assessing biophysical and socioeconomic factors, generally speaking about NBS literature to date, governance and civic participation in NBS remains underexplored compared to research in biophysical efficacy (Frantzeskaki, 2019). To meet the complexities driven by their cross-disciplinary nature, NBS projects tend to be managed collaboratively (Mell and Clement, 2019). This is the case for URBAN Green UP in Liverpool which is a collaborative partnership between Liverpool City Council, The Mersey Forest and University of Liverpool alongside private, public and non-governmental stakeholders (Kabisch *et al.,* 2016; Mell and Clement, 2019). As such, the project tends towards governance principles which have been set out by EKLIPSE and also align and overlap with the wider aims of meeting 'good governance' principles (refer to Section 2.4: Good governance).

These principles emphasise the importance of:

- Co-creation
- Knowledge co-production
- Community engagement
- Socially inclusive NBS
- Promoting stewardship
- Enhancing connection to nature

URBAN GreenUP has established a number of expected impacts that overlap with outcomes articulated in Challenge 7 of EKLIPSE including:

- Connecting citizens with nature
- Citizen science for data collection
- Collecting data on citizen perceptions of urban greening

Ultimately, URBAN Green UP aims to shape NBS policy, which is still evolving in this relatively novel field. This research will examine the role of public participation in shaping NBS policy by using EKLIPSE guidelines as a framework for examining the role of participatory planning and governance in URBAN GreenUP at present. This will involve collecting and analysing qualitative data on the project and looking to the examples of existing NBS literature that references citizen participation to inform and support findings of the research.

1.5 Socioeconomic context

URBAN GreenUP represents an exciting opportunity for Liverpool to act as a leading UK city on NBS. Without the funding and support of other city partners and the European Commission, it is unlikely that the city would be able to do so. Liverpool has long suffered high levels of unemployment, urban depopulation and deep socioeconomic deprivation, ranking the 4th most deprived local authority in the UK (Liverpool City Council, 2015). At the same time this project has been ongoing, the council has had to limit all but essential spending, due to a £57 million debt and a 63% decline in funding since the Global Financial Crisis (BBC News, 2019).

Following a prosperous industrial era during which Liverpool thrived as a global commercial hub, the city suffered greatly from deindustrialisation that followed in the mid-twentieth century (Couch and Cocks, 2013). Since then, central UK government has made

decisions that have contributed further to the city's socioeconomic problems. Citizens of Liverpool feel the city was abandoned during Thatcher's government, with her aide pushing for a strategy of 'managed decline' following the Toxteth Riots of 1981 rather than reinvesting the city (Thompson, 2015). This strategy described essentially abandoning the city and hoping this would force inhabitants to move to more prosperous areas in the south. The reverberations of deindustrialisation and a lack of a guiding hand or financial injections from central government have contributed to socioeconomic decline. Recently, there have been investments in the city totalling £6 billion following key events such as Liverpool being named European Capital of Culture in 2008 (Couch and Cocks, 2013). Reinvestment has helped to begin funding regeneration but a significant amount of work will be required to help the city fully recover (Jones and Wilks-Heeg, 2004).

Figure 1: Image of empty homes on Garrick Street, Liverpool reflecting the impact of decades of deindustrialisation and depopulation (Power, 2015)

1.6 Austerity and Liverpool green space

Despite attaining significant amounts of funding for regeneration in recent years, the problems discussed above have been compounded by austerity measures imposed in the UK by the Conservative-Liberal Democrat coalition since 2010 (Parnell *et al*., 2015). Although the multiple co-benefits of NBS are well-documented, there are major roadblocks to their mainstreaming in the UK which largely relate to funding. In turn, this has limited the capacity of local authorities to innovate in terms of climate change adaptation strategy

(Whitten, 2019). Austerity describes the strategy to reduce the national deficit that resulted from the global financial crisis by dramatically cutting public spending (Whitten, 2019). Although these cuts occurred across all public spending, local governments were disproportionately impacted and the degree of cuts varied between local governments. For example on average in the UK there was a reduction of 27% to local government funding in 2014-2015 compared to 2010-2011 (Lowndes and Pratchett, 2012). Meanwhile the city of Liverpool has suffered some of the worst budget cuts in the UK where funding has been reduced by 63% since the Global Financial Crisis (Forrest, 2019; North *et al.,* 2017). This stands in stark contrast to cities such as Oxford where public spending has actually increased during the austerity period (Forrest, 2019). The funding gap created by austerity has mostly impacted the management of services deemed to be non-essential such as public libraries, youth centres and green spaces. This is because the funding of services such as education and social care had to be prioritised instead (Mell, 2018). The cuts to spending on green spaces risks stunting mainstreaming of NBS into UK policy as lack of funding has curtailed the ability of local governments to implement new and innovative forms of urban green space (Faivre *et al.,* 2017).

Not only has the development of NBS been constrained by austerity in terms of green space budgets, but austerity measures has forced councils such as Liverpool to source alternative funding methods – for example, Liverpool City Council has adopted an 'invest to earn' strategy (Whitehead, 2015). As the term implies, this is a strategy based on generating income by intensive investing in the private sector (Blackhurst, 2018). Although the strategy of invest to earn goes some way to filling the gap left by austerity, it also encourages councils to sell areas of open green space to developers, leading to conflict with the local community (Neild, 2017; Thorp, 2019). Examples in Liverpool include development of Bixteth Street Gardens along with threats to Calderstones Park, Sefton Park Meadows and Rimrose Valley Country Park (Thorp, 2019; see Figure 2). Liverpool already ranks lowest of UK cities in terms of green space compared to other UK cities, such as Edinburgh which is comprised 49.2% green space. In comparison, the Liverpool city area comprises just 16.7% green space according to map-based survey by ESRI (Neild, 2017). This heightens the stakes of green space development, as there is such little green space left to lose in central areas of the city.

Austerity presents a double-edged sword in advancing NBS policy in Liverpool, as well as many other areas of the UK because open green space is being sold to developers to generate funding for essential services whilst austerity measures limit local authorities' available funding to invest in new NBS. Although there is potential to use Community Infrastructure Levy funding or Section 106 agreements to partially fund NBS, to date this has

not been done in Liverpool, and the use of such funds for NBS must consider a number of other competing values, benefits, and trade-offs (Jones and Somper, 2014). Given the challenging economic climate, without external funding and resources it may be considered inappropriate for the city council to invest in NBS if it was seen to be at the detriment to essential services. At the same time, the issues Liverpool has faced in recent history demonstrates why Liverpool can be considered a prime candidate to use as an experiment in NBS as a means of meeting 'wicked' sustainability problems in the UK. The impact of new NBS interventions may even be more noticeable in a city such as Liverpool where there is limited extant green space, compared to a setting which already benefits from a high proportion of green space. In industrialised cities like Liverpool where most land is privately owned, there may also be potential to leverage funding from other sources, since NBS are necessarily implemented in partnership with private actors.

Figure 2: Image of Bixteth Street Gardens, a small parcel of green space in Liverpool city centre. Despite campaigns to protect it, it was sold to developers in 2019 (Thorp, 2018)

The political, social and economic context NBS are being implemented has importance beyond funding considerations. It is also relevant to understanding how communities will be engaged in such projects. Political decisions at the national and local level since the 1980s has given rise to a major issue of mutual mistrust between citizens and Liverpool City Council (Thompson, 2015). Hostility towards the local authority has worsened in the austerity years as development of open green spaces as part of the 'invest to earn' strategy has sparked a number of battles between residents and the council. This may make it difficult to engage residents with NBS as it may be viewed as hypocritical policy, and further erode social capital. It is worth noting that European Capital of Culture 2008 was awarded on the basis of the communities engaged with the bid, who actively felt they had a stake in the regeneration process as a result of engagement (Jones and Wilks-Heeg, 2004). Implementation of NBS is hoped to be a part of Liverpool's regeneration narrative; to enjoy the success of ECOC 2008, it may be beneficial for communities to be taken on board.

2 Chapter 2: Literature Review

2.1 Introduction to the Literature Review

This chapter reviews the literature that outlines the development and trajectory of NBS in the context of their relevance to developing climate change resilience and acknowledging related approaches to urban green space management. Governance was identified as a key determinant of the success of NBS and public participation was explored as an important aspect of collaborative management. The literature review outlined the history of participation in landscape management over the latter half of the 20th century and 21st century, and how it developed in line with changing policy and legislation. The literature review contextualises the research approach used to examine public participation in NBS, reflecting the importance of meaningful engagement in generating favourable outcomes for NBS projects. NBS is a relatively new concept in the context of approaches to urban greening, and therefore related concepts need to be addressed in order to understand where they may be complementary, and where NBS deviate. The following section aims to establish a broad overview of the NBS concept before delving into governance and participation in both the wider literature and their specific application to NBS.

2.2 Development of the concept of NBS

Cities around the world are under immense pressure to build resilience as we approach a scenario where scientists and policymakers have now recognised that the once popular rhetoric of limiting global warming to 2°C will be insufficient to limit catastrophic impacts to human livelihoods (Folke *et al.,* 2005; IPCC, 2018; Kabisch *et al*. 2017). This is intensified by urbanisation; of the urban area in Europe that will exist in 2030, only 40% has already been built, reflecting the rapid expansion of cities over the next decade (Kabisch *et al*., 2016). The growing built environment will accommodate a rapidly expanding urban population, as the proportion of European citizens living in urban areas will rise to 80% by 2020 (Voytenko *et al.,* 2016). Cities will feel the impacts of climate change more intensely than rural areas due to urban heat island effect (UHIE), brought about by low albedo building materials and use of air conditioning units (Bowler *et al.,* 2010). Therefore, a higher proportion of the population will be affected by climate change as they migrate to the intensifying conditions of the built urban environment.

NBS can be described as a set of interventions that aim to protect cities from future shocks such as climate change by building their capacity to adapt and resist against such shocks and improve the resilience of the social-ecological system (European Commission, 2015; Kabisch *et al.,* 2017; Folke *et al.,* 2005). The European Commission has its own definition of NBS "actions which are inspired by, supported by or copied from nature" that "result in multiple co-benefits for health, the economy, society and the environment" (European Commission, 2015). The term 'nature-based solutions' is a relatively novel concept, gaining traction through Horizon 2020 and the IUCN Commission on Ecosystem Management's work to develop global guidance and standards on NBS (Nesshöver *et al.,* 2017). The roots of the concept can be traced back to earlier terminology popular within environmental policy literature such as ecosystem-based adaptation (EbA) and green infrastructure (GI) (Ambrose-Oji *et al.*, 2017; Connop *et al.,* 2016; Wolch *et al.,* 2014; Kabisch *et al.* 2017). The development of such terminology represents a systems shift in the contemporary era from conceptualising the city as an engineered structure separate from nature, to an ecological system (Connop *et al.* 2016). The ecological system of the city is inextricably linked with those who live within it, and therefore the term 'social-ecological system' is used to encompass the importance of both aspects and their interdependency on one another (Folke *et al.,* 2005). Social-ecological systems thinking underlies the principles of NBS, which aim to solve challenges that relate to the two interlinked parts of the system simultaneously rather than solely focusing on challenges affecting 'social' *or* 'ecological' arenas (Albert *et al.,* 2019).

Approaches to land use planning have long recognised the benefits of using green space as a strategy to conserving nature whilst also supporting human health, for example the creation of urban parks during the Victorian Industrial era in the United Kingdom and the popular early twentieth century example of Ebenezer Howard's 'Garden City' (Scott and Lennon, 2016). Indeed provisions for green space have been part of UK Town and Country Planning since it was first established and this is true of many other national planning frameworks (Fischer, 2016).

It is also worth looking to Germany's Federal Environmental Protection Act (FEPA; originally the Federal Nature Conservation Act, 1976), which provides a useful example of how green space planning can be well-integrated into urban planning in the long term. This is very different to the generally piecemeal NBS project approach. The FEPA requires landscape planning to be conducted to preserve nature whilst benefitting human health (Fischer, 2016). This is achieved by ensuring that the landscape plan works with spatial planning (Fischer, 2016). Environmental reports in Germany will look at the current and anticipated state of nature in order to set aims for the future conservation of nature and

landscape. The present and anticipated status of nature is evaluated against these objectives, and whether land use planning might conflict with the objectives. Based on this, measures will be taken to mitigate conflicts with the primary aim of protecting and managing nature and landscape as an integral part of land use planning (Fischer, 2016). This reflects an integrated system of land use planning and landscape management that works in tandem to produce society supported by functioning ecosystems. For example, in Hamburg, the Green Network has been implemented with the aim of protecting nature but this simultaneously supports objectives for social benefits by creating a pedestrian and cycling corridor which provides an opportunity for exercise and recreation, and reduces reliance on cars in the city thus improving air quality (Fischer, 2016).

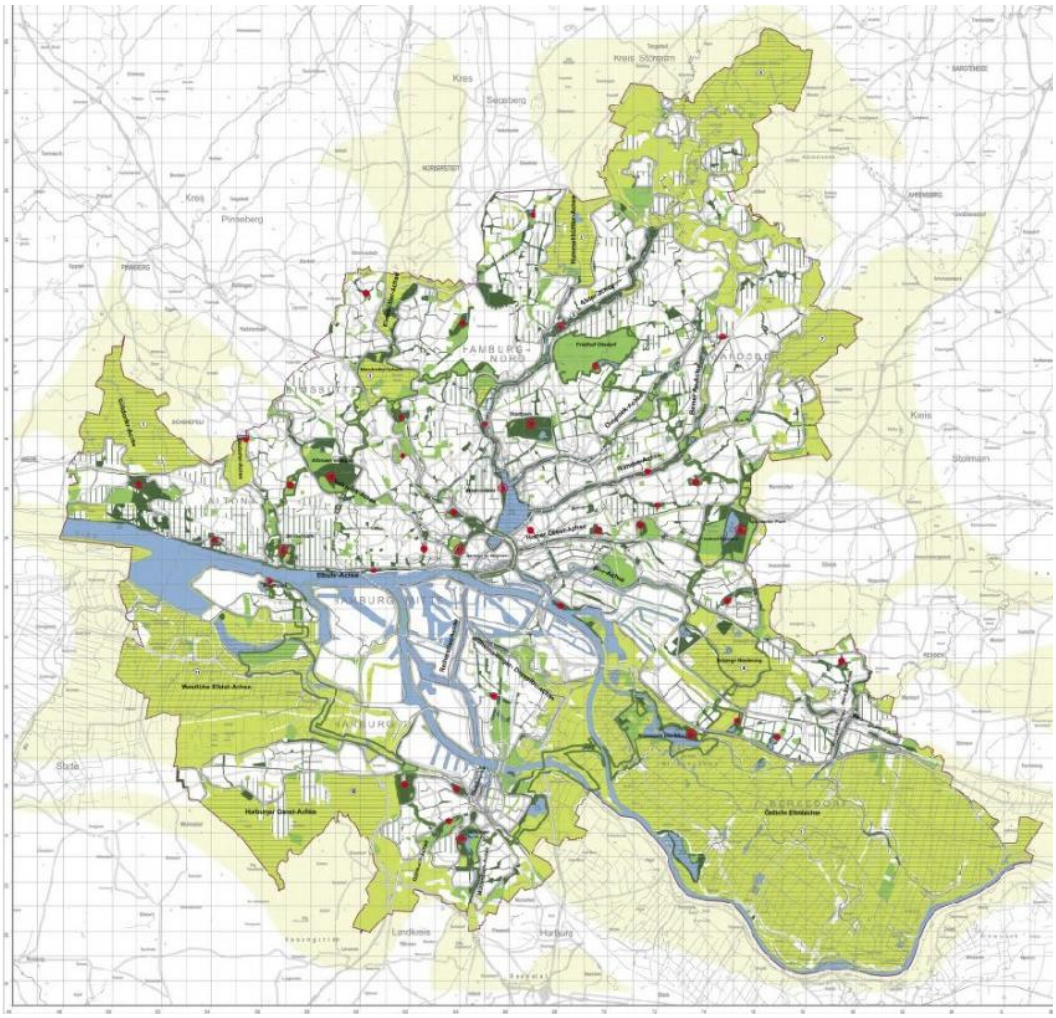

Figure 3: Map of Hamburg's Green Network, which accounts for 50% of the city area (Lavars, 2014)

Aspirations to use natural or 'nature-inspired' landscapes and processes for the benefit of societal functioning is described by the term 'ecosystem services' (Cohen-Shacham *et al*., 2016). In line with EbA and GI literature, NBS utilises the concept of ecosystem services in

order to operationalise visions of sustainable, climate resilient and liveable cities (Cohen-Shacham *et al*., 2016). The term 'ecosystem services' first came into use in the 1980s to try to draw attention to the value of natural processes to human activities by inserting it into the language of economics, which was presumed to be more easily understandable for policymakers (Ehrlich and Ehrlich, 1981; Rapport *et al.*, 1998). 'Ecosystem services' assigns monetary value to the perceived support offered by environmental resources to human social and economic activities when the resource is appropriately managed. This anthropocentric value system can be considered problematic as it attempts to assign value to what is considered by many to be invaluable but it remains popular today, and is referred to in definitions of nature-based solutions (Schröter *et al.,* 2014). NBS adopts the ecosystem services approach in its anthropocentric iteration, using natural processes to support human wellbeing, health, social and economic outcomes in the urban environment. They offer methods of harnessing natural processes to maximise potential ecosystem services that can be provided to society (Nesshöver, *et al.*, 2017). Whilst NBS may adopt the view of urban areas as a social-ecological system, the agenda mostly serves human needs for resilient cities (Nesshöver *et al.,* 2017).

In some cases, the terms urban GI and NBS are used interchangeably, as both champion the idea that cities designed to incorporate natural ecosystem processes offer multiple benefits across environmental, social and economic sectors; however the social aspects and integrated nature of multiple co-benefits are made more explicit for NBS compared to GI (Connop *et al.,* 2016). However, there are several key differences that are said to set NBS apart as an innovative approach to solving the challenges associated with rapid urbanisation in the face of climate change (Faivre *et al.,* 2017; Kabisch *et al.,* 2017). Terms such as GI and EbA usually reflect specific solutions to specific land-based issues whereas NBS are more holistic, employing multiple methods to solve multiple problems at once, with a view towards enhancing social cohesion and integration in cities (Nesshöver *et al.,* 2017). In this thesis, NBS is the preferred term due to the prioritisation of social benefits and innovation, and in line with recent European Commission literature (2015). It is also consistent with the framing of the interventions in the case study under investigation, and even when the term NBS is not used in communicating with the public, it informs the way that the interventions are discussed and promoted in the project.

NBS is an umbrella term which can be used to describe a wide range of interventions, including but not limited to: green walls and roofs, SUDS, urban wetlands, urban forests, street trees – even GM crops have been described as NBS (Wolch *et al*., 2014; Scott, Lennon *et al.,* 2016, Maes and Jacobs, 2017). These interventions may be equally or more effective than grey infrastructure in meeting multiple challenges simultaneously. For

example, creating an urban wetlands has potential to deliver services such as flood prevention, water quality enhancement, carbon capture and cooling simultaneously – usually at a reduced cost compared to engineered infrastructure such as flood walls that only prevent flooding (Morris *et al.*, 2018). Furthermore, urban wetlands can meet social needs of supporting human health – as part of the creation of the Salford Flood Scheme wetlands, a green pedestrian and cycle route was created to provide opportunities for recreation within the wetlands as well as linking Salford to Manchester city centre (Environment Agency, 2018).

Figure 4: Urban wetland created as part of £10 million Salford Flood Scheme (Environment Agency, 2018)

In particular this thesis seeks to explore the use of renaturing, greening and green space as NBS (Hartig and Kahn, 2016; van den Bosch and Sang, 2017). Urban green space can be used to describe an incredibly diverse set of NBS interventions, which serve a wide range of functions that deliver both ecosystem services and can derive social benefits (Green Surge, 2015a). This category includes parks, green walls and roofs, urban forests and spaces adjacent to blue space; essentially describing all vegetation contained within the urban environment (Green Surge, 2015a). Specifically, renaturing and greening reflects desires to retrofit built up spaces with natural features as a means of enhancing the city as a resilient social-ecological system (Scott and Lennon 2016). Greening efforts involve maintaining, enlarging and enhancing existing green space and improving the networking between green spaces (Haase *et al.*, 2017; Kabisch *et al.* 2017). The process of returning

natural elements back into the urban environment is theorised to reconnect humans with nature in order to stimulate multiple social and health co-benefits alongside biophysical changes that will help cities adapt to climate change (Connop *et al.,* 2016). Many of the purported social benefits are hypothesised to stem from theories of 'biophilia', a term which refers to the connections between humans and nature that suggest green space can significantly stimulate mental and physical wellbeing (Tidball and Stedman, 2013).

Indeed, creation of NBS will be key in future efforts to combat mounting threats to the health of those living in urban environments posed by global warming (Bowler *et al.* 2010). UGS can be used as NBS interventions to protect populations against increased frequency and intensity of flooding and enhanced UHIE as a result of climate change. Green space as an NBS to UHIE demonstrates its ability to tackle the issue on multiple fronts. Firstly, through evapotranspiration which cools surrounding air; secondly, through the shading provided by the tree canopy and additionally by altering air movement and heat exchange (Bowler *et al.* 2010). Indeed, studies suggest that an urban park may reduce air temperature by 1°C and could therefore have a substantial impact on urban climates, reducing reliance on expensive grey infrastructure such as air conditioning units (which only act to intensify UHIE through creation of heat) (Kabisch *et al*., 2016, Korn *et al.,* 2017). Furthermore, the benefits stretch beyond cost-saving and altering microclimates; what makes green space an especially effective strategy to meet the evolving needs of social-ecological systems is its huge scope for social co-benefits. Green space forms social meeting places, and research has proven that there are health benefits that span both mental and physical health. This is because it provides opportunities for people to connect with nature which enhances wellbeing whilst also providing places to engage in physical exercise. Co-benefits also benefit non-humans, as creating better networks of green spaces enhance habitat connectivity and provide refugia for wildlife (Scott and Lennon, 2016). This reflects the philosophy of NBS, where the function of green space is considered in terms of co-benefits for health, social opportunities and biodiversity.

The discussion above reflects how the concept of NBS ties together several developments within environmental policy over recent decades to create what is being presented as a new approach to the management of urban environments in an era of rapid climate change and urbanisation. However, NBS is set apart from its predecessors in its purported focus on enhancing social innovation as a catalyst for the mainstreaming of sustainable urban development (Faivre *et al.,* 2017). It is hoped that using NBS will encourage improvements to environmental governance such that it can radically change how we conceptualise approaches to urban challenges by ecouraging integration of the three pillars of sustainability (Faivre *et al.,* 2017; Nesshöver *et al.,* 2017). Key to the

concept's ever-growing popularity has been this ability to look beyond the physical environmental benefits to an integrated method of addressing the multifaceted societal problems that we face at present – not just the issues associated with climate change (Faivre *et al.,* 2017). Over the last few years NBS has drawn interest in academia and increasingly within policy; as a result, it has been put forward as a key strategy in achieving the targets set by national, regional and global policy regarding sustainability and the envrionment (Faivre *et al.,* 2017).

2.3 Challenges to mainstreaming NBS

The biophysical justification for using NBS as an urban climate change adaptation and mitigation strategy can now be considered to be well-established, with considerable benefits of using urban greening as opposed to using other methods (Matthews *et al.,* 2015). Firstly, NBS are relatively politically acceptable and therefore on a surface level are unlikely to cause controversy. On the other hand, limiting carbon emissions through nuclear power or increasing water supply by creating large scale desalination plants is likely to cause much political furor (Byrne and Jinjun, 2009). Furthermore, due to their multibeneficial nature, green space has wide public appeal, feeding into political support for NBS (Byrne and Jinjun 2009). The multiple co-benefits of NBS will satisfy multiple political aims such as improving health and wellbeing which is more cost effective and less time consuming than having to employ multiple separate strategies simultaneously. Therefore NBS represent a holistic approach to societal problems that is unlikely to face opposition (Byrne and Jinjun, 2009).

However, the prioritisation of researching the efficiacy of biophysical impacts of NBS has perhaps eclipsed deeper discussion of potential institutional barriers to their effective deployment in cities, and many assumptions about societal impact have been made. In part this may be attributed to NBS literature being relatively disconnected from the institutional literature. Some of the NBS literature briefly highlights the role of institutions in shaping NBS projects but fails to engage with the influence of actors and organisations involved in depth (Nesshöver *et al.,* 2017). The following discussion highlights current debates in institutional and sociocultural barriers that require closer attention.

At present, the key issue in mainstreaming NBS is a significant lack of evidence base of their efficacy given that the concept is relatively new and is yet to be implemented on a scale large enough to comprehensively study their impact at the city-scale (Raymond *et al.,* 2017; Albert *et al.,* 2019). This may engender mistrust in the potential of NBS to solve societal problems, which deters urban planners and policymakers from adopting NBS (Kabisch *et al.,*

2016). However, this is rapidly changing; worldwide there are now over 70 projects working towards developing an evidence base to promote the efficacy and validity of NBS (OPPLA, 2018). The projects are largely being conducted in Europe; in particular, the lack of evidence from the Global South is considered a barrier to widespread implementation but projects are now increasingly being initiated outside of Europe (Fan *et al.,* 2017; Byrne and Jinjun, 2009).

Although NBS may offer value as a boundary object that facilitates communication across disciplines and sector, like all boundary objects, there is danger that the vagueness of the term affects its ability to be mainstreamed and can result in misuse of the term to meet certain political agendas (Mell and Clement, 2019; Scott *et al.,* 2016; Maes and Jacobs, 2017; Nesshöver *et al.*, 2017). For example, NBS are purported to foster social cohesion and bring about environmental justice for all; these values lean towards socialism. On the other hand, critics warn NBS are at risk of adoption by neoliberal discourse, which typically utilises green space as a tool to increase land values and attract higher tax revenues as a result (Haase *et al.,* 2017; Kabisch *et al.,* 2017). Examples of urban greening such as High Line Park, New York City are cautionary tales of the risk of 'eco-gentrification' that can follow if greening is performed without appropriate market control. In this case, the opening of High Line Park resulted in a 103% increase in adjacent house prices, completely restructuring the pre-existing socioeconomic characteristics of the neighbourhood (Scott *et al.,* 2016). Furthermore, a lack of concise definition opens NBS to dismissal as the latest buzzword in urban development (Eggermont *et al.,* 2015; Calliari *et al.,* 2019). The resultant poor understanding of NBS may lead to it being rejected in favour of more traditional urban planning that fits into pre-existing planning and policy frameworks. Therefore it is paramount that information about NBS is disseminated widely, with clear distinctions drawn between NBS and related terminology such as GI and EbA (Calliari *et al.,* 2019). Endorsement of NBS by European Commission publications, with clear definitions of NBS could bolster the credibility of NBS for mitigating and adapting to climate change and facilitate its integration into institutions (Faivre *et al.,* 2017).

The vagueness of NBS may lead to the term being used to make claims of certain co-benefits despite limited empirical evidence to support such claims (Haase *et al.,* 2017, Kabisch *et al.* 2017). Whilst the justification for NBS is well-established within NBS literature from a biophysical perspective, much of the knowledge gaps that cause doubt in their efficacy relate to the touted social co-benefits of NBS (Matthews *et al.,* 2015; Lauer *et al.,* 2018). This is particularly problematic given that meeting social challenges alongside climate change adaptation is considered to be what makes NBS a unique strategy. NBS are celebrated for their holistic view, in particular for claims of bringing about social justice and social cohesion through effective creation and management of green space (Haase *et al.,*

2017). However, there is little explanation of exactly how this will arise from developing the quantity and quality of green space (Rutt and Gulsrud, 2016). This perhaps opens NBS to potential criticism regarding the unclear mechanism behind purported claims of 'social cohesion'– and may cast doubt whether they actually have the capacity to deliver on social challenges.

As a result of delivering multiple co-benefits, the governance of NBS is inherently complex and transdisciplinary. This requires the cooperation of multiple stakeholders from different knowledge traditions (Kabisch *et al*., 2016). However, in most cases knowledge is confined to 'sectoral silos', which means that different forms of knowledge rarely overlap, which may stifle innovation (Ershad Sarabi *et al.,* 2019). This can result in tensions but alternatively, can be viewed as a unique opportunity to explore new forms of governance; as such, collaboration between traditionally separate sectors can in fact be beneficial to environmental projects (Eggermont *et al.,* 2015). Theoretically, collaboration of different organisations and actors has the potential to result in knowledge co-production; essentially creating new expertise and ideas about how best to implement NBS (Wyborn *et al.,* 2019). It could even have effects that span beyond climate change adaptation policy, by encouraging governance reform in wider arenas based on successes of experimental governance forms practiced through NBS projects.

A core principle of NBS is that they are to be 'locally adapted'; contrary to the aspiration to be place-based and sensitive to the local context, NBS have been criticised for being implemented with a 'view from nowhere' (Gulsrud *et al.,* 2018). This poses a number of potential barriers to the success of NBS. Firstly, it may limit the benefits offered to cities, by missing opportunities to address local problems. Secondly, it risks rejection by local communities if they are not aesthetically in tune with the local surroundings or if they feel an alternative may offer more benefits (Andersson *et al.,* 2017). More work needs to be done to explore the potential of fully tailoring NBS to local cultural and socioeconomic contexts and exploring the impacts of improving this aspect.

Although NBS provide opportunities for innovation, they may face opposition from the problem of path dependence in planning initiatives (O'Donnell *et al.,* 2017). Path dependence refers to the tendency towards stasis in institutions. This tendency to follow a certain way of doing things is less time and resource intensive and allows planners to continue to enjoy success, but circumscribes new learning opportunities and potential better solutions (Matthews *et al.,* 2015). Institution's favouring of path dependence over adoption of new strategies makes it more likely that the novelty of NBS may hinder its mainstreaming and uptake (Aghion *et al.,* 2019). Path dependency and the known tendency towards stasis in institutionalised environments may also mean that NBS will face the same issue as other "innovative" concepts, where actors simply rebrand existing practice (Clement *et al.,* 2015).

For NBS, this may mean that we will see a rise in the re-branding of conventional urban greening activities as NBS, even if they do not meet the definition and fall short of the standards being developed by the EU, IUCN, and others.

Clearly NBS represents a wealth of opportunities not only to improve the resilience of cities against future issues of increasing urbanisation in the face of climate change but as an entire new learning experience (Frantzeskaki, 2019). In order for this to be fully realised however, there are barriers that must be navigated through research and innovation. Importantly, empirical evidence, particularly regarding social implications of NBS must be improved to enhance trust and understanding in the efficacy of NBS to realise its goals (Albert *et al.,* 2019). The discussion above reflects that the operationalisation of NBS remains in its infancy, and will require some experimentation if it is to be put into mainstream planning practices and incorporated into policy (Frantzeskaki, 2019). A great deal of work will be needed to overcome institutional barriers at present but in doing so will present an exciting departure from associated traditional urban planning and governance.

Many of the barriers associated with NBS at present result from their complexity; for example, the requirement for different knowledge traditions to be blended results from a need to meet multiple challenges at once, rather than targeting one specific issue (Ershad Sarabi *et al.,* 2019). This reflects the key problem in traditional planning which regards social systems and ecological systems as separate whereas the NBS approach favours the view of the urban environment as a social-ecological system (Gulsrud *et al.,* 2018). A social-ecological systems governance approach may be viewed as an apt method to bridge the organisation of such systems – meeting the multiple needs of both by simultaneously managing the two. The complexity of delivering NBS demands novel strategies in order to balance the desires and needs of multiple stakeholders. Although new strategies are clearly needed, decision-makers in cities may struggle to break away from traditional planning and governance in reality due to path dependency. Given the cross-cutting nature of NBS, the interplay between different policy domains will also constrain change, and even willing actors may find that existing governance structures and policies constrain their capacity to implement NBS. For example, there will be constraints from necessary interaction with institutions such as building and highway codes, statutory planning responsibilities and conservative legal contracts.

NBS largely focuses on the need to enhance the biophysical stability and resilience of urban environments against imminent climate change impacts. The main priority of such resilience measures are to protect human livelihoods from environmental hazards such as heatwaves. This is imperative as environmental risks ultimately have massive impacts for the ‘social’ aspect of cities as social-ecological systems. In order to promote biophysical

resilience of SES, social instruments will be needed to implement NBS, which partially form the ecological elements of the city (Folke *et al.,* 2005). The definition of 'resilience' spans beyond physically protecting built infrastructure and livelihoods in cities but includes building the institutional and social capacity for innovation in the face of rapid change (Folke *et al.,* 2005). These social instruments that allow for implementation of NBS are grouped under the term 'governance' which describes the institutions, organisations and multiple actors who manage NBS. Governance essentially bridges the gap between the social and the ecological aspects within the social-ecological system (Clemet *et al.,* 2015; Folke *et al.,* 2005; Figure 5). As a consequence, any discussion of NBS should pay close attention to governance of their implementation and ongoing management as it will ultimately impact their effectiveness as solutions to societal problems.

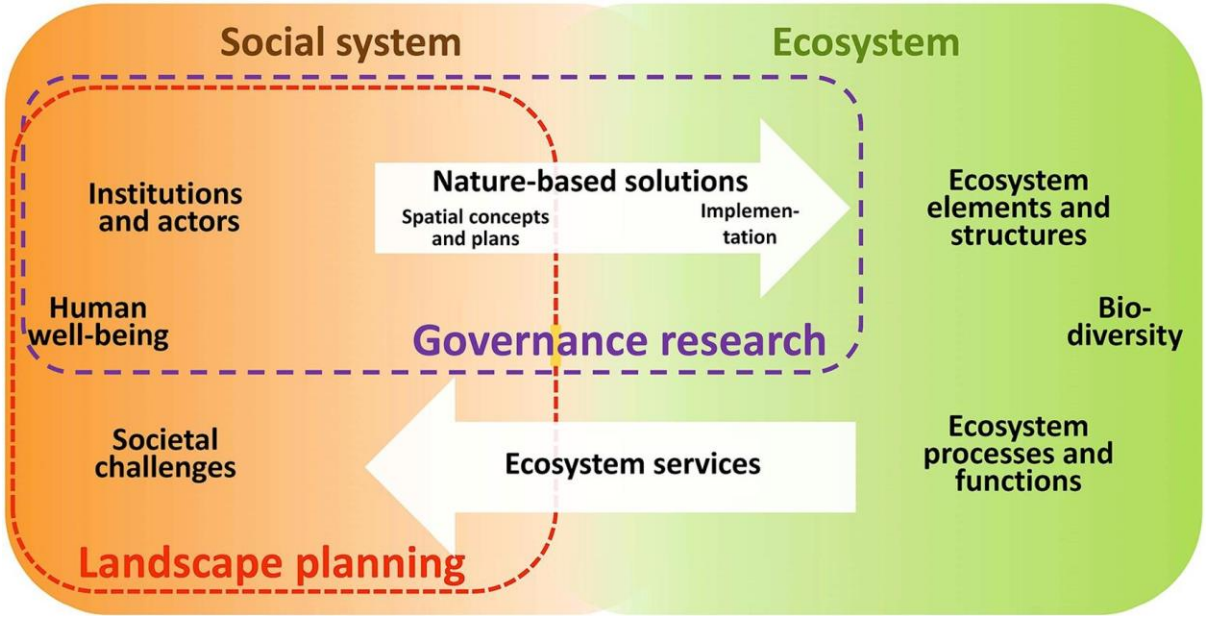

Figure 5: Conceptual diagram of how governance research links social and ecological systems within the context of nature-based solutions (Albert *et al.,* 2019)

2.4 Governance

The way in which society is governed has seen significant change since the post-war period of centralised, top-down control of public institutions. Top-down methods of control were facilitated by organisation into separate sectors, each with unique hierarchies (Baptista *et al.,* 2019). This reflects a time in which national and local government bodies possessed substantial resource power that allowed for post-war rebuilding and rolling out new institutions such as the welfare state (Healey, 1998). It would be hyperbolic to state that this

form of governing has now completely eroded, but political and economic changes and new forms of governance have certainly changed the institutional arrangement of society (Healey, 1998). Emerging modes of governance represent a departure from 'government' which in political theory refers to management by a centralised body that holds overarching legitimate authority over society (Stoker, 1998). In the wake of post-Fordist economic restructuring and an increasingly globalised world, the importance of central government has paled as the role of corporations has come to dominate discourses of progress. Furthermore, as cities have become more independent from nation states, there has been increasing pressure for cities to simultaneously innovate whilst nurturing environmentally sound urban landscapes (Healey, 1998; Stout and Love, 2018). Such goals cannot be met by the state and municipal governments alone, especially as economic restructuring, resistance to tax increases, and shocks to the economy have resulted in a general trend of cities facing financial austerity (Baptista *et al.,* 2019). All these intersecting factors have given rise to collaboration between organisations; government no longer possesses the capacity to issue such 'command and control' style governing as was the norm in the post-war prosperity period (Healey, 1998). Governance describes a departure from an emphasis on "government" and thus the traditional ways decisions and policies have been made, which ultimately influences the trajectory of how societal issues are approached. This affects all decisions from global problems such as climate change to local problems such as city infrastructure, including NBS interventions (Stoker 1998). Over the last few decades, governance has emerged to describe new processes in governing, which aim to produce the same outcomes of government through novel means of social coordination. In broad terms, governance remains tied to responsibilities of the state whilst making room for non-state actors and networks such as public-private partnerships (Ansell and Gash, 2008). Although the term is used in a variety of contexts, such as to describe the organisation of businesses or charities, some general observations reflect that governance tends to be polycentric (rather than central), involving multiple actors spread vertically and horizontally. Importantly, governance reflects a move towards self-organisation of actors rather than actors simply mobilising the decisions of a central power.

Innovations in governance have emerged in recent decades for a number of reasons, in large part due to experience of failure of institutional capacity of central governments to handle increasingly complex, overlapping societal challenges that cannot be easily confined to single sectors (Innes and Booher 2003). Furthermore, the rise of neoliberalism has further eroded faith in power of central governments, such that the role of governing has become privatised as increasing responsibility has been transferred to the hands of corporations (Bevir, 2011). A critical perspective recognises that governance discourse is convenient for

governments to reduce commitment of resources and spending to society, by passing on responsibility to other organisations and actors (Rosol, 2012; Buijs *et al.,* 2016). There is also concern that it is potentially dangerous to entrust so much of the functioning of society to corporations who naturally will primarily aim to serve private business interests (Young and McPherson, 2013). However, in a society facing increasingly complex problems, it is impossible to imagine that one central body is capable of managing all of them; instead, the collaboration of multiple actors and organisations is required. This is not to say that society is entirely self-organised, completely fragmented and governed by corporations and non-governmental organisations; the state remains powerful in decision-making and policy implementation. However, much of the work traditionally performed by governments have now been outsourced to other actors and this increasingly the norm (Rosol, 2012). The governance associated with NBS tracks with these broader societal changes, and explicitly emphasises the importance of partnerships and collaborations.

2.5 Good governance

'Good governance' is the term used to describe basic principles of how best to align governance with values considered to result in exemplar practice (Lockwood, 2010). This is believed to engender effective management. A principle reason to ensure good governance is employed is to ensure that the institution, organisation or project concerned maintains its social licence with citizens who will be impacted by it (Lockwood, 2010).

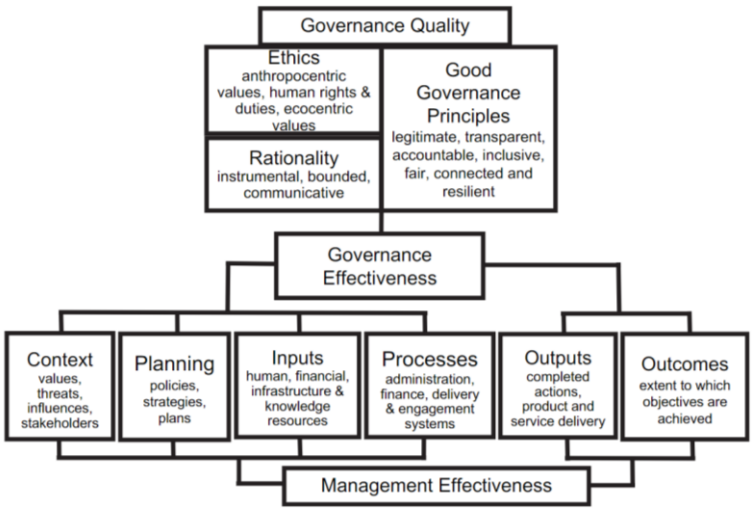

Figure 6: Flow chart of principles underlying good governance, and how this contributes to governance effectiveness (adapted from Lockwood, 2010)

Key principles highlighted by the diagram above include legitimacy, transparency and accountability (Lockwood, 2010). Legitimacy refers to whether a project is perceived to act acceptably, and this is largely defined by those outside key decisionmakers, such as the public. This ultimately decides whether the organisation's actions can be justified. Transparency refers to how open decision makers and project leaders are with information regarding an organisation or institution; this is important as it feeds into perceptions of legitimacy. Accountability refers to the structures in place to ensure the promises of the ruling organisation, along with more universal principles of legitimacy and transparency are upheld by key decision makers and project leaders (Lockwood, 2010).

Adopting such principles is essential to gaining trust in institutions, organisations and project from stakeholders such as citizens and private actors. This trust is required to encourage participation and collaboration with NBS projects and allow for the co-production of knowledge between different stakeholders (Devaney, 2016). Measurements of legitimacy, transparency and accountability can aid in assessments of governance quality of NBS (Devaney, 2016). Many of these measures are premised on external perceptions of a project, and require qualitative assessments including stakeholder perceptions. Some, but not all, of these principles have been highlighted in governance guidance on NBS - for example, the IUCN highlights the need for transparency, inclusivity and fairness. Similarly, the EU Guidance, via EKLIPSE, emphasises the importance of legitimacy (IUCN, 2020). It is not clear how or why only some principles of good governance have been incorporated into NBS policy to date, but this thesis aims to interrogate how some of these principles interact with community engagement when implementing NBS.

These principles can be considered core not only to NBS governance, but to governing in general. However, it should be noted there is a long-standing debate on whether quality of governance necessary results in better outcomes overall and this certainly applies to NBS where NBS projects to date have been carried out under a variety of governane models (Clement *et al.,* 2019). This is largely due to the difficulties associated with attempting to develop evidence-based approaches to assessing governance effectiveness (Clement *et al.,* 2019). It is impossible to separate out the effects of a particular governance approach from the multiple aspects that determine project outcomes; in part, this led me to examining how these good governance principles were reflected in the approach to citizen participation in URBAN GreenUP, as governance approaches has been underexplored in NBS and poses an important knowledge gap.

2.6 Governance of NBS

The governance of social-ecological systems is not confined to one particular 'typology' of governance, but blends aspects of both adaptive and collaborative governance based frameworks. Indeed, such governance formations are foundational to NBS which tend to champion the cooperation and collaboration of nested, multilevel stakeholders whilst also emphasising aspects of experimentation and a 'learning-by-doing' approach as a means of resilience building (Frantzeskaki, 2019). The following discussion will consider the contribution of adaptive governance and collaborative governance theory to NBS.

Adaptive governance has emerged as a popular theory within environmental governance and natural resource management literature to provide guidance on improving resilience in the face of rapidly changing conditions, such as climate change (Folke *et al.,* 2005). Borrowed from theories in ecology of how ecosystems respond to external shocks, resilience refers to the ability of social-ecological systems to maintain their essential functions under rapidly changing conditions (Folke *et al.,* 2005). This concept of increasing resilience of cities lies at the heart of the European Commission and IUCN's rationale for employing NBS; the core principles of adaptive governance aligns with such aims (European Commission, 2015; IUCN, 2016). In using the social-ecological system framing, an adaptive governance approach recognises that a large part of the role of NBS in improving urban environments' resilience to climate change will in require people to develop our cognitive resilience to climate change (Buijs *et al.,* 2016). This framing also highlights the significance of the influence of human changes to the environment - for example, introducing NBS which will ultimately alter ecosystem functioning. Both aspects of the social-ecological system are dependent upon one another, engendering strong feedbacks between the two (Folke *et al.,* 2005). Adaptive governance can be described as a strategy that pays due attention to each, that is sensitive to their propensity to change rapidly and dependence on one another.

Prior research into NBS has promoted cities as sites for experimentation, with management of NBS being conceptualised as experiments based on theories of biophysical changes to the urban environment and associated co-benefits within the literature (Frantzeskaki, 2019). The concept of experimentation is echoed by adaptive governance which encourages testing novel methods of governing which should be flexible to promote resilience to external shocks such as climate change. For example, if there is a sudden change in the social-ecological system, the governance mode will be able to reflexively adapt to such change at an equally rapid pace (Folke *et al.,* 2005). Not only does adaptive governance attempt to cope with rapid change in social-ecological systems, but seeks to

turn it into an opportunity for innovation – this is reflected in the inclusion of NBS in the European Commission's Research and Innovation agenda.

NBS projects tend towards collaborative governance approaches, and therefore it is appropriate to consider the benefits of collaboration in NBS as well as adaptive governance (Frantzeskaki, 2019). Collaborative governance theory recognises that to function in practice, a project must be supported by multiple actors operating at different levels, as well as those operating at the same levels (Ershad Sarabi *et al.,* 2019). Naturally, different actors within the network will have diverse and sometimes conflicting interests which must be addressed in order to make progress in governing environmental issues (Baird *et al.,* 2019). Collaboration allows public agencies to directly engage with non-state stakeholders, in an attempt to reach consensus and eventually implement policies as a result of decisions made through such cooperation (Ansell and Gash, 2008). In discussions of collaborative governance, actors involved in formal processes of deliberation and policy implementation are usually referred to as 'stakeholders', to recognise that they all have some attachment to the issue (Stout and Love, 2018). This refers to public and private organisations, as well as citizens as individuals.

Resilience-building is a central tenet of NBS and therefore considering adaptive governance may be useful in achieving this aim of NBS, as it is also oriented towards enhancing resilience by attempting to adapt to rapid change (Frantzeskaki, 2019). As stakeholders take part in and observe management of NBS, under changing conditions, collaborative governance may provide learning opportunities as stakeholders co-produce knowledge and find innovative solutions together to issues that may crop up in the process (Wyborn *et al.,* 2019) . The collaboration of different actors may help to strengthen NBS projects holistically, as constant input and engagement from multiple stakeholders over the life time of the project may help improve the co-benefits attained compared to the outcomes of one-off consultations in the pre-planning and planning stages (Sarzynski, 2015). Furthermore, constant engagement of a wide audience increases transparency and democracy which will build knowledge and trust in NBS; this can help to garner political, financial and public support which is necessary to facilitate implementation, especially when the support of multiple stakeholders is required (IUCN, 2020).

As well as employing novel forms of governing, it is important to acknowledge that NBS can be successful through more traditional top-down governing alongside novel forms. In recent years, NBS have been successfully managed by state-led projects. Young and McPherson (2013) describe the Million Trees NYC tree planting initiative in New York that was successfully implemented by the public sector with very little external assistance. This example reflects that NBS implementation is always context specific; in some cases the public sector may have the capacity to manage climate change adaptation measures without

altering existing governance modes whereas others may requires external funding, resources and expertise. This reflects how governance can be dependent on capacity and is context specific. The example provided by Young and McPherson (2013) reflects the importance of a context and therefore a place-based approach to NBS (Gulsrud *et al.,* 2018). For example, the Introduction highlighted the role of austerity in NBS policy in the UK (Mell, 2018). Whilst in many ways NBS has been stifled by lack of funding, the opportunity for Liverpool to bid for URBAN GreenUP has increased the capacity of the local council, along with private and non-governmental stakeholders to deliver NBS. The project has brought in funding along with the expertise of partners, improving opportunities to innovate and the capacity to co-create NBS.

2.7 Public participation history

Involving citizens in NBS, by considering them as a stakeholder in collaboratively governed projects may have instrumental benefits to outcomes of NBS. The knowledge co-production and co-creation literature sheds light on some of the substantive (e.g. local knowledge that contributes to planning) and instrumental (e.g. gaining political support) benefits of collaborative governance in NBS (Nesshöver *et al.,* 2017). However, this literature should be linked to literature on participation, particularly in environmental management and NBS in order to gain better insight into the roles of citizens in NBS. Participation focuses on the particular role of knowledge co-production with citizen stakeholders, rather than all actors and organisations in collaboratively governed projects as a whole. The benefits of participation are linked to and overlap with knowledge co-production and co-creation, and can provide a more foundational understanding of civic participation in environmental management. The following section will outline how public participation is defined in this research, the history of public participation in environmental management and the key benefits of citizen participation, within the context of NBS.

2.8 Collaborative governance: facilitating co-creation in NBS

Increasing capacity to co-create and co-produce NBS is an important aspect of collaborative planning. The use of such terminology with regard to NBS is relatively new. Co-creation of NBS describes the process of developers and stakeholders collaborating on the design and implementation of NBS; in the case of citizen co-creation it describes their

key role in decision-making throughout the process (CLEVER Cities, 2019; Wyborn *et al.,* 2019). Co-creation and co-production has been adopted from public administration literature and is increasingly being used in environmental policy literature (Baptista *et al.,* 2019; Frantzeskaki and Kabisch, 2016; Turnhout *et al.,* 2020). Co-production and co-creation are terms now increasingly used in discussions of NBS, which by definition deliver 'services' in the form of ecosystem services to society, and therefore terminology from public administration literature lends itself to discussions of environmental management in this way (Keesstra *et al*., 2018). Co-production of knowledge has been recognised as important for NBS, which requires formation of transdisciplinary knowledge to ensure their success in managing the social-ecological system (Frantzeskaki and Kabisch, 2016; Mendes *et al.,* 2020).

Knowledge co-production and co-creation in collaborative governance of NBS should be considered not only internally within public-private partnerships, but to external stakeholders. For example, citizens have been identified as essential individual actors in collaborative governance networks. This is because NBS relates to ecosystem service delivery to those who live in the city - citizens can be considered a stakeholder within the capacity of being an 'affected citizen' (Stout and Love, 2018; Wyborn *et al.,* 2019). From this social justice perspective, citizens should have a role in co-producing knowledge of NBS and co-creating interventions to shape designs because their experience of the city will ultimately be impacted by NBS. There are also instrumental benefits to be considered – incoprorating citizen perspectives may result in more innovative designs of NBS, that may work more effectively as a result of co-creation with this stakeholder (Wyborn *et al.,* 2019).

A review of the literature on co-production highlighted a number of potential beneficial outcomes of knowledge co-production that extend beyond increasing capacity of private-public partnerships to innovate and co-create NBS particularly when the role of citizens is considered:

- Building trust between project partners and citizens
- Better service delivery for end-users as a result of contribution of local knowledge from citizens
- Social learning as a result of taking part in planning and management; partners learn from one another and from citizens; citizens learn from partners and other citizens
- Urban place-making; partners make use of local knowledge, ensuring NBS are tailored to the local geographical context to provide community defined problems and solutions. This may result in positive transformations to sense of place
- Legitimacy – the project may be perceived to be more legitimate, as co-producing knowledge enhances transparency and trust; this encourages political support

- Sense of ownership – if communities assist in co-creation of NBS they are more likely to take on stewardship roles and ensure longevity of NBS
- Feeling there is environmental justice – taking part in co-production and co-creation of NBS allows citizens to exercise democratic rights to participate in projects affecting the SES

Much of the literature on NBS pays close attention to the benefits of managing interventions through collaborative governance processes, and stipulate public participation within core principles in assessment frameworks as a means of achieving this (Raymond *et al.,* 2017). Engagement and communication with stakeholders including citizens throughout the NBS project is considered essential in theory in the interest of upholding principles of good governance and ensuring solutions are 'locally adapted' (Raymond *et al.,* 2017; Ambrose-Oji *et al.,* 2017). However, in practice, engagement tends to be in pre-planning and planning stages, and is generally used to satisfy statutory requirements after which engagement of civil society tends to be considered superfluous (Sarzynski, 2015). Sustained engagement on the other hand allows citizens to question approaches and potentially change tactics in line with current environmental and political climates. This may allow planning of NBS to be a more adaptive and flexible strategy, which will be necessary in line with changing climatic conditions that affect the social-ecological system (Vandergert 2016).

In NBS literature there has been a sustained focus on the substantive outcomes in biophysical parameters; instead, more attention should be paid to the social benefits of participation particularly with regard to NBS (Mendes *et al.,* 2020; Frantzeskaki, 2019). NBS are championed for their so-called holistic nature but in reality, academic work remains focused on demonstrating efficacy and effectiveness of SES resilience building rather than working towards institutionalising NBS. Furthermore, participation should not be merely for statutory purposes as NBS aims to set itself apart from the planning of the built environment – rather, participation should help promote social-environmental justice as an indicator of successful NBS (Sarzynski, 2015; Raymond *et al.,* 2017). This is an important move away from solely focusing on substantive environmental quality indicators such as air quality. Instead, NBS should work towards a holistic approach to managing social-ecological systems by promoting the social principles and their reciprocal impact on nature (Albert *et al.*, 2019). Using a collaborative governance approach that recognises citizens as a key stakeholder may help to institutionalise co-creation with citizens as an integral part of any NBS project.

2.9 ‘Good governance’ and citizens as a key stakeholder

Therefore, although NBS can be considered a key CCA strategy which has naturally resulted in a sustained focus on environmental indicators, the role of collaboration and participation needs to be considered to fulfill the social aims of NBS through the means of novel urban governance strategies (Gellers and Jeffords, 2018; Raymond *et al.,* 2017). The combination of multiple knowledge forms via collaboration has instrumental benefits beyond being considered to be ‘good urban governance’, which promotes participation on the grounds of being inherently positive (Sarzynski, 2015).

In this thesis, the position of citizen involvement in NBS will be considered with the citizen regarded as a key stakeholder within a collaborative governance framework. The principles of good governance for planning and managing social-ecological systems explicitly refers to the benefits of involving multiple stakeholders, including the input of citizens (Folke *et al.,* 2005; Baird *et al.,* 2019). Citizens can be considered a key stakeholder as they will usually be impacted in some way by changes to the social-ecological system brought about by introducing NBS. Regarding the citizen as a stakeholder, with influence on policy and practice aims to avoid some of the issues surrounding assumptions of public participation being inherently good, with little critical assessment of its actual contribution to the project in question and wider impacts.

Clearly, there is a need for citizens to be able to interact with and have input into the implementation and management of NBS for a number of substantive, instrumental and democratic reasons (Nesshöver, et al., 2017). The biophysical effects of interventions have been the main focus of research to date, but social impacts should be prioritised to help build social resilience and capacity to handle climate change (Sarzynski, 2015; Vandergert, 2016). The social impacts of NBS are often used to justify the divergence of NBS from earlier terminology – engagement of citizens with NBS might be key in helping to maximise the social impact of these projects. Opportunities to engage with NBS is a key part of enabling them to meet criteria such as those outlined in Challenge 7 in the EKLIPSE framework that are used to measure its success (Raymond *et al.,* 2017).

2.9.1 Definition

Public participation refers to the process of involving affected citizens in decision-making and planning. It is defined by the International Association of Public Participation as:

"a process that involves the public in problem solving or decision making and uses public input to make decisions. It includes all aspects of identifying problems and opportunities, developing alternatives and making decisions. It uses tools and techniques that are common to a number of dispute resolutions and communication fields." (Ross et al., 2016).

Public participation is also commonly termed community engagement, citizen participation, civic participation and citizen engagement – IAPP note that as the leading body, they tend to use the terms interchangeably but in recent years community engagement has come to the forefront as the most popular term (Ross *et al*., 2016). Others note subtle differences, with community engagement perhaps being a little wider and referring to participation that takes place over a longer period of time (Ross *et al.,* 2016). Terminology used to describe activities that constitute 'public participation' can vary dependent on the practical or academic context.

2.9.2 Public participation in environmental governance: 20th century – present day

Public participation has become increasingly important in environmental and climate change governance discourses in what has been named the 'participatory turn' – which describes the increasing democratisation of policy (Blue, 2015). Its place within planning and decision-making has gradually developed over time, becoming enshrined by legislation and culture particularly during the 1990s.This has followed a number of policy reforms and new legislation over the last few decades. Public participation in environmental governance initially emerged as a statutory requirement at the end of the 60s and into the 70s across the USA, Australia, NZ and the UK (Ross *et al.,* 2016). The legal requirement for public to be able to participate in environmental affairs emerged with the introduction of environmental impact assessment (EIA) in the United States under the National Environmental Policy Act of 1969; procedures involved compiling documents of the impacts of a development which would be published and made available for public commentary (Ross *et al.,* 2016). This was an important step towards improving participation but it would be considered rudimentary by contemporary standards.

The emerging discourse of advancing environmental management strategies through widening governance networks continued to develop into the 1970s. At the UN conference entitled 'The Human Environment' in Stockholm in 1972, debates resulted in the conclusion that efforts needed to be made to collect more environmental information and it would be necessary to collaborate by sharing this data between nations (Haklay 2003). This ultimately led to the formation of the United Nations Environmental Programme (UNEP) which would

facilitate the development of a collaborative global environmental research agenda. In 1987, "Our Common Future" was published; retrospectively attributed as the launch of wider sustainability discourses that recognised the role of societal development in impacting the environment and how both development and improving sustainability must be addressed in tandem. The Rio Declaration 1992 and Agenda 21 were key in promoting the position of public participation within sustainable development, speeding the participatory turn. In particular, Principle 10 states:

*"Environmental issues are best handled with the **participation of all concerned citizens**, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, … and **the opportunity to participate in decision-making processes.** States shall facilitate and **encourage public awareness and participation by making information widely available**…"*

Not only does it stress the importance of access to information, but involvement within decision-making (Newman *et al.,* 2017). Local Agenda 21 was brought in as a way to introduce such democratic principles at the municipal level (Freeman 1996). It recognised the need to diversify stakeholder engagement in policy decisions, and drew attention to the voices of individuals in communities (Freeman, 1996). This shaped participation in local environmental management and climate change adaptation as it is today – directly involving citizens in decision-making on LA21 projects.

2.9.3 Aarhus Convention 1998

Agenda 21 spurred greater involvement of civil actors in environmental matters, which has since led to development of environmental policy instruments to facilitate public participation local, state and international levels (Gellers and Jeffords, 2018). The right for citizens to participate in NBS and other matters that impact upon the social-ecological system is not just a moral imperative, but has come to be enshrined in both national and international law. One such legislative example that promotes public participation in environmental planning measures is the Aarhus Convention (1998). Three pillars delineate its overall values – the public has a right to access information regarding environmental policy and legislation, a right to participate in environmental decision-making and a right to challenge any decisions made on environmental matters (Lee and Abbott, 2003). In reality, enforcement of the Aarhus convention is relatively weak with no real mechanisms to monitor whether it helps protect the rights of EU citizens and promote access to environmental

justice, but it does bolster the position of the importance of public participation (Lee and Abbot 2003).

The Aarhus Convention 1998 is often cited as strong motivation to ensure the inclusion of citizens in environmental affairs. Its values are divided into three pillars:

1. the public has a right to access information regarding environmental policy and legislation
2. the public has a right to participate in environmental decision-making
3. the public has a right to challenge any decisions made on environmental matters

(Lee and Abbot, 2003).

Although there are important questions regarding whether the Aarhus Convention has done enough to promote environmental justice in terms of practical outcomes, its existence suggests that civic participation is an important democratic norm. Each of the incremental changes to environmental governance over the course of the 20th century has contributed to the notion that interventions within the social-ecological system requires the meaningful participation of civil actors. This approach recognises that any changes made will significantly impact the environment and in turn, society (Collins and Ison, 2009). Environmental participation discourse has inevitably shaped the aspiration of NBS to involve citizens in co-creation and knowledge co-production relating to NBS. However, whilst participation is recognised as a vital element in environmental management, there is still debate over how it can best be rendered meaningful and effective rather than being done from the perspective of 'good governance' alone (Collins and Ison, 2009).

2.10 Arnstein's Ladder: discourses of power in participation literature

So far, the literature review has discussed the history of public participation, mainly from a timeline perspective. However, it is important to also pay attention to theories in the literature which shaped real-world approaches to public participation, particularly in environmental management. This is because theories drawn from participation literature has shaped what have come to be the accepted standards for civic participation. For example, Arnstein's paper published in 1969 remains the dominant paradigm in defining ideals for the degree of participation in public affairs by citizens (Tritter and McCallum, 2006).

There are a number of theories surrounding different scales of participation, which aim to define (1) how much participation is taking place and (2) how meaningful it is, and

these two concepts tend to be interrelated. This way of thinking about public participation is described by Arnstein's ladder of public participation (Arnstein 1969). The ladder has eight 'rungs' to describe the type of public participation, which are sectioned into three groups that broadly groups the level and power of public participation described by those 'rungs' of the ladder. The bottom two rungs make up the 'non-participation' group, moving into the next three which can be considered 'degrees of tokenism' and at the top of the ladder sits the three 'degrees of citizen power'(Arnstein 1969). It is a simple framework that helps to distinguish that participation is not one homogenous 'good' but appears in many forms which calls such assumptions into question. The form it takes represents a power struggle between the haves and have-nots; the type of participation is often determined by those in power to meet specific politically mediated ends (Arnstein, 1969). Arnstein's ladder has long been established within participation literature and provides a good basis for considering the value of participation within a wide range of issues, including planning for nature-based solutions.

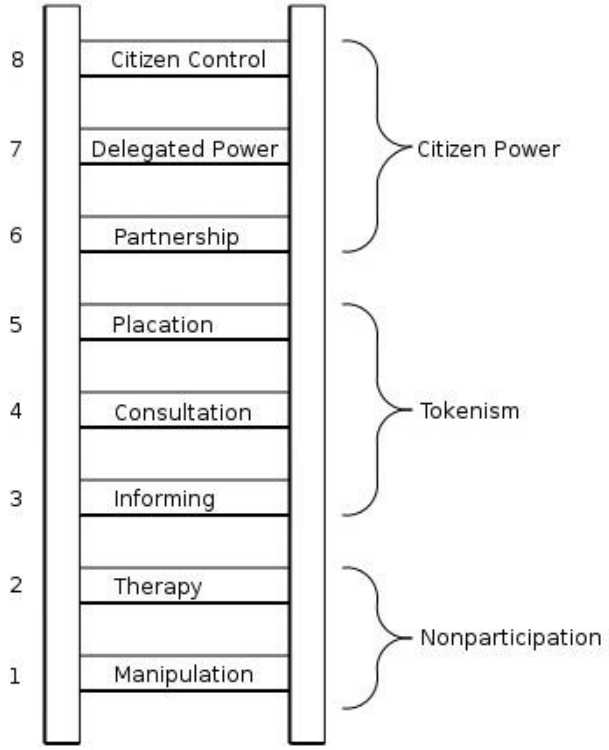

Figure 7: Arnstein's Ladder of Participation, describing the levels of citizen participation by degree of empowerment given to citizens from manipulation up to complete citizen control (Arnstein, 1969)

2.10.1 Empowerment

Despite efforts to explore approaches to public participation, many discussions of effective public participation remain rooted in empowerment based on Arnstein's Ladder (Tritter and McCallum, 2006). Meaningful participation that enables knowledge co-production to take place in NBS projects may help participation discourse to move away from empowerment (Reed *et al.,* 2010; Blue, 2015). Empowerment may be a positive result from co-production processes with citizens in some respects, however academic discussions of participation have moved away from empowerment as a goal for developed nations as it can be a sign as a lack of capacity on behalf on public and private sectors. This is because citizen control tends to result from society having to make up for a deficit in effective governance and resources. The goal of empowerment tends to apply to local environmental initiatives in developing nations, rather than city-scale, public-private NBS projects like URBAN GreenUP and therefore is not appropriate for this context (Cornwall and Brock, 2005).

2.11 Benefits of participation in NBS

2.11.1 Knowledge co-production and co-creation

One of the main ways of looking at the instrumental benefits of viewing citizens as a stakeholder is to frame participation within its contribution to knowledge co-production and NBS co-creation. This moves away from traditional models of citizen participation that view it as a redistribution of power in decision-making (Arnstein, 1969). Knowledge co-production and co-creation may be useful in shifting focus away from linear hierarchies of power towards instrumental benefits of participation. Normative aims of participation include improving democracy, improving services for end users and empowerment but achieving this is somewhat complex in reality (Baptista *et al.,* 2019). Knowledge production of SES management strategies such as NBS should be democratised (hence 'co-produced') to ensure that knowledge can be transferred and built upon through the social networks of communities of practice (Wyborn *et al.,* 2019). Furthermore, LA21, brought in following the Rio Declaration 1992 identified learning as key to allowing people to voice their views regarding sustainable development initiatives; recognising that people cannot fully contribute if their knowledge and understanding of an issue is limited (Freeman, 1996). Knowledge co-production describes a process of building knowledge collaboratively, leading to the

democratisation of knowledge and would help citizens be able to contribute more to the development and institutionalisation of NBS (Mendes *et al.,* 2020).

2.11.2 Trust

The IUCN's forthcoming guidelines on NBS has recognised the importance if facilitating trust between citizens and key decision-makers, for the success of NBS projects (IUCN, 2020). Trust is also an important precursor to being able to bring citizens on board with NBS and has been recognised as such. However, increasing mistrust in governments to deliver public services has been mirrored in a decline in participation in civic affairs and this may prove to be a barrier in involving citizens with co-creation of NBS (Wondolleck and Yaffee, 2000). This is likely because of the relation of trust and legitimacy; citizens do not believe local governments are delivering enough services, or have been badly let down in the past (Thompson, 2015). Meaningful engagement with NBS might help to begin to remedy these issues and build positive relations between citizens and local government by showing a commitment to improving the urban environment with the input of citizens.

2.11.3 Knowledge co-production and social learning

Co-production of knowledge in the management of NBS as part of the SES may be instrumentally improved through planning and management processes that results in an improved understanding of management principles by learning from a diverse set of actors (Wyborn *et al.,* 2019*)*. Citizen participation in NBS may lead to changes in perceptions of NBS which will ultimately influence their future management, which has wide implications for the social-ecological system. For example, although NBS are nature-inspired, interventions such as green walls are not particularly 'natural' in their appearance; in part this is due to differing practitioner perspectives on how natural NBS ought to appear (Mendes *et al.,* 2020). Participation in discussions and workshops around NBS aesthetics may help strike a balance between practitioner aspirations for functioning NBS and citizens' desires for 'natural' areas in cities (Hoyle *et al.,* 2019). Furthermore, with knowledge co-prodcution as the aim, discussion and learning might result in citizens may changing their views on more novel approaches to urban greening. Taking this approach of social learning as an outcome of participation leaves room for actors' perspectives to change. This flexibility is important in developing knowledge within the social networks that govern the social-ecological system to increase adaptive capacity for managing NBS under uncertain future conditions such as

climate change (Blue, 2015; Andersson *et al.,* 2017). Social learning from participation in NBS planning and management could act as a catalyst for the social benefits of NBS, the mechanisms behind which are poorly explained and accounted for at present. Knowledge and understanding may be communicated through social networks, creating a new green space culture and communities of practice. This may expand learning beyond those with the highest capacity to participate in NBS.

2.11.4 Connection to nature and urban place-making

Many of the benefits of participation are general to all forms of participation in different contexts, however there are benefits specific to engaging with NBS compared with other forms of public services due to their environmental basis (Andersson *et al.,* 2014). One of these benefits is the potential to enhance connection to nature for urban citizens. Nature-based solutions represent an opportunity to re-connect urban populations with the environment, when traditionally city dwellers have experienced growing geographic and resultant cognitive distance from nature (Andersson *et al.,* 2014; Lumber, et al., 2017). This is a huge problem in the context of the climate emergency, as it contributes to people failing to connect their demand on ecosystem services that occur in distant places (Andersson *et al.,* 2014). Therefore engaging people with NBS and educating them about the ecosystem services they provide may be a method of improving cognitive resilience to climate change, and promoting sustainability culture (McPhearson *et al.,* 2015).

Connection to the natural environment is also deeply intertwined with biophilic constructions of place, reflecting how NBS can contribute to our cultural heritage (Hoyle *et al.,* 2019; Lumber *et al.,* 2017; Kyle and Chick, 2007; Fink, 2016). This imbues NBS with the potential to contribute to urban place-making, which is important for strengthening community place attachment and improving mental health and wellbeing (Gulsrud *et al.,* 2018). Sense of place is pertinent to SES thinking as it relates social phenomena of ‘sense of place’ to physical NBS present in the urban environment (Gulsrud *et al.,* 2018). Urban place-making that takes place through implementation of NBS, and feeling part of this process may help transform negative perceptions of a place to positive (Thompson, 2015) . This could be particularly important for NBS that are implemented in deprived areas, as deprivation can contribute to eroded place attachment which represents an opportunity for NBS to remedy this issue (Livingston *et al.,* 2010).

2.11.5 Opportunities to learn about the environment

An important aim of URBAN GreenUP relevant to this research is to encourage learning about the ecosystem services provided by URBAN GreenUP interventions, termed 'ecological reasoning' (URBAN GreenUP, 2018). Although this particular learning-based outcome is not central to URBAN GreenUP Liverpool, it has been adopted my Izmir, Turkey and Valladolid, Spain (URBAN GreenUP, 2018). This aim is strongly interlinked with connecting citizens to nature, as the expected outcome is that it will help educate people about how their actions impact the environment and therefore encourage sustainable living (Fink, 2016; URBAN GreenUP, 2018). One of the key engagement techniques in URBAN GreenUP is to engage citizens using a bioapp that allows citizens to record wildlife observed in the green corridors (URBAN GreenUP, 2018). This reflects a knowledge co-production process where citizens will contribute to monitoring biodiversity changes throughout the project by engaging in citizen science directly related to NBS (Cornwell and Campbell, 2012). It provides an opportunity to learn about NBS and ecosystem services through hands-on activities which will also promote connections to nature.

2.11.6 NBS policy support

The more knowledgable people are about NBS, the more likely they are to show political support for NBS (Andersson *et al.,* 2017). In contrast, if people are unaware of benefits of NBS to the social-ecological system, NBS risk being removed in favour of alternatives (usually hard engineered) (Andersson *et al.,* 2017). Furthermore, due to lack of local government funding there is sometimes an expectation that the community will take on a stewardship role; if people lack awareness of this because of failure to engage them, NBS risk being degraded by poor management (Andersson *et al.,* 2017).

2.11.7 Environmental stewardship

It is hoped that engaging communities with NBS will promote sense of ownership, and encourage them to steward and manage interventions. This helps to reduce cost of managing NBS, which is important given the financial constraints on municipalities' green space budgets, particularly in the UK (Mell, 2018). Environmental stewardship also has social co-benefits that are considered important within the NBS literature, fostering social

cohesion and civic engagement. Of course, there are wider benefits to promoting environmental stewardship beyond reducing maintenance costs. Stewardship programmes can build trust in local government, improved participants' ecological understanding and built a sense of ownership of the local environment through co-production activities (Baptiste *et al.,* 2015). This reflects a key opportuntiy for NBS to maximise potential benefits of encouraging citizens to help manage interventions.

2.12 Examples of collaboration with citizens in NBS

There are many examples of citizen participation in NBS which exemplify its importance to project outcomes. They also help shed light on potential trade-offs and barriers to meaningful participation which may elucidate the diversity in what is considered 'engagement' with NBS. A 2019 paper by Frantzeskaki references a selection of NBS projects throughout Europe which provides some insight into the purpose and impact of citizen participation in NBS for projects and those who participate. The examples, discussed below, reflect aims general to participation and specific to NBS such as co-creation, knowledge co-production, social learning, promoting connection to nature and encouraging NBS policy support.

2.12.1 Co-creation and knowledge co-production in NBS projects

Generally it is agreed that if community engagement is to take place, it should be as early on in a project as possible and they should be kept on board throughout the course of the project (Healey, 1998). When citizens become involved in the co-creation of NBS, they tend to be brought in during the design process for the aesthetics and functionality of NBS. In Katowice, Poland, citizens were invited to consider using design aspects of pocket parks in the remodelling of a courtyard called Plac Na Glanc (Frantzekaki, 2019). Working with architects allowed citizens to shape the design and draw attention to the importance of aesthetics which may encourage use of the space (Frantzeskaki, 2019). This also reflects that co-creation with citizens is important to generating feelings of ownership, to promote support of NBS policy and encourage stewardship of interventions; this in turn, would hopefully increase the longevity of NBS as it increases the likelihood they will be desired in the urban environment and well managed into the future. This example took a process traditionally associated with design professionals, and created an opportunity to engage

citizens and open up the design process to allow for co-creation (Frantzeskaki, 2019). Incorporating citizens into planning puts local and tacit place-based knowledge onto an equal footing with professional experience of NBS (Gulsrud *et al.,* 2018). This allows knowledge co-production to take place by making room for discussion between practitioners and citizens facilitating the formation of new approaches and designs of NBS. It should be noted that this was a very small scale intervention; photographic evidence indicates that landscaping of the courtyards mainly involved addition of turf and seating areas, which may only bring about social benefits of NBS, rather than the holistic suite of co-benefits purported by more complex interventions (Katowice 24, 2016). This may reflect that projects with a focus on citizen co-design may be more suited to more traditional urban greening interventions than more technical designs – but it should also be noted that this is just one early example of citizen co-design with architects, in one location.

2.12.2 Trust

The participation of citizens in NBS can increase trust between citizens and other stakeholders including municipal governments and private partners; this may be particularly important in remedying mounting distrust in local and national governing authorities (Frantzeskaki, 2019). Trust-building is premised on transparency and legitimacy of project partners; therefore any participation activities should begin by being open in explaining what NBS aim to do whilst listening to frustrations about problematic past actions or concerns regarding NBS (Frantzeskaki, 2019). Citizens need to trust an NBS project in order to perceive to be worth the contribution of their time; whilst engagement can require time and resource tradeoffs on the part of the NBS project, citizen participants are also contributing their time and expertise and therefore have their own trade-offs to consider before participating (Kabisch *et al.,* 2017). Another example from Katowice was the River Valley Ślepiotka, a degraded area which suffered litter pollution. It was important to build trust with citizens to help rebuild positive narratives in an area that had negative connotations due to its degraded state. Planners shared information regarding strategies to safeguard biodiversity and restore river bank habitat so that citizens felt they had been involved in the process and understood the aims of NBS in this case (Frantzeskaki, 2019). This was done by first, hosting informational meetings with members in affected districts, local groups and local schools. Attendees were then invited to workshops and visits to the project site. Throughout the project, information was shared via press releases and internet websites. Citizens had the opportunity to continue to attending meetings and workshops with employees of local government. Over the four year lifetime of the restoration project, results

indicate that 300 citizens participated directly with the meetings and workshops. It is necessary to highlight that this is not necessarily an ideal example of how to build trust; citizens were largely informed, rather than brought into decision-making which might help build trust by showing a commitment to co-creating with citizens but this may not have been possible in this case. However, engaging citizens in this way has the potential to reflect a willingness to address community needs by taking a place-based approach rather than one-size fits all and may promote future participation in NBS projects (Kabisch *et al.,* 2017).

2.12.3 Environmental education and connection to nature

NBS may create more opportunities for urban residents to experience nature, and learn more about the environment (McPhearson, 2013) The restoration of an old minefield, Lambhill Stables, Glasgow resulted in the site becoming a location for environmental education (Frantzeskaki, 2019). The community garden has a weekly roster of gardening activities, and regularly hosts youth groups in the grounds. This project has been identified as an opportunity to use this NBS as a site for environmental education, which may help citizens connect to nature and encourage ecological behaviours (McPhearson *et al.,* 2015). Environmental education may also engender political support for NBS, by highlighting the value of nature and ecosystem services; this may lead to increased demand for NBS (Kabisch *et al.,* 2017.

2.13 Critique of participation: trade offs and barriers to participation

Although this research focuses on citizen participation and its benefits for NBS projects, it is important to acknowledge that there are a number of legitmate debates about the extent to which this idea of an engaged citizenry can (or should) be implemented in practice. This ultimately affects how citizen engagement is performed in practice, and how effective it is in achieving positive outcomes for delivering services to improve societal functioning.

The importance of public participation in environmental planning has become a well-established debate over the last five decades; there remain many questions over its value, who gets to participate and who is really served by participation (Head, 2007). It is insufficient to assume that the more people involved, the better – the systems that facilitate public participation, reasons for its employment and potential trade-offs must be thoroughly

interrogated (Hong, 2015). These factors will vary between spatio-temporal settings and projects and therefore there will never be a one size fits all model of public participation in urban planning. One of the basic principles of public participation is that decision-making by elected officials is insufficient to always be representative of public opinion and therefore formal institutions to facilitate dialogue with the public are necessary (Head, 2007). Most commonly, such institutions take the form of public consultations, forums and advisory boards which ultimately inform governmental decisions (Head, 2007).

Citizen participation in collaborative planning aims to be inclusive to expand democracy but this does not necessarily result in benefits for the project. This is because although more citizens may be invited to participate, they are not necessarily equipped with the knowledge or skills to account for the time and resource trade-offs associated with engagement (Hong, 2015). This is particularly relevant for NBS, which are highly technical and require transdisciplinary knowledge of engineering, biology, climate science and environmental management (Ershad Sarabi *et al.,* 2019).

A key issue in promoting participation is encouraging citizens to engage in the first instance. This is perhaps what underlies many issues associated with participation, primarily the fact that it is often the same types of people who tend to participate and at the city level it is often the same individual actors who participate over and over (Sarzynski, 2015). This is associated with issues such as mistrust in governing authorities, whose legitimacy has been eroded by the sale of open green spaces during the UK's most recent austerity period (Mell, 2018). Therefore, it is important to develop civic capacity to interact with NBS such that participation and meaningful encounters can occur and perhaps work towards delivering some of the less tangible, non-biophysical aims of NBS such as social cohesion. The social aims of NBS are linked to their targets of being a collaborative enterprise, and therefore developing civic capacity could be considered a prerequisite to achieving collaborative governance of NBS.The growing body of research on NBS still has much bias towards the biophysical capabilities of NBS, rather than the social gains which sets NBS apart from earlier, related terms such as green infrastructure and ecosystem-based adaptation (Raymond *et al.,* 2017; Mendes *et al.,* 2020).

2.13.1 Arnstein's Ladder critique

Arnstein's Ladder has become the defining criteria for meaningful participation and therefore will shape what is perceived to be meaningful participation in NBS. However, whilst it provides a good basis for considering how participation should be incorporated into policy and planning it is not a perfect model and there are others that have shed new light on participation theory such as Davidson's wheel of empowerment (Davidson, 1998 *in* Ross *et*

al., 2016). The wheel focuses on finding appropriate ways to involve the public but does not envision 'climbing the ladder' as the goal, as criticism of Arnstein's ladder has drawn attention that full citizen control may not be the best outcome for many cases (Davidson, 1998).

The issue of conceptualising models of participation solely through Arnstein's ladder is that Arnstein frames participation as an issue of citizen empowerment, but there are more aspects to be explored within participation (Collins and Ison 2009). The hegemonic power framing of participation may even be considered problematic within the conceptual framework of collaborative governance. It ignores that some support from the state, or other governing body is often essential to the success of a project such as NBS. The power framing essentially makes anything other than citizen control appear to be a failure and escalates conflict between those in power and Arnstein's 'have nots' which may act to undermine the effectiveness of participation if it becomes viewed as a power struggle, rather than instrumental benefits of participation. In particular, an Arnstein style approach to participation may not work well for collaborative city-scale projects such as URBAN GreenUP where the level of citizen control would be considered to be on a relatively low rung of the ladder.

2.13.2 Who participates?

Matters are further complicated when considering who is the 'public' or the 'community' who are participating (Head, 2007). Often this is simplistically assumed to be a united group, ignoring the socio-economic, cultural intricacies of individuals that make up the community being considered (Arnstein 1969; Barnes *et al.,* 2003). In reality, communities are gendered, racialized and divided by characteristics such as sexuality, age and class (Barnes *et al.,* 2003). There is a tendency for forms of engagement such as consultation and public meetings to appear tokenistic; these opportunities for engagement may be rare or even one-off events and are usually attended by the 'usual suspects'. In participation literature this refers to the problem of community engagement opportunities attracting the same types of people – usually older, white, well-educated middle class citizens which exemplifies the issue of the community being assumed to be a homogenous group (Sarzynski, 2015). Restricting contributions to the views of a narrow subset of the population only acts to undermine these public participation exercises which in theory, aim to diversify the perspectives on a particular project (Baird *et al.,* 2019). Additionally, Arnstein wrote about

using participation to redistribute power to society's 'have-nots'; if the only people involved are those who are relatively powerful, the status quo prevails (Arnstein, 1969).

2.14 Summary

The research examined the role of citizen engagement in NBS policy over the course of one year, exploring multiple means of engaging citizens and the outcomes of that engagement. This work began with the literature review which has discussed participation of citizens as part of the collaboration inherent in multi-stakeholder endeavours that characterises governance of NBS interventions (Ershad Sarabi *et al.,* 2019). The following sections discuss the methodology used to further examine the themes and knowledge gaps identified by the literature review.

3 Chapter 3: Methodology

3.1 Introduction to the methodology

The aim of the literature review was to elucidate the development and current position of NBS in the field of environmental planning and climate change adaptation. The objectives and barriers to their successful mainstreaming have been identified, with attention drawn to the role of governance in mediating the trajectory of the impacts of NBS interventions in the social-ecological system (Albert *et al.,* 2019). In particular, NBS literature makes reference to aspects of collaborative and adaptive governance as a means of attaining success for the role of NBS in making society more resilient to oncoming climate change, whilst aiming to attain success for a number of economic, social and environmental parameters at the same time (Frantzeskaki, 2019). One central theme of the NBS literature is the requirement for such projects to be a multi-stakeholder endeavour, with civil society being a key actor; civil society in the locality of NBS will be impacted by the interventions and so they are considered to have a 'stake' in the results (Frantzeskaki, 2019; Kabisch *et al.*, 2016; Nesshöver *et al.,* 2017). The concept of multi-stakeholder endeavours is central to a successful collaborative governance approach, where input from as diverse a set of actors as possible is seen to increase potential beneficial outcomes such as knowledge co-production, co-creation and political support (Nesshöver *et al.,* 2017; Wyborn *et al.,* 2019). According to NBS literature, the input of citizens is expected to contribute in a collaborative governance system. However, there are barriers to such participation occurring in reality; for example, the technical nature of NBS can lead to the crowding out of non-scientists by 'experts', and assumptions that the public will not understand abstract concepts such as NBS (Gulsrud *et al.,* 2018). This presumption could result in citizens being excluded from NBS planning without attempting meaningful engagement, which may be considered a barrier to civic capacity to engage with NBS.

However, there may be strategies to overcome barriers of limited experience of NBS through alternative engagement techniques that could help enhance knowledge of ecosystem services, and the role of NBS in climate change adaptation at the city-scale (MacPhearson *et al.,* 2015). Therefore community engagement itself may be a useful strategy to build civic capacity to participate in NBS implementation by seeking to co-produce knowledge of NBS rather than top-down, one way communication (Sarzynski, 2015). Furthermore, engagement that attempts to operate as a multiway knowledge sharing endeavour may allow experts to better fit NBS strategies from a place-based perspective, by

utilising local knowledge that may be picked up through this type of engagement rather than one-way consultation that does not act to facilitate discussion (Gulsrud *et al.,* 2018).

3.2 Epistemelogical and philosophical framework

The research was undertaken through a pragmatist lens, recognising that perceptions and changing conditions of governance structures are inherently open to interpretation and change. Pragmatism takes pluralism into account, allowing several beliefs about the reality uncovered by the research to coexist (Hepple, 2008). Therefore, perceptions garnered from questionnaires, interviews and workshops may reveal complementary as well as conflicting views on the subject of NBS; but all are considered valid in the process of drawing meaning from them (Hepple, 2008). NBS may be considered a pragmatist framing of green space, as this terminology prioritises the economic gains of investing in and innovating green space (rather than framing urban greening as an inherent good, or for the sole benefit of nature). Therefore, NBS already fits into pragmatist thought as they are one way of framing green space to appeal to certain audiences. Cities are regularly referred to in adaptive governance and NBS literature as spaces for experimentation; the pragmatist view advocates such ideas of social experimentation (Hobson, 2006)

3.3 Research aims

The table below outlines how the methodology meets the aims and objectives identified in the Introduction.

Table 2: Research aim, points of action and methods used to investigate citizen engagement with URBAN GreenUP

Aim	
Assessing the contributions of citizen engagement to designing and implementing NBS that confront societal and environmental challenges	
Points of action	**Method**
1. To investigate current literature about NBS and civic participation 2. Examine governance of NBS	Literature review of: • History and trajectory of NBS • Governance and NBS • Civic participation (particularly with regard to environmental projects and NBS) Targeted interviews
3. To identify the degree of participation within a research-led NBS project, with URBAN GreenUP as the case study	Targeted semi-structured, in-depth interviews with different stakeholders Participant observation - attending stakeholder meetings and speaking to key personnel in the case study
4. To underpin the role of the public as a key NBS stakeholder • Role of citizen engagement in planning and management of URBAN GreenUP • Benefits to citizens from participation in NBS • Benefits to URBAN Green UP from participation of citizens	Running PPGIS workshop in the Baltic Triangle Citizen science workshop in Sefton Park Surveys pre- and post- workshop to ascertain learning outcomes of engagement Analysis of data obtained and summary of key findings

3.4 Case study overview

This research adopted a single case embedded design, exploring multiple units of analysis. The units of analysis were policy documents, project partners and citizens which were drawn together to explore URBAN GreenUP as a NBS project (Baxter and Jack, 2008; Yin, 2009). The aim of this strategy was to build a detailed profile of community engagement with URBAN GreenUP, and NBS in general – gathering perspectives of both project partners (decision-makers) and those primarily affected by NBS implementation (citizens) (Baxter and Jack, 2008; Gulsrud *et al.,* 2018). Case studies allow for in-depth investigation of social phenomena and draw attention to the importance of contextual conditions in influencing phenomena, and the inherent subjectivity of research participants' experiences that formed answers to key research questions (Baxter and Jack, 2008). Case studies are especially valuable to investigate 'how' and 'why' research questions (Baxter and Jack, 2008). Rather than attempting to simplify social phenomena, case study analysis aims to reveal the complexity that arises from unique contextual conditions and the subjectivity of the individuals and organisations studied (Yin, 2009). The following passage details the temporal and geographical context of this case study of community engagement with NBS.

Public participation with NBS was examined in the case study of URBAN GreenUP in Liverpool. URBAN GreenUP embraces the narrative of cities as an experimental arena for NBS, which will essentially create a methodology for 'follower' cities to adopt (URBAN Green UP, 2018; Chaffin *et al.,* 2014; Frantzeskaki *et al.*, 2017). It is funded by Horizon 2020 as part of its research and innovation agenda and will be key in making progress towards bridging current gaps in knowledge and overcoming current barriers to the mainstreaming of NBS. URBAN Green UP is expected to be completed by 2022 (URBAN GreenUP, 2017b).

At the time of writing, progress in Liverpool is at the implementation stage and baseline monitoring is being completed, which will provide a baseline data set for evaluations of performance of interventions once they have been implemented. Interventions in Liverpool will be carried out in three key demonstration areas, each with unique issues and diverse built and social environments – acting as test sites for NBS. They are divided into three areas of the city; Sub-Demo A – The Baltic Corridor; Sub-Demo B City Centre Retrofit and Sub-Demo C – Jericho Lane SUDS (URBAN GreenUP, 2017b). The differing built and social environments of each area means that each has different issues to be addressed and therefore different NBS will be required. Using URBAN Green UP as a case study can be seen through the lens of a social constructivist approach which holds that reality is embedded in changing social affairs; the current perceptions of NBS are

inextricably held up in a moment prior to implementation, before the biophysical and social impacts can be studied (Cresswell, 2009).

3.5 Description of URBAN Green UP Sub-Demo Areas

Figure 8: Map of locations of the URBAN GreenUP Sub-Demo Areas in Liverpool

NBS interventions associated with URBAN GreenUP will be implemented in three 'Sub-Demo Areas' in the centre and south of the city; each has a unique socioeconomic, cultural and environmental profile, which affects the interventions that will be installed in that area. The Baltic Corridor, 'Sub-Demo Area A' is a historically industrial area south of Liverpool city centre that has undergone massive regeneration following decline in the post-industrial era, quickly becoming a hub of creative industries and independent bars, restaurants and shops. Although the area is fast becoming a regeneration success story, it is significantly lacking in green space; that which exists currently is poor in quality. Nearly three-quarters of the Baltic Corridor are built up, and 17% of green space is privately owned; just 10% is public, and is largely made up by the docks area, which is mostly open water rather than open green space that provides opportunities to socialise (URBAN GreenUP, 2017b). Furthermore, there are issues regarding connectivity for cyclists and pedestrians to the waterfront and city centre areas.

Figure 9: Image of Sub-Demo Area A showing industrial buildings repurposed into creative businesses and housing (Jessett, 2019)

The 'Sub-Demo B' area focuses on the City Centre Business Improvement District, which makes up Liverpool's historic centre. The city centre attracts a footfall of over 60 million people per year, so enhancing the character of the city centre is crucial to maintaining its appeal to visitors to sustain economic resilience. The businesses located in the area generally view greening as positive in reaching such ends, providing benefits to customers,

staff and increasing expenditure and footfall. At present, green infrastructure comprises just 5% of the area, so there is huge scope for improvement in this regard (URBAN GreenUP, 2017a).

Figure 10: Image of Williamson Square in Sub-Demo Area B; this image is representative of majority of the Sub-Demo Area which is paved, with the occasional street tree (Good News Liverpool, 2018)

In contrast, the Sub-Demo C Jericho Lane/Otterspool corridor is an area perceived to already benefit from a number of large, high quality green spaces with high biodiversity; the issues in this area are largely drainage, connectivity for pedestrians and local air quality. Parkland accounts for nearly a quarter of the area; nearly as high as the built-up area – this is extremely high compared to the former two demonstration areas discussed. Overall, 77% of the area can be considered to be green infrastructure. Both Sub-Demo A and Sub-Demo B are similar in terms of the fact that at present, there is little opportunity for citizens to have meaningful encounters with green space and understand its relevance for future resilience; whereas Sub-Demo C has substantial extant green space that could be viewed as NBS, and so it is more likely that citizens in the locale will be able to regularly experience encounters with green space.

Figure 11: Aerial photograph of Sefton Park in Sub-Demo Area C, a large area of open green space with areas of mature trees and artificial lakes – contrasting starkly with Figure 9 and 10 (Browne, 2017)

3.6 Layer methodology

A key benefit of using a case study is the ability to group together multiple investigative strategies to build information on social phenomena (Baxter and Jack, 2008). Participatory planning and governance of NBS in URBAN Green UP was further explored in this thesis through policy document analysis, semi-structured interviews and workshops accompanied by participant observation and questionnaires, to provide data for units of analysis. Data collected was organised into layers following the layer approach by Gulsrud *et al.,* 2018. Their study of urban forestry in Melbourne examined the role of green place-making as a nature-based solution using the case study of Melbourne's Urban Forestry Scheme. The different parts of the case study were ordered into 'Layers' to uncover place-making from different perspectives (see Figure 12).

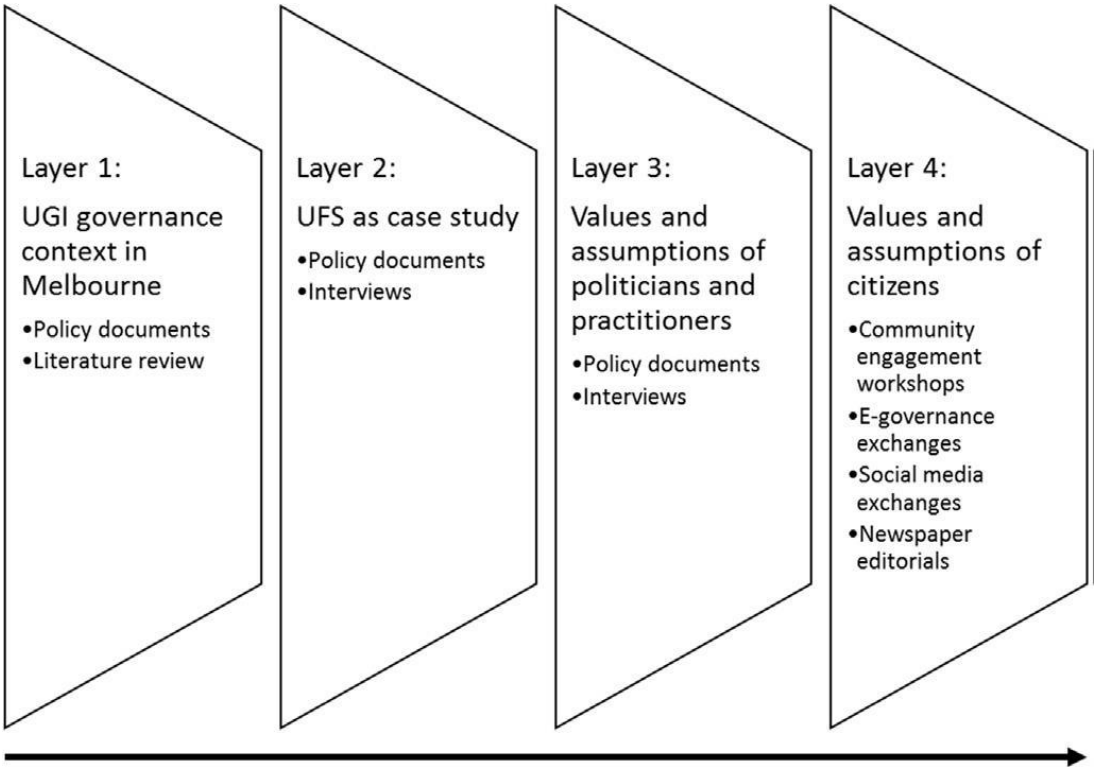

Figure 12: Diagram of layer methodology from Gulsrud *et al.,* 2018.

The literature review (Layer 1, see Figure 13) identified the contemporary context in which NBS are being implemented, the importance of governance to NBS management and policy, along with the role of citizen participation in NBS. Policy document analysis (Layer 2, see Figure 13) was conducted to explore the contemporary context of URBAN GreenUP and NBS policy in Liverpool (including the role of citizen engagement). Semi-structured interviews (Layer 3, see Figure 13) were conducted with the main partners of URBAN Green UP, which helped to develop a practitioner perspective. Workshops (Layer 4, see Figure 13) were hosted for citizen participants, to create opportunity for discussion and social learning and questionnaires also formed data drawn from the workshop. Organising the case study into multiple layers allowed NBS governance and citizen participation to be examined at the organisational level of URBAN Green UP (top-down) as well as from the perspective of citizens (bottom-up) (Gulsrud *et al.,* 2018).

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Methods were adapted to follow the Layer methodology as below:

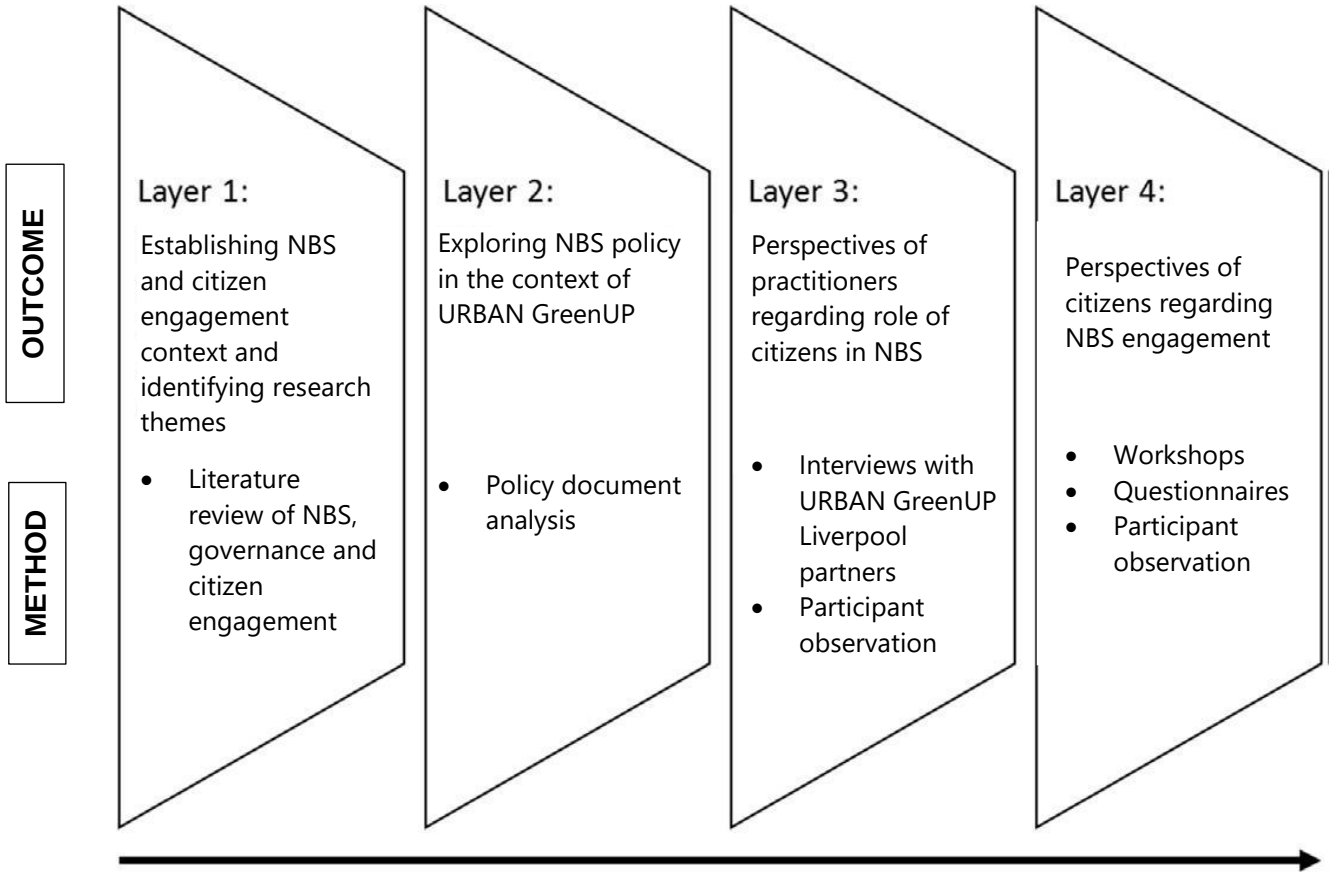


Figure 13: Diagram of URBAN GreenUP case study layer methodology adapted from Gulsrud *et al.,* 2018.

The Layer methodology helped to organise the multiple units of analysis that form the case study and associated research methods (Yin, 2009). Table 3, below, demonstrates how each Layer addresses the Research Objectives identified in Table 2 (see Table 2). Note that each objective, with the exception of Objective 1 will be met by methods contained within multiple layers. This is due to the importance of considering citizen engagement with NBS from multiple perspectives and capturing as much information as possible through a mixed qualitative methodology approach (Yin, 2009).

Table 3: Table linking Research Objectives (see Table 2) to Layers 1 – 4; demonstrating which of the Layers described in Figure 13 will address

Research Objective	Methods	Associated Layer(s)
1. To investigate current literature about NBS and civic participation	Literature review	Layer 1
2. Examining governance of NBS	Literature review URBAN GreenUP policy document analysis Interviews with URBAN GreenUP partners	Layer 1 Layer 2 Layer 3
3. To identify the degree of participation within a research-led NBS project, with URBAN GreenUP as the case study	URBAN GreenUP policy document analysis Interviews with URBAN GreenUP partners	Layer 2 Layer 3
4. To underpin the role of the public as a key NBS stakeholder • Role of citizen engagement in planning and management of URBAN GreenUP • Role of citizens in formation of NBS policy • Benefits to citizens from participation in NBS • Benefits to URBAN Green UP from	Literature review URBAN GreenUP policy document analysis Interviews with URBAN GreenUP partners Citizen participant workshops	Layer 1 Layer 2 Layer 3 Layer 4

participation of citizens		

3.7 Qualtitative research methods description

The case study of citizen engagement in URBAN GreenUP, Liverpool employed several qualitative research methods to investigate each of the layers described above including:

- literature review
- thematic analysis of policy documents
- interviews
- questionnaires
- workshops
- participant observation

The following sections will describe these methods in detail, linking them with the relevant case study layers (Figure 13) and providing justification for the methods selected to study citizen engagement with NBS.

3.7.1 Literature review

Literature reviews are used in research for several reasons – helping to set direction by acknowledging work that has been done in this field and systematically finding potential knowledge gaps to be explored (O'Brien and McGuckin, 2016). Primarily, in this instance, the literature review can helped establish the research context, demonstrating where this case study fitted in with prior NBS research. In this case, this included describing the conceptual roots of NBS, along with their trajectory ande development towards mainstreaming and importantly, the current gaps in NBS policy and management (O'Brien and McGuckin, 2016). In particular, citizen engagement was identified as an underexplored aspect of NBS policy as a result of initial study of contemporary literature (Mendes *et al.,* 2020). Literature was initially selected on the basis of its relevance to the overarching research context of NBS. Once citizen engagement was revealed as a line of questioning, literature was selected through a variety of key word searches in journal databases to find more specified literature relating to this topic (Sarzynski, 2015). This helped to develop the research objectives detailed in Table 2. Key word searches in academic search engines (Web of Science, Web of Knowledge) and grey literature search engines (Google Scholar)

were used to seek out literature that formed the wider conceptual framework (Sarzynski, 2015).

Key word searches included the following terms, and variants of:

- NBS
- Governance
- Climate change adaptation
- Public participation
- Co-production

This literature was used to support preliminary research into citizen engagement in NBS which necessarily involved investigating surrounding topics including governance, public participation, knowledge co-production and co-creation.

3.7.2 Policy document analysis

Selected URBAN GreenUP policy documents were thematically analysed with reference to themes highlighted in the introduction and literature review (Layer 1) including socioeconomic context, co-creation, knowledge co-production, engagement and potential outcomes of engagement (Alhojailan, 2012). Thematic analysis allows for data to be analysed through its connection to these recurring themes embedded in different aspects of the case study (Alhojailan, 2012). Policy document analysis formed Layer 2 of the methodology, and was also used to help determine themes that would be further explored in interviews and workshops. This section also helped to develop the interview guide for use in interviews conducted to form Layer 3, as URBAN GreenUP project partners wrote the documents and would be able to expand on topics discussed in the documents (Yin, 2009). The table below highlights key concepts drawn from the literature review that informed which aspects of the URBAN GreenUP policy documents had the most relevance in the context of this research.

Table 4: Table outlining key concepts identified in the literature review (Layer 1), and the most important aspects to be explored through Layers 2 – 4, including the academic references they have been drawn from. Key concepts inform thematic analysis of policy documents, interviews, questionnaires and participant observation.

Key Concept	Aspects	Key academic references
Context-specific	• NBS as overarching thematic context • Socioeconomic context of Liverpool • Impact of austerity on NBS management	IUCN, 2020 European Commission, 2015 Mell, 2018 Thompson, 2015 Nesshöver *et al.,* 2017 Mendes *et al.,* 2020
Co-creation	• Co-design of interventions with citizens at each stage of the NBS project	Frantzeskaki *et al.,* 2019 CLEVER Cities, 2019
Knowledge co-production	• How multiple actors can co-produce knowledge about NBS in workshop setting • Application of knowledge co-production to development of NBS policy	Norström *et al.,* 2020 Wyborn *et al.,* 2019 Needham, 2008
Place-making	• Transforming perceptions of place • Ownership	Gulsrud *et al.,* 2018 Livingstone, 2010
Citizen engagement	• Methods of engagement • Procedural outcomes of engagement • Substantive outcomes of engagement	Arnstein, 1969 Lauer *et al.,* 2018 Frantzeskaki *et al.,* 2019

3.7.3 Semi-structured interviews

Semi-structured interviews were used to develop an in-depth knowledge of the views of the role of citizens for implementing NBS from the perspective of URBAN GreenUP project partners for Liverpool, primarily to gather data to form Layer 3 of the research (King and Horrocks, 2010). The goal was to develop a detailed picture of stakeholder involvement and collaboration in NBS through URBAN Green UP. Interviewees were selected on the basis of their role as partner on a key NBS project in the Liverpool area. The interviewees were partners of URBAN Green UP who had a large role in planning and management of NBS. Given that NBS is a novel field, and I was looking specifically at their application in Liverpool there was a limited pool of elite interviewees from which I could draw participants from. Interview participants were reached out to via an e-mail that explained why they had been selected, the scope of my research and gave an information sheet about the study and consent form.

The selected expert informants included representatives for Liverpool City Council, The Mersey Forest and University of Manchester. Each individual interviewed had a unique perspective of NBS, influenced by differing interests, values and life experience. Although the three project partner organisations are working towards a common goal, they come from different organisations and professional backgrounds. Interviewing each of the project partners allowed for a cross-section of these views to be obtained. The semi-structured style was useful in giving flexibility to the interview, rather than keeping in line with a rigid list of questions (King and Horrocks, 2010). For example, if an interviewee had a particularly in-depth perspective of a particular topic within NBS policy, it was found to be more useful to focus on a topic the interviewee was particularly knowledgeable about than getting very brief answers for all potential questions. The semi-structured approach therefore featured the use of interview guide (Appendix 1) rather than an interview schedule (King and Horrocks, 2010). This helped to ensure that key topics were covered whilst allowing the interview to follow the natural flow of conversation. Questions in the interview guide covered citizen engagement, collaboration and public perceptions of NBS and was adapted in parts dependent on the candidate interviewed. These themes were drawn from those identified in the literature review and policy document analysis, as the partners had written the policy documents and would therefore be able to explain themes drawn from the documents (Yin, 2009).

All interviews were recorded using a digital voice recorder, before being transcribed into Microsoft Word documents. Each transcribed interview was imported into an NVivo 13 document. This allowed for each interview to be coded thematically in accordance with the main concepts outlined by Table 5 (Alhojailan, 2012). As with the literature review and policy

document analysis, interviews uncovered new themes that helped shaped the direction of analysis for Layer 4 and the overall Discussion.

3.7.4 Participant observation

Participant observation was primarily used to investigate Layer 3 and 4 of the case study (Figure 13). Attending URBAN Green UP partner meetings and an URBAN GreenUP citizen engagement event partially informed Layer 3 which focused on developing knowledge of NBS policy in Liverpool and the perspective of URBAN GreenUP Liverpool partners. This helped me gain experience of a contemporary NBS project and helped develop new lines of investigation. In Layer 4, participant observation was key to documenting interactions between participants in the workshops including discussion-based activities, which couldn't be captured by questionnaires.

Participant observation has been employed primarily in anthropology and sociology research as a means of ethnographic research to build a cache of detailed qualitative data (DeWalt and DeWalt, 2011). It goes beyond information that can be elicited through methods such as interviews or questionnaires, by garnering both explicit information people can tell you about themselves as well as tacit information that is not so easily communicable which is gradually picked up from multiple interactions with a group or in a certain setting over time (DeWalt and DeWalt, 2011). Participant observation field notes provided a useful method to support data gathered from interviews and workshops to support Layer 3 and 4 of the case study. Participant observation helped to provide a spatiotemporal context for workshops. For example, the case study of URBAN Green UP was situated within the specific geographic location of Liverpool and the data captured the early 'pre-intervention' stage. These context-specific details gathered from participant observation helped support and go some way to helping explain several key findings (Yin, 2009). This captured perceptions and attitudes of citizen participants that are not easily gleaned from workshop questionnaire responses; for example, discussions between participants regarding distrust in the council occurred in the workshops but the theme wasn't so apparent in questionnaires. This important theme may have been missed if data from workshops had been captured through questionnaires alone.

3.7.5 Workshops

The period in which I was conducting my research was in the 'pre-intervention' stage, e.g. before any NBS implementation went underway. Although construction work had not begun, however, the plans for URBAN GreenUP had largely been finalised by this stage and so there would be no opportunity to see citizens influence planning in URBAN GreenUP. At the beginning of URBAN GreenUP (several months prior to the beginning of my research), there had been a couple of engagement events held in Sefton Park (Sub-Demo Area C) and the Baltic Triangle (Sub-Demo Area A), to showcase plans and invite public comment. In June 2018, just before I began my research there had been an engagement and the Moving Forest engagement event in Williamson Square had just passed. At this point, the next engagement event, the Forest Bathing Pod was scheduled for end of June 2019 and so opportunities to observe URBAN GreenUP citizen engagement events was limited. Therefore, I wanted to be able to examine how people respond to nature-based solutions engagement events in general, to get an idea of how this may work for URBAN Green UP. Participation with NBS was examined through two different workshops, doing two different activities in two different Sub-Demo Areas – the first was citizen science based and the second was a discursive PGIS activity. The workshop setting was key to examining participation with NBS and green space as it provided a socially situated learning environment, which is key to facilitating social learning and generating multiway communication (rather than one-way communication). Interactions in the workshop were mediated by social norms and values; people learned not just from taking part in the activity itself, but from one another (Garmendia and Stagl, 2010).

3.7.5.1 Workshop participant selection process

Workshop participants were recruited through a variety of methods including social media, physical flyers and working with local community groups. Social media strategies included Facebook, Twitter and Eventbrite. I created an event for the citizen science workshop and the PGIS workshop on Eventbrite that was visible publicly, with free 'tickets' to help me predict attendance in advance. I then publicised these events on a Twitter account associated with my academic work, and using Facebook events. Twitter was particularly useful, as it allowed me to connect with local organisations in Liverpool that I may not have otherwise come across. These groups were able to see posts about the event, and share them to increase their reach. Although this was useful in extending the reach of publicity related to the workshops, they mostly reached local environmental organisations; this was

beneficial, as I was looking to engage citizens local to the Sub-Demo Areas who would be most affected by implementation of NBS interventions.

Friends of Sefton Park and Soroptimists International Liverpool are two local groups associated with Sefton Park, the area in which I was planning to run the citizen science workshop. These organisations had already been working with URBAN GreenUP at this time, so had some familiarity with the project and expressed an interest in greater involvement in NBS. I met with two representatives of Soroptimists International, Liverpool initially and volunteered with Friends of Sefton Park at their weekly litterpick, to get to know members better. We decided to run the citizen science in conjunction with a suite of environmentally based events in the park: a short documentary on wildfowl in the park, and a wildlife and history walking tour. Friends of Sefton Park circulated an e-mail detailing this event and encouraging members to attend the citizen science workshop.

Sub-Demo Area A, being dominated by student accommodation and studio flats has less community groups associated with it as there is quite a high turnover of residents moving in and out of the area. I chose to mostly use social media to publicise the PGIS event, but I also contacted a mailing list of local business, faith group and resident stakeholders passed onto me by an URBAN GreenUP elite interviewee.

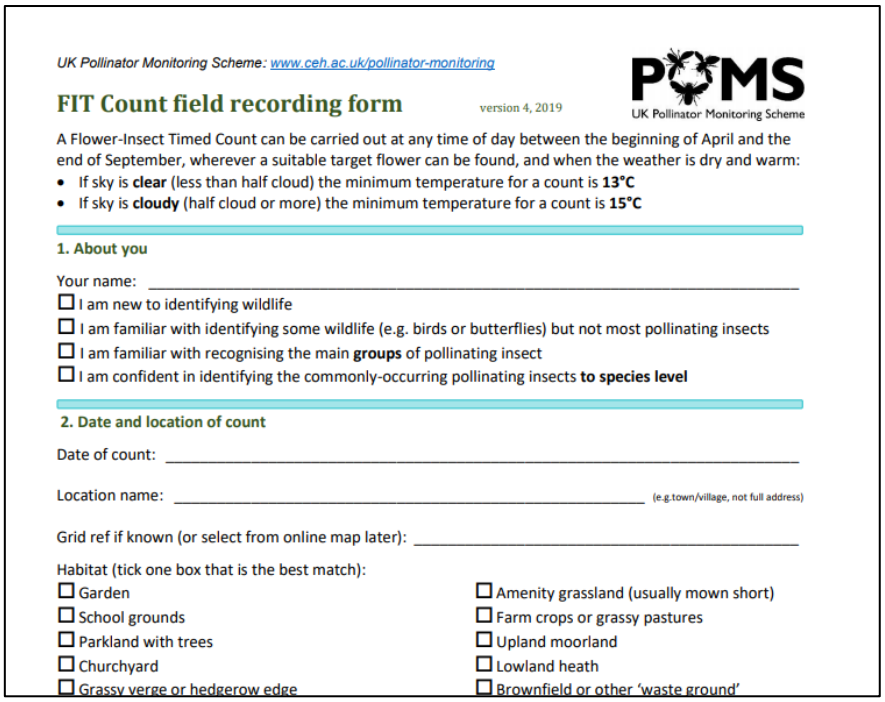
The year 2019 was designated the Liverpool City Region Year of the Environment, and had a calendar of environmental events listed on their website. I submitted details of both the citizen science and PGIS workshops, which were then listed on the calendar.

3.7.5.2 Citizen science workshop

Citizen science was selected as the theme of the first workshop, in line with URBAN GreenUP plans to create a “bioapp” that allows citizens to co-produce knowledge by contributing to biodiversity monitoring. The advent of technology has facilitated the creation of comprehensive databases, which has led to the growing popularity of citizen science as a method of gathering data, particularly in the field of ecology. Examples include the RSPB’s annual Big Garden Birdwatch, the world’s largest garden wildlife survey (RSPB, 2019). Involving non-experts in the collection of scientific data naturally results in validity issues. These errors and biases can be accounted for and data can be ‘cleaned’ but critics have drawn attention to this as a major problem in using citizen science in data collection (Cornwell and Campbell, 2012). On the contrary, it is worth examining citizen science beyond the quality of data gleaned and viewing the holistic impacts that engaging with citizen science can have for those involved (Cornwell and Campbell, 2012). For non-scientists, there are very limited opportunities to learn more about ecology, environmental science and conservation especially for those no longer in formal education or living in urban

areas. Citizen science may be considered one part of reconnecting city dwellers to nature as part of building cognitive resilience to climate change (McPhearson *et al.,* 2015). Citizen science can give those not engaged in science on a daily basis an opportunity to learn about science in a practical, hands on way that contributes to their social learning about NBS, climate change and associated environmental challenges. Meanwhile, practitioners such as ecologists may learn from participants who possess local knowledge and will view the scientific practice of monitoring from a different perspective (Wyborn *et al.,* 2019). This represents the multidirectional flows of knowledge that could enhance capacity for adaptive governance as practitioners and citizens co-produce knowledge through monitoring activities.

The first workshop focused on using NBS as a setting for education about ecosystem services, to actively demonstrate how NBS can act to enhance these services (McPhearson *et al.,* 2015). In this case, the setting was Sefton Park in Sub-Demo Area C. It was hoped that contextualising the workshop within the NBS of the park may stimulate learning as there would be direct interaction with green space as an NBS (Wolsink, 2016). Citizen science was selected as a forum for practical engagement with NBS, to examine whether this method of engagement had an effect on citizens' perceptions and knowledge of NBS. All participants were required to complete a questionnaire prior to attending the citizen science workshop to provide a baseline of their current level of participation with community affairs, and knowledge and attitudes towards NBS. All participants met at Sefton Park on May 12th and the topic of citizen science and pollinator surveys was introduced. The brief highlighted the role of green spce such as parks in supporting pollinators, and how introducing NBS may improve biodiversity. Volunteers were then required to complete a pollinator survey. This involved drawing out a 0.5m^2 quadrat around a flower selected from an ID chart, and then watching the area for 15 minutes, identifying and noting down each pollinator that entered the quadrat. Recording sheets, pollinator ID charts and flower ID charts were adapted from the UK Pollinator Monitoring Scheme, part of a monitoring programme run by the Centre for Ecology and Hydrology (Carvell, 2017). Following the survey, participants were invited to discuss results of their survey, how the presence of NBS in the city may enhance pollinator biodiversity and the potential social, economic and environmental co-benefits that may result from NBS that increases biodiversity.



UK Pollinator Monitoring Scheme: www.ceh.ac.uk/pollinator-monitoring

FIT Count field recording form version 4, 2019

PoMS UK Pollinator Monitoring Scheme

A Flower-Insect Timed Count can be carried out at any time of day between the beginning of April and the end of September, wherever a suitable target flower can be found, and when the weather is dry and warm:

- If sky is **clear** (less than half cloud) the minimum temperature for a count is **13°C**
- If sky is **cloudy** (half cloud or more) the minimum temperature for a count is **15°C**

1. About you

Your name: _____

☐ I am new to identifying wildlife
☐ I am familiar with identifying some wildlife (e.g. birds or butterflies) but not most pollinating insects
☐ I am familiar with recognising the main **groups** of pollinating insect
☐ I am confident in identifying the commonly-occurring pollinating insects **to species level**

2. Date and location of count

Date of count: _____

Location name: _____ (e.g.town/village, not full address)

Grid ref if known (or select from online map later): _____

Habitat (tick one box that is the best match):

☐ Garden
☐ School grounds
☐ Parkland with trees
☐ Churchyard
☐ Grassy verge or hedgerow edge
☐ Amenity grassland (usually mown short)
☐ Farm crops or grassy pastures
☐ Upland moorland
☐ Lowland heath
☐ Brownfield or other 'waste ground'

Figure 14: Example of UK Pollinator Monitoring Scheme FIT Count field recording form used in the citizen science workshop (Carvell, 2017)

Figure 15: Example of a 0.5m^2 quadrat, similar to those used in the citizen science workshop (Science Photo Library, 2020)

Sub-Demo Area C was identified as an ideal location to conduct a citizen science themed activity owing to the presence of a number of parks linked to URBAN Green UP interventions; in particular, Sefton Park was identified as a key cultural focal point of the city which has a number of community groups attached to it and located in and around the area. A pollinator survey was chosen to be a relatively straightforward activity, with clear links between NBS and biodiversity. In recent years, the decline of pollinators has had a huge media presence; it was hoped that this may help spur interest in the workshop. However, this did risk attracting the 'usual suspects' – those who are already interested in environmental issues. The purpose of examining the impact of citizen science as a method of citizen engagement in this research was to rethink how citizens can be engaged with NBS. It also links with expected outcomes within Challenge 7 for URBAN Green UP regarding connecting citizens with nature and engaging citizens with the monitoring stages. URBAN GreenUP itself plans to engage citizens with monitoring using a citizen science "bioapp". Therefore, it was thought that the citizen science activity might be appropriate to help reflect potential benefits of using the bioapp as well as linking to overarching themes drawn from EKLIPSE Challenge 7.

3.7.5.3 PGIS workshop

The second workshop was designed to have a focus on green space mapping, or participatory geographic information systems (PGIS). PGIS describes activities where citizens take part in a mapping exercise, which can demonstrate the relevance of a specific issue by explicity connecting it to the local context (Brown and Fagerholm, 2015). In this case, the aim was to provoke thinking about the benefits of green space in the Baltic Corridor area (Sub Demo Area A) and where progress needs to be made in terms of addressing societal issues through urban greening. It was hoped that a spatially focused, discursive activity may act to refocus how people perceive green space. The focus of this activity differed from the first in that PGIS would stimulate thinking about NBS and the localised context, rather than in the citizen science activity in which people engaged practically with NBS in the physical environment (Brown and Fagerholm, 2015). It is important to note that for the purpose of this workshop the focus would be on improving understanding of the benefits of NBS being used and how they work; considering the issues being addressed by NBS and how (Brown and Fagerholm, 2015). This was important as planning for URBAN GreenUP at the time had been largely finalised, and it would be misleading to present the mapping exercise as taking part in planning. However in future there is potential that citizens may be able to provide local knowledge through similar

activities could contribute to future placement of NBS and management ideas. PPGIS has previously been used in the ongoing collaborative management and co-creation of GI and environmental management, and could be used in URBAN GreenUP if interventions need to be adapted over time and require further input from citizens to enhance their value locally.

Citizens were invited to attend one of two workshop sessions on June 9th 2019, in the Women's Organisation in Sub-Demo Area A. The workshop was split into three stages designed to stimulate conversation around the benefits of NBS and their value in the local context of the Baltic Corridor (Sub-Demo Area A).

3.7.5.4 Activity 1

All participants were asked to introduce themselves to the group, before proceeding to the Activity 1. This involved organising the participants into two smaller groups, sitting around a table. In the centre were two sheets of paper, marked with a happy face and an unhappy face. Participants were asked to discuss and write down what they thought were the main assets of the Baltic Triangle and what they thought were the challenges of the Baltic Triangle. Participants were then asked to discuss the draws and challenges they had come up with and collectively decide what they thought the top 3 of each category were.

Activity 1 was followed by a short presentation about nature-based solutions and ecosystem services, before moving on to the next activity.

Figure 16: Participants discuss draws to the Baltic Corridor, along with current and potential future challenges (Activity 1)

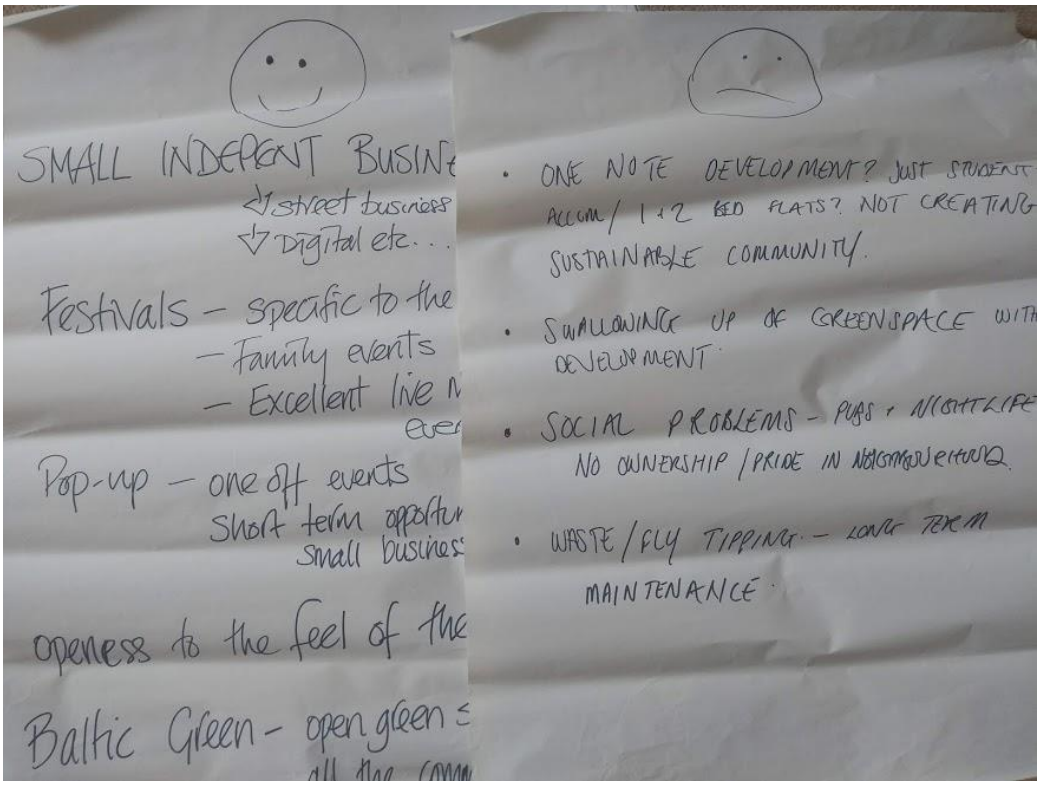


Figure 17: Examples of “draws and challenges” discussion sheets created by participants in Activity 1

3.7.5.5 Activity 2

Activity 2 was intended to allow participants to visualise benefits of urban green space, focusing on the Baltic Corridor Area. The two groups were given a map of the area each, and colour coded sticky notes.

They were instructed to label the map with sticky notes as follows:

- Orange – why participants like existing green space
- Yellow – perceived social or economic benefits are of green space
- Green - perceived environmental benefits of existing green space
- Blue – how can green space be improved to deliver more benefits

This activity was designed to elicit citizen values for ecosystem services from urban green space. This activity did not work so well for the Baltic Corridor at the pre-implementation stage due to there currently being limited green infrastructure for participants to label and describe.

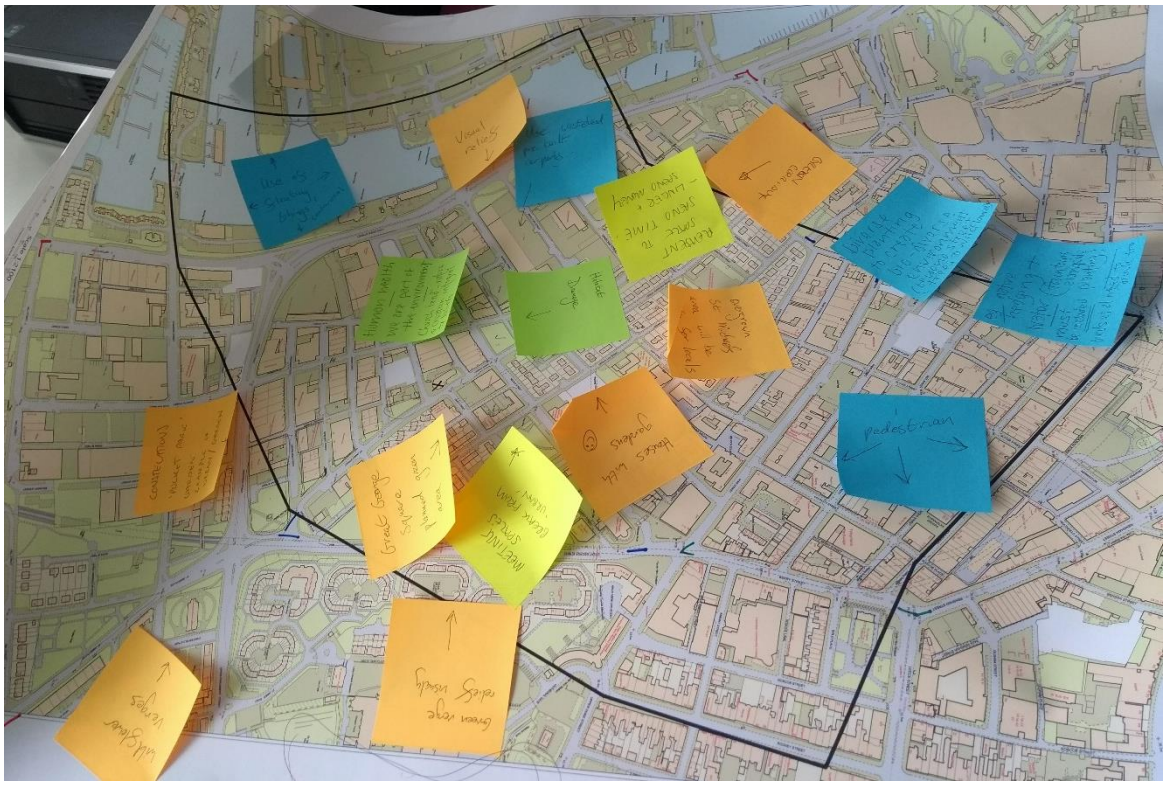


Figure 18: Map of the Baltic Corridor labelled with colour-coded sticky notes, used as basis for Activity 2

3.7.5.6 Activity 3

Activity 3 was a discussion based activity where participants were asked how ecosystem services identified on their maps may or may not provide solutions to the challenges they identified, or contribute further to the areas' assets in Activity 1.

Figure 19: Participants discuss potential benefits of nature-based solutions in the Baltic Corridor during Activity 3, with 'happy' and 'unhappy' sheets from Activity 1 in background to refer back to

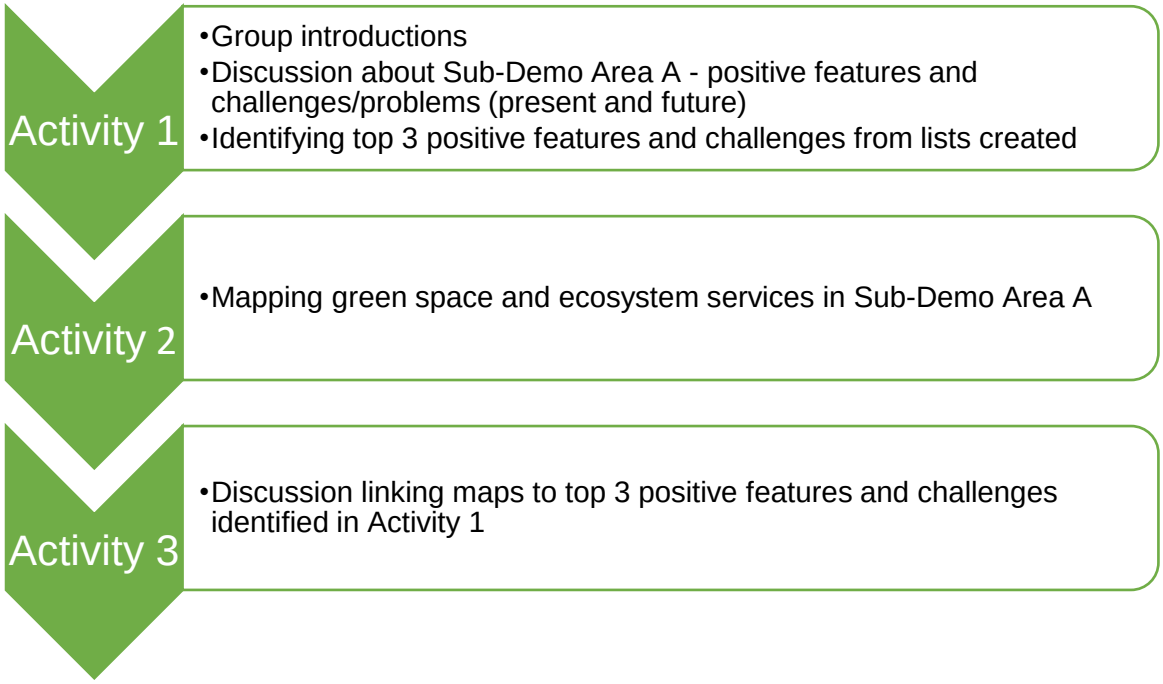


Figure 20: Flow chart of PGIS workshop activity schedule

3.7.6 Questionnaires based on workshops

Questionnaires were designed for participants to fill out both prior to and after taking part in the citizen science and PGIS workshops. The aim of these questionnaires was to reflect changes in learning and perceptions of NBS that may come about as a result of engaging with NBS. Questionnaires were selected as one method of measuring the impact of participating in the workshops as an efficient means of both detecting tangible learning outcomes regarding NBS and ecosystem services, along with other key participation outcomes such as empowerment, place-making and connection nature (Patten, 1998). The questionnaire format allows answers to be tabulated and scored in Microsoft Excel, which made patterns in the data very clear during the analysis stage (Patten, 1998).

The first questionnaire, administered before the workshop activities began contained a mix of quantitative and qualitative questions and made use of a mix of question styles, with questions designed to capture:

1. Degree of involvement and type of public participation that people already engage in – to detect potential relationship between NBS workshops and greater and diversified involvement

2. Extant knowledge and perceptions of NBS and environmental issues – to provide a baseline for comparison with questionnaires following the workshop
3. Motivations for taking part in the workshop, to try to understand why people might engage in NBS

The questionnaire following the workshop followed a very similar schedule of questions, in order to assess change in knowledge and perceptions, as well as changes in participants' self-certification of their own knowledge and whether they have formulated any new perceptions and understandings of NBS. Using a similar format of questions to the first questionnaire allowed comparison of data from both questionnaires. Questionnaires in the 'after' workshop schedule included:

1. Perception of the NBS workshop
2. Knowledge and perceptions of NBS and environmental issues following the workshop – using the same or similar questions to those in the pre-workshop questionnaire
3. Perceived likelihood of being motivated to participate in environmental issues and NBS in future
4. Opinions of the workshop activitiy as a tool for engaging in NBS

3.7.7 Workshop data analysis

Quantitative data from questionnaires were coded in Microsoft Excel, as this software allowed data patterns to be visualised easily (Patten, 1998). Qualitative data from questionnaires and other materials from workshops such as green space maps were thematically analysed by coding using NVivo 13. I used both Microsoft Excel and NVivo 13 to explore themes of citizen participation in NBS, paying specific attention to knowledge co-production, co-creation of NBS interventions, potential for place-making, policy support, social learning and connection to nature. This helped to elucidate the roles of all stakeholders involved which allowed me to compare and contrast how citizens were involved compared to other stakeholders such as business and landowners.

3.8 Limitations of the methodology

Due to the time available, I was only able to study NBS in the pre-implementation phase. This limited my ability to see change in perception and understanding from direct

interaction with URBAN Green UP interventions, and to observe any long term changes in perceptions before and after NBS implementation. For the citizen science workshop I had to use extant green space which is very different to planned URBAN Green UP interventions, such as green walls. I used the very traditional green space of Sefton Park, but NBS projects are often only 'nature-inspired' and might provide a very different setting. I was also unable to compare pre-implementation perceptions with post-implementation perceptions.

A limitation of the workshops was that they were not actually part of URBAN Green UP planning and management, which might influence how people approach the activity. For example, they might not feel as empowered as they know their ideas won't make a difference to outcomes of the project. However, in some respect it also offered a potential advantage in that I was independent from the project and did not "speak" for the council, so I was able to step outside of administrative constraints and be open to a wide range of views and interested in broader perception. In reality, the funding of the project meant there was very little flexibility to modify the interventions and locations, so it would have also been unethical to have held the workshop under the pretense that input could affect the project. The workshops can, however, provide data that can inform future NBS work in Liverpool and ideas about more creative forms of engagement than those required in planning law.

The methodology employed uses a single case study; it has been acknowledged that the specific spatio-temporal context that characterises qualitative research inherently limits its replicability compared to a multi-case study approach (Yin, 2009). A multi-case study approach would allow for comparison across community engagement in NBS projects, and build a richer picture of how URBAN GreenUP measures up to other forms of NBS implementation and management. The methodology has sought to employ multiple units of analysis embedded within the single case study to account for this, by attempting to capture as many different aspects and perspectives as possible (Yin, 2009).

3.9 Summary

This chapter has outlined the single-case study methology used to examine citizen engagement with NBS. It explained the mixed qualitative methods used to uncover themes that united multiple units of analysis that formed the single case study (Yin, 2009). These methods included literature review, thematic analysis of policy documents, semi-structured interview, questionnaires and participant observation (King and Horrocks, 2010). A layered approach has been selected on the basis of work by Gulsrud *et al.,* 2018, in order to organise units of analysis and make for a more coherent approach to the case study. The

layered allows citizen engagement to be explored from multiple perspectives, in recognition of the underlying pragmatist epistemology where multiple perceptions of reality may coexist (Hepple, 2008). It is particularly important considering that different actors and organisations will have a differing view of how citizen engagement in NBS is being performed (Gulsrud *et al.,* 2018). For example, practitioners may believe citizen engagement is satisfactory and meets project aims whereas citizens may believe current models of engagement are not meeting their needs. Examining citizen engagement through a layered model, that takes multiple perspectives from multiple actors into account helps to ensure potential knowledge gaps and bias towards one stakeholder is limited as much as possible.

4 Chapter 4: Results

4.1 Introduction to Layer 2: Policy document analysis

The literature review (Layer 1) examined the trajectory of NBS and how NBS projects are impacted by governance. In particular, this looked at how NBS tends to be multistakeholder, and considers the participation of citizens as a key part of this. This is because NBS alter the social-ecological system which citizens are a part of and therefore they should be given opportunities to contribute to the shaping of NBS policy (Stout and Love, 2018). This was tied into wider discussions of participation in environmental policy to examine its evolving role, as well as looking at further advantages of participation beyond influencing planning and policy.

The literature review highlighted that public participation is a key tenet of the EKLIPSE framework which is used to evaluate the performance of NBS solutions. Therefore, in part it is essential that NBS projects exemplify these principles of 'good governance' outlined by Challenge 7. I wanted to examine how URBAN GreenUP policy may relate to the themes in the literature review, particularly the EKLIPSE framework to use as a basis for exploring community engagement in the project. This in part is due to the use of EKLIPSE by URBAN GreenUP itself as an evaluation framework. The data was obtained from key URBAN GreenUP documents including the Baseline Report, Diagnosis Report, Technical Interventions documents and Barriers Document. The Policy Document Analysis, Layer 2 of the results will explore the socioeconomic context in which NBS will be implemented in Liverpool, pre-existing NBS and NBS policy in the city, potential barriers to implementing NBS and how community engagement is discussed in policy documents. Not only does this help to capture the unique spatio-temporal context but it may also help give some indication of the role of community engagement in NBS.

The full list of NBS interventions planned for the three Sub-Demo Areas described in the Methodology section can be found in the URBAN GreenUP Technical Interventions document (URBAN GreenUP 2018a).

4.1.1 Existing NBS and NBS policy context

Existing green infrastructure is discussed in the policy documents, to reflect where NBS may fit in to the urban environment in Liverpool (URBAN GreenUP, 2017a). According

to the Diagnosis document, green infrastructure makes up 62% of the total area of Liverpool local authority, however much of it is outside the core of the city; over a third of GI is coastal habitat (23.5% of land cover) and 22.3% is private domestic gardens (15.4% of land cover). Private gardens represent the overwhelming majority of green infrastructure on land. Private gardens have some function as NBS by delivering a limited suite of environmental co-benefits associated with biodiversity improvement and water management, but have limited social amenity due to not being publicly accessible. Furthermore, 7.5% of land cover is accounted for by institutional grounds or sports amenities which require membership to an institution to access (URBAN GreenUP, 2017a). This conflicts with definitions of both GI and NBS that stipulate public accessibility as a key requirement to being defined as such (Raymond *et al.,* 2017).

Although the overall figure, calculated to be 62%, presents a high degree of green infrastructure in Liverpool, it is mainly outside the core city area or access is conditional on land ownership or membership to an institution (URBAN GreenUP, 2017a). Based upon this criteria, it is currently insufficient to meet EKLIPSE Challenge 7's aims of achieving social justice by ensuring that green space is accessible to citizens (URBAN GreenUP, 2017; Raymond *et al.,* 2017). Furthermore, the resolution of the assessment of land cover in the Diagnosis document is such that the mixed cover of landscaped private gardens is not accounted for. Private gardens tend to contain mixed cover such as paved areas or gravel which may mean there is an even lower level of green space than presented in the policy documents, which count all private gardens as green space regardless of mixed cover (Mathieu *et al.,* 2007). On a similar note, it is likely much of the 'coastal area' includes concrete sea defences.

Descriptions of the level of green infrastructure differs between policy documents (URBAN GreenUP, 2017a; URBAN GreenUP, 2017b). The Baseline document that focuses on green infrastructure in the URBAN GreenUP demonstration areas which cover large parts of the central area notes the current deficit in the 2 areas: the Baltic Corridor has just 7% (rising to 17% when the docks are included) and the City Centre BID only 5%. The highest coverage by green infrastructure is Jericho Lane and Otterspool which has total GI coverage of 23% (URBAN GreenUP, 2017b). These levels of GI coverage appear to be extremely low in contrast to the overall Liverpool area figure of 62%. On Page 11, I have referenced a map-based study that found that Liverpool ranked the lowest of all UK cities in terms of green space in the core city area, comprising just 16.7% compared to Edinburgh with 49.2% (Neild, 2017). Accoridng to this study, even the top-ranked city had lower levels of green infrastructure compared to Liverpool in the Diagnosis report, which further brings into the question the figure of 62% in the Diagnosis as there is such great disparity between this

map-based survey and URBAN GreenUP's assessment (Neild, 2018; URBAN GreenUP, 2017a).

Liverpool City Council has described the 'Vision for Green Infrastructure' which was taken from the Local Plan:

*"To **protect** and **enhance** Liverpool's green infrastructure to ensure **more attractive** and **cleaner** residential neighbourhoods; sustain and **promote biodiversity**; **mitigate against and adapt to climate change** including contributing **to flood risk management**; and to provide **greater opportunities for sport and recreation** and **growing food locally** to encourage **better health and wellbeing.**"*

There are 4 themes in the Local Plan Vision for Green Infrastructure; the theme of Sustainable City was identified as being linked to Challenge 7: Participatory Planning and Governance. This reflects how using NBS to meet the aims set out by EKLIPSE may be beneficial to meeting the aims of Liverpool's pre-existing Local Plan.

This section also drew attention to the disparity between the North and South of the city in terms of green space. According to this section, there is an even split in green and open spaces but the quality, access and functionality differs between the two areas which may raise questions regarding the lack of interventions being implemented in the North of the city (URBAN GreenUP, 2017a). URBAN GreenUP's Sub-Demo Areas are all in the centre and south – this may affect the credibility of the project if people feel NBS should focus on remedying issues in the north of the city. However, the lack of quality green space in Sub-Demo Area A might act as a good proxy for conditions in north Liverpool in terms of testing the effectiveness of NBS. This is because Sub-Demo Area A lacks green space and the population is more similar in socioeconomic terms to the north of Liverpool, compared to Sub-Demo Area C which contains some of the most affluent areas in the city.

The Diagnosis explained that the Challenge arenas outlined by EKLIPSE formed the basis of monitoring parameters that could be used to evaluate the effect of NBS. Relevant to this research, it highlighted that Challenge 7 parameters could include 'citizen participation in the development and delivery of interventions' and 'perceptions of citizens on urban nature' (URBAN GreenUP, 2017a).

4.1.2 Socio-economic context and its implications for NBS policy

The policy documents reference both historic and recent social and economic challenges in Liverpool, both of which have had an impact on how NBS are managed. This

represents a case study where NBSmay be useful in meeting the challenges of economic decline, yet at the same time has been circumscribed by these very same issues. The Indices of Multiple Deprivation (IMD) describes the relative deprivation of areas in the UK, from the city scale down to wards. This was used in URBAN GreenUP policy documents to examine the socioeconomic context in which NBS will be implemented (URBAN GreenUP, 2017a). As a city, Liverpool is ranked 4th in English Indices of Deprivation with wards such as Anfield, Kirkdale and Everton within the 1% most deprived in the country (URBAN GreenUP, 2017a). Furthermore, health deprivation is ranked third in England; demonstrating that improving NBS may be a major opportunity to improve health in the city.

In recent decades, there has been huge investment and regeneration along with growth in many important economic sectors. There has also been significant population growth since 2000, largely due to a huge influx of students and young professionals (URBAN GreenUP, 2017a). However, austerity measures since 2008 has been a major issue for Liverpool City Council, who have lost 58% of government funding (Whitehead, 2015). This poses problems in particular for delivery of NBS such as parks and green open spaces are a non-statutory requirement and priority must be given to essential services. Proving efficacy of nature-based solutions through URBAN GreenUP may prove instrumental in advocating for the importance of urban green space as not just something 'nice to have', but essential to enhancing Liverpool's natural capital and helping the city adapt to climate change (Orr *et al*., 2014).

4.1.3 URBAN GreenUP potential outcomes relating to community engagement

There are a number of potential outcomes outlined in the Interventions documents that relate to the theme of citizen participation:

- Opportunities to learn about the role of green infrastructure in the city
- Promotion of Ecological Reasoning (URBAN GreenUP project level, not Liverpool specific)
- Engagement with NBS interventions
- Social learning concerning NBS
- Perceptions of citizens on urban nature

The outcomes described focus on the potential of NBS to provide opportunities to learn about GI through direct engagement with interventions (URBAN GreenUP, 2018a). They outline the importance of involving citizens in monitoring through the use of a bioapp and

providing opportunities for outdoor education for children (URBAN GreenUP, 2018a).This has the expected outcome of creating positive perceptions of NBS and encouraging a culture of sustainability by showing how humans influence the social-ecological system (URBAN GreenUP, 2018a). Creating positive perceptions of NBS by improving citizens understanding of ecosystem services generated by NBS might be instrumental in boosting political support of NBS (URBAN GreenUP, 2018a). This reflects that whilst gaining support of councillors, it is also important to URBAN GreenUP to gain the support of citizens through engagement activities (URBAN GreenUP, 2018a).

4.1.4 Political support

Policy documents noted the importance of gaining political support of local councillors who ultimately make decisions on policy at the city level. One aspect of gaining political support from local councillors in approval by their constituents. Support of councillors is essential when green infrastructure is considered in the context of austerity and may not automatically be considered a priority as a non-statutory requirement.

4.1.5 Barriers to engagement with NBS

The Barriers document discusses potential issues in implementing NBS through URBAN GreenUP in Liverpool (URBAN GreenUP, 2018b). The political, technical, legal, social and financial barriers for each NBS in Liverpool were scored from 1 – 5 for likeliness to proceed, with 1 being most likely to succeed and 5 being least likely to succeed. The 'engagement' based interventions mostly scored 1 – 2 for each of the 5 categories indicating there are few barriers to planned engagement activities. 'GI for Education' and 'Green Art/engagement' scored 3 for financial barriers indicating this was the biggest issue in terms of enabling engagement – this score means that additional funding will likely be required (URBAN GreenUP, 2018b). The financial cost of engaging citizens is usually a major trade-off to be considered in NBS projects, and may limit the degree of participation in NBS that can occur.

Policy documents reflected on the potential impact of lack of awareness of NBS amongst stakeholders. If stakeholders, from residents through to local politicians and businesses are not sufficiently informed, NBS risk being rejected despite their title implying future benefits to society (Andersson *et al*., 2017). It may be difficult to garner support for NBS in policy if stakeholders lack awareness. Scoring for socio-cultural barriers was based on citizens' values in terms of green space. It was suggested that education about the

benefits of NBS could overcome these issues; for example explaining nutrient releasing soils and maintenance of specific types of NBS such as pollinator verges which may appear untidy for a period of time. Ensuring a certain level of transparency is key to maintaining the social licence of URBAN Green UP and therefore its political approval going forward.

Whilst URBAN GreenUP may be an opportunity to strengthen the position of NBS in local policy, the city's approach to raising funds to meet the gap left by austerity cuts may have damaged relations with the public. Privatisation and development of green space has become a contentious issue in Liverpool with several examples in recent history and ongoing conflicts (LOGSCIC, 2019; URBAN GreenUP, 2018b). The website "Liverpool Open and Green Spaces (LOGS) CIC" has documented conflicts such as Allerton Priory, Sefton Park Meadows and Calderstones Harthill Park. This may be a barrier to successful engagement and support of NBS in Liverpool. Recent austerity, and associated development of open green space has become ingrained in the public psyche which may be linked to rising mistrust in local authorities and projects associated with them. This may foster issues in communicating aims of nature-based solutions as people might not believe funding is secure, or do not understand why green space is being improved in some areas but sold off to developers in others. In turn, this may damage support for nature-based solutions and weaken policy outcomes of implementing NBS. This risks being further compounded by Brexit, as URBAN GreenUP is a Horizon 2020 project and is therefore directly associated with the EU; citizens might be wary of investing time in a project they believe to be unstable following the UK's exit from the European Union.

4.1.6 Integration of citizen engagement into monitoring

URBAN GreenUP has a Monitoring Program which outlines how each KPI will be monitored, and the purpose of monitoring this KPI to prove the efficacy of NBS (URBAN GreenUP, 2018c). EKLIPSE Challenge 7 is discussed in the Monitoring Program, which explains the use of the framework that highlights the relevance of governance of NBS. This makes reference to the Aarhus Convention which enshrines the rights of citizens in access to environmental information and to participate in environmental decision making. It also highlights the National Planning Policy Framework which outlines statutory requirements for public participation in planning (URBAN GreenUP, 2018c). This reflects acknowledgement of the importance of public participation in NBS at the national scale. Examining the links of the URBAN GreenUP Monitoring Program is key to developing understanding knowledge co-production in URBAN GreenUP, particularly with citizens. .

The Monitoring Program states that to meet the aims of Challenge 7: Participatory Planning and Governance, citizen perceptions of urban nature will be collected. In the EKLIPSE report, ability to understand citizen perceptions of urban nature is one expected outcome of the action “supporting processes that enrich or regenerate ecological memory for restoring urban ecosystems with NBS” (Raymond *et al.,* 2017). After gaining a better insight into citizen perceptions of urban nature, decision makers should integrate this knowledge into design of interventions, with the eventual outcome being a sense of ownership for communities (Raymond *et al.,* 2017). This is included amongst a list of actions including: knowledge co-production, environmental stewardship, producing creative and adaptive designs, improving accessibility of green space and supporting community greening projects. Elucidating citizen perceptions on urban greening is the main monitoring protocol discussed in this section, as a metric to monitor success of this Challenge arena (URBAN GreenUP, 2018c). This suggests that documentation of the application of Challenge 7 to URBAN GreenUP is limited to date, given the wide range of potential outcomes discussed in this section of the framework. Other ways in which URBAN GreenUP has enacted potential actions to meet all aspects of Challenge 7 will be explored in Layer 3 and 4.

4.2 Summary

Overall, the main focus of the policy documents was on improvements to climate change adaptation through improved resilience from promotion of ecosystem services such as water management, shading and cooling and air filtration. This reflects that URBAN GreenUP policy is in line with the literature’s sustained focus on environmental impacts of NBS (Frantzeskaki, 2019). Challenge 7: Participatory Planning and Governance, particularly the community engagement aspects were not the focus of the URBAN GreenUP policy documents studied; however the documents outlined some methods for engagement, expected outcomes and potential barriers. The URBAN GreenUP policy documents were particularly useful in outlining Liverpool’s surrounding socioeconomic and political context that might influence community engagement with NBS. This highlighted key themes to be explored in interviews and workshops.

4.3 Layer 3: Interviews

4.4 Introduction

Following policy document analysis (Layer 2) which provided an introduction to community engagement with NBS in URBAN Green UP, the main partners for URBAN Green UP in Liverpool were interviewed to gain insight into how the project is being governed with particular emphasis on the role of community engagement in NBS (Layer 3). Themes in interviews were identified from literature on NBS and participation in environmental planning and policy, URBAN Green UP document analysis (Section 4.1), as well as recurring topics from successive interviews. Themes included:

Role of stakeholder groups in URBAN GreenUP

- How is the role of community stakeholders perceived by partners?
- What methods of community engagement are used by URBAN GreenUP? What is the impact of the methods used?

Impact of community engagement

- How does community engagement affect URBAN GreenUP?
- How does community engagement affect citizens?
- Covering themes of ownership, shaping project outcomes, learning, wellbeing and enabling knowledge sharing

NBS policy

- What is the role of community engagement in NBS policy?
- How do governance structures affect the role and degree of community engagement?

Limitations of community engagement in URBAN Green UP

- What are the limitations of community engagement in URBAN GreenUP?

The aim was to elicit the partner perspective on participation with NBS and how this fits in with Challenge 7 of the EKLIPSE Framework, providing a view on how these principles may play out in practice and what the challenges to participation in NBS might be.

The table below outlines codes used below to identify interviewees representing partner organisations of URBAN GreenUP Liverpool.

Table 5: Identifying codes for interviewees acting as representatives of each partner organisation

Partner Organisation Representative	Code
Liverpool City Council	LCC1, LCC2
The Mersey Forest	MF1, MF2
University	U1

4.4.1 Role of different stakeholder groups in URBAN GreenUP

URBAN Green UP is a collaborative, multi-stakeholder project and therefore it is important to elicit partner views on who they perceive to be the main stakeholders in the project and their views on the roles of the stakeholders. Some interviewees mentioned community stakeholders first which may indicate they feel the community has a central role in NBS planning and policy. However, in written correspondence, requests to interview included an overview of the interview topics and so it was known in advance that the research was oriented towards community engagement. This may have led to partners emphasising the role of the community in NBS. Different partners had a different view of which stakeholders' values should take precedence, and to a large degree this depended on what angle the project is viewed from. Interviewees grouped the stakeholders into six main roles outlined in Table 6:

Table 6: Outline of the 5 identified stakeholder groups, and the roles that comprise that group

Stakeholder group	Stakeholders
Political	Mayor, cabinet members, government organisations
Community	Educational institutions, religious institutions, Friends of Parks Groups, business owners
Private	Business owners, landowners, statutory providers (e.g. United Utilities)
NGOs	The Mersey Forest
Academic	University of Liverpool, University of Manchester, Sensor City

Largely, interviewees prioritised the roles of policymakers and politicians as they ultimately decide whether NBS are worthwhile. MF1 emphasised the role of The Mersey Forest in influencing green infrastructure policy over the last 25 years, and now nature-based solutions policy. On the basis of this viewpoint, built on years of experience in GI policy, they felt the “main audience” that needed convincing of the efficacy of NBS would be politicians and policymakers. MF2 corroborated this statement, noting that URBAN GreenUP partners will be accountable to local politicians. Both representatives noted that although The Mersey Forest’s work is generally community based, this was not the focus for URBAN GreenUP where politicians are fundamental players in advancing NBS policy.

On the other hand, a pragmatic view was that it is the land and business owners who are most important because the city cannot be retrofitted with NBS without the consent and funding of landowners. The understanding was that the project relies heavily on businesss stakeholders go ahead. MF2 explained that a level of trust needed to be built with business owners, so that they would agree to place NBS interventions on their property. MF1 stated that there were very limited opportunities to engage citizens in Sub-Demo Area B, as not many citizens live in this business district and therefore engaging with business stakeholders was a priority. MF2 noted that engaging these business owners may be instrumental in gaining political support for NBS; if NBS are perceived to benefit their business they will advocate for NBS policy to be pushed forward. However, it was noted that a drawback of an absence of citizens’ voices in stakeholder consultation can be problematic if business owners are concerned about possible problems posed by NBS interventions. For example, over the course of URBAN GreenUP, business stakeholder engagement was undertaken in the absence of citizen engagement which led to the rejection of pedestrianisation of Bold Street by business stakeholders who thought it might impact their businesses negatively.

Partners adopted an instrumental approach to stakeholder engagement, with the value of engaging a particular stakeholder influenced by the practical outcomes that would be achieved through that engagement. This was considered to be pragmatic and in part due to the time and resources used to engage stakeholders; therefore the value of this engagement must be considered. Although this may be viewed as pragmatic, this explicitly frames stakeholder engagement in the context of seeking out those with power and influence such as business owners. Therefore, this form of stakeholder engagement risks reproducing pre-existing power dynamics in the city of Liverpool – ultimately resulting in a NBS strategy that mostly serves those with the most influence.

When considering the city as a whole and who is affected by URBAN GreenUP, citizens were perceived to be a prominent stakeholder as the primary end user of NBS interventions. However, unlike stakeholders who had a role in planning or delivering the

intervention, citizens' role as stakeholder was defined by them 'receiving' NBS rather than being perceived to possess useful knowledge that could help co-produce NBS.

4.4.2 Methods of engaging the public

Due to the perception that citizens would be mostly part of URBAN GreenUP as end-users, interview candidates referred to engagement methods that would be mostly categorised as one way flows of communication; the main purpose being to inform. Methods included informing via:

- the city council website
- social media channels
- press releases
- lectures to University students
- open days on site
- pop-up forest events
- radio
- presentations to communities
- leaflet distribution

Interviewees felt there was an imperative to ensure citizens were sufficiently informed about URBAN GreenUP, and made aware of the benefits of NBS as this would be the main method of gaining political support of citizens. Much of engagement so far has focused on ensuring citizens are informed, targeting language to encourage NBS to be perceived positively and keeping the process transparent. At times, there has been confusion over what is included in URBAN GreenUP's remit, and to maintain trust, it was understood that this needs to be made clear to manage expectations. For example, during consultation there were requests for a city-wide network of bicycle lanes and therefore to ensure transparency, LCC1 informed them that a bicycle lane network would be too large for URBAN GreenUP's budget and scope, which is to create a network of relatively small NBS interventions.

There have been some examples of citizen engagement that might be defined as allowing for two-way information flows such as consultation events that have allowed for community input to provide partners with information on preferences, values and situated local knowledge. Other methods of engagement were described as being close to two-way information flows, such as events including the Moving Forest in summer 2018 and 2019 and an open day in Sefton Park explaining the purpose of interventions in Sub-Demo C. This

allows for one-to-one conversation between partners and citizens, sharing ideas and thoughts about URBAN Green UP. This cannot fully be considered to be a two-way communication flow as the information provided by participants cannot be incorporated into plans at this stage. Although the consultation stage for URBAN GreenUP has long finished, a large degree of community engagement activities will occur post-implementation, including Forest Schools and Forest Church described by MF1 and use of a citizen science bioapp to log biodiversity in Sub Demo areas, described by LCC1 and LCC2. Project partners have also noted that there will be opportunity for citizen input on NBS through future URBAN GreenUP engagement events and through access to an online URBAN GreenUP citizen portal.

4.4.3 Benefits of community engagement with URBAN GreenUP

As much of the engagement with URBAN Green UP will occur post-implementation, many benefits of community engagement focused on educating citizens about ecosystem services provided by nature-based solutions and reconnecting city dwellers with nature. There were also references to examples of knowledge co-production with citizens regarding input on the design of interventions and contributing ideas for NBS.

4.4.3.1 Situated knowledge and place-making

Key to the participatory planning and governance challenge arena is giving citizens platforms to contribute to shaping NBS that will affect the local area. This involves ensuring that communications are two-way and transparent. Within URBAN GreenUP there have been limited opportunities for citizens to shape NBS – this is due to logistical constraints, interventions going in areas with limited citizen stakeholders or lack of capacity for sustained involvement of citizen stakeholders. Due to such constraints, it is possible to say there are aspects of co-creation with citizens but may be more considered as ‘shaping’ nature-based solutions than being a truly co-creative process.

There were a number of examples given where the community been involved in co-creation of URBAN Green UP interventions to some degree. For example, residents had suggested a community orchard with fruit trees and bushes, open to the public for foraging. It was explained that the idea for a community orchard had been directly put forward by community members attending a consultation event. The extent to which this can be badged as ‘co-creation’ is questionable, as it was simply an idea put forward during a consultation event, rather than an on-going creative process between partners and citizens. Althought this instance of ‘co-creation’ has been succesfful, and the community orchard is planned to

go ahead, this approach has had varied success. This is because it depends heavily on the capacity of actors involved to commit to longer term co-creation processes. For example, a college had been involved in co-design of a floating island but due to constraints of term times and staffing issues at the college it was not possible in the end because it was feared that the level of management would not be sufficient.

Another example of co-creation developed indirectly from consultation. For example, plans for NBS interventions have been put forward but issues have been highlighted by members of the public, which were not identified using desk-based tools such as GI Val. This has resulted in partners having to revise plans based on this knowledge; without this information there may have been logistical issues in future, or dissatisfaction from the public which could ultimately lead to URBAN GreenUP losing its social licence to operate.. Partners felt that collaborative governance worked well in planning NBS as it recognises the need to bring together multiple forms of expertise, whether this is practitioner knowledge or the intimate knowledge of space held by citizens that live within a specific area. Citizens can be key in identifying issues or imparting ideas that comes from everyday encounters interacting with green space. Interview participants noted that local knowledge can be essential in informing NBS planning and policy; this highly specified situated knowledge is not merely reflective of preference but informs what is practical – for example LCC1 noted that there had been plans to plant a pollinator verge but local residents reported that this area was used as parking for picking up children from school which led to plans being reconsidered. Without the input of users of the spaces, NBS delivery risks being impractical and in a worst case scenario, risks failure. In general, partners believed that involvement in nature-based solutions can help communities feel empowered in shaping the environment around them and engagement can give citizens a voice in such matters

LCC1 identified that situated knowledge of citizens could also be used to develop engagement tools, for example utilising historical knowledge about Liverpool's parks from Friends of Parks groups may be useful to create interactive trails through the parks in Sub-Demo Area C. This might help contribute to a localised, place-based approach to interventions by incorporating Liverpool's unique culture and history.

4.4.3.2 Learning

Using NBS to facilitate learning about ecosystem services and urban nature was a key topic to explore as it is related to KPI's regarding reconnecting urban dwellers to nature, involving citizens in the monitoring process and perceptions of citizens on urban nature.

Expanding awareness of NBS allows a wider section of the public to become involved; increasing political support and expanding transparency

Stakeholders described opportunities to collaborate with local educational and religious institutions such as Forest Schools and Forest Church which provides formal avenues for directly learning about nature-based solutions, ecosystem services and raising environmental awareness with younger generations. LCC1 explained how interventions will be signposted or labelled with QR code to indicate that they are part of URBAN GreenUP and give some information about how that intervention might be benefiting the local area or explain the role of green space in climate change adaptation. This may be described as an opportunity for passive engagement with NBS. Further engagement opportunities may allow for more sustained learning about aspects such as biodiversity. LCC1 and LCC2 described the development of the bioapp which will allow citizens to learn about biodiversity in the URBAN GreenUP corridors and contribute to monitoring biodiversity. This was described as citizen science; the app will allow citizens to log biodiversity in the URBAN GreenUP corridors. It was hoped that being part of URBAN GreenUP's monitoring may promote feelings of ownership amongst citizens and encourage stewardship of NBS, and also build political support.

4.4.3.3 Social co-benefits of URBAN GreenUP

Participation may be valuable in its connection with other benefits associated with nature-based solutions, enhancing the opportunities to increase participants' wellbeing as a result of taking part in URBAN GreenUP events and interventions. LCC2 reflected that enjoyment of participation in NBS could benefit participants by supporting wellbeing benefits at the same time as meeting citizen engagement project aims. Interviewees felt that participation in NBS planning had the potential to bring together groups of people who may not have necessarily interacted and helps formulate ideas that may not have otherwise come about, representing key opportunities for knowledge co-production. This may help stimulate innovation from involving different actors from different sectors, differing expertise; providing a unique opportunity to collaborate and co-produce knowledge.

All of these experiences feed into participants having a positive experience of nature-based solutions and may build trust in URBAN Green UP and mean that citizens feel the project has legitimacy. Much of the language used to discuss informing the public was packaged in marketing and promotion, such as referring to stakeholders as an audience or using terms like "selling". This can be described as a normative outcome of participation as it

focuses on participation as a means to an end – for example, involving citizens because it is a statutory requirement, to promote legitimacy of the project.

4.4.4 NBS policy

4.4.4.1 Role of monitoring and evaluation to strengthen NBS policy

Key to URBAN Green UP is that the project will be using evidence from monitoring environmental, social and economic KPI's to strengthen NBS policy and potentially repeat NBS interventions on a larger scale (URBAN GreenUP 2017c). This is hoped to prove that NBS have the capability to deliver workable solutions to a suite of societal problems, and provide multiple co-benefits in the process. Providing this evidence is a vital aspect of URBAN GreenUP, in justifying the development of replicable NBS policy. The role of URBAN Green UP for strengthening NBS policy was a strongly recurring theme in the interviews. The main justification for this was that URBAN Green UP involves a high degree of monitoring, data collection and evaluation which will ultimately inform future NBS policy and planning for Liverpool, as well as at a national and international level.

Policy was also mentioned by project partners in relation to community engagement and engaging local politicians. Interviewees felt that gaining approval of local politicians was viewed as key to making a case for NBS in cities. In an era of austerity, this was thought to be particularly important, as green space is a non-statutory requirement and therefore the case for it needs to be championed. I observed that partners felt that if communities show support for NBS, there was a logical connection to political support, as councillors would then support NBS. The next logical link, felt participants, was that this could foster a receptive environment that values NBS. This is particularly important where councillors are not experts in GI or NBS as community support can help inform their decisions, sign-posting that the public perceive NBS to be a positive.

4.4.4.2 Momentum

Interviewees referred to how successive rounds of interaction with interventions and events would build up URBAN GreenUP's engagement portfolio and gradually raise the profile of NBS through a layering of positive impressions. Interviewees recognised that URBAN GreenUP is a 5 year project, and will hopefully continue to have impact beyond the

project timescale. Considering this recognises that perceptions of NBS by citizens is subject to change and this will be dependent on how they interact with interventions, knowledge of the purpose of NBS, whether it feels relevant to them and their daily lives and interaction with green space in Liverpool. If efforts are made to engage citizens throughout the project this is likely to leave a positive impression as the successive interactions may foster trust and increase social capital and support for URBAN GreenUP.

4.4.4.3 Role of collaborative governance in promoting participation

URBAN GreenUP is a private-public partnership, collaboratively governed by Liverpool City Council, Mersey Forest, University of Liverpool working with private landholders, the LiverpoolBID, and other private companies that are involved in design, management, and monitoring of the interventions. The roles of partners, and their work outside of URBAN GreenUP impacts their approach to urban greening with each bringing unique experience and expertise. Representatives of The Mersey Forest explained their role in developing GI policy and their 25 year legacy of community forestry, based on an ethos of ownership, involvement and participation (The Mersey Forest, 2019). MF2 described how this has been positive part of the regeneration story of the northwest since deindustrialisation. Their role in URBAN GreenUP has been identified by other partners as an asset to citizen and business stakeholder engagement in the project. This is an example of how collaborative governance can promote participation, depending on which organisations are selected as key decision makers.

4.4.5 Limitations of community engagement in URBAN GreenUP

4.4.5.1 Limits to co-creation

Partners recognised that there were a number of constraints on the degree of co-creation with citizens that could occur within URBAN GreenUP. MF2 reflected that an open, bottom-up approach to co-design in NBS would be impossible due to constraints imposed by the inherently technical nature of NBS and retrofitting a city with NBS. These constraints are informed by expertise on diverse factors such as ability to engage landowners, pre-existing infrastructure in the area and cost. Therefore MF2 felt that it was only really viable to offer citizens a suite of limited design options and that presenting NBS design as completely open risks appearing dishonest, eroding trust and consequently social capital.

On a related note, partners noted that the nature of URBAN Green UP may lend itself less to co-creation with citizens than other types of NBS projects due to difficulties in managing co-creation within a project covering multiple interventions, with a large set of objectives and limited time and resources. In general, monitoring and evaluation of NBS was the main priority, and communicating these outcomes to politicians will be the main impacts on policymaking. URBAN Green UP tends towards a technocratic governance system rather than using situated knowledge to inform policy from the bottom up. Co-creation was further limited by capacity of actors to engage; for example, a college in Sub-Demo Area A was originally set to participate in the co-creation of the design of the floating island in this corridor, but constraints imposed by term times and staffing issues ultimately prevented this from going ahead. Interviewees recognised that whilst community engagement can be a time and resource drain on the project, it is also a major commitment on the part of community stakeholders which can limit their ability to collaborate.

4.4.5.2 Limiting scope of community engagement to policy support

A general thread revealed by interviews was that engagement was focused on informing citizens, as a means of generating support for URBAN GreenUP. Engagement was also described as a means to meet a statutory planning requirement to consult citizens, required by the UK's National Planning Policy Framework. The purpose of citizen engagement with NBS was viewed differently in terms of perceived outcomes, in comparison to EKLIPSE framework Challenge 7 outcomes. In general, engagement was viewed as a means of ensuring NBS would be accepted and well-received, with the hope of ensuring NBS would be supported politically compared to Challenge 7 outcomes that had a more sustained focus on place-making and knowledge co-production with citizens.

4.4.5.3 Limited understanding of NBS

The novelty of NBS terminology was identified by partners as a barrier to understanding and reception of NBS in the city of Liverpool. When asked about citizen perceptions of NBS, MF2 stated that "most people wouldn't understand what that meant". Terminology surrounding NBS was also perceived to be poorly understood within city council departments that typically don't handle environmental affairs. Lack of understanding of NBS on the part of both citizens and council employees was largely considered to be due to NBS being new terminology that can be highly technical and is seldom used by those outside the field.

Interviewess felt unfamiliarity with the NBS concept might be a barrier in explaining URBAN GreenUP to non-experts as it is typically not used outside of policy. However, there was general agreement that using the term NBS may not be necessary to engage citizens, and more traditional phrases like urban greening could be used to explain NBS concepts instead. Furthermore, MF2 stated that they felt that a deep, scientific understanding of NBS wasn't overly important for citizens; rather it was mainly important that citizens understood that NBS were beneficial so that they would support URBAN GreenUP. This invites questions to be answered regarding whether such assumptions about citizen understandings of NBS are true and whether or not technical language is necessary to explain key concepts linked to URBAN GreenUP to citizens.

Overall, partners believed that URBAN Green UP has not reached a large number of citizens to date, which is understandable given that the project remains in its pre-implementation phase. URBAN GreenUP's website claims that over the course of the project, between 50,000 – 250,000 people will engage online and offline, depending on the intervention discussed (URBAN GreenUP, 2020). This indicates that a large degree of citizen engagement should occur following implementation of NBS interventions. U1 reported that during a recent engagement event they found it difficult to communicate the aims of URBAN Green UP without having an example to point towards and therefore, until there is something the project is an abstract concept which impedes disseminating knowledge about NBS, and limits what can be done in the pre-implementation phase. There remains large scope for awareness of the project to increase.

In general, superficial aspects of green space that are traditionally valued, such as aesthetic improvements and recreational space were indicated to be the easiest to communicate. Well-maintained green space was perceived to be well received by citizens by LCC2, regardless of NBS framing. Communicating the impact of NBS in cities beyond aesthetic value was perceived to be a positive, but perhaps difficult or not a high priority compared to other aspects of the project. This may indicate that largely, engagement is useful for promoting political support for URBAN GreenUP, and granting social licence to operate as it just needs to be well received by the public rather than it being essential that citizens understand the potentially important role of NBS in cities.

4.4.5.4 Reaching consensus

NBS planning that involves multiple stakeholders naturally increases the chance of competing interests to arise. U1 stated that when citizens are engaged planning NBS, co-

creation can be difficult due to difficulties in reaching consensus. This was perceived to result in differences between citizens such as length of tenure, age and lifestyle affects what they might want from NBS and make it harder to reach consensus. Furthermore, special interest groups and more vocal citizens with time to attend consultations may be considered unrepresentative, and 'consensus' that is reached may be unrepresentative of community aspirations (Rydin and Penning, 2000). LCC1 pointed to the example of the floating islands planned for the docks, which had been unpopular with a very small grup of citizens during consultation. Whilst it was perceived to be important to try to adjust for citizen preferences, in the interest of upholding democratic principles and 'good governance' reaching consensus takes priority over vocal pressure groups.

4.4.5.5 Lack of pre-implementation engagement

Prior to finalisation of URBAN GreenUP plans, there were some opportunities for citizens to contribute to plans at formal consultation events, open days and the project worked with local organisations such as colleges and religious groups. However in general, there has been limited engagement to date for a number of reasons described by project partners. Firstly in some areas, particularly Sub Demo Area B there are not many residents and MF1 stated that for this reason, work has mainly been done with the BID Company, which represents local businesses in the area. Another limit to pre-implementation engagement has been due to the fact that without any physical examples of URBAN GreenUP interventions to point towards, NBS remains an abstract concept that was perceived by U1 to be difficult to communicate and base engagement activities around.

4.4.5.6 Usual suspects

Citizen engagement across all sectors often struggle to attract participants from diverse groups in society. This may be particularly problematic for Horizon 2020 NBS projects using EKLIPSE to monitor project outcomes. Challenge 8: Social Justice and Cohesion states the importance of actively engaging marginalised groups in NBS; but in reality, it may be difficult to ensure this happens. Interviewees noted that participants who have attended URBAN GreenUP consultation and other events to date tend to be those who already have an interest in the environment and climate change, or fit the participation literature's 'usual suspects' criteria: older, white, middle class (Sarzynski, 2015). However, whilst this issue remains a persistent problem that applies to engagement with a range of

policy interventions, interviewees described efforts to engage schools and faith groups, demonstrating outreach to the younger generation and people from different backgrounds.

4.4.6 Austerity

Representatives of project partners were acutely aware of the impact of austerity for Liverpool City Council, noting cuts to staff and budgets. The need to redirect or constrain resources was viewed as a potential barrier to effective community engagement, because improper management of expectations for the future of green space might risk aspirations not being met which could diminish trust in the local authority and erode social capital. U1 reflected on the recent Local Green Open Space Review which has been a contentious issue related to Liverpool City Council's 'invest to earn' strategy (Whitehead, 2015). The Local Green Open Space Review raised concerns for development on green space. This provided an example of recent negative press surround the council's role in green space, and may have contributed to mistrust in Liverpool City Council to deliver on the objectives of URBAN GreenUP. This may deter citizens from investing their energy into the project, or outright rejection based on not feeling the project is legitimate. More positively, MF2 reflected that lack of funding for green infrastructure and green spaces was indicated to be a key motivation to bid to be part of URBAN Green UP. Interviewees reflected that without collaboration on URBAN GreenUP and the public-private partnership governance model, it is unlikely that Liverpool would see major improvements to NBS. One benefit of improving green space using this novel governance and funding structure is that community engagement aims such as reconnecting citizens with nature, raising environmental awareness are all URBAN GreenUP KPI's whereas traditionally there is no requirement to get community involved with green space in this way.

4.5 Summary

Interviews contextualised information from key URBAN GreenUP policy documents, and explored themes identified the literature review, and also provided insight into how policies "on paper" translated to practices in a live NBS project, which is important as it has made clear that practice and policy it stems from can vary greatly. Qualititative data gleaned from interviews with partners deepened insight into the purpose of engagement, its role in NBS policy and what the limitations and barriers may be. The main reasons for carrying out community engagement was perceived by partners to be to inform citizens about the project,

gain political support and meet statutory planning requirements. There was limited insight into how engagement might affect participants in terms of place-making, learning, encouraging future engagement and stewardship of NBS, reconnecting citizens with nature and the impact of URBAN Green UP for participants beyond the planning stages – all of which are important aspects of Challenge 7: Participatory Planning and Governance (Raymond *et al.,* 2017). The workshops on pollinator surveys and mapping were used as a way of exploring citizens perceptions of NBS and engagement and fill in areas that were not fully addressed by interviews.

4.6 Layer 4: Citizen Workshops

4.7 Introduction

The next part of my research, Layer 4 aimed to elicit the perceptions of citizens about NBS by inviting citizens to take part in NBS themed workshops. In part, this was because when I began my research, the consultation for URBAN Green UP had been completed but many of the future engagement activities around the project were to be carried out once interventions were in place. I wanted to understand how participation affected people and how it might contribute to NBS policy, but it was difficult to get a feel for this from consultation comments and expertise of partners alone. Furthermore, I wanted to directly understand what sort of activities could be formed around NBS and how they may work in practice. I was inspired by literature on citizen science and PGIS, and used this work as a basis to plan workshops in the two demonstration areas with highest potential for citizen engagement; Sub Demo A and Sub Demo C. Due to their varying land uses, I chose to do a participatory mapping workshop in Sub Demo A and a more hands on pollinator survey in Sub Demo C where there is a large area of high quality green space. The workshops were conducted in different areas, doing different activities to gather data on engagement with different populations and compare different forms of NBS engagement with one another. I drew on themes within the URBAN GreenUP KPI's for Challenge 7 including opportunities to engage with citizen science, connecting citizens with urban nature and perceptions of citizens on urban greening to create the workshop programmes and associated questionnaires.

4.8 Layer 4, Workshop 1: Citizen science workshop

The first workshop was a citizen science workshop based in Sefton Park in Sub-Demo Area C. Local groups such as Friends of Sefton Park and Soroptimist International had already been engaged with URBAN GreenUP by project partners. The planned activity was a pollinator survey as described in the Methodology section (Section 3.7.5), to consider approaches to engaging citizens with monitoring biodiversity associated with the presence of NBS in urban environments. This is particularly pertinent to URBAN GreenUP which will be using a citizen bioapp to allow citizens to assist with monitoring biodiversity in green corridors and take part in knowledge co-production in NBS.

4.8.1 Description of workshop activities

As part of the workshop, participants answered a questionnaire before and after the pollinator survey activity, to examine how perceptions might change after engaging with NBS. A quick 'Introduction to NBS' presentation was given before participants went out into the park to complete the FIT pollinator survey. Afterwards we discussed the results of the pollinator survey and what types of NBS may be beneficial to pollinators.

4.8.2 Pre-workshop questionnaire results

4.8.3 Participant profile

Most participants were older, white and well-educated and more than half the group were female. The group were extremely active in terms of participation in community activities with most attending community activities at least once a week.

Community activities were defined as:

- Voting in local elections
- Attending public consultations
- Attending community meetings
- Social media
- Answering questionnaires
- Member of community group
- Volunteering for local group

In general, engaging passively through social media or attending one-off events was most popular but some were involved in more regular civic activities such as community groups and volunteering representing sustained engagement with civic life. The majority of participants stated that they vote in local elections reflecting a strong interest in local democracy. Many felt that it was important to take part in community activities as they felt it was part of being a responsible community member, could help create a better future and make a difference. This reflects a strong sense of stewardship and a desire to make a difference. Another reason for taking part was to learn something new reflecting the community activities may be an important space for social learning and knowledge sharing. In terms of the citizen science workshop, the main reason participants wanted to attend was due to concerns about the environment and wanting to learn more about it as well as making

a difference and contributing to science. The participants felt there were few barriers to taking part in community activities, but time and other priorities were noted as minor barriers.

4.8.4 Prior knowledge about NBS

Participants felt that green space in Liverpool was important because it provides wildlife habitat, improves air quality, regulates air temperature and is part of the city's cultural heritage. Participants did not feel it was important for aesthetics, flood defence or somewhere to go. This reflects a group that recognises the multifunctionality of NBS.

Participants were asked what actions were most important for Liverpool to take to adapt to climate change. A large proportion of participants felt it was extremely important to educate people about climate change, invest in green energy and technology followed by encouraging more sustainable lifestyles and investing in public transport and cycle lanes. The majority of participants felt that creating more parks and green space and planting more trees was an extremely important action towards tackling climate change. All participants thought the actions listed would be at least somewhat effective in tackling climate change at the local level.

Participants were asked whether they recognised the following terms, and their confidence in their knowledge of the topics:

- climate change
- green space
- green infrastructure
- nature-based solutions
- URBAN GreenUP

All participants had heard of climate change and felt they had some knowledge of the topic, and 13 of 14 participants knew of the term 'green space'. Most had heard the term 'green infrastructure' but NBS and URBAN Green UP were not recognised by many. Half the group felt they had no knowledge of URBAN Green UP, and a significant proportion felt they had no knowledge or little knowledge of nature-based solutions and green infrastructure.

Although recognition of the terms tended to be high, definitions in general were weaker. Definitions of climate change and green space were strongest overall. Definitions for nature-based solutions were likely based on the title itself e.g. solutions from nature, and green infrastructure and URBAN GreenUP were poorly defined.

This reflects difficulties in communicating policies for climate change adaptation and sustainability when policy terms are not well known outside of the institutions they tend to be used within. Understanding may need to be enhanced to allow for meaningful engagement with NBS. Participants were given a list containing engineered solutions and nature-based solutions to climate change, and asked to identify which were nature-based solutions (refer to Citizen Science Pre-Workshop Questionnaire in Appendix 1). Across the group, recognition of nature-based solutions was very accurate, with very few incorrect answers – this contradicts participants' self-rated knowledge. For non-experts in this area, it may be difficult to define these terms but participants were able to recognise NBS when examples were given.

4.8.5 Post-workshop

4.8.5.1 Impact of engagement for participants

The majority of participants felt they had learned something new about ecology and green space and had increased their awareness of environmental problems. They also felt they had been given an opportunity to connect with nature. This was a positive outcome, given that participants' motivation for attending was to learn more about environmental issues. Participants reported feeling that the workshop had changed how they thought of green space in Liverpool. This included reporting an increased awareness of pollinator decline and biodiversity and that they had learned more about benefits of green space. In particular one participant noted they learned green space has value beyond recreational or aesthetic, perhaps indicating a deeper recognition of ecosystem services and benefits of urban green space. The NBS workshop referenced URBAN Green UP as a case study, and participants reported increased awareness of current green space initiatives in relation to this. When asked how the workshop had benefitted them, participants reported the following:

Table 7: Benefits of engaging in NBS workshop for participants

Social learning	Environmental stewardship	Connecting people to urban nature	Support for NBS policy
Learning and developing new skills Enjoyed meeting like-minded people Found activity interesting	More likely to engage with Friends of Sefton Park programme of events Feeling they had contributed to society	Feeling connected to nature	Showing support for URBAN Green UP

All participants stated that they were more interested in NBS after taking part in the workshop. 80% of participants reported feeling more interested in the environment in Liverpool, climate change, citizen science as a way of learning about the local environment and participating in future activities based around the environment. Just under half of participants stated they were equally as interested in climate change as before the workshop; this might indicate a high level of interest in the topic prior to the workshop or the workshop wasn't clearly linked to climate change. Participants felt that a citizen science activity was a good way to engage with NBS and learn about both global and local environmental issues for the following reasons:

Table 8: Impact of using citizen science as a means to engage with NBS and the environment

Learning	Connecting people to urban nature	Engagement with NBS	Monitoring
Practical, hands on learning about environment Opportunities for social learning Education	Activity for young people and families – learning across generations Might motivate people to be more proactive in environmental initiatives	Makes environmental issues feel relevant Raise awareness of URBAN GreenUP Help society adapt to climate change	Citizens can contribute to monitoring of the project

Motivations to participate in a similar workshop in future were the same as prior to the workshop: enjoying the outdoors, learn more about ecology and the environment in Liverpool, being concerned about the environment. However this did vary from the motivations prior to engaging which included making a difference and contributing to science. On the day, there were not many pollinators as it was quite early in the season; temperatures were on the threshold for monitoring (17°C). Participants may have felt they had not made an effective contribution to monitoring. Furthermore, the activity was not directly related to shaping NBS policy and therefore participants would not feel they were making a difference.

4.8.5.2 NBS knowledge impacts

Most participants felt that their understanding had improved following the workshop, ranging from a little improvement to feeling their understanding had extremely improved. This may reflect efficacy of the workshop in promoting knowledge of NBS as well as baseline knowledge prior to taking part. Questions from the pre-workshop questionnaire were repeated to look at how perceptions and knowledge changed as a result of engagement with NBS. When asked to define the key terms the workshop was based around, most participants were more confident in defining the key terms surrounding nature-based solutions. There was a marked improvement in defining nature-based solutions and URBAN Green UP. NBS definitions made reference to green walls, floating reed beds and connected to ideas of delivering ecosystem services. Definitions of green infrastructure showed

improvement but remained poorly understood – the term ‘infrastructure’ understandably appears to have extant links to the built environment, transport and building materials in the minds of participants. Overall, this reflects some learning about nature-based solutions as a result of participation in the workshop.

When self-rating their knowledge about NBS, green infrastructure, green spaces, URBAN Green UP and climate change there was variation in how much confidence in knowledge had changed. Nearly 50% felt they still had little knowledge of NBS following the workshop. This reflects the workshop had limited effect in increasing participants’ self-rated knowledge of these topics. This may be due to the workshop activity feeling disconnected from URBAN Green UP and nature-based solutions. Parks and green spaces pre-date green infrastructure and NBS discourse, and at the time of fieldwork URBAN Green UP interventions were not in place so it was not possible to conduct a workshop using URBAN Green UP interventions which may have made these connections more apparent.

Participants were asked how green spaces might help Liverpool adapt to climate change. A high number of responses referred to pollinators, biodiversity and habitat which may be due to the citizen science activity being based on pollinators. Many answers referred to increasing biodiversity, water management, reducing temperatures, improving air quality and social impacts such as education, raising awareness of climate change and how they can contribute, and spiritual wellbeing. All answers were in some way reflective of the ‘ecosystem services’ links in the workshop. Some answers were more specific than others e.g. ‘reduce CO_2’ whereas some answers detailed potential solutions ‘help to attract pollinators by selecting certain plants’. This reflects thinking on a deeper level about the connections between nature-based solutions and the ecosystem services they might promote. Furthermore, people looked beyond using NBS to adapt to climate change in a biophysical sense, noting that NBS might allow more people to get involved and provide practical opportunities to learn.

After completing the workshop, there was little change in what participants thought were the most important reasons to have green space in Liverpool. Increased health and wellbeing, better air quality, reduced heat wave risk, improved water quality, better habitat provision and learn about nature were the most frequently selected reasons from a list of 13. The reasons selected were all related to the environment, rather than social or cultural reasons, possibly reflecting engagement with the ideas of ecosystem services that formed the central topic of the workshop.

Responses to the question asking participants to identify NBS in a list of NBS and engineered solutions changed in the second questionnaire. There were noticeably fewer

incorrect answers in the second questionnaire that asked this question, reflecting that participants had formed knowledge of what NBS interventions might look like. For example, there were 0 answers for air conditioning or electric cars as a NBS, and only 2 participants selected flood wall and solar panels. All 14 participants identified a pollinator wall as an NBS.

4.8.5.3 Perceptions of NBS

Most participants felt that a great amount and variety of green space was extremely important, with all participants rating it as 'important' or higher. The majority of participants said they'd be interested in participating in environmental activities based on their experience at the pollinators and NBS workshop – with more than a third saying it is something they would definitely attend in future. Furthermore, 78% of participants felt that citizen science was an effective way of engaging communities in NBS. This reflects a positive experience with citizen science based activities may be a good method to engage communities with NBS.

When asked about the benefits of green space in Liverpool specifically, answers tended to lean towards social benefits of NBS. These impacts referred to health (spaces to exercise, mental health), learning (environmental awareness, connection to nature), places to socialise and social cohesion. Ecosystem services that contribute to CCA were also key impacts. Impacts specific to this question were more focused on aesthetic value, social impacts, and the idea of Liverpool being a leader in climate change adaptation.

Half of participants thought that access to information regarding climate change adaptation was extremely important. Six participants thought access to information on changes to green space management in Liverpool (e.g. projects like URBAN Green UP) and being involved in education programmes for green space in Liverpool was extremely important. Five participants thought having input into decision-making for climate change adaptation and mitigation and having input in decision-making for green space was extremely important.

4.9 Summary

In general, the workshop was well-received, indicating that future citizen science based engagement such as interacting with URBAN GreenUP using the bioapp may be successful in generating enthusiasm for NBS and raising awareness of sustainability issues. Perceptions of NBS were overall positive, and participants were keen to learn more about urban biodiversity. The group were very interested in local green space issues and

expressed a desire for a greater role in decision-making in Liverpool's climate change adaptation strategy. The activity itself did not make much difference to participants' understanding of NBS – this may be due to the design of the workshop, or participants already having good prior knowledge of climate change and nature-based solutions.

4.10 Layer 4, Workshop 2: PPGIS workshop

4.10.1 Description of workshop activities

At the beginning of The Baltic Corridor workshop, participants were asked to fill out a pre-workshop questionnaire before proceeding with 3 activities based on green space in the Baltic Corridor (see Section 3.7.5).

4.10.2 Pre-workshop questionnaire results

4.10.2.1 Participant profile

The group were mostly white, well-educated, over 45 and mostly female. Every participant was educated to degree level, and over a third held a Masters' degree, representing a similar demographic group to the citizen science workshop. Participants were invited to introduce themselves at the beginning of the workshop. Three of the attendees were local business owners, whose businesses are all based around an area of open green space referred to as 'The Hub' and 'The Baltic Green' locally. One attendee was a local architect, interested in development in the Baltic Corridor area. Two participants had a background in civic planning. One participant was involved in the Extinction Rebellion campaign, a global movement focused on gaining political momentum to work towards solution multiple environmental issues, with a focus on climate change. One participant was a local councillor, as well as a resident from the area. Two participants were members of a local branch of Soroptimists International. One participant came from the group Faiths4Change. One participant was a planning student. This represents a group with linked interests in planning and the environment, as well as differing perspectives based on professional and organisational backgrounds.

The group in general were relatively active in their participation in civic life - every single participant attended community activities at least every 2-3 months. A third of the group were involved once a week or more. Of the community activities listed (see Citizen Science, Participant Profile for activities listed), voting in local elections was most popular, followed by attending public consultations and engagement via social media. This reflects that amongst the group, there is participation in 'real' events along with virtual involvement. The high frequency of participants attending public consultations and voting in elections suggests a politically active group.

The majority of people wanted to feel their voices were heard and help improve their communities. This may be reflective of the 'politically active' nature of the group - driven by desire for change and development rather than immediate personal needs such as socialising. Participants tended to identify time and other priorities as major barriers. Other less frequently reported barriers were feeling their actions don't make a difference or that actors with power in formal institutions don't listen and respond. Although these barriers were reported, most of the participants suggested there were no barriers for them to engaging; indicating that this group has no difficulty accessing platforms for civic engagement. Participants were motivated to take part in the mapping workshop by wanting to learn more about environmental matters, and participants were concerned about climate change. The workshop was marketed as an environmental event and therefore mainly attracted those who already had an interest. Other motivations were concern over loss of green space; this fear stems from a recent history of green space in Liverpool being sold for development. This could be reflective of there being limited outlets for people to vent such frustrations and felt the workshop would be a good place to talk about this.

4.10.2.2 Prior knowledge about NBS

Participants were asked about why they thought green space in Liverpool was important, and were given a list of reasons spanning environmental and social benefits. 'Improves air quality' was by far the most frequently ranked as highest priority followed by flood defence, wildlife habitat, recreation and looks nice. This was followed by 'keeping the city cool' and 'wellbeing and mental health'. This indicates that in general, participants believed the environmental benefits of NBS are most important reflecting an understanding of ecosystem services provided by urban green space. The least important was 'unites the community', somewhere to go and opportunities to learn. Social cohesion and learning were perhaps not viewed as direct benefits of NBS.

Seven key benefits of green space for climate change adaptation were identified by participants: improving air quality, water management, biodiversity, reducing temperatures, engagement and learning, connectivity of bike and pedestrian routes, mental and physical health. Answers varied in level of detail; in terms of air quality some mentioned particulate matter or in reference to water management, how green space can slow and absorb runoff. Others just stated 'air quality' or 'flood defence'. This may reflect varying understanding in how green spaces benefit urban environments across the group. There was variation in the number of examples participants were able to provide; ranging from 3-5 answers.

When discussing benefits of NBS at the local scale of the Baltic Triangle, a large proportion of the answers referred to aesthetic value of green space and social benefits including health, social cohesion, recreation and engagement. Additionally, there were some references to the previously mentioned climate change impacts; reducing CO2, improving air quality, reducing temperatures and improving biodiversity. There were also general references to green spaces being positively perceived, or known to be of benefit to the environment but with no further detail. This might indicate that whilst green space in the Baltic Triangle is perceived to be positive, participants might not be confident in articulating why. Whilst local scale impacts were more prominent, this reflects understanding of how local scale interventions can help alleviate and contribute to global issues.

Participants were asked whether they recognised the following terms, and their confidence in their knowledge of the topics:

- climate change
- green space
- green infrastructure
- nature-based solutions
- URBAN GreenUP

The most familiar terms were green space and climate change – these were the terms participants felt most confident in their knowledge. The other terms were also recognised by most of the group. This likely reflects that a large proportion of the group were interested in environmental issues and had prior knowledge of the benefits of green space. Most participants who recognised the term ‘nature-based solutions’ were able to define or make comments relevant to the term. Many did this by providing an example of an NBS – trees for carbon capture, swales, wildflowers. Others identified a benefit of NBS e.g. flood prevention, air quality improvement, encouraging pollinator populations. One participant noted the use of natural systems to benefit urban environments, which may reflect some understanding the place of NBS in social-ecological systems. Another identified that nature-based solutions aim to connect green spaces, and they function by promoting ecosystem services. Weaker definitions included identifying what they are not (hard engineering) or identified that they are using nature as solutions which may have been indicated by the title.

Based on detail of response, definitions were coded as being weaker or stronger; half were coded as stronger responses, indicating a group that is relatively knowledgeable about such topics and able to articulate this understanding. The strongest definitions were those that established (a) use of nature and natural systems and (b) used an example or an example of a benefit derived from NBS. Definitions that included (a) or (b) were seen to

show some understanding. Definitions absent of (a) or (b) were considered weak. There was an even split between definitions containing both (a) and (b) and definitions containing either (a) or (b), and three weak definitions that included neither. This reflects a group with a range of understanding of nature-based solutions – most had at least some understanding and others had at least passing knowledge or were able to derive meaning from the term itself.

When asked to identify nature-based solutions from a list of NBS and engineered solutions, a quarter incorrectly identified traditional engineered solutions as NBS, such as electric cars or solar panels. Only half of the group identified SUDs and urban carbon sink as NBS, reflecting a lack of confidence in terms that don't directly refer to green space. Participants believed that improving or creating new green space in the Baltic Triangle would promote health and wellbeing, improve air quality, increase access to green space and improve habitat provision for wildlife.

4.10.3 Post-workshop questionnaire results

4.10.3.1 Impact of engagement for participants

Survey responses reflected that participants were more interested in local affairs and environmental issues, and they felt they had learned more about the benefits of NBS than before taking part in the workshop. Participants also expressed frustration, or doubt in whether URBAN GreenUP will be occurring at a scale to make a noticeable impact on the city. One participant expressed they felt the workshop was an event where the public had been invited to attend just to meet the project's requirements. A positive outcome was that participants felt they had learned from other attendees, who had diverse areas of expertise and made important links to affect change in future. The interest in being more aware of local affairs and environmental issues reflects a group that was very politically motivated and want to see real change in their city, particularly its approach to environmental issues, particularly climate change. Furthermore, the additional comments reflected frustration at how green space is managed and has been managed over the last decade highlighting this desire for change. Participants felt more interested in learning about and engaging with NBS as well as taking part in green space workshops. Just under half of respondents said they would definitely attend a similar event in future; this may reflect prior strong motivation to engage with these types of events.

4.10.3.2 NBS knowledge impacts

Improving air quality and wildlife habitat remained the most frequently highest ranked reasons to have green space in the Baltic Triangle. This was followed by socialising and flood defence; reflecting that social benefits of green space emerged as an important factor after completing the workshop. This might be following discussion in the workshop about how green space is used for socialising in the Baltic Triangle. Opportunities to learn were frequently low ranked, perhaps in context of the type of green space in this area.

The majority of participants felt their understanding of NBS had improved after taking part in the mapping workshop. Overall, this shows the workshop had some efficacy in improving understanding of NBS but a significant proportion of the group felt it was not helpful for this end. Participants stated they had gained a better awareness and understanding NBS and local environmental matters. Some felt the group setting of the workshop enabled discussion and learning from one another which was beneficial. They also stated that community engagement and input into environmental policy was necessary.

Definitions of the key terms: NBS, green infrastructure, green space and climate change remained the same. The strongest definitions were for climate change. However, there was no detectable change in how participants thought green space might impact climate change after taking part in the mapping workshop. Some NBS definitions were strong, indicating the environmental benefits that can be gained, promotion of ecosystem services, improving aesthetics through green areas. URBAN GreenUP was defined mainly by its links to the EU and Horizon 2020.

In terms of how green space could improve the Baltic Triangle, participants focused on mental health, water management, having community space for socialisation and air quality rather than aesthetic appeal. This may reflect that people showed greater interest in the diversity of solutions provided by natural interventions having taken part in the workshop.

4.10.3.3 PGIS as an engagement method for NBS

Participants felt climate change should be a priority in policy and that we need to adapt to it quickly. One participant stated it seemed like ‘too big an issue’ – reflecting some of the discussions in the workshop where participants had been discussing whether NBS would make a significant impact or not, in the context of individual choices as well as the national and global environmental policy context.One comment regarding NBS was ‘leave our green space alone not for sale’. This reflects the difficulty in communicating how green

spaces may be improved or created when there has been a history of policy that does not protect green space, which has ultimately eroded social capital.

Overall, most participants in particular valued the opportunity to meet others with similar opinions regarding environmental issues and green space. Another benefit stated was meeting people from different disciplines and those with different viewpoints. Some felt they gained a better contextual understanding of NBS in the Baltic Triangle e.g. that it is occurring alongside major development of green space in Liverpool in recent years. Participants felt that mapping was a good way to show scale of issues and visualise how location impacts suitability of interventions. They felt it was a good method to learn about environmental matters and that it gave an opportunity to collaborate with others. One participant stated that the session was a waste of time – reflecting that citizens are not so concerned with learning about NBS, but require a platform to express their ideas regarding NBS policy.

4.10.4 Participant observation findings

The questionnaires captured some aspects pertinent to the study of citizen engagement with nature-based solutions, but much of the interesting points raised by the workshop were the discursive elements of the activities. This raised key issues of mistrust in the council and the issues of a ‘placeless’ approach to NBS.

The mistrust in the council was evidenced by the hostility shown towards me as facilitator; it was difficult to communicate my position as an independent research student. People wanted to express frustration at the management of green space during the austerity years, and felt that leadership of URBAN GreenUP by Liverpool City Council was highly hypocritical. One participant did not want to take part in Activity 2 and did not fill in their questionnaire because they felt the project wasn’t legitimate due to the council’s leading role. The workshop activities were stalled by discussions of plans to develop an area of green space locally known as the Flat Iron. Many participants felt it was futile to discuss relatively small-scale retrofitting of NBS when there were imminent development threats to existing open green spaces.

During Activity 2, one group redrew the boundaries of Sub-Demo Area A because they felt the interventions should cover a different spatial extent. This reflects that citizens may be able to impart local knowledge on the most appropriate places to implement NBS. In addition to this, Activity 3 revealed that participants felt that NBS, particularly those associated with URBAN GreenUP plans would not be sufficient to meet the challenges they

had identified in Activity 1. These challenges included unsustainable and unsuitable development that encouraged transient residents only (studio flats and student accommodation), gentrification and building on green space. One participant stated that ordinarily, they would support urban greening but they felt a lack of ownership as they had been unaware of the project until attending the workshop and this would deter them from supporting NBS in Baltic Corridor. Although one of the main challenges identified by the groups was lack of green space, they felt URBAN GreenUP interventions were too small to make a difference. Although NBS are holistic, participants felt that NBS would not be an appropriate solution to their identified local challenges.

4.10.5 Summary

The Baltic Corridor mapping workshop was designed with the intention of exploring citizen perceptions of urban greening, and the outcomes of taking part in engagement activities based around nature-based solutions. Outcomes focused mainly on use of NBS as a tool for learning about ecosystem services and climate change. Discussions in the workshop highlighted the draws of the area as well as the challenges. It emerged that perceived irresponsible development and threats to green space was considered to be a major challenge, especially considering that they believed that green space in the Baltic Corridor was a key asset to the area.

Participants in the workshop were knowledgeable about ecosystem services but prioritised the social benefits of urban greening more often compared to environmental benefits after taking part in the workshop. They reported feeling more confident in their knowledge of nature-based solutions, but there was little change in questions assessing learning. Overall, participants mostly felt it was a good method for learning about nature-based solutions as it allowed for discussion and learning from other participants, ability to visualise impact of urban greening and scale of issues. However, some expressed feeling frustrated and that it had been a waste of time.

Many of the most interesting findings from the workshop were observational, or couldn't be captured from surveys alone. This was mainly deep mistrust in the council particularly with regard to protection of open green spaces. The expression of feelings of frustration or that their time had been wasted might be linked to this; as the workshop focused on learning and discussion about benefits of urban greening there was no scope to influence policy regarding open green space protection. This reflects that prior to workshops on nature-

based solutions, participants should be consulted on what they hope to get out of the workshop.

4.10.6 Reflections on experience of citizen science and PGIS workshops

The two workshops provided several points of comparison, beyond being held in different Sub-Demo Areas and operationalising different activities. Although I attempted to bring a discursive element into the citizen science workshop, on reflection I feel the activity did not enable enough meaningful discussion and knowledge co-production between participants. As a result, hosting the PGIS workshop was challenging at the time but provided a valuable learning experience.

As raised in section 4.10.2.1 *Participant profile,* some attendees at the PGIS workshop were part of what would be categorised as two special interest groups (Sarzynski, 2015); a 'Save the Baltic Green' campaign and Extinction Rebellion. This meant that much of the discussion in that workshop was dominated by these individuals who were looking to push forward their agenda and use the workshop as a platform. In part, this might be a reflection on the timing and lack of engagement by URBAN GreenUP until that point, and lack of wider engagement on behalf of the local authority regarding development of open green spaces in Liverpool.

The variation in the experience of the workshops might also be related to socioeconomic inequality in Liverpool. Generally, the south of the city has always been much wealthier, and has most of the green spaces in the city perceived to be of high quality including Sefton Park and Princes Park, which are both included in URBAN GreenUP's interventions (Sub-Demo Area C). URBAN GreenUP partners have made efforts to involve local groups attached to these parks and the surrounding community including Friends of Sefton Park and Friends of Princes Park as well as Soroptimists International, Liverpool. This reflects that work has been done to build social capital in this area. On the other hand, Sub-Demo Area A, being a post-industrial area has little extant green space whilst undergoing rapid development, threatening the small pockets of green space and leading to issues associated with gentrification. It is understandable that even across the small geographic area separating the two Sub-Demo Areas, perceptions' of Liverpool City Council's work would be very different. This reflects the importance of meaningful, well timed engagement and reaching out to local organisations that can help build social capital whilst also highlighting the challenges posed by decades of mistrust when attempting to engage citizens with NBS.

4.11 Forest Bathing Pod participant observation summary

Before I began my research, I was aware there would be little opportunity to observe any engagement events directly linked to URBAN GreenUP, due to the timing at which I began my work. As described in the methodology, this was part of the justification behind designing my own citizen workshops. However, I did have the opportunity to observe an event where URBAN GreenUP set up a 'Forest Bathing Pod' in Williamson Square, Sub-Demo Area C on June 26th and 27th, 2019. The Forest Bathing Pod was a pod filled with comfortable seating, trees and mirrors designed by bcal, a local landscape architecture firm and assembled by the Royal Court Theatre; it was then place in Williamson Square, Liverpool. The concept of the pod is derived from the Japanese practice of 'shirin-yoku' which roughly translates to forest bathing. Research has shown proven physiological and psychological benefits of spending time in forest - the purpose of the pod was to demonstrate the benefits of shirin-yoku on a micro-scale, in an urban context to demonstrate forests bathing as NBS for improving mental wellbeing. I observed the event and distributed short surveys after citizen participants exited the pod.

Feedback overall indicated that the engagement event was very well received; participants reported feeling relaxed and calmed by sitting in the Forest Bathing Pod for 5-10 minutes, which was the intended effect and indicates it demonstrates this co-benefit of urban greening well. However, when participants were asked what they thought the benefits of urban greening might be more generally, participants mainly focused on mental wellbeing benefits – this reflects that although the event demonstrates this particular co-benefit well, it perhaps did not demonstrate the wider benefits of NBS as well. All but one of the participants reported feeling their knowledge of NBS had increased, but mostly only reported an increase from 1) no knowledge to 2) slight knowledge; indicating a lack of deeper engagement and meaningful participation. Very few of the participants reported having heard of URBAN GreenUP prior to engaging with the Forest Bathing Pod, reflecting that as of June 2019, knowledge of the project had not reached many citizens. A reoccurring theme in verbal responses reflected concern over loss of green space in the city to development – they stated that they were confused about why URBAN Green UP was going ahead whilst extant green space is being sold to developers.

5 Chapter 5: Discussion

5.1 Introduction

The literature review examined NBS as a new way of framing and extending the concept of green infrastructure, paying close attention to the role of governance in shaping its development. In particular, it examined the importance of collaboration in NBS and how citizens can be considered a key stakeholder. It also looked at wider themes around social-ecological systems governance such as the role of public participation in environmental policy, to better understand why citizen involvement is relevant to NBS projects such as URBAN GreenUP. This is backed by the EKLIPSE framework for assessing NBS which includes the challenge arena 'Challenge 7: Participatory Planning and Governance'. This stipulates the importance of involving citizens in co-creation, transparency in governance processes, understanding citizen perceptions of urban nature and increased accessibility to green open space.

Next, I wanted to understand how these themes may be relevant to the case study of URBAN GreenUP in one of the three frontrunner cities of Liverpool. I searched URBAN GreenUP policy documents for information relating to EKLIPSE Challenge 7 and community engagement. The literature review and policy document analysis provided an outline for themes to be explored through interviews with URBAN GreenUP partners and workshops with citizens. The next section will analyse results from both interviews and workshops in the context of URBAN GreenUP policy, EKLIPSE and previous research on NBS.

The discussion will examine how citizen engagement with NBS may contribute to better planning and governance of sustainability initiatives in cities, which has been identified as a key knowledge gap in NBS research to date (Frantzeskaki, 2019). This is because research on green infrastructure and NBS has largely focused on their efficacy end efficiency of delivering multiple co-benefits. The discussion pays particularly close attention to the role of co-production and implications of such a framing for citizen engagement.

5.2 Co-creation and co-production in NBS

Co-creation of NBS describes the process of stakeholders collaborating on the design and implementation of NBS; in the case of citizen co-creation, it describes their key role in decision-making throughout the process (CLEVER Cities, 2019). Discussion of co-creation in NBS is a relatively new phenomena, and thus has received minimal critical attention in contrast to research specifically into the role of co-creation in general. Many successful NBS projects have claimed to involve some degree of 'co-creation' with citizens (Frantzeskaki, 2019). There are several principles that define complete co-creation. Most important to this work is that end-users should have a central role, a wide group of stakeholders should participate in every phase, all information regarding NBS should be accessible (transparency) and the process should eventually lead to the implementation of a co-created solution that creates values for both end users and parties involved in co-creation (CLEVER Cities, 2019; Turnhout *et al.,* 2020). Examining co-creation in NBS is key to this study of community engagement with NBS because it is the highest level to which citizens can be involved. This links co-creation with key principles of participation discourse that traditionally places value on citizen empowerment, such as Arnstein's Ladder (Arnstein, 1969). Bringing citizens on board in co-creation processes gives citizens an instrumental role in decision-making throughout the NBS project's lifespan and is reported to result in empowerment, better solutions for end-users, improved trust in governing authorities and transformations to sense of place (usually from negative to positive) (Baptista *et al*., 2019).

However, clearly there is a lack of consensus on what co-creation means in the context of NBS. For example, EKLIPSE Challenge 7 mentions co-creation of new *institutions* for urban ecosystem restoration and management to facilitate nature-based solutions but references co-production with regards to generating *knowledge* about NBS for the use of transparent participatory planning processes. In contrast, Frantzeskaki, 2019 discusses examples that directly link citizen co-creation to NBS interventions themselves, rather than institutions which facilitate NBS. However, processes discussed such as citizens working with architects on the aesthetic design of a pocket park in Katowice, Poland may also be described by co-production. Co-production is defined by Wyborn *et al. (*2019) as:

"Processes that iteratively unite ways of knowing and acting – including ideas, norms, practices and discourses – leading to mutual reinforcement and reciprocal transformation of societal outcomes"

In the case of the pocket park in Katowice, knowledge of architects was co-produced with knowledge of citizens which ultimately resulted in final designs for the pocket park (Frantzeskaki, 2019; Wyborn, et al., 2019). Uniting the two ways of knowing that come from architects and citizens resulted in a unique design of the pocket park, which may have been

very different if either group had been working alone. However, this example exemplifies how co-creation and co-production can be 'conceptually fuzzy', leading to confusion (Lember *et al.,* 2019; Voorberg *et al.,* 2013). This might be problematic, as it makes it difficult to know whether co-production or co-creation (sometimes both) has really been achieved. It also makes it easier to claim one or both have been achieved on the basis of involving citizens in some way, even if in reality this is limited (Lember *et al.,* 2019).

Co-creation and co-production with citizens in NBS may be desirable as it has the potential to achieve a number of instrumental benefits for NBS projects described in Table 9, below:

Table 9: Table of hypothesised outcomes of benefits that can be gleaned from co-creation and co-production (Wyborn *et al.,* 2019)

Benefit of co-creation and co-production	Hypothesised value to project outcomes
Urban place-making	Positive transformations to sense of place as a result of being actively engaged in co-creation of NBS – allows residents to self-govern spaces they want to control (Frantzeskaki, 2019) Takes into account geographical, historical and socioeconomic context in which NBS are implemented; can tailor NBS to be appropriate for this context (Gutiérrez, et al., 2018) If NBS are not deemed appropriate to the character of the local community, there is a risk of them being removed
Enhancing value creation and services for end-users	The public sector is better able to respond to citizens needs if they are directly coproducing knowledge and co-creating solutions to problems communicated by citizens (Baptista *et al.*, 2019). Community actively define their needs, therefore governing authority improves solutions to these challenges Potentially maximises multiple co-benefits NBS delivered; therefore enhances wellbeing (both physical and mental) This is related to urban placemaking; if NBS are tailored to the character of the local area they will be more valuable to the community
Innovation	More ideas exchanged, different ideas to practitioners – could result in new modes of thinking, new institutions, new designs of NBS interventions

Legitimacy and transparency	Involving citizens from an early stage enables them to understand processes of NBS planning and implementation and reflects willingness on behalf of project partners to be transparent – in turn promoting trust. Trust that a project has legitimacy means that people are more likely to engage and support the project as they feel it is worthy of their time (Frantzeskaki, 2019).
Promotes feelings of ownership – may improve resilience of NBS	Feelings of ownership promotes environmental stewardship – ensures maintenance of NBS into the future and adds to their resilience. Even more important for municipalities with strained budgets that lack funding to maintain NBS.

Fully co-creative processes in NBS projects are difficult to achieve, particularly with regards to citizens because this naturally incurs extra time and resource cost, and it is difficult to engage all sections of society (Sarzynski, 2015). This limits ability to involve citizens at every single stage due to resource constraints. When co-creation with citizens is discussed in relation to NBS, it is often at the small scale (e.g. a single pocket park) and it is difficult to ascertain the level and nature of involvement of citizens in the co-creation process. In part, this is due to lack of clear definition of what is meant by the term co-creation in academic literature. Although it is important to celebrate collaboration that brings a diversity of actors into play it is important to acknowledge the trade-offs of engagement and potential barriers that occur in complex real world settings.

5.2.1 Trade-offs of co-production

Although co-creation and co-production with citizens has demonstrable positive outcomes, there are barriers and trade-offs to these processes occurring. These barriers are institutional, social and financial. This means although co-creation and co-production may be considered desirable for an NBS project, it is not always realistic to expect a high degree of citizen involvement. The majority of funding for URBAN GreenUP was allocated to the interventions, leaving limited resources available for community engagement. Interviews and the document analysis revealed that only a very small number of citizens took part in the planning phase, and were presented a suite of pre-planned options rather than co-creating solutions. Part of this is due to the difficulties that arise in retrofitting a city, as well as the need for technical expertise in green infrastructure. As a requirement of funding, URBAN

GreenUP also has limited scope to change interventions that were developed in the proposal stage, so even with good intentions, meaningful engagement and co-creation is necessarily limited. Participants in workshops reported not having heard about URBAN GreenUP consultation events and they felt they had been intentionally left out, and this gave them a negative impression of the project despite supporting urban greening in general – this is because they felt it was being done without their consent or input. This reflects the importance of including citizens from an early stage in co-production of NBS. Furthermore, there may be limits to citizens' capacity to contribute at every stage due to their own time and resource constraints. For example, in the case of URBAN GreenUP, municipal representatives worked with local college students in a co-creative process for the design of floating islands in Sub-Demo Area A but this ultimately did not go ahead due to a lack of capacity to engage on behalf of the college. This exemplifies one of the main barriers to co-production with citizens; it incurs extra time cost, as the process usually requires iterative dialogue and work from both the project partners and stakeholders – this is not only a cost to the council but a time cost for the college that also has existing commitments to deliver core course curriculums.

A problem common to community engagement is the narrow profile of citizens it attracts, and this project was consistent with the literature in this respect. This results in a lack of representation of often marginalised communities, and risks only a narrow set of interests being presented (Needham, 2008). Without full representation, knowledge co-produced in NBS fora may only reproduce dominant paradigms that exist in society. Furthermore, particularly in environmental management, engagement events are well attended by specialist interest groups; this results in co-production of knowledge, ideas or solutions that are heavily oriented towards those groups. The NBS literature also explicitly highlights the role of green space in addressing social cohesion, environmental justice, and economic and health inequalities (Raymond *et al.* 2017), which makes inclusion of a broad range of stakeholders even more important.

All NBS projects aim to have community engagement to some degree as an integral part of delivering solutions to communities which is part of a wider tradition of active citizenship as part of a democratic society and principles of good governance (IUCN, 2020). However, innovation is also necessary to develop effective NBS and this requires the contribution of partners with technical expertise in NBS (Sherlock, et al., 2004). These dual commitments mean that NBS must walk a fine line between effective service delivery whilst leaving ample room for citizen involvement. For example, an NBS project that focuses too heavily on biophysical capabilities may be criticised for being overly technocratic and not responding enough to citizens' needs but one that gives too much responsibility to the

community risks being accused of attempting to pass on accountability for project outcomes. This brings in to consideration the value of co-production to NBS projects. Involving more community members may only provide limited knowledge resources assuming the majority of the community engagement activity mainly provides local knowledge and preferences rather than a wider view of urban greening (Wyborn *et al.,* 2019). At the same time, incorporating such processes to engender knowledge co-production can be a massive drain on limited time and reources. This is particularly important to consider for URBAN GreenUP, a project on a short time scale that was required to allocate the majority of the budget to interventions. Technical expertise will still be needed in addition to local expertise which typically comes from academics and practitioners. Therefore when considering the role of citizens in co-production of NBS, there will need to be careful consideration of the value of their contribution to the planning process alongside the time and resource cost of implementing procedures to open up the process to citizens.

Accountability also affects the degree of co-creation and co-production. URBAN GreenUP is accountable to the European Commission, private partners that provide match funding along with fellow frontrunner cities, Izmir and Valladolid rather than citizens of Liverpool. This is an example of top-down accountability. Therefore, the importance of co-production with citizens to URBAN GreenUP in Liverpool is dependent on whether there is top-down pressure to show evidence of this parameter. The value these organisations place on co-production will affect the perceived size of trade-offs that come with co-production processes.

Co-production and co-creation in the context of collaborative governance may also obfuscate accountability; in the case of URBAN GreenUP, a number of leader and follower cities are involved, which inherently involves a number of associated public, private and third sector partners (McAllister and Taylor, 2015). Although citizen engagement events such as the Moving Forest, and my own research workshops introduced urban greening in Liverpool under the banner of URBAN GreenUP, participants tended to focus solely on the role of Liverpool City Council in the partnership. They questioned the legitimacy of URBAN GreenUP as a whole, given the council's role within it as there are high levels of mistrust in the local authority. In this case, shared accountability as a result of co-production with partners and bringing citizens on board may go some way to building legitimacy and therefore trust. However, this requires citizens to understand that Liverpool City Council will be held accountable by URBAN GreenUP partners; this might not be clear from an external perspective.

5.2.2 What does co-production mean for URBAN GreenUP

URBAN GreenUP has been used as a case study into community engagement with NBS. The interrelated concepts of knowledge co-production and co-creation of NBS have been identified as core aims of citizen engagement. Therefore it was pertinent to examine how engagement with NBS may facilitate co-production and co-creation with citizens; and whether there are instrumental benefits to the project and citizens outside of such aims.

*"Designing **knowledge co-production processes** that foster transparency in governance processes and give legitimacy to the knowledge of **civil society**, practitioners and policy stakeholders"* (Challenge 7: Participatory Planning and Governance from the EKLIPSE Framework; Raymond *et al.,* 2017)

Knowledge has been 'co-produced' with citizens via engagement processes in URBAN GreenUP largely via feedback on plans in consultation events. There are a number of productive outcomes including ensuring transparency, which builds and maintains trust and results in better outcomes for end-users (citizens), as it prevents NBS from causing problems and reveals demand for locally tailored solutions such as requests for an orchard. However there were limits to knowledge co-production – for example, improved outcomes for end users is circumscribed by consulting citizens post-design (which occurred for reasons that will be outlined later in the Discussion section).

Researchers have identified that there is a 'conceptual fuzziness' between co-creation and co-production, and therefore in the interest of maintaining clarity it is best to use one term when discussing the case study of URBAN GreenUP (Wyborn *et al.,* 2019). Whilst some authors state that the terms can be used interchangeably, co-production tends to have wider application particularly for public service provision, and will be used from here to discuss the nature of public participation in NBS (Baptista *et al.,* 2019).

5.2.3 Method of engagement: enabling or impeding knowledge co-production?

It is unclear the extent to which citizen engagement with URBAN GreenUP may be considered to stimulate 'knowledge co-production' processes as the degree of it that occurs has varied with each activity to date. In the planning stages, citizens contributed local knowledge that prevented NBS being placed in unsuitable areas and contributed ideas for NBS such as a community orchard. This may constitute an example where citizen

suggestions were given legitimacy in the planning process as they were used to inform and develop NBS interventions, along with the knowledge of experts. Over the course of the project, this may enhance trust as citizens see their suggestions have been used and services are delivered to the local community.

On the other hand, much of engagement with URBAN GreenUP has so far occurred mostly via one-way communication processes, although partners have explained that feedback will be taken into account as part of the ongoing aims of the project. Communication categorised as 'one-way' includes press releases, online information, open days, pop-up forest events which have occurred over the course of the project. Engagement in this form may improve transparency and therefore boost legitimacy of URBAN GreenUP as an entire project, as it keeps citizens informed (Mendes *et al.,* 2020). However, the nature of these one-way flows of information limits capacity for knowledge co-production. The same can be said of the workshops about NBS that I facilitated – although there was opportunity for discussion about NBS, they would not be considered a valid knowledge co-production process as feedback from participants was not fed back into NBS projects. Knowledge transfers can ensure the work of an NBS project is transparent, boosting legitimacy and therefore public support but there are limits to the effectiveness of this when knowledge co-production is not featured in engagement, as citizens only become aware of the project once planning stages are complete.

Bringing more knowledge co-production into engagement processes has been identified as a way of fostering transparency in governance processes, as they feel part of the project. Transparency is important in NBS projects as this is part of building trust between citizens and governing bodies. Trust in the governing authority can be considered a pre-cursor to meaningful engagement; it reassures citizens that the NBS project is worth their time and contribution (Frantzeskaki, 2019). Part of building such an environment of trust is ensuring citizens are aware of the aims of the NBS project (Needham, 2008). Observing the 'Forest Bathing Pod' reflected an opportunity to communicate such aims; questionnaire results reflected some change in knowledge about NBS and recognition of specific aims such as wellbeing. However, passive, one-way knowledge flows regarding NBS projects like URBAN GreenUP may have limited scope to ensure citizens gain an in-depth understanding of project aims and to gain public support – largely, because it has been conducted once the project is set to go ahead. This means engagement has limited use in furthering the cause of the NBS project. One potential benefit is it may help to push forward future NBS plans in Liverpool. Furthermore, in this case transparency as a trust-building factor to enable engagement that will shape project outcomes – at this stage in URBAN GreenUP there is limited scope for citizens to impact project outcomes and therefore trust building may be

somewhat redundant if only this specific project or these particular NBS interventions are considered. However, in the wider context of building social capital it might be considered beneficial (Innes and Booher, 2003).

5.2.4 Improved services for end users vs. service delivery

A central tenet of co-creation in NBS is that end-users should have a central role in delivery of NBS as they are best able to define community needs but in reality there are often many barriers to co-creative processes (CLEVER Cities, 2019; Turnhout *et al.,* 2020). For example in the case of URBAN GreenUP, where a highly built up urban area was being retrofitted with NBS there was pressure to prioritise engagement of landowners who ultimately decide whether interventions go ahead or not. URBAN GreenUP is a private-public partnership, delivered by Liverpool City Council (the 'public' governing body) in collaboration with Mersey Forest and University of Liverpool (two non-governmental organisations). The partners have been working in conjunction with private stakeholders, including United Utilities, CARTIF, the Liverpool BID and Grosvenor Estates in order to deliver NBS interventions. This type of governance model is common in NBS projects (Droste *et al.,* 2017). There is evidence of co-creation and knowledge co-production between these stakeholders as described by EKLIPSE Challenge 7, but it is unclear as to whether such a role fully extends to citizens as stakeholders. The private-public partnership model ensures NBS can be funded and delivered but crowds out citizens who don't have the relevant expertise or financial stake in urban planning. This reflects a tension between giving citizens an opportunity to have more control over NBS interventions with other obligations of NBS project delivery, most importantly the multiple co-benefits they aim to deliver for the benefit of end-users. Furthermore, partners in collaboratively governed NBS projects like URBAN GreenUP arguably have increased responsibility to deliver interventions on tight timescales due to accountability to other leading cities and Horizon 2020 (Droste *et al.,* 2017). Interviews reflected that lack of capacity on behalf of community groups involved had been an issue in this regard (Sarzynski, 2015). Local colleges that had been involved in co-creation of a floating island were restricted by term times, and meant that work was halted outside of term time and ultimately, the college could not commit. URBAN GreenUP in Liverpool is one of three frontrunner cities, and the partners are held accountable to other cities involved as well as Horizon 2020. Therefore, it is essential that the project meets set deadlines which enables efficient project delivery but risks constraining co-creation processes such as involving local educational institutions.

5.2.5 Co-production of knowledge – citizen engagement with monitoring

Community engagement with URBAN GreenUP may be better described as co-production to some degree (rather than co-creation), as these activities will largely facilitate in the 'service delivery' of NBS, rather than contribute to their planning (Baptista et al 2019). Co-production has been popularised in public services and administration literature as a means to improve efficiency of service delivery (Needham, 2008). For example, post-implementation activities such as monitoring may equate to knowledge co-production as citizens are working with URBAN GreenUP to understand changes in biodiversity as a result of NBS (Droste *et al.,* 2017). This demonstrates the practical benefits that involving citizens may provide to nature-based solutions, hopefully helping to prove efficacy of NBS in improving biodiversity in the green corridors which would demonstrate the economic value of NBS to Liverpool (Droste *et al.,* 2017). The visibility of citizens actively taking part in monitoring may be more likely to come to the attention of local councillors who are a key aspect of gaining policy support, whilst also providing essential biodiversity data to be used as evidence of the efficacy of NBS (Andersson *et al.,* 2017).

In the EKLIPSE framework, co-production of knowledge with citizens is perceived to be beneficial because this is expected to have the outcome of 'citizen empowerment' rather than addressing the instrumental benefits to service delivery described in the co-production literature (Needham, 2008). However, the results of the workshops don't appear to support this. In particular, the citizen science workshop results reflected that citizens did not feel they were shaping the community or contributing to science and monitoring as a result of taking part in the workshop. This reflects that work may need to be done to ensure the intended benefits of knowledge co-production are enjoyed by citizens. Furthermore, it may reflect that the EKLIPSE framework viewing 'citizen empowerment' as the end-goal of co-production is out-dated. The participation literature has moved on from Arnstein's model of citizen empowerment to examine instrumental benefits instead (Tritter and McCallum, 2006)

5.3 Engagement: benefits beyond co-production

EKLIPSE Challenge 7 does highlight other outcomes of engagement with NBS projects aside from knowledge co-production and empowerment (Raymond *et al.,* 2017). Outcomes of citizen engagement includes providing evidence of good governance, promotion of legitimacy, connecting citizens to nature, promoting environmental stewardship and urban place-making (Raymond *et al.,* 2017). Although all of these beneficial outcomes are mentioned as important 'outcomes', EKLIPSE is intended to be a framework and therefore lacks clear examples from NBS projects and so it is difficult to explain *why* these

outcomes may be beneficial from the framework alone. This results in a key issue in that many of the outcomes listed may have limited value if they do not lead to co-production, or are not the result of co-productive processes - this will be discussed in the following sections.

One of the main outcomes of knowledge co-production cited by EKLIPSE is 'citizen empowerment'. Although this is a valid outcome of co-production, it is reductive to state citizen empowerment as the only outcome when there are many other instrumental benefits that are arguably more productive than empowering citizens such as improving NBS for end-users (Liverpool citizens) (Baptista *et al.,* 2019). Furthermore, whilst the literature on public participation, collaborative planning and collaborative governance has long advocated for the goal of greater citizen empowerment as a cornerstone of living in participatory democracy, this view has received much critique. This is because citizen control can indicate an absence of support from governing bodies that would normally offer resources for services; full citizen control does not necessarily equate to the best outcomes from a project or policy. However, there is consensus that some degree of decision-making from citizens should be a central tenet of good governance (IUCN, 2020). Many of the outcomes for co-creation and co-production are in line with the benefits of participation literature which advocates citizen involvement in planning and implementation as the main benefits (Frantzeskaki, 2019). Co-production may be considered as a bridge between passively considering the role of citizens in NBS implementation and complete citizen control – ensuring engagement is effective in eliciting change whilst limiting trade-offs (Needham, 2008). In contrast, participation literature has failed to discuss the potential benefits of this more pragmatic approach. However, co-production does echo the sentiment of public participation, collaborative planning and collaborative governance - that citizen engagement which does not enable citizens to make decisions about NBS may be considered a waste of limited resources (Wyborn *et al.,* 2019). Therefore engagement with NBS should have the goal of contributing to building capacities of citizens to co-produce knowledge of NBS through open discussions with partners and other private and non-governmental stakeholders who may be involved (Turnhout *et al.,* 2020). Opportunities for citizens to be involved in the planning of NBS may result in greater levels of citizen empowerment, but this will stem from from other key benefits of co-production such as feeling they have directly improved the multiple co-benefits delivered by NBS and created a better urban environment for future generations.

Levels of 'citizen empowerment' perceived by citizen participants as a result of engaging with NBS was very low due to a lack of opportunities for citizens to steer design and delivery of NBS (Mendes *et al.,* 2020). When considered in Arnstein's ladder (1969),

participation in URBAN GreenUP would be considered to be tokenistic, as it focuses on informing with some consultation. Environmental awareness, is at a record high in the UK which tends to be associated with a higher demand for citizen control of environmental management (Carrington, 2019). Participants in both workshops reported a strong desire to shape the future of their community as their primary motivation to get involved with NBS. One of the main reasons for dissatisfaction in the Baltic Corridor mapping workshop was the lack of opportunity to contribute to future plans for greening the Baltic area. This invites reflection on what the purpose of engagement is within URBAN GreenUP if co-creation and co-production is limited, as even engagement activities intended to inform usually spurs desire for greater involvement. In the absence of widening NBS participation, it is difficult to pinpoint reasons for encouraging citizens to engage with URBAN GreenUP if they will not be involved with decision-making.

The citizen science workshop was intended to mirror potential impacts of citizens using the URBAN GreenUP bioapp to monitor biodiversity changes in the URBAN GreenUP Green Corridors. Therefore findings from this workshop may to some degree reflect how using the bioapp will impact citizens. Participants did not feel empowered by the workshop, which may be because there was limited opportunity for a two-way dialogue. Despite this, participants did report enjoyment of the pollinator survey, which suggests the URBAN GreenUP bioapp would be well received and garner political support. If this engagement activity is well-received, this may help gain long-term support as it allows citizens to better understand how NBS improves biodiversity through the opportunity of hands on learning. This is supported by research into citizen science apps, which will be utilised by URBAN GreenUP as part of KPI's to connect citizens to urban nature whilst improving data quality for biodiversity KPIs (Graham *et al.,* 2011).

Ecosystem services provided by NBS are integral to improving social-ecological system resilience, but governance of NBS should also allow for significant input from citizens as a means of promoting resilience (Kabisch *et al.,* 2017; IUCN, 2020). Citizens may be more likely to support NBS projects in the long term if they have been actively engaged in co-creating them, rather than through one off events designed to inform (Mendes *et al.,* 2020). This will improve the resilience of the social-ecological system by ensuring citizens continue to support transitions to a more sustainable urban environment. Improving levels of citizen empowerment by incorporating citizens into co-production processes may ensure resilience of NBS by boosting public support.

5.3.1 The role of good governance in successful engagement

Good governance is considered essential to developing trust in a project. This is because it rests upon core principles of legitimacy, transparency, accountability, inclusiveness and fairness (Lockwood, 2010; Figure 6). These principles that inform the quality of governance are linked to an ethical imperative to ensure that human rights are protected; in this case, the democratic right to participate (Lockwood, 2010; Figure 6). People are more likely to engage now, and in the future when they feel a project meets the criteria of good governance.

5.3.2 Legitimacy

Legitimacy is foundational in any community engagement process, referring to how an organisation's beliefs and values are perceived by individuals and groups on the basis of the organisation's actions (Knox, 2016). Legitimacy is socially constructed based upon iterative actions of the organisation; for example, some participants clearly did not feel Liverpool City Council was a legitimate institution due to the recent intensified development of green space to fill funding gaps left by austerity measures in the last decade (Knox, 2016; Hoyle *et al.,* 2019; Thompson, 2015). Citizens' engagement tends to be conditional upon whether they trust those governing the project along with what the project is. In Liverpool, and as a more general finding in research, urban greening is usually well received, and therefore perceived by partners on URBAN GreenUP to be an 'easy win'. Creating more green space tends to be uncontroversial amongst members of the public, with only minor concerns relating to maintenance of NBS. However, this does not account for recent history of different departments within this council being responsible for selling open green spaces to developers as part of the city's 'invest to earn' strategy. Although different departments within municipal government often work separately, the public will view their actions as a homogenous body, thus raising issues regarding hypocrisy of introducing NBS, whilst destroying areas of extant GI.

Any major urban infrastructure project that will affect the everyday lives of citizens must be transparent to promote legitimacy as part of good governance (Kronsell, 2013). This is particularly important for NBS, because as an environmental management system they fall under laws regarding public participation in environmental decision-making enshrined by the Aarhus Convention, as well as requirements in the UK National Planning Policy Framework for citizens to be involved in planning (UNECE, 1998; URBAN GreenUP, 2018c). In order for NBS to be considered a resilient solution, the public needs to have a good understanding of what they are and why they are worth implementing. In part, this is because of their

association with Liverpool City Council and people want to feel that taxes they pay are spent appropriately (Dorste *et al.,* 2017). Part of being transparent includes ensuring people understand wider topics such as climate change and ecosystem services (McPhearson *et al.,* 2015). If citizens don't understand the role of NBS and their benefits, they are unlikely to show a preference for NBS over other potential solutions to societal issues. This reflects that transparency is not just part of legitimacy and trust; it also relates to public support of NBS as it is impossible to gain support if people are unaware of the problem-framing that is used to justify NBS as a solution over potential alternatives.

Partner interviews and workshops highlighted a potential issue regarding transparency in the terminology used surrounding urban greening including NBS, the latest term in this sector of urban greening approaches. Partners perceived terminology associated with NBS projects and URBAN GreenUP to be too technical for citizens to understand – this language was perceived to have limited use outside of policy arenas particularly those relating to the EU. Contrary to this, citizens appeared to find the term NBS more intuitive than GI, which caused confusion mainly due to the word 'infrastructure' that is inherently tied to the built, hard-engineered environment of the city. Potentially, policy terminology forecloses transparency of NBS projects as in this case, it was assumed that the associated policy language was too technical for non-experts to understand. This contributes to technocratic governance of NBS and may be part of the issue of limited opportunities for civic participation.

On the other hand, as discussed in the literature review (Chapter 2), NBS has emerged from the foundations of GI, ecosystem services and ecosystem based adaptation, all the way back to the roots of urban greening (which has a long history stemming back to the Victorian industrial era in Europe) (Scott and Lennon, 2016). Workshop questionnaire results indicated that urban greening and green space, and their associated benefits are well understood across stakeholder groups including citizens. Common examples such as parks were easily identified as well as more innovative examples like green walls in questionnaires. Ultimately, urban greening or green space come under the NBS umbrella in some form – and therefore engagement can remain transparent if appropriate language is used for the audience. This was iterated by partner interviewees who felt that language regarding NBS could be adapted to allow citizens to understand and engage with URBAN GreenUP. Furthermore, questionnaire answers and research by Mendes *et al.* (2020) reflected that the term 'nature-based solutions' is more intuitive and easily understandable for citizens, especially compared to related terms such as GI; which contrasts with partner perceptions that citizens wouldn't understand the terminology.

5.3.3 Trust

It became apparent during the mapping workshop that trust in Liverpool City Council regarding management of green space is extremely low. Overall, participants in workshop questionnaires reported that they did not feel there were practical barriers to engaging, but one key barrier was that they felt those in power did not respond to their concerns and therefore their engagement doesn't make a difference – indicating a lack of trust in public officials. Although there was a lack of practical barriers, this shows a barrier posed by a lack of legitimacy which acts as a deterrent to engaging (Kronsell, 2013). This shows that lack of transparency around how feedback is handled may translate to the public as inaction even when this is not the case. It may also reflect that participants don't believe their contributions have been utilised effectively in the past.

Indeed, participant observation in the mapping workshop reflected deep mistrust in the local council in light of disputes regarding green space; there was clear hostility towards NBS projects that had any association with the council and participants showed little interest in completing the workshop activity or questionnaires. Responses on questionnaires indicated that they felt NBS would not be an effective climate change adaptation strategy and might be considered to be 'greenwashing' – an attempt to appear to be improving the city's sustainability but having little or no real effect. This was perhaps less of a reflection of participants' opinion of NBS and more reflective of their faith in the council to deliver based on historical performance. They felt the scale of NBS implementation was too small and therefore tokenistic, which would indicate they felt urban greening efforts need to be scale-appropriate to have any real impact on Liverpool.

Concerns were also iterated verbally at the Forest Bathing Pod event which I attended to observe an official URBAN GreenUP engagement event. In particular, there was a great deal of confusion regarding the council having a role in URBAN GreenUP whilst other departments within the same council have historically made decisions to sell green space to developers. This is one of the many difficulties of improving green infrastructure in the wake of deep austerity cuts. Although NBS aim to unite different 'sectoral silos' and organisational departments (e.g. different departments within the council) this issue may highlight that this lack of communication and consensus between departments may be problematic to building trust regarding nature-based solutions (Droste *et al.,* 2017). Transparency regarding such institutional dynamics may aid public understanding of green infrastructure policy that may seem contrary to previous actions.

Lack of trust proved to be an instant barrier to meaningful engagement, particularly for the mapping workshop in Sub-Demo Area A, the Baltic Corridor where participants expressed unhappiness regarding green open spaces in Liverpool – there was limited interest in the activities focused on the benefits of NBS as development threats to open green space took centre stage. It is clear that deep austerity cuts in the local authority has resulted in erosion of trust in Liverpool City Council which may act as a deterrent to engaging with URBAN GreenUP. This may represent challenges to future engagement plans for URBAN GreenUP. On the other hand, whilst URBAN GreenUP's planned engagement activities may be limited in their potential for knowledge co-production, they could be beneficial in starting to re-build trust in the council to lead NBS projects by helping to demonstrate their commitment to improving and creating innovative NBS in the city. It may be useful for future engagement events around URBAN GreenUP to focus on their commitment to transparency, as there is a lot of confusion surrounding the council's role in the partnership (IUCN, 2020). URBAN GreenUP partners will be asking for suggestions on future NBS, so it is vital that citizens are able to see how this feedback has been used. Transparency regarding the use of feedback on NBS ameliorates the risk of undermining trust, by avoiding misconceptions that nothing has been done with feedback given.

5.3.4 Place-making

"Place-making and connecting people to nature through NBS" (Raymond *et al.,* 2017).

Place-making is considered to be an important outcome of implementing NBS in Challenge 7 of the EKLIPSE framework (Raymond *et al.,* 2017). However, the potential role of NBS in place-making and regeneration is unclear and underexplored at present (Gulsrud *et al.,* 2018). The EKLIPSE framework only mentions 'place-making' in brief and does not detail the contribution of NBS to place-making or why place-making may be considered to be a co-benefit of NBS. As it has been included as in 'Challenge 7: Participatory Planning and Governance', one might assume that civic participation in knowledge co-production of NBS woul be a key aspect of place-making as an outcome.

In URBAN GreenUP the perceptions of green space by citizens are being collected over the course of the project to ascertain whether citizens are able to access green space they perceive to be high quality (URBAN GreenUP, 2017c) This is essential to design socially inclusive NBS. Sometimes when discussing multiple co-benefits of NBS social

cohesion and social inclusion are stated to be benefits of NBS without explaining the mechanism – in order for NBS to result in such outcomes, views of citizens need to be gathered so that NBS can address community needs (Haase *et al.,* 2017). This is expected to improve delivery of multiple co-benefits, promote social inclusion and transform perceptions of the area by tailoring NBS to the local area considered.

NBS have been described as distinct from both highly engineered environmental management methods as well as previous related concepts such as GI by adopting social-ecological principles (Gulsrud *et al.,* 2018). This is clear within the Challenge 7 defined by EKLIPSE, which expresses the importance of the process of place-making and connecting people to nature through NBS (Raymond *et al.,* 2017). These principles recognise the profound impacts re-naturing can have for human wellbeing that cannot be separated into 'social' or 'ecological' categories as they inform one another. Historically, delivering ecosystem services to urban areas has been done with a 'view from nowhere' focusing on the economic gains from services such as flood defence, rather than recognising sociocultural values that are deeply place-based, with green space having a vital role in forming community identity (Gulsrud *et al.,* 2018). NBS can therefore be instrumental in shaping community identity and everyday social practices through their presence in the urban environment.

The passion expressed for the few green spaces in Sub-Demo Area A, the Baltic Corridor by participants reflects the importance of a place-based approach that recognises how green spaces contribute to the construction of community identity, with participants stating that it is a vital social space for local residents. In this case participants felt that the Baltic Green was a key part of the areas' character and draw for those visiting the area and were extremely concerned for its future (Livingston *et al.,* 2010).

Questionnaires from the workshop revealed that citizens placed a high value on biophysical benefits of NBS, when discussed as a general concept, such as improved air quality and biodiversity. However, when considered specific to the local level more priority was placed on aesthetic value. Different communities may hold different values for which NBS they think improve the character of the local area; this may be a good reason to increase the degree of co-creation with citizens. A community might support the idea of NBS, but if they feel the design conflicts with the character of the area the intervention is unlikely to last beyond the lifetime of the project.

This reflected that workshops could work as a useful tool for NBS engagement as a workshop can be structured to elicit perspectives on green space that cannot always be captured by direct questions in questionnaires alone. Bringing together different individuals allows participants to consider what NBS might mean to sense of place in their community,

and help communities reach consensus on what are the exact 'solutions' they are looking for from NBS. The process of social learning allows participants to make informed decisions and understand NBS in the geographical context considered through iterative interactions and open, creative discussions (Lauer *et al.,* 2018; Turnhout *et al.,* 2020). This also minimises the risk of discussions being dominated by special interest groups, allowing multiple constructions of sense of place to be articulated at once (Sarzynski, 2015).

This links back to the discussion on co-production; place-making is a continual process that is deeply intertwined with people's relationship to a particular locale. EKLIPSE Challenge 7 states that NBS will connect people to nature and contribute to place-making but does not expand on the mechanism that results in 'place-making'. Arguably, this outcome of engagement cannot happen without knowledge co-production taking place, as citizens perceptions are one of the main elements of construction of place. Place-making may be the most important outcomes of citizen engagement, as it relies upon and brings about many more beneficial outcomes for NBS (Gulsrud *et al.,* 2018). As highlighted above, the workshop setting represents an opportunity to consult citizens on what they think characterises the area and highlight challenges (Gulsrud *et al.,* 2018). This was demonstrated in my green space mapping workshops in Sub-Demo Area A where participants were asked to define the character of the Baltic Corridor; finding out what people valued as well as what people thought were problems in the area. This brought to light personal ties to green space there; for example, campaigners are fighting to 'Save the Baltic Green', and highlighted an event that was part of this campaign. Furniture had been constructed from pallets by local artists and placed on this area temporarily to show how the green space could be used. People felt that community focal points such as these were being lost to development which is occurring unsustainably. This was tied to wider issues such as only attracting transient populations such as students due to the high number of studio apartment blocks under development. This is in line with issues articulated in the media about gentrification in the Baltic Corridor; a problem being experienced in cities across the world which is growing in prevalence (Houghton, 2017; Scott and Lennon, 2016).

The final activity of the mapping workshop reflected the importance of always keeping place-making at the forefront of NBS. Activity 3 was a discussion of whether the nature-based solutions identified in Activity 1 might be solutions to the unique challenges faced by Sub-Demo Area A. Participants in the workshop reflected that NBS were unlikely to make much impact on what they had decided were the 3 most important challenges: irresponsible development/overdevelopment (directly linked to belief that the council is corrupt), gentrification and accessibility of the area. If NBS are simply implemented *in* the community instead of *with* the community, they may receive limited support compared to

addressing issues defined by local people. For example, part of the plans Sub-Demoa Area A include a floating island, which partners reported has faced some opposition during the consultation phase – potentially, once URBAN GreenUP comes to an end in 2022 it may risk removal (Andersson *et al.,* 2014). Partners reported that in Sub-Demo Area C, URBAN GreenUP has engaged Friends of Parks groups such as Friends of Sefton Park to assist with monitoring and co-producing knowledge about the floating reed beds and biodiversity in the corridor. This may be instrumental in creating a sense of ownership over these URBAN GreenUP interventions and contribute to their longevity by encouraging maintenance and monitoring from these groups. This reflects the difference between co-producing NBS *with* communities, compared to implementing NBS *in* communities.

5.3.4.1 Place-making and trust

Implementing NBS from a place-based perspective may have reach beyond improved service delivery and could be useful in addressing the council's legitimacy issues. As discussed in previous sections of the Discussion, the mapping workshop uncovered deep-seated mistrust in Liverpool City Council that has stemmed from decades of unsustainable development (Thompson, 2015). This has been amplified by austerity as the council has fallen under pressure to fill in huge gaps left by central government funding cuts – resulting in choices that help meet these shortfalls in the short term, with little regard for longer term impacts (Mell, 2018). These choices have proved extremely unpopular with citizens, who have now come to expect battles over many open green spaces and believe the council to be corrupt.

Co-production of NBS with citizens as a place-making exercise may be useful in reinstating trust in the local authority – however, austerity has caused issues that are more pressing in the daily lives of people than development of open green space. Mistrust has sprung from decisions made under austerity, along with the legacy of Thatcher's government. It should be noted this is not a claim that co-production workshops on NBS would be able to remedy deep-rooted problems and associated mistrust caused by central government. Any workshops on NBS should be clear about the scope of what they aim to achieve in order to manage expectations (Needham, 2008).

5.3.5 Connection to nature and environmental stewardship

EKLIPSE Challenge 7 recognises the positive impact NBS can have for connecting people in urban areas to nature. Participants in the citizen science workshop in particular felt that NBS based workshops might be a good method of supporting the role of NBS in connecting citizens with nature through ecological learning-based activities. In an increasingly urbanising society, connecting people to nature is recognised as a vital function of NBS (Hoyle *et al.,* 2017). In part, 'connection to nature' is part of the mechanism by which green space can improve mental health by prompting feelings of biophilia, which describes an innate appreciation of nature. In this way NBS can act as the mediating platform that engages people with nature in the context of the city, where it is often difficult to access due to the areas being mostly entirely built up. Participants in the citizen science activity reported enjoyment of feeling close to nature. This reflects that engaging citizens with monitoring, which will be part of URBAN GreenUP in the form of a bioapp may have outcomes beyond EKLIPSE Challenge 7 and link into other co-benefits of nature-based solutions.

Using NBS as a means of promoting the principles of environmental stewardship may be important for multiple reasons. Although funding for implementation of NBS in Liverpool has been secured through URBAN GreenUP, there may be limited budget for maintenance given the economic conditions imposed by austerity measures since 2010 (Dorste *et al.,* 2017; Mell, 2018). Whilst some cities in the UK suffered lower central funding reductions or have somewhat recovered, Liverpool has a £57 million deficit in their budget (BBC News , 2019). Addressing this issue will require further cut-backs and further limit maintenance of green infrastructure. Promoting environmental stewardship through activities based around NBS therefore might be useful in encouraging citizens to help take part in maintaining green infrastructure around the city where possible.

Results from the workshops support the position that engagement with NBS might encourage environmental stewardship, particularly those from the citizen science workshop (Cornwell and Campbell, 2012). Some participants expressed an interest in volunteering with Friends of Sefton Park, who run weekly activities such as litter picks in the park to help maintain the green space. This reflects that publicity of NBS and activities that involve actively interacting with NBS might encourage people to help maintain them; for example, as part of planned monitoring activities to co-produce knowledge with Friends of Sefton Park.

Workshops around NBS might encourage environmental stewardship on a greater scale than maintaining NBS in the local area. For example, an interviewee reflected on the potential of NBS to inspire citizens to see what they could do with their own gardens – for example turning lawns into a wildflower meadow to encourage pollinators. However, as

highlighted in Layer 2 (see Figure 13; P 78) with regards to considering private gardens in green infrastructure coverage, altering private gardens may have limited impact as an NBS because the garden is only accessible to the landowner and this does not fulfil social justice aims of NBS (Haase *et al.,* 2016; Raymond *et al.,* 2017). Another impact of the workshop may be to help citizens connect with nature and reflect on the role of humans in a social-ecological system – this might inspire a wider culture of sustainability and stewardship for the wider global environment (Lauer *et al.,* 2018). For example, many citizens that participated in the citizen science workshop felt motivated to participate in activities around NBS.

Although directly following the citizen science workshop, participants may have felt more inclined to take part in environmental stewardship activities, there is no evidence that this had social learning impacts e.g. actual behavioural changes. Due to time constraints, it was not possible to study the long term effects of engagement with NBS. However, other studies have examined the immediate and longer term effects of environmental education activities in outdoor settings similar to this workshop (Stern *et al.,* 2008).

Generally, inclination to engage in environmental stewardship activities tends to be short-lived (Stern *et al.,* 2008). Whilst self-reported questionnaires reflect that participants may be more likely to engage environmental stewardship behaviours, it was not within the scope of this research to conduct follow up questionnaires to detect lasting behaviour change. However, studies reflect that the impact of learning about the benefits of nature can be limited in terms of promoting connection to nature and environmental stewardship on a long-term basis (Stern *et al.,* 2008). A study on outdoor environmental education by Stern *et al.* (2008) reflected that inclination to perform environmental stewardship activities increased by 10% compared to pre-experience when measured directly after participation, but after a period of three months the increase was only 5%. Connection to nature only increased by 2.1% in the pre-experience results compared to the directly following post-experience results. The difference in the three month follow up results were not significant. Furthermore, other studies question the value of environmental education – in Otto and Pensini, 2017, gaining environmental knowledge did not increase connection to nature. This might suggest that engaging with NBS and learning more about them may not lead to the expected outcome detailed in EKLIPSE Challenge 7 of connecting citizens to nature. However, on the other hand, increasing connection to nature can be more important to promoting environmental stewardship than having environmental knowledge (Otto and Pensini, 2017). In Stern *et al.* (2008) there were lasting impacts of increased awareness of the benefits of nature, which might mean engagement with NBS won't necessarily boost connection to

nature or encourage ecological behaviours but could contribute to increasing awareness of NBS and climate change.

5.3.6 Environmental literacy

Public concern regarding the environment is at a record high – 27% of British people believe it is one of the three most important issues facing the country. This number rises to almost half of 18-24 year olds (Carrington, 2019). This research has reflected that workshops might be a good method of raising the profile of NBS, as well as using NBS as a tool to learn about wider sustainability issues such as climate change. Environmental awareness has been identified an integral precursor for civic participation in environmental management schemes such as NBS. However, awareness alone is limited in is capacity to drive meaningful engagement; participants need to have a good understanding of the impacts of NBS in order to form informed opinions (Hawkins and Wang, 2012).

Policy documents and interviews support that the presence of NBS in the city may have a role in raising awareness of the services natural processes provide to society. This has been specified as a major role for the floating island in Sub-Demo Area A. Interviewees described potential for some interventions to be accompanied with an information plaque or QR code to describe their function, because the ecosystem service delivery function of NBS is not always obvious. Another example from policy documents and interviews is the use of signage to explain that pollinator verges require an autumn dieback phase, as this can appear to be lack of management (Hoyle *et al.,* 2017). In both cases, the visibility of NBS helps the public to learn about the function of NBS – people are more likely to support NBS if they understand its benefits and conflicts may be minimised if the potential for misunderstanding management techniques is minimised. There is potential to engage citizens on differing functionality of green spaces such as the difference between biodiversity improvements of a playing field and an urban forest which might go further in terms of how NBS might improve environmental literacy (Hoyle *et al*., 2019)

Understanding NBS may be an important precursor for effective engagement in co-creation of NBS because people need to understand what can be done and what cannot. Interviews highlighted that during the consultancy phase of URBAN GreenUP, citizens requested cycleways across the city. Whilst NBS form a key part of strategies to improve the sustainability of cities, cycle lanes were not considered within the remit of NBS in the URBAN GreenUP case study. However, it should be noted there may be some scope for cycle lanes to be adopted into NBS generally should they meet key criteria of increasing green space if they are made of permeable green surfaces or by forming green corridors with bioswales and tree planting accompanying the routes. However, different NBS projects

will have varying goals, budgets and definitions of key criteria for an intervention to qualify as NBS and this needs to be understood by all stakeholders including citizen stakeholders. If citizens don't understand these key aspects which may constrain the remit of a particular NBS project they may be disappointed if that project is then unable to deliver potential solutions for sustainable cities. Expectations of NBS need to be managed to avoid undermining trust in the project.

5.3.6.1 Can learning about nature using NBS go beyond 'awareness' of the function of NBS?

URBAN GreenUP has informed the public about what nature-based solutions can offer but so far, has not explicitly linked wider themes such as ecosystem services, sustainability and climate change in engagement materials. Interviews indicated that citizen science via use of an URBAN GreenUP bioapp will be one of the main ways the project will engage citizens in NBS. Workshops looked at how NBS might be used an environmental education tool that uses NBS as a platform to engage people with wider themes that are connected to NBS and to gain understanding of ecosystem services through hands-on learning. This might help facilitate outcomes outlined by EKLIPSE such as connection to nature and fostering environmental stewardship. However, as discussed in the section above, there is evidence that these outcomes can be insignificant and don't change much compared with prior to engagement. The citizen science and mapping workshops may be considered as a way to demonstrate how NBS themselves can be used an educational tool and therefore increase their use-value (Dorste *et al.,* 2017). The workshops resulted in some improvement to participants' knowledge of NBS and ecosystem services and their confidence to articulate this knowledge. However, much of the learning was superficial and the difference between knowledge before and after the workshop was insignificant. In part, this may be because attendees to both the citizen science and mapping workshop were highly educated and already engaged with environmental stewardship activities or were involved in the environmental sector as a practitioner. Results may have been different if there had been more time to seek out a more diverse sample. Furthermore the types of workshops that could be carried out were limited as it would have been disingenuous to portray workshops as an opportunity to have input into NBS planning in Liverpool.

There is some evidence from workshops and interviews that NBS may be useful as a learning tool that would connect citizens to nature, a key aim of EKLIPSE Challenge 7 but further evidence suggests this might not have a huge impact on promoting an ecological culture in Liverpool (McPhearson *et al.,* 2015). However, as earlier remarks in this

discussion have indicated that a more environmentally literate society may seek out a larger role in decision-making. Therefore, future NBS workshops should focus on learning about NBS in a way that equips participants with skills for decision-making in NBS policy (Hawkins and Wang, 2012). This can only be done if the workshop will lead to participants being able to have input on real life decisions for NBS, otherwise it risks undermining trust, which has already been identified as a barrier to engagement with NBS projects in Liverpool.

5.3.7 NBS policy support

Policy support was identified by URBAN GreenUP partners as a key benefit of engaging citizens with urban greening projects. In theory, if citizens have access to information about NBS and see positive changes to the city as a result of urban greening then policymakers at the municipal level may be more likely to support NBS policy and ensure they continue to be maintained and improved (Kabisch *et al.,* 2017). The potential for engagement to build political support for NBS was also identified by attendees to the citizen science workshop.

Participants expressed that having taken part in the workshop, they felt supportive of URBAN GreenUP's aims. This echoes the project partners' claims that engaging with NBS may be beneficial to increasing participants understanding of the multiple co-benefits of NBS and result in gaining political support for urban greening projects. This is important as citizens approval of NBS will be key to maintaining their presence in the city; if they do not understand multiple co-benefits of NBS, they risk being replaced by infrastructure perceived to be of higher value (Hawkins and Wang, 2012; Kabisch *et al.,* 2017).

However, the effectiveness of citizen engagement as a means to gain policy support is variable depending on how citizen experiences are used (Gulsrud *et al.,* 2018). The presumed mechanism behind citizens driving NBS policy strengthening is via locally elected officials. Authors on public participation have criticised the status quo of relying on elected officials to communicate citizens' needs as being insufficient to meet democratic aims, hence the need for direct public participation (Nelson *et al.,* 2008). This may represent an opportunity to utilise citizen voices to allow the public sector to respond to citizens needs more effectively by directly involving them in co-producing knowledge and co-creating nature-based solutions (Baptista *et al.*, 2019). Making room for these processes may allow citizens to directly communicate which areas they perceive to be areas of need in their community. Policy support for NBS could be further enhanced if citizens feel a sense of ownership of NBS that result from processes of knowledge co-production.

6 Chapter 6: Conclusion

6.1 Summary of key findings

This research has examined the role citizen participation in NBS, by examining the case study of URBAN GreenUP. The key finding has been that in comparison to many NBS projects documented in the literature (Frantzeskaki, 2019), citizen participation in URBAN GreenUP has been relatively weak to date. This may be because in this example, citizen participation has taken the rational decision-making approach where citizens act as voters rather than having direct involvement with planning NBS (Healey, 1998). There are number of reasons this approach has been taken rather than actions to support citizen involvement to a higher degree. Co-creation with citizens has not been central to the project, in part because of the type of project it is; a collaborative private-public partnership rather than a bottom-up local sustainability initiative. Other NBS examples that have had a greater emphasis on co-creation have been small-scale to date; such as the creation of one pocket park (Frantzeskaki, 2019) – whereas URBAN GreenUP encompasses multiple interventions across three green corridors. There may be scope to scale up engagement, even in larger citywide projects but co-creation with citizens would need to be a central aim from the outset of the project. Furthermore, it would be extremely difficult to engage citizens in the planning of a suite of interventions rather than just one, as the trade-offs would exponentially increase due to the scale of the project. Other considerations include the capacity of citizens to be involved to such a high degree, funding and flexibility of a technocratic approach to urban greening.

This brings into question what role citizens have as stakeholders in URBAN GreenUP, given the limited opportunities to participate in the planning stages. It appears that the main role of citizen engagement in this case study has been to inform citizens about the project. This has been successful in many respects, for example in meeting IUCN guidelines and EKLIPSE Challenge 7 aims of maintaining transparency throughout NBS projects, to foster trust in URBAN GreenUP and promote NBS policy in Liverpool. So far, in URBAN GreenUP engagement events and in my own workshops members of the public have expressed positive perceptions of NBS as a result of engagement. At the same time, however, workshops revealed serious mistrust in Liverpool City Council, who are leading the collaborative public-private partnership and are the most obvious accountable body, as a government organisation. This research suggests thi is based on public knowledge of decisions made by local Labour councillors during austerity measures imposed by several

central consecutive British Conservative and Conservative coalition governments, mostly relating to an 'invest to earn' strategy which has led to development of open green spaces (Whitehead, 2015). This may reduce the willingness of citizens to engage with URBAN GreenUP and cause them to be sceptical of information they are given about urban greening plans. There is consensus from literature on collaborative planning, governance and participation that the best way to engage citizens is to ensure they are on board with a project as soon as possible (Stout and Love, 2018; Mendes *et al.,* 2020; Frantzeskaki, 2019; Ambrose-Oji *et al.,* 2017). Citizens have only been informed from the consultation phase of URBAN GreenUP onwards, which imposes limits on how the citizen engagement approach can be changed, given that implementation of interventions is set to go underway. However, it may inform future NBS projects in Liverpool and demonstrate the potential benefits of enhancing knowledge co-production with citizens.

NBS are defined as being separate, or a step beyond related terms such as green infrastructure, as they take a social-ecological approach that looks at their holistic impact on both the environment and communities in urban areas (Gulsrud *et al.,* 2018). For this reason it is important that NBS projects adopt a place-based approach that takes the unique needs of the communities in which they are implemented into account. This is especially important given that defintions of NBS highlight that they provide solutions to specific problems and should be adapted to the local context (European Commission, 2015; IUCN, 2020). NBS shouldn't just have assumed social impacts on a community; communities should have some input in defining what their needs are to maximise multiple co-benefits. This approach to citizen engagement could be particularly important in Liverpool for remedying trust issues in the local council by showing a commitment to urban greening that is socially inclusive.

6.2 Relation of key findings to objectives

The table below summarises all key findings directly in relation to research objectives outlined in Table 2 in the Methodology section.

Table 10: Linking research objectives to key findings

Research objective	Key findings
4. To investigate current literature about NBS and civic participation	The literature review explored in detail, the emergence of the field of NBS and identified particular barriers to their mainstreaming. Civic participation was

	explored as a subject, as well as specifically One of the key issues that emerged from the literature review was the
5. Examine governance of NBS	Governance approach was a key focus of the Literature Review, due to its profound influence on the role of community engagement and collaboration with citizens in design and implementation of NBS. I found that NBS, being an umbrella term encompasses a range of approaches which vary in governance strategy; including public-private partnerships, government led approaches and citizen-led grassroots interventions. To date, the role of governance and whether it has a profound impact on effectiveness of NBS remains unclear and has been underresearched. URBAN GreenUP was a private-public partnernship, a model which lends itself to urban settings because much of the city area is privately owned, so the role of private stakeholders in such NBS projects is essential. This ultimately contributed to a lack of meaningful engagement with citizens, as engagement of private stakeholders had to be prioritised to ensure interventions could go ahead. Although as stated previously, governance cannot be directly linked with effectiveness but this finding suggests some link between private-public partnerships and the stakeholders that are prioritised in engagement methods.
6. To identify the degree of participation within a research-led NBS project, with URBAN GreenUP as the case study	Citizen participation in URBAN GreenUP so far has been categorised as weak, with the majority of efforts to date having a primary

	aim to inform citizens with limited consultation. This approach would be considered low on Arnstein's Ladder of Citizen Participation, at the level of tokenism. Partner interviewees were enthusiastic about involvement of citizens on the project, but were balancing this aspect alongside a long list of competing objectives, reflecting a barrier to widening participation. Workshops revealed enthusiasm on the part of citizen participants for greater involvement in NBS and other climate action interventions, but also distrust in the council which has built over a number of years leading on from deindustrialisation and austerity measures.
7. To underpin the role of the public as a key NBS stakeholder: • Role of citizen engagement in planning and management of URBAN GreenUP • Benefits to citizens from participation in NBS • Benefits to URBAN Green UP from participation of citizens	Citizens' role in URBAN GreenUP has been very limited to date. There have been a small number of engagement activities aimed at informing, such as the Forest Bathing Pod and consultations for each Sub-Demo Area following initial design of interventions. Outside of events, interview participants detailed radio announcements, press releases, the URBAN GreenUP website and leaflets. These one-way communications reflect the limited role of citizens during the time in which I was studying URBAN GreenUP, which was following the majority of planning but pre-implementation of interventions. Interviewees detailed plans for engagement post-intervention including use of the bioapp iNaturalist, for citizens to help monitor biodiversity in the Sub-Demo Areas, and creation of an online citizen

	portal for feedback on URBAN GreenUP. This reflects a greater level of knowledge co-production with citizens but of course, remains speculative at present. Citizens who took part in workshops on the subject of NBS reported feeling more confident in their knowledge of NBS, and wanting to get more involved in NBS and climate action. In the pollinator survey activity, citizens enjoyed having an opportunity to connect with and learn about nature. The PGIS activity in particular however, revealed that having limited voice in the actual planning stages has been a point of contention and risks undermining already eroded trust in decisionmakers, which may lead to negative view of NBS. Given the limited scope of citizen engagement with URBAN GreenUP to date, it is difficult to pinpoint benefits to the project from engaging citizens. Partner interviewees expressed the view that citizens might be more likely to provide political support for NBS as a result of engagement, whether passive or directly; this link is difficult to prove in absence of long term study. There was some disparity between what decisionmakers think citizens are looking for and their actual concerns, reflecting the importance of centralising place-making and co-creation in NBS. For example, citizens in the PGIS activity felt URBAN GreenUP interventions were much too small to improve environmental parameters such as air quality, whereas

	partner interviewees held the view that citizens would be supportive purely due to perceived aesthetic improvement to an area through urban greening. This gap in actual citizen perception of NBS versus that presumed by project partners may result in lower levels of political support from the public than hoped for by decisionmakers.

6.3 Contribution to Scholarship

The principal finding of this research has shown that there was a real lack of depth of engagement and the timing within the project timeline limited the ability to make the best use of knowledge co-production capabilities of community engagement when it is utilised from the early planning stages onwards. This suggests that engagement activities should feature as early in the project as possible, and should endeavour to improve outcomes such as co-production which tends to occur in relation to in-depth engagement from an early stage. NBS are marketed on the basis that harnessing natural processes can solve social, economic, and governance challenges as well as environmental issues but it may fail to 'solve' those most important to peoples' daily lives if engagement is performed inadequately. Community engagement in NBS can be used as a form of urban place-making resulting in positive transformations in both perceptions of place alongside the delivery of climate change adaptation interventions. At present there is a gap in defining the value of community engagement to NBS outside of perceived inherent value of engagement or accepting it as an essential statutory planning requirement. Examining engagement with NBS from an urban place-making perspective highlights its instrumental value to NBS projects. In this case, it was found that lack of trust has eroded social capital in Liverpool – and meaningful engagement with NBS may go some way to rebuilding it. 'Meaningful engagement' means engagement that leads to citizens being involved in decision-making for NBS from an early stage as being informed about NBS has limited use beyond enjoyment of the individual activity. Therefore, if community engagement is to have instrumental benefits to NBS policy (as a 'means to an end') that are not related to perceived inherent value of 'engagement' as an aim in itself, it is imperative that knowledge co-production with citizens becomes the main aim of engagement, rather than as the dead-end aim of 'raising awareness' of multiple co-benefits – which does little in terms of improving NBS. Placing knowledge co-production at

the centre of engagement activities would prioritise ensuring ‘solutions’ provided by NBS meet the needs of the local community, taking into account the geographic, historical and socioeconomic context. It may also engender feelings of ownership, if citizens feel they’ve had a role in creation, maintenance and monitoring of interventions; hopefully promoting the longevity of interventions.

6.4 Limitations

There are a number of limitations that have occurred over the course of this research and recognition of these is warranted to gain insight into potential knowledge gaps that could be explored in future. Issues mainly relate to time constraints and the timing of the research in relation to the phases of Urban GreenUP, but some issues were identified after following the methodology protocol set out in the planning phases of the research.

URBAN GreenUP is a 5 year project running from 2017 to 2022, but I have only had the opportunity to study it for one year. This has limited to depth and breadth of my research, only providing a snapshot of the period 2018-2019. A major issue is that I have observe short-term impacts of engagement with NBS. This is an issue because research indicates some outcomes of engagement, particularly those that relate to knowledge outcomes, are likely to weaken over time. It also limits ability to observe whether URBAN GreenUP’s citizen engagement strategy changes over time – this important, as any findings drawn about engagement with NBS are related to the engagement strategy at present. Furthermore, this highlights the problem of using a single case study method; approaches to citizen engagement varies from project to project based on governance framework, scale of project and the aims of the NBS project. It therefore might be insightful to examine a project where citizen engagement in co-creation of NBS takes more precedence – this however may have the drawback of being smaller in scale.

A further issue related to the single case study approach is that this limited my ability to compare how governance approaches impact citizen engagement with NBS; for example, examining a grassroots, community-led NBS project might act as an interesting point of comparison. In the case study used, it was found that the role of citizens in decision-making was quite limited – this made it difficult elucidate potential benefits of engagement with NBS. Therefore, focus was on what had not been done and it was difficult to elucidate the impact of engagement beyond ‘awareness’ of NBS. It may be easier to be able to examine an example where knowledge co-production and co-creation of citizens has been a cornerstone of the project. Conclusions regarding the role of citizen engagement with NBS may vary in the case of an NBS project with a different approach.

A major limitation in my workshops was an inability to facilitate two-way knowledge transfer. This seriously limited my ability to demonstrate the use of workshops to engage participants in NBS in meaningful ways. It is difficult to draw conclusions about the use of workshops to improve engagement when they ended up repeating the pattern of engagement in URBAN GreenUP so far – with a style that lends itself to informing, rather than giving participants an opportunity to shape NBS. Part of this issue arose from joining the project following the planning phase; more insight into the role of urban place-making through knowledge co-production may be gained by researching an NBS project in the planning phase, particularly if it is heavily oriented towards co-creation with citizens. In particular, the citizen science workshop did not facilitate enough discussion between participants compared with the PGIS workshop, which majorly limited insights into place-making and trust. The PGIS workshop followed the citizen science workshop, and it was only after listening to participants of that session that it came to my attention how deep the distrust in the council was, and that a positive reception to NBS cannot be guaranteed. Having seen NBS so well received in the first workshop, I had not been prepared for such a contrasting response; the session highlighted the very real impact of place even across a very small geographical area. It also suggests that, in situations where this distrust is so prominent, it may be valuable to bring in a trained facilitator who is experienced with these situations and could potentially act as a broker between citizens and the local government. It also underscores the fact that those implementing NBS need to invest time in building trust and rapport with communities, if they want meaningful co-creation and co-production to take place, as is the intent with NBS interventions.

Time constraints limited my ability to select a diverse group of participants; as a result the participant profile tended towards what is described as the usual suspects (Sarzynski, 2015) – older, well educated, white and those already keenly interested in environment and planning. This is an issue as participation in urban greening aims to open up involvement to those who might not usually be given a voice in local matters, rather than attract dominant views that end up reproducing the same outcomes over and over. Future research might examine NBS project partners' approach to engaging citizens, and what strategies they employ to open up participation proceses. Marginalised communities can be reached by engaging with organisations who work with such groups; this will require some degree of research and networking in order to seek out relevant organisations in the local area. For example, Groundwork UK is a federation of UK charities that work with disadvantaged groups on NBS-based community projects such as gardens (Groundwork UK, 2020). It should be noted it may take a significant amount of time to build the social capital that acts as a prerequisite to engaging, and thus may be difficult to achieve in NBS

projects such as URBAN GreenUP which work to extremely short timelines (Lee and Abbot, 2003; Rydin and Pennington, 2000).

6.5 Reflections

Conducting research within the boundaries of a pre-defined project, URBAN GreenUP was challenging for a number of reasons. First and foremost, I was unable to observe URBAN GreenUP's engagement directly for the most part, particularly the consultations and open days which would have provided a lot of insight into this aspect of the project. I was able to attending the Forest Bathing Pod event, but this was late into my fieldwork and thus, was only able to inform a very small part of the overall body of work, and did not fit well with the methods I had chosen to try to work within the bounds of what I could do linked to URBAN GreenUP. In part, this was due to the timing at which I joined the project, which again, was outside my control. Additionally, some of the tension in the workshops arose from the failure of URBAN GreenUP to engage citizens earlier on in the project which understandably led to frustration. This of course, reflected the importance of a platform for citizens' voices to be heard in a democratic society but it did make this aspect of the research difficult to conduct. For example, participants wanted to redraw the boundaries of the Sub-Demo Area A, reflecting that engagement with the project had been inadequate, as no one was aware of where interventions were going and why those locations had been selected. As one partner interviewee had described, retrofitting is one of the main reasons interventions cannot always go in what may be considered optimal locations by the public, and better engagement might have eased this particular issue.

Part of the problem of community engagement in URBAN GreenUP was the fact that at its core, the project was not looking to co-produce knowledge on planning, design and management of NBS interventions with citizens as a focal area to assess the 'success' of NBS in Liverpool. I have included this in my reflections section as it is important to note that the Key Criteria used to assess the effectiveness of URBAN GreenUP had been pre-selected before I joined the project (URBAN GreenUP, 2017a). Ultimately, this meant that interventions were designed to be assessed by this set of pre-selected criteria in which citizen engagement was one small aspect, alongside a range of environmental, social and economic co-benefits to be measured and evaluated.

Given a different situation in which I had been given the opportunity to be involved in URBAN GreenUP at an earlier stage, and at a deeper level than an external, independent researcher I would have suggested that Key Criteria ensures a critical evaluation of the role of citizens throughout the URBAN GreenUP project, looking at the pragmatic benefits of

involving them in the project rather than seeing any type of ‘engagement’ no matter how passive (e.g. press releases) as a benefit. I would seek to engage citizens prior to finalised designs of interventions, and perhaps plan an altered version of the mapping workshop but instead, use it as a planning exercise. I would also recommend consulting citizens on what they perceive to be problems in their area that might be solved with NBS, rather than solely relying on using intelligence tools to detect problems in urban areas. Making use of early engagement approaches such as engaging citizens on scoping exercises would likely have more impact in terms of increasing knowledge co-production with citizens. These approaches would help engage citizens on the deeper levels of co-production and help shape project outcomes directly. Again, time and resource tradeoffs must be considered, particularly in a project where the overwhelming majority of funding went directly into interventions themselves. However, if resources are to be set aside for community engagement it makes sense to maximise potential returns in terms of accessing citizens’ knowledge, rather than focusing on one-way, passive methods such as press releases or events such as the Forest Bathing Pod. Activities such as the pollinator survey could be run as part of encouraging citizens to log biodiversity changes in the Sub-Demo Areas using the iNaturalist app, and may be appropriate to contributing to knowledge co-production in the post-implementation phase. In the case of post-implementation phases engagement activities such as this, I would encourage seeking feedback on the project from citizens to help continue to improve NBS from a localised, place-making perspective.

6.6 Further research

The main gap identified in the Limitations section is the inability to examine the full impacts of participation and implications for knowledge co-production due to constraints on the level of citizen involvement in case study used. In order to fully explore how engagement can benefit NBS projects, it would be beneficial to study a project where citizens a granted a larger role in decision-making, from the outset of the initiative. This might allow for creation of workshops designed to develop skills in planning NBS and help citizens make informed decisions. Research over a longer time period would also be required to examine the long-term impacts of novel citizen engagement practices and whether increasing co-production has worthwhile benefits compared to the current model employed by URBAN GreenUP.

Workshop participants identified the benefits of meeting and learning from other participants; leading on from this, it might be interesting to explore the effects of social learning on effective governance of NBS, and how it might help facilitate the role of citizens

in co-creation of NBS and perhaps ultimately influence outcomes. Although the link between collaboration and effectiveness is a challenging area to research, it is an important knowledge frontier in governance research (Clement *et al.,* 2019). NBS projects are increasingly widespread, and this means that they could potentially act as living laboratories to study these interactions between participation, governance, and substantive outcomes.

NBS projects, where possible, should facilitate participatory governance and equip citizens with skills to co-create NBS where appropriate. This is particularly important in cities where trust and social capital is an issue; co-creation would be an opportunity to alter perceptions of place and role of green space in sustainable urban development. A project that engages deeply with an NBS project over a longer time scale would be useful to examine whether there would be significant gains in levels of trust and social capital that extend beyond urban greening.

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7 Appendix 1

7.1 Interview Guide

1. Can you tell me a bit about yourself, your role in URBAN GreenUP?
2. How long have you been involved in URBAN GreenUP?
3. How many stakeholders are involved in URBAN Green UP in Liverpool?
4. Can you describe their role to me? E.g. financial/consultancy/implementation/creative/public/private
5. What do you think are the main benefits of collaborating with different stakeholders?
6. As URBAN Green UP progresses how do you think the role of each stakeholder might change?
7. How flexible are plans for URBAN Green UP? Do you think there is capacity for plans to change in response to changing economic, environmental and social change?
8. What do you think are the main benefits of introducing NBS to Liverpool?
9. Do you think there is potential for NBS to be introduced in other UK cities, following the example of Liverpool?
10. Are there any benefits of addressing climate change through NBS rather than 'grey engineering?'
11. In general, how do you think citizens perceive NBS?
12. How aware are members of the public of URBAN Green UP and NBS?
13. Do you think NBS around the city will help raise awareness of climate change?
14. How will citizens be engaged with NBS throughout the course of URBAN Green Up?

15. How do you think engagement will change what citizens know and think about NBS? How important do you think this process is?

7.2 Workshops Questionnaires

7.2.1 Citizen Science Pre-Workshop Questionnaire

Candidate number: _____

Age:

Please circle appropriate category

18-26 27-35 36-42 43-51 51-59 60-68 69-77 78+

Gender:

Female ☐ Male ☐ Transgender female ☐ Transgender male ☐

Non-binary, please state here _____ ☐

Educational level:

Please tick highest level attained

No formal qualifications	
GCSEs/O-Levels/BTEC Level 2 or equivalent	
A-Level/BTEC diploma or equivalent	
Bachelor's degree or equivalent	
Master's degree or equivalent	
Doctoral degree	

Ethnic group:

		Please tick one box below
A	**White**	
	English	
	Other British	
	Irish	
	Any other white background, write in:	
B	**Mixed**	
	White and Black Caribbean	
	White and Black African	
	White and Asian	
	Any other Mixed background, write in:	
C	**Asian or Asian British**	
	Indian	
	Pakistani	
	Bangladeshi	
	Chinese	
	Any other Asian background, write in:	
D	**Black or Black British**	
	Caribbean	
	African	
	Any other Black background, write in:	
E	**Other ethnic group**	
	Arab	
	Gypsy/Romany/Irish Traveller	
	Any other, write in:	

Section 1

How do you take part in local affairs and community activities?

Please tick all that apply.

Answering questionnaires/surveys	
Through social media e.g. Facebook, Instagram, Twitter	
Attending public meetings, consultations and workshops	
Voting in local elections	
Volunteering in local initiatives	
Member of a community group e.g. Friends of Sefton Park, Soroptimist International	
Attending community meetings	

How often do you take part in local affairs and community activities listed above?

Please tick one box.

Every day	
Once a week	
Once a fortnight	
Monthly	
Every 2-3 months	
Every 6 months	
Every 1 – 3 years	
Never	

How many local community or council meetings or other community engagement events have you attended in the last 12 months?

Please tick one box.

I have not attended any local meetings	
1-3	
4-7	
7-10	
>10	

Why do you participate in these community-based activities?

Please tick **all** that apply.

I want to make a difference	
Socialise	
Feel like my views and opinions matter	
Doing 'my bit' for society – being a responsible community member	
Help create a better future	
Learning new things	
Something to do	

What stops you participating or participating more?

Please tick **one** box per row.

	Not a barrier	Minor barrier	Major barrier
Time			
Transport to meeting/consultation/activity locations			
Doesn't interest me			
Not enough opportunities to participate			
I have other priorities			
I feel my action and opinions have little impact on what happens in the community			
Community meetings and consultation are only used to meet councillors' agendas			
Other reason please state here:			

Why do you want to take part in the citizen science activity?

Please tick one box per row.

	Very influential	Fairly influential	Not very influential	Not influential
Making a difference in Liverpool				
Getting involved with the local community				
Enjoying the outdoors/nature				
Socialising				
Learn something new				
Learn more about ecology and the				

environment in Liverpool				
Opportunity to contribute to science				
Concerned about the environment				
Do something different				
Other motivation – please state here				

Section 2

Thinking about parks and green space in Liverpool, what do you think are the most important reasons for having areas like Sefton Park in the city?

Please rank each from 1 – 13, with 1 being most important and 13 being least important. Use each number once.

Recreation e.g. ball games, dog walking, picnics	
Socialising and meeting friends	
Flood defence	
Wildlife habitat and conservation	
Looks nice, pleasant views	
Spirituality and/or wellbeing	
Improves air quality	
Regulating air temperature/keeping the city cool particularly in summer	
Part of Liverpool's cultural heritage and history	
Unites the community	
Pleasant nature sounds	
Opportunities to learn	
Somewhere to go	

Of the following, which do you think are most important for Liverpool to prepare for climate change as a city?

Please tick one box per row.

	Extremely important	Important	Not important or unimportant	Unimportant	Extremely unimportant
Build flood defences					

Educate people about climate change and raise awareness					
Ensure local people get some input into how Liverpool tackles climate change					
Plant more trees					
Encourage recycling					
Regulate air temperatures in the city					
Invest in health care					
Create more environmental/climate change jobs					
Encourage more sustainable lifestyles					
Invest in public transport and cycle lanes					
Create more parks and green space					
Invest in green energy and technology e.g. solar panels					

What do the following terms mean to you?

Please write YES or NO in Box 1.

Please write a comment in Box 2 – if unsure or no opinion, please tick Box 3.

Term	1. Heard this term before (YES/NO)	2. What it means to me	3. Don't know/not sure/no opinion

Nature-based solutions			
Green infrastructure			
Green space			
URBAN Green UP			
Climate change			

How would you rate your knowledge about the following themes, on a scale of 1 - 5?

1 – No knowledge, 2 – Little knowledge, 3 – Some knowledge, 4 – fairly knowledgeable

	1	2	3	4	5
Nature-based solutions					
Green infrastructure					
Green space					
URBAN Green UP					
Climate change					

Below is a list of engineered solutions to climate change, and nature-based solutions to climate change.

Please tick each option that you would consider to be a **nature-based solution.**

Pollinator wall	1
Flood wall	2

Solar panels	2
Parks	1
Street trees	1
Electric cars	2
Sustainable Urban Drainage Systems (SUDS)	1
Air conditioning	2
Urban carbon sink	1
Green roof	1
Cycle lanes	2

How do you think improving existing green space, and creating new green spaces might improve Liverpool as a city?

Please tick all that apply.

Job creation	
Increasing house prices	
Increased health and wellbeing	
Crime reduction	
Learning about urban nature	
Better air quality	
Better habitat provision for wildlife	
Increased access to green space	
Flood resilience	
Improved water quality	
Reduced heat wave risk	
Less carbon dioxide in the atmosphere	

7.2.2 Citizen Science Post-Workshop Questionnaire

What do you feel you have gained from the activity today? Please tick all that apply

Learned something new about science and ecology in green spaces	
Increased awareness of environmental problems e.g. water pollution, climate change	
Feel able to make a difference in the community	
Increased awareness of community/local affairs	

Getting in touch with nature	
Feeling part of the community	
Opportunity to socialise	
Nothing	
Other (please state the reason)	

Think about your understanding of nature-based solutions, climate change and citizen science prior to today. On a scale of 1-5 how much would you say your understanding has improved having completed the activity?

1	2	3	4	5

<u>Knowledge outcomes</u>

What do the following terms mean to you?

Term	What it means to me	Don't know/not sure/no opinion
Nature-based solutions		
Green infrastructure		
Green space		
URBAN Green UP		
Climate change		

Write down up to 5 ways in which green space might help us adapt to climate change in future

1.
2.
3.
4.
5.

Write down 5 benefits of having green space in Liverpool

1
2
3
4
5

Attitudes towards citizen science as an engagement method

How has taking part made you feel about the following?

	More interested	No difference	Less interested
The environment in Liverpool			
Climate change			
Parks and green space as a nature-based solution			
Citizen science as a way of learning about the local environment			
Participating in future community activities based around parks and the environment			

On a scale of 1 – 5 how effective do you think **citizen science** is to make people more interested in the following?

	1	2	3	4	5
Climate change					
Wildlife and habitat conservation					
Ecology and environmental science					
Nature-based solutions					

How did participating in citizen science make you think or feel about the following?

Ecology and environmental science	

Nature-based solutions	
Local environmental matters	
Protecting wildlife and habitats in Liverpool	
Climate change in the city	

How do you think having more green space in Liverpool might change the city?

On a scale of 1 – 5 how important is it that the city has **more** green space?

On a scale of 1 – 5 how important is it that the city has a larger variety of green space?

Has taking part in the event made you feel differently about green space in Liverpool? If 'YES', how?

YES/NO

_____

For you personally, what is the value of taking part in citizen science in Liverpool's parks?

In wider society, what do you think of the value of citizen science as a way of learning about local and global environmental matters?

7.2.3 PGIS Pre-Workshop Questionnaire

Candidate number: _____

Age:

Please circle appropriate category.

18-26 27-35 36-42 43-51 51-59 60-68 69-77 78-86

Gender:

Female ☐ Male ☐ Transgender female ☐ Transgender male ☐

Non-binary, please state here _____ ☐ Prefer not to say ☐

Educational level:

Please tick highest level attained

No formal qualifications	
GCSEs/O-Levels/BTEC Level 2 or equivalent	
A-Level/BTEC diploma or equivalent	
Bachelor's degree or equivalent	
Master's degree or equivalent	
Doctoral degree	

Ethnic group:

		Please tick one box below
A	**White**	
	English	
	Other British	
	Irish	
	Any other white background, write in:	
B	**Mixed**	
	White and Black Caribbean	
	White and Black African	
	White and Asian	
	Any other Mixed background, write in:	
C	**Asian or Asian British**	
	Indian	
	Pakistani	
	Bangladeshi	
	Chinese	
	Any other Asian background, write in:	
D	**Black or Black British**	
	Caribbean	
	African	
	Any other Black background, write in:	
E	**Other ethnic group**	
	Arab	
	Gypsy/Romany/Irish Traveller	
	Any other, write in:	

Section 1

How do you take part in local/community activities?

Please tick all that apply.

Answering questionnaires/surveys	
Through social media e.g. Facebook, Instagram, Twitter	
Attending public consultations and meetings	
Voting in local elections	
Volunteering in local initiatives	
Member of a community group	
Attending community meetings	

Contacting local councillors	

How often do you take part in community activities listed above?

Please tick **one** box.

Every day	
Once a week	
Once a fortnight	
Monthly	
Every 2-3 months	
Every 6 months	
Every 1 – 3 years	
Never	

How many of these community activities have you attended in the last 12 months?

Please tick **one** box.

I have not attended any local meetings	
1-3	
4-7	
7-10	
>10	

Why do you participate in these community-based activities?

Please tick **all** that apply.

Want to make a difference	
Socialise	
Feel like my views and opinions matter	
Doing ‘my bit’ for society; responsible community member	
To help work towards a better future	
Something to do	

What stops you participating or participating more?

Please tick one box per row.

	Not a barrier	Minor barrier	Major barrier
Time			
Transport to meeting/consultation/activity locations			
Doesn't interest me			
Not enough opportunities to take part			
Other priorities			
I feel my action and opinions have little impact on what happens in the community			
Community meetings and consultation are only used to meet councillors' agendas			
Other reason, please			

Why do you want to take part in the Green Baltic mapping workshop?

Please tick **one** box per row.

	Very influential	Fairly influential	Not very influential	Not influential
Getting involved with the local community				
Enjoying creative activities				
Socialising				
Learn something new				
Learn more about the environment in Liverpool				
Concerned about the environment/climate change				

Interest in regeneration				
Something to do				
Do something different				
Other motivation – please state here:				

Section 2

Thinking about green space in the Baltic Triangle, what do you think are the most important reasons for having these areas in the city?

Please rank each from 1 – 13, with 1 being most important and 13 being least important.

Please use each number **once.**

Recreation e.g. ball games, dog walking, picnics	
Somewhere to go	
Socialising and meeting friends	
Flood defence	
Wildlife habitat and conservation	
Looks nice, pleasant views	
Spirituality, wellbeing, mental health	
Improves air quality	
Keeping the city cool, particularly in summer	
Part of Liverpool's cultural heritage and history	
Unites the community	
Pleasant nature sounds	
Opportunities to learn	

Of the following, which do you think are most important for Liverpool to prepare for climate change as a city?

Please tick **up to 5** boxes.

Build flood defences	
Educate people about climate change and raise awareness	
Ensure local people get some input into how Liverpool tackles climate change	
Plant more trees	
Encourage recycling	
Regulate air temperatures in the city	
Invest in health care	

Create more environmental/climate change jobs	
Encourage more sustainable lifestyles	
Invest in public transport and cycle lanes	
Create more parks and green space	
Invest in green energy and technology e.g. solar panels	

13. What do the following terms mean to you?

Please state YES or NO in Box 1.

Please write what you think the definition of the term might be in Box 2. Please leave Box 2 blank if you don't know.

Term	1. Heard this term before (YES/NO)	2. What I think it means
Nature-based solutions		
Green infrastructure		
Green space		
URBAN Green UP		

Climate change		

14. Write down up to 5 ways in which green space might help us adapt to climate change in future.

1.
2.
3.
4.
5.

15. Write down 5 benefits of having green space in the Baltic Triangle.

1
2
3
4
5

16. How would you rate your knowledge about the following themes?

Please tick **one box** per row.

	No knowledge	Little knowledge	Some knowledge	Fairly knowledgeable	Very knowledgeable
Nature-based solutions					
Green infrastructure					
Green space					
URBAN Green UP					

Climate change					

17. Below is a list of engineered solutions to climate change, and nature-based solutions to climate change.

Please tick each option that you would consider to be a **nature-based solution.**

Pollinator wall	
Flood wall	
Solar panels	
Parks	
Street trees	
Electric cars	
Sustainable Urban Drainage Systems (SUDS)	
Air conditioning	
Urban carbon sink	
Green roof	
Cycle lanes	

18. How do you think improving existing green space, and creating new green spaces might improve the Baltic Triangle?

Please tick **up to 5** options.

Job creation	
Increasing house prices	
Increased health and wellbeing	
Crime reduction	
Learning about urban nature	
Better air quality	
Better habitat provision for wildlife	
Increased access to green space	
Flood resilience	
Improved water quality	
Reduced heat wave risk	
Less carbon dioxide in the atmosphere	

7.2.4 PGIS Post-Workshop Questionnaire

Candidate number: _____

Section 1

What do you feel you have gained from the activity today?

Please tick all that apply.

Learned something new about how green spaces benefit cities	
Increased awareness of environmental problems e.g. climate change, sustainable cities	
Increased awareness of local affairs	
Feeling part of the community	
Opportunity to socialise	
Nothing	

Other (please state here)	

How has taking part affected how interested you are in the following categories?

Please tick one box per row.

	More interested	No difference	Less interested
The environment in Liverpool and the Baltic Triangle			
Climate change			
Using green space as a nature-based solution			
Participating in workshops about green space			
Future development of the Baltic Triangle			

Having completed the workshop, how likely would you be to attend a similar event in future?

1 = Would not attend in future, 2 = Very unlikely, 3 = Quite likely, 4 = Very likely, 5 = Definitely

1	2	3	4	5

Section 2

Thinking about green space in the Baltic Triangle, what do you think are the most important reasons for having these areas in the city?

Please rank each from 1 – 13, with 1 being **most** important and 13 being **least** important. Please use each number **once.**

Recreation e.g. ball games, dog walking, picnics	
Somewhere to go	
Socialising and meeting friends	
Flood defence	
Wildlife habitat and conservation	
Looks nice, pleasant views	
Spirituality and/or wellbeing	
Improves air quality	
Regulating air temperature/keeping the city cool particularly in summer	
Part of Liverpool's cultural heritage and history	
Unites the community	
Pleasant nature sounds	
Opportunities to learn	

Of the following, which do you think are most important for Liverpool to prepare for climate change as a city?

Please tick **up to 5** boxes.

Build flood defences	
Educate people about climate change and raise awareness	
Ensure local people get some input into how Liverpool tackles climate change	
Plant more trees	
Encourage recycling	
Regulate air temperatures in the city	
Invest in health care	
Create more environmental/climate change jobs	
Encourage more sustainable lifestyles	
Invest in public transport and cycle lanes	
Create more parks and green space	
Invest in green energy and technology e.g. solar panels	

Think about your understanding of nature-based solutions, climate change and sustainable cities prior to today.

On a scale of 1-5 how much would you say your **understanding** has **improved** having completed the activity?

1 = No improvement, 2 = Little improvement, 3 = Some improvement, 4 – Very improved, 5 – Extremely improved

1	2	3	4	5

What do you think the following terms mean?

Please write on comment per box.

Term	What I think it means
Nature-based solutions	
Green infrastructure	
Green space	
URBAN Green UP	
Climate change	

Write down up to 5 ways in which green space might help us adapt to climate change in future.

1.
2.
3.
4.
5.

Write down 5 benefits of having green space in Liverpool

1
2
3
4
5

On a scale of 1 – 5 how effective do you think mapping green space is for learning about the following?

	1	2	3	4	5
Climate change					

Wildlife and habitat conservation					
Sustainable urban development					
Nature-based solutions					

What did participating in the mapping activity make you think about the following?

Please write a comment in each box.

Nature-based solutions	
Local environmental matters	
Protecting wildlife and habitats in Liverpool	
The impact of climate change on Liverpool	

For you personally, what is the value of taking part in Green Baltic mapping workshop and learning about green space in Liverpool?

What do you think of mapping as a way of learning about environmental matters and sustainable cities?