



# Exploring different framings of nature-based solutions with respect to governance, and citizen participation, beneficiaries, and quality of life outcomes

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## ABSTRACT

Cities are increasingly looking to nature-based solutions to not only tackle climate change, and biodiversity loss, reconnect people with nature but also make just transitions to sustainability. However, some scholars argue that normative framings that drive the implementation of NBS continue to reinforce hegemonism and neoliberalise nature. Furthermore, while cities increasingly foreground climate adaptation and green growth actions in social and economic inequality considerations, the drive for growth and profit can lead to issues of inequality being side-stepped or even reinforced. Consequently, normative framings can lead to uneven distribution of the benefits of NBS, but also, opportunities to engage in fair and just participatory processes are missed. This has led to calls for the framing of NBS to be revised to support social change by moving away from hegemonic framings to focus on a more inclusive, collaborative, and interconnected framework. However, few papers have examined how the pattern of interaction between governance, and participatory engagement relates to equitable, democratic and diversity considerations that are needed to transition to just cities through NBS and how this pattern relates to the beneficiaries of NBS and the quality of life outcomes in cities. Drawing on statistical relational methods to analyse data published in the Urban Audit and Urban Nature Atlas, this paper unpacks the interplay between different types of governance, participation and citizen involvement, and the beneficiaries of NBS and relate to different social and economic conditions that influence quality of life in cities.

## 1. Introduction

Cities are increasingly looking to invest in nature-based solutions (referred to as NBS hereafter) to help address the intertwined challenges of climate change, biodiversity loss and urbanisation by reconfiguring the dichotomous relationship between people and nature. Scholars argue that by harnessing the power of urban nature, NBS can protect, manage and restore natural or modified ecosystems by creating bundles of interconnected ecosystem services (Cohen-Shacham et al., 2016; Frantzeskaki, 2019; Raymond et al., 2017). In doing so these goal-orientated solutions can help tackle deeply complex and often highly interrelated urban challenges. While acknowledging the potential of NBS and limited evidence of the impact (Van de Berg et al., 2015;

Dumitru et al., 2020), it has been suggested that the breadth of the conceptual framework, and lack of understanding of the interrelationship between different framings that underpin NBS, could hinder the transition towards just cities (Pineda-Pinto et al., 2021; Tzoulas et al., 2021).

Fainstein (2010, 2014) argue that a 'just city' is one in which public investment and regulatory policy facilitate equitable outcomes for those that are disadvantaged in society and not just those that are already well-off. The author argues institutional decision-making processes on investments intended to support development and sustainability in cities should encompass equity, democracy, and diversity considerations. However, Hughes and Hoffmann (2020) highlight municipalities increasingly make decisions to deliver climate adaptation and green

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growth actions foregrounded by social and economic inequality, but the drive for growth and profit can lead to issues of inequality being side-stepped or even reinforced (Nutti, 2019). Consequently, normative framings and hegemonic narratives may lead to the uneven distribution of the benefits of NBS, and opportunities to engage in fair and just engagement and participation processes being missed (Raymond et al., 2023; Calderón-Argelich et al., 2021; Kotsila et al., 2021).

Despite calls for the framing of NBS to be revised to support social change by moving away from hegemonic framings to focus on a more inclusive, collaborative, and interconnected framework (Cousins, 2021; Welden et al., 2021) few empirical papers have explored how the pattern of interaction between governance, participatory engagement, and beneficiaries of NBS relate to the quality of life outcomes in cities and to what extent they place exhibit evidence of equitable, democratic and diversity considerations. To explore these relationships, we draw on statistical relational methods (Faulconbridge, 2017; Boggs and Rantisi, 2003) to unpack the interplay between different types of governance, participation and citizen involvement, and the beneficiaries of NBS and relate to different social and economic conditions that influence quality of life.

## 2. Understanding the relationship between NBS and Quality of Life

### 2.1. Governance and participatory engagement in NBS

Sekulova and Anguelovski (2017) argue that the governance of NBS involves complex phenomena that involve different social and political actors, premises, and visions. These phenomena encompass the relationship between government and society, which embodies both formal and informal institutions, rules, mechanisms, and processes of collective decision-making (Buizer et al., 2015; Chaffin et al., 2016). While the conditions that enable actors to influence and co-ordinate their independent interests and interactions with the environment operate at different scales, Toxopeus et al. (2020) argue just NBS require an emphasis on community-based decision-making across policy and practice to ensure the delivery of just outcomes for both society and the environment. In this study, we adopt the typology developed by Sekulova and Anguelovski (2017) and Almassy et al. (2017) that categorised the governance arrangements of NBS into three types: public or state-led forms of governance, multistakeholder forms of governance such as co-governance or hybrid governance, or governance led by non-governmental actors. Government-led refers to those conditions where the government or the state has control over policy development and its implementation. Co- or hybrid governance (Toxopeus et al., 2020) relates to collaborative forms of governance that may involve multiple actors including citizens, the state, business, and civil society (Kabisch et al., 2016). Toxopeus argues that hybrid governance overlaps with concepts such as polycentric (Ostrom, 2010), mosaic governance (Buijs et al., 2019) or co-creation processes (Frantzeskaki, 2016, 2019). In contrast, NBS governed or managed by non-governmental organisations may include the private sector, business, citizens, NGOs and public or private institutions are referred to as ‘governance led by non-governmental actors’ by Naturvation<sup>4</sup> (Almassy et al., 2017). To unpack the interrelationship between governance, participation and quality of life, we draw also on the concept of citizen participation. Participation in governance processes is not only important for increasing resilience to climate adaptation and providing a sense of project ownership, but it also allows local and indigenous knowledge to be built into the design, planning, management, and implementation of

<sup>4</sup> Naturvation refers to the NATure Urban innoVATION project that sought to understand what NBS can achieve in cities, their role in innovating with nature and potential to respond to urban sustainability challenges ([www.naturvation.eu](http://www.naturvation.eu), [www.una.city](http://www.una.city))

NBS. However, the term ‘citizen’ is a ‘heterogenous and contested category’ (Kiss et al., 2021, pp. 248), it is understood as a ‘continuum of interaction’ between different political institutions, a diverse array of governmental and non-governmental actors and citizens (Kiss et al., 2021). To unpack the interplay between governance and different types of participatory approaches adopted by NBS, we draw on the seminal work of Arnstein (1969) that provides a continuum divided into ‘eight’ categories of participation that range from non-participation to complete delegation and empowerment of stakeholders or citizens in participatory processes. In the context of Naturvation<sup>1</sup>, participatory methods or community involvement are terms adopted by the project to describe the type of participatory methods embedded within governance or the management of NBS and different approaches used to involve citizens in the evaluation or assessment of the NBS. Primary beneficiaries of NBS is also a phrase used by Naturvation<sup>1</sup> to describe the direct beneficiaries of NBS that were self-assessed by those responsible for primary data collection.

### 2.2. Quality of life and socio-economic position

Nature plays a pivotal role in the quality of life recognised in the Global Standard for NBS (IUCN, 2020), describing our relationship with nature as fundamental to human existence and essential for ‘good life quality’. Quality of life is a contested, multifaceted construct and interdisciplinary field of study with no agreed definition that is more akin to a conceptual framework than a theory (Murgaš and Klobučník, 2018; Pacione, 2003). In this study, we draw on the definition developed by Veenhoven (2014) who argues that quality of life is a networked concept with dynamic interactions between objective (such as income), subjective life conditions (family structure, social networks) and the degree of congruence or dissonance that people have with their everyday living environment. Veenhoven suggests that quality of life is also influenced by socio-political factors, access to resources and principles of justice. To represent quality of life in this study, we use different indicators of Socio-Economic Position (SEP) published in the Urban Audit that closely relate to the concept (Rubin et al., 2014; Galobardes et al., 2007). SEP is an aggregate concept with no single preferred indicator that is indicative of people’s position within the social hierarchy of society, their likelihood of being exposed to harmful effects of urbanisation or climate change, and/or their capability to resources that might mediate these effects or enhance health (Lynch and Kaplan, 2000; Marmot, 2010, Galobardes et al., 2007). This definition describes material or social resources and assets (such as income or education) and prestige-based measures related to the social class position (Krieger et al., 1997). Factors such as resource ownership and control, cultural, and behavioural factors and power differentials may also be influential (Salmond et al., 2007).

Salmond et al. (2007) argue that combining different theoretical approaches that underpin the measurement of SEP creates a stronger evidence base of socio-economic adversity in cities than using individual measures of SEP. Thus, we create an area measure of SEP, based on indicators for education, occupation, income, and risk of poverty published by the Urban Audit to represent quality of life (see Table 1). Education captures opportunities for knowledge-related assets; lack of

**Table 1**  
Summary of the theoretical basis of the socioeconomic position indices.

Indicators of Social Economic Position	Source
Education	Galobardes et al. (2007); Lynch and Kaplan (2000)
EU_SILC (Statistics on Income and Living Conditions) Occupation indicator	Purcell (2018); Galobardes et al., (2006, 2007)
Average or median income	Krieger et al. (1997); Salmond et al. (2007)
Poverty due to social transfers / low working hours	Purcell (2018); Salmond et al. (2007)

formal qualifications is an essential feature of deprivation and a driver in inter-generational socio-economic mobility. It can also be used as a proxy measure of income since it is a strong determinant of future employment and income (Galobardes et al., 2007; Lynch and Kaplan, 2000). In contrast, occupation can reflect a person's place in society related to their social standing, income, and intellect. However, patterns of employment have changed markedly across different economies, altering the pattern of distribution of occupation types and unemployment levels across the economically active population. However, scholars (Purcell, 2018; Galobardes et al., 2006, 2007) highlight that these schemes have not been updated to reflect these patterns. Thus, this study uses indicators for income to represent access to material resources (such as food or housing) and risk of poverty since some indicators of occupation exclude those social groups at risk of the consequences of social stratification (Salmond et al., 2007).

### 3. Methodology

This section briefly outlines the data sources used in this study and explains how geometric data analysis techniques were used to explore the interrelationship between different characteristics of governance and participation of NBS and how these relate to quality of life.

#### 3.1. Data sources and approach

##### 3.1.1. Urban nature Atlas

The Urban Nature Atlas (UNA) database and online mapping tool include quantitative and qualitative data describing the type, form, function, and distribution of 1000 NBS across European cities. Master's students from different European institutions completed discourse analysis of secondary documents (including project reports, information published online, etc.) for up to ten NBS in each European city between January and September 2017. Data collected included binary categorical variables that described the goals of the intervention, its key characteristics such as the ecological domain, scale and primary beneficiaries, but also the forms of governance, innovation and evaluation and learning being adopted by each NBS alongside qualitative commentaries for indicators such as the goals of the intervention or types of stakeholders involved in the governance of NBS. Table 2 summarises the variables published by the UNA used in the analysis. In addition, textual commentaries accompanied some of the binary variables (to add context or further explain the variable in question). Using autonomous counting (following Hannah and Lautsch, 2011), qualitative data were transformed by Naturvation to create binary categorical variables representative of urban conditions of NBS (Almassy et al., 2017).

While Hannah and Lautsch (2011) is critical of the use of count frequencies, arguing that the process limits the ability to generate insights from qualitative research processes, other scholars (Bourdieu, 1984; Lebaron, 2018; Monrouxe and Rees, 2019; Neale et al., 2014) argue that independent analysis of quantitative and qualitative data can conceal complex relationships within systems and enhance the transparency of analysis.

##### 3.1.2. Urban audit

To create a composite indicator representative of SEP, the study conducted a principal component analysis of secondary data published in the Urban Audit, one of the only pan-European datasets comprising quality of life indicators for cities (Eurostat, 2017). The Urban Audit includes demographic, social, economic, environmental, training/education, and (for a limited number) mortality indicators for selected European cities. Many of the indicators collected by the Urban Audit play a central role in capturing the everyday realities of social inequality and can help illuminate how different urban conditions that influence the quality of life relate to different practices of governance and participation that have influenced the implementation of NBS

**Table 2**

Summary of the indicators published in the UNA that formed the basis of the MFA. (Note: Indicators that were used as supplementary indicators to aid contextual understanding but were not used to construct the principal components are listed as supplementary variables) (Source: adapted from Almassy et al., 2017).

Group variable	Subcategories
Governance arrangements that characterise the power distribution of an NBS	Government-led, hybrid or mixed governance, or governance led by non-governmental actors
Stakeholders that lead co-governance or non-governmental actors that lead the governance of NBS	Public sector, non-governmental organisation or civic society, private sector, corporate or business, research institutions, citizens or community groups, or coalition of different actors
Participatory methods or forms of community involvement	Subcategories of participatory methods as defined by Naturvation: Co-creation, co-development or co-planning; crowdsourcing or crowd-funding; participatory budgeting; task force or citizen juries; information dissemination; consultation; joint implementation; joint or co-management; citizen oversight; citizen science; citizen monitoring or review.
Modes of citizen involvement	Modes of citizen involvement as defined by Naturvation: Focus groups; interviews; questionnaires; online forums; submission of monitoring data by citizens.
Primary beneficiaries	Naturvation defines primary beneficiaries of NBS as stakeholders or social groups that benefit directly from the services being provided or the challenges being addressed by each intervention. Naturvation grouped different types of beneficiaries of NBS as follows: <ul style="list-style-type: none"> <li>• National-level government (includes national ministries, government, or public agencies)</li> <li>• Local government or municipality (includes mayors office, city council, city assembly, and town council)</li> <li>• Public sector institution (such as a school or hospital)</li> <li>• Non-government organisation or civil society (including a not-for-profit organization, international organizations, or the private sector)</li> <li>• Private sector, or corporate company (for-profit organisations run by companies or individuals)</li> <li>• Researchers/university</li> <li>• Citizens or community groups</li> <li>• Disadvantaged groups (e.g. older or disabled people, families with small children).</li> </ul>
Supplementary Variables Ecological domains	Categories of different types of NBS and their subcategories that consist of parks, blue spaces, grey infrastructure connected to greenspace, green areas for water management (such as SUDS), allotments and community gardens and external green buildings (such as green roofs).
Ecosystem services	Four types of ecosystem services with each subcategory including provisional, regulatory, habitat supporting or cultural ecosystem services.
Key Actors	Naturvation categorised key actors into multilateral organizations, EU bodies, national or regional or local government, public sector institutions, non-governmental organisations/civil societies, business associations, private sector/corporate/company, or private foundation, transnational network, researchers/universities, citizens or community groups.

(Nolan and Whelan, 2011). Table 2 (Section 2.2) summarises the indicators published by the Urban Audit that were used to create the SEP indices to represent quality of life.

### 3.2. Multiple factor analysis

This study uses relational quantitative methods to unpack how different attributes of NBS, such as governance typologies and modes of participation interact within complex systems to influence quality of life. Scholars argue large, structured datasets (such as the UNA) require systematic analysis that takes a heuristic approach to unravel their complex patterns (Faulconbridge, 2017; Le Roux et al., 2019; Lebaron, 2019; Lefèvre et al., 2014). This approach allows the interplay between inter-relationships within structured data to be unpacked both in terms of how the pattern between governance, citizen participation and quality of life are clustered, but also analyses how different cities implementing NBS are grouped. To achieve this, we apply a geometric data analysis technique known as Multifactor Analysis (MFA) using the FactomineR package in R software and visualise the results in the FactoExtra package (Le Josse and Hudson, 2008; R Core Team, 2020). MFA is a geometric data analysis technique that represents structured datasets as clouds of points in a multidimensional space (Le Roux et al., 2019). Unlike other similar techniques (such as PCA) MFA can simultaneously analyse the strength of the relationships between different observations described by sets of variables (or groups) as well as relationships between groups and different subsets of variables (for example, relationships between different categories of grouped variables and their subset of indicators listed in Table 1) (Escofier and Pagès, 1994).

Action on what researchers, policymakers and practitioners refer to as NBS has slowly evolved over time leading to different terms being used to describe the concept such as natural solutions and ecosystem adaptation (see Nesshover et al., 2017). The concept wasn't given a formal name until the World Bank published 'Biodiversity, Climate and Adaptation: Nature-based Solutions World Bank Portfolio' in the late 2000 s following the introduction of the ecosystem services framework (MacKinnon and Sobrevila, 2008). Around this time, scholars argue paradigm shifts were also occurring in nature conservation (Mace, 2014); people were not just passive beneficiaries of efforts to external nature but the relationship between people and nature is deeply intertwined and co-evolves across time and space, influencing the interface between preconditions for good quality of life (Folke et al., 2021; Reyers et al., 2018).) Thus, to trace the network of interrelations between different types of governance, participation and quality of life over time, we disaggregate the UNA dataset into two matrices for analysis, selecting the timing of introducing the definition of NBS as the dividing point. An MFA analysis is completed on each matrices analysis based on the attributes of NBS that relate to governance, participation, beneficiaries and quality of life. While indicators representing different types of ecological domains and key actors involved were used as supplementary variables to aid contextual understanding; these variables were not used to construct each of the dimensions or principal components.

### 3.3. Hierarchical k-means clustering on MFA

To identify groupings of different factors that influence the interrelationship between governance, type of participation, beneficiaries and quality of life, hierarchical cluster analysis was applied to the results of the MFA. Clustering is a method of machine learning that is used to identify groupings, or clusters, within data based on similarities or differences. Hennig et al. (2015) define clustering as identifying groupings in data based on partitions within the data that are 'hard' or categorical, or 'soft' based on the degree of membership within each group or cluster. The authors describe these types of clustering as flat, but if each group can be partitioned into subgroups, this is referred to as hierarchical clustering. Using the FactomineR package, we conducted

hierarchical clustering using Ward's (1963) criterion on the first five factors selected for analysis from the MFA. Similarly, to multidimensional ordinal methods such as MFA, hierarchical clustering is based on multidimensional variance as well as the analysis of principal components (Husson et al., 2010). Hierarchical K-means cluster analysis that partitions the data into a set of groups or classes (i.e.,  $k$  clusters) based on their similarity.

## 4. Results

This section analyses how the complex interplay between different types of governance and participatory methods used by NBS and quality of life outcomes evolve over time based on analysis of  $v$ -test statistics significantly associated with each cluster. These statistics indicate if the clusters mean is lower or greater than the overall mean of the cluster; only  $V$ -test statistics higher than  $+/- 1.96$  correspond to a  $p$ -value less than 0.05 (Le Josse and Hudson, 2008; Le Roux et al., 2019).

### 4.1. Pattern of clustering of interaction between governance, participation, beneficiaries, and quality of life from 1990 to 2009

Fig. 1 shows the factor map of the Hierarchical Cluster Analysis applied to the MFA of different types of governance, participation, beneficiaries of NBS, and quality of life outcomes in cities. The factor map shows that before introducing the formal definition of NBS and the Millennium Assessment Framework for Ecosystem Services (MEA, 2005), different types of governance and participatory methods adopted by NBS were divided into distinct three clusters. An in-depth analysis of the characteristics of NBS with statistically significant  $V$ -test statistics (Fig. 2) suggests that throughout the 1990 s and early 2000 s, collaboration through public-private partnerships using a diverse range of methods of participatory engagement was seen as an important means for delivering benefits to a broad range of different stakeholders or social groups. From 2010 onwards, the pattern of interaction between governance, participation and who benefits from NBS begins to evolve transferring more power to societal actors. Sections 4.1.1 to 4.1.3 show the pattern of clustering of different characteristics of governance, participation, and indicators of quality of life in each cluster.

#### 4.1.1. Collaboratively governed NBS lack empowerment opportunities – cluster 1

Cluster 1 represents just over 50% of the NBS deployed in European cities (represented by the UNA) throughout the 1990 s and 2000 s Fig. 2 shows that cluster 1 features a diverse array of participatory methods are associated with government-led or collaborative forms of governance led by non-governmental actors (such as the public sector, community groups or civic society). In this cluster, power is delegated through joint implementation or management of NBS, although opportunities to share power among different actors, such as citizen management, are lacking. This is further highlighted by the association of what could be regarded as more tokenistic modes of participation (Kiss et al., 2020; Arnstein, 1969) such as co-planning, consultation and information dissemination or citizen oversight. A closer examination of the constellation of key actors involved in the delivery and implementation of this group suggests that it consists of elite actors involved in climate adaptation or water management projects including national or local government, private companies or business.

associations while actors from civic society or disadvantaged groups are only identified as direct beneficiaries.

#### 4.1.2. Community-led governance excludes disadvantaged groups – cluster 2

Unlike the first cluster, the interaction pattern between governance, participation, and beneficiaries of NBS that characterise cluster 2 is associated with a much smaller group of indicators for implementing community gardening projects. Fig. 2 shows that this group of NBS are



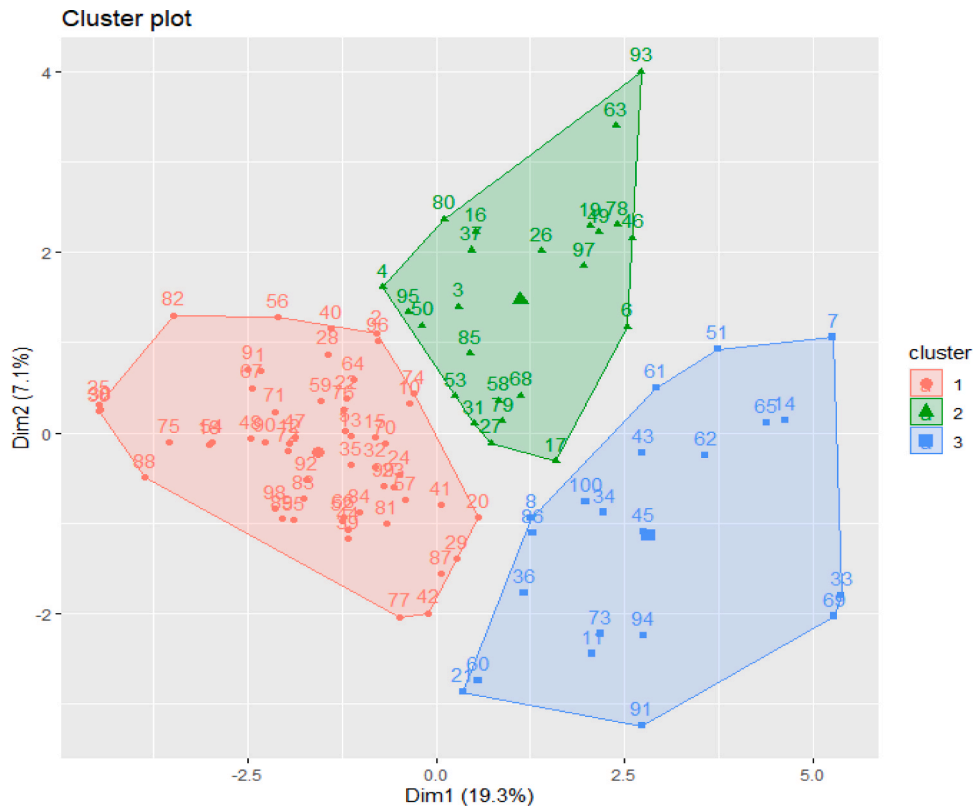


Fig. 1. Factor Map showing distribution of clusters of NBS implemented between 1990 and 2009.

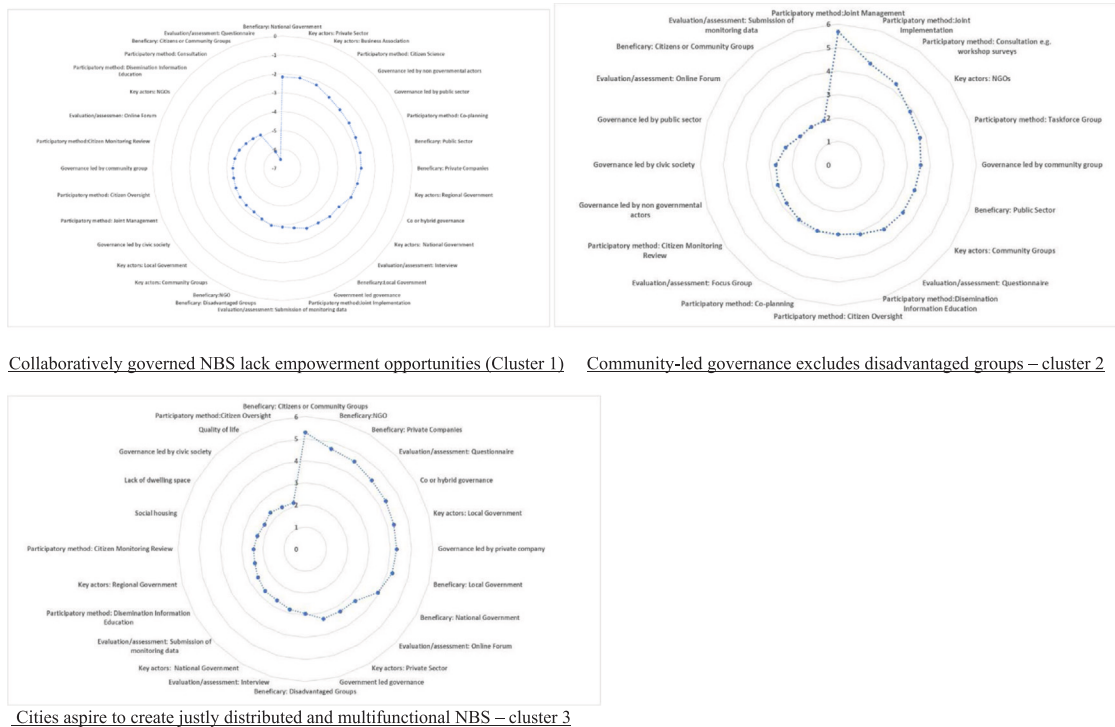


Fig. 2. Spider graph showing distribution of V-test scores for each cluster of NBS implemented between 1990 and 2009 (significant p value 0.05).

often governed by the state or collaboratively by non-governmental actors such as the public sector, civic society, or community groups. Unlike the first cluster, community groups are directly involved as key actors in implementing NBS are significantly associated with this cluster.

However, key actors such as disadvantaged groups and quality of life outcomes are not. This could suggest that the practice of community-led governance may not be as inclusive as first apparent not only risking the exclusion of marginal and vulnerable groups but, like the first cluster,

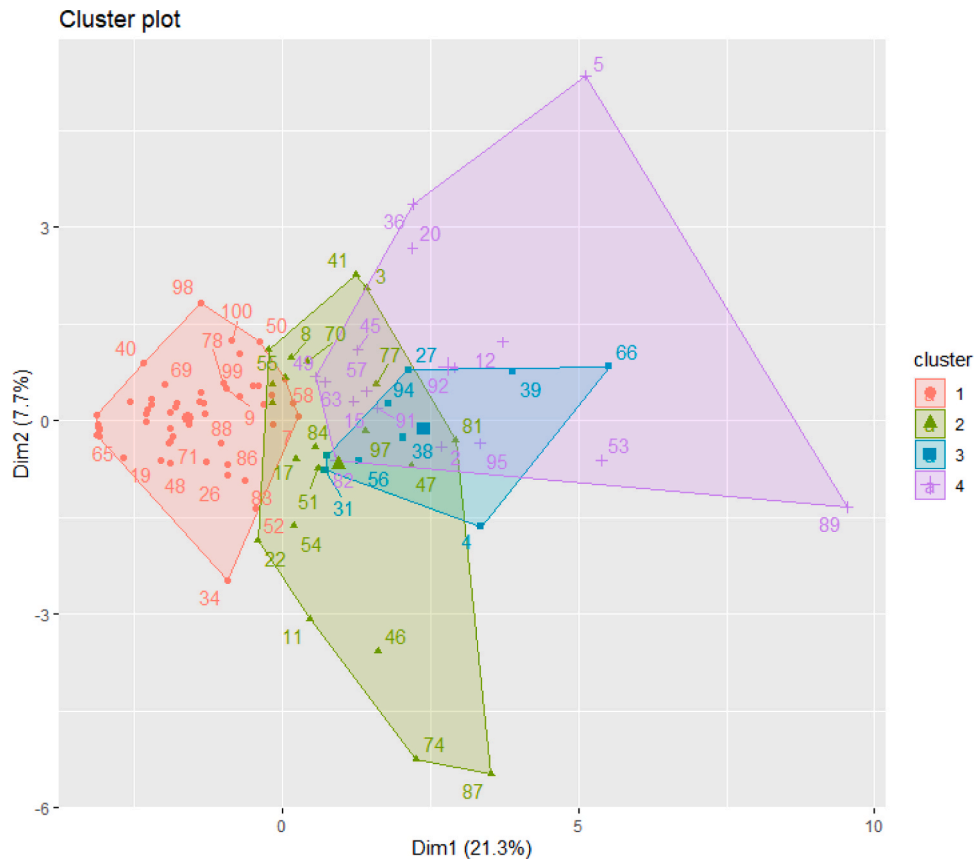


Fig. 3. Factor Map showing the distribution of clusters of NBS implemented between 2010 and 2017.

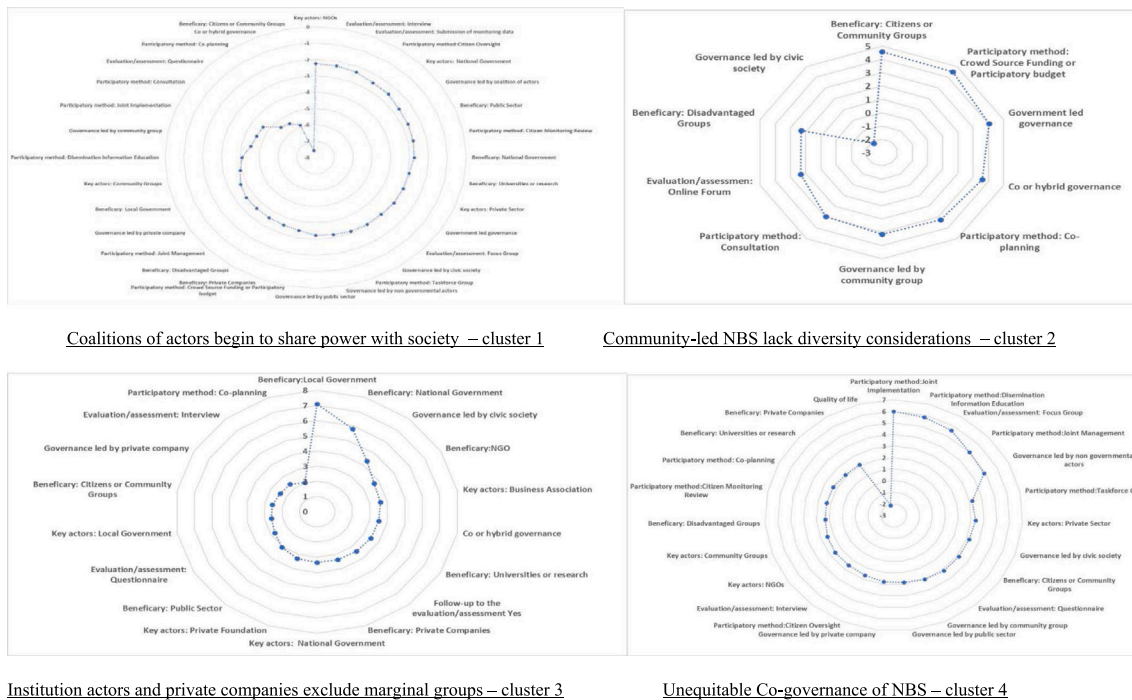


Fig. 4. Spider graph showing the distribution of V-test scores for each cluster of NBS implemented between 2010 and 2017 (significant p value 0.05).

could disempower communities by limiting democratic involvement to tokenistic methods of participation.

4.1.3. Cities aspire to create justly distributed and multifunctional NBS – cluster 3

Similarly, to the first cluster, the third group has a broad range of beneficiaries (including citizens, community groups, private companies,

and disadvantaged groups) self-assessed as having directly benefitted from NBS. Unlike the first and second clusters, governance is led by civic society or private companies with involvement from key actors such as national and regional governments. Quality of life outcomes are significantly related to this group which could suggest cities implementing these solutions aspire to create justly distributed, multifunctional NBS to benefit a broad range of actors and social groups (Frantzeskaki et al., 2019). However, like the previous two clusters, opportunities for power-sharing with community groups, civic society or disadvantaged groups seem limited. This, in turn, denies these groups opportunities to share knowledge and inform the design, delivery and implementation of NBS.

#### 4.2. Pattern of clustering of the interactions between governance, participation, and citizen engagement from 2010 to 2017

##### 4.2.1. Coalitions of actors begin to share power with society – cluster 1

After 2010, the delivery or implementation of NBS is characterised by four typologies of interaction between governance, participatory engagement, and self-assessed beneficiaries. The first, the largest cluster, is characterised by NBS that are co-governed by coalitions of actors or led by different groups of non-governmental actors such as civic society, the public sector, or private companies with involvement from NGOs, local or national government, or community groups. Similarly, to the first cluster, ‘Collaboratively governed NBS lack empowerment opportunities’ deployed before the late 2000 s, various participatory methods are associated with co- or hybrid modes of governance. The results also suggest that the pattern between governance-participation interaction is evolving, with some power for decision-making, monitoring and review being transferred to societal actors. However, power-sharing in the form of joint management or joint implementation and more tokenistic modes of participation, such as citizen oversight, remain dominant.

While the interaction between governance and participatory democracy begins to evolve, there is no evidence that these processes have become more equitable by including disadvantaged groups as key actors. Similarly, none of the quality of life indicators included in the analysis is significantly related to this cluster. Together, these results suggest that marginalised and vulnerable groups are not recognised as central actors despite being self-assessed as a direct beneficiaries of these interventions.

##### 4.2.2. Community-led NBS lack diversity considerations – cluster 2

In the second cluster, V-test statistics for NBS co-governed by community groups or civic society, or those governed by the state are significantly associated with a limited number of participatory methods, including participatory budgeting or crowdsourcing, co-planning, and consultation. Supported by the involvement of regional or local government, private companies and community actors, this group of NBS are being deployed NBS to help revitalise urban areas and provide opportunities for recreation and health well-being for the benefit of disadvantaged groups. The lack of evidence of different modes of power being shared among these actors could suggest that these NBS were in their planning phase at the time of data collection, but the absence of an association between disadvantaged groups and quality of life outcomes with this group could suggest democratic processes lack diversity considerations.

##### 4.2.3. Institution actors and private companies exclude marginal groups – cluster 3

This group of NBS are governed by civic society or private companies to create opportunities for urban food growing or blue-green infrastructure. Similarly, to the second cluster of NBS deployed since 2010, the interaction pattern between governance and participation is limited to co-planning or planning and data collection for the evaluation and assessment of NBS through interviews and questionnaires. Lack of

evidence of empowerment of societal actors including disadvantaged groups by employing devolving power or jointly delivering NBS could suggest interventions are primarily for the benefit of the national government, private companies, and research institutions. Consequently, private actors that govern these solutions miss opportunities to adopt more inclusive governance processes and lack representation from marginal or vulnerable groups which could lead to procedural and recognition injustice.

##### 4.2.4. Unequitable co-governance of NBS – cluster 4

The final cluster is most closely associated with quality of life outcomes and joint implementation of NBS that are governed by civic society NBS for the benefit of private companies, research institutions or citizens including disadvantaged groups through the creation of blue-green infrastructure to regulate flooding, but also create habitats for species and maintain genetic diversity. Our analysis suggests that these NBS adopt a broad array of participatory methods to engage communities in the planning, management, and implementation of NBS, but while these interventions are for the benefit of disadvantaged groups, it is not clear to what extent this group are deeply engaged with these processes.

## 5. Discussion

In this paper, we examine how patterns of interaction between governance, participatory engagement, beneficiaries of NBS and quality of life outcomes have evolved over time and to what extent these processes reflect equitable, democratic and diversity considerations. Our results suggest that different patterns in the interaction between governance, participatory engagement, beneficiaries of NBS, and quality of life outcomes rarely consider equity and diversity considerations (Fainstein, 2010, 2014) with the exception of two clusters. We suggest that socio-political processes adopted by different groups of actors may appear to be inclusive because they adopt a broad range of participatory approaches giving the ‘illusion of inclusion’ (Few, Brown and Tompkins, 2007). However, evidence from our analyses suggests that NBS frequently exclude marginal and vulnerable groups leading to recognition and procedural or participatory injustice (Schlosberg, 2007; Honneth and Fraser, 2003).

The study found that across the clusters of interactions between governance, participation, and the beneficiaries of NBS, only two groups were statistically related to quality of life outcomes. These results suggest that the benefits of NBS are more equitably distributed, but in terms of participation in governance and the management of NBS, opportunities are limited to delegated power such as citizen oversight or data collection. Similarly to Kiss et al. (2021), we find that governance-participation interactions appear tokenistic, utilising these groups for resources to monitor and evaluate NBS, and lack evidence of empowerment of civic society. Consequently, opportunities to help upskill communities to help them develop the capability to actively engage in the management of NBS are missed. These findings also concur with other studies that suggest current institutional arrangements that include citizen engagement are driven by strategic considerations to aid validation of decision-making or manage (or prevent) conflicts (Kiss et al., 2021; Puskás et al., 2021; Wamsler, 2016; Brink et al., 2018). We argue that the lack of attention to the role that equity and diversity play in decision-making, particularly that led by communities could also deeply constrain transitions to just cities through NBS (Raymond et al., 2023; Woroniecki et al., 2020; Wamsler, 2016; Toxopeus et al., 2020). Following 2010, our study also found that NBS are mainly unrelated to quality of life outcomes. Only the fourth cluster ‘Unequitable co-governance of NBS’ was related to quality of life. Despite including a broad range of municipal and societal actors, our analysis shows that actors with responsibility for governing or managing these interventions frequently exclude marginalised and vulnerable groups from decision-making processes or deny these groups the

opportunity to play a role as central actors. We suggest that this not only leads to the disempowerment of these actors (Goddard and Farrelly, 2018) and triggers recognition or participatory injustice (Schlossberg, 2007; Fraser and Honneth, 2003) but hinders their potential to deliver transformational change in cities.

Most clusters of interactions between governance, participation and beneficiaries of NBS were not significantly related to quality of life outcomes. These results suggest that the design of institutional arrangements for NBS is not centred around equity and diversity considerations leading to the uneven distribution of responsibilities among different municipal and societal actors. These findings concur with studies by Goddard and Farrelly (2018) and Hölscher et al. (2019) who highlight that institutional arrangements led by municipal actors rarely empowerment of broader societal and marginal groups as central actors. This suggests that municipal actors are driven by strategic considerations (such as climate, water management or growth) without critically reflecting on how existing governance and management practices could evolve to provide opportunities to empower different groups of societal actors including disadvantaged groups. Chu and Michael (2019) also suggest that a lack of recognition of vulnerable groups of actors can also lead to some groups experiencing environmental marginality where intersectional impacts merge to deepen vulnerability and marginalisation.

Lack of consideration of the role that NBS could play in facilitating just transitions also undermines claims made by several scholars that NBS has evolved to centre the benefits on nature and people. Scholars argue that the conceptual framework for NBS advocates fair and equitable distribution and broad participation (Mace, 2014; Cohen-Shacham et al., 2019; Folke et al., 2021). However, findings from this study suggest a lack of knowledge and understanding of the concept and how it fits with other interconnected frameworks (Howe et al., 2014; Pineda Pinto et al., 2021) leads to inequitable distribution of responsibilities between actors (Goddard and Farrelly, 2018) and inattention to equity considerations (Nutti, 2019; Fainstein, 2010, 2014). We suggest that the actors designing and deploying these solutions may also 'assume' the delivery of benefits to marginalised and vulnerable groups rather than actualising them due to a lack of awareness of the synergistic relationship between different challenges that NBS seek to address. To aid further understanding of these issues, future research should conceptualise understandings of NBS differ across different groups of actors governing or managing NBS and how these perceptions influence just transition arrangements in cities.

Referring to NBS that aim to address climate change policy goals, Dodman et al. (2022) argue that the goals that cities aim to address through NBS often place these interventions in opposition to socio-cultural and behavioural drivers of inequality and injustice in cities. We agree with these sentiments and argue that focusing on goal-orientated outcomes has led to missed opportunities to centre institutional procedures and processes away from just and equitable engagement and participation, particularly among marginalised and vulnerable groups. Similarly, to Fainstein (2010, 2014) we suggest that institutional processes adopted by cities through NBS frequently lacked equity or diversity considerations or limited opportunities to share power with disadvantaged groups of actors. However, if NBS are to contribute to just transitions they rethink city-citizen interactions to open the door to vulnerable and marginalised groups and ensure that voices are heard, and opportunities are made available to help different societal groups influence decision-making outcomes. Further research with just transitions theory should explore how the role of different actors, institutional practices and methods of participation may evolve to empower marginalised and vulnerable groups to play a key role in the governance and management of NBS.

### 5.1. Conclusion

Comparison of the patterns of clustering of different interactions

between governance, participation, beneficiaries of NBS and quality of life outcomes suggests that city-citizen interactions lack equity and diversity considerations that risk disempowering citizens and denying citizens their right to access opportunities to develop capabilities that could improve quality of life and help to facilitate just transitions to sustainability. We suggest the narratives that underpin these interventions continue to reinforce the human-nature dichotomy despite claims by Mace (2014) that nature conservation paradigms that underpin NBS have evolved to equally benefit society and nature. These findings are consistent with studies by Welden et al. (2021) and Woroniecki et al. (2020) who suggest that narratives that dichotomise nature continue to dominate across policy, research and practice leading to environmental and ecological injustice. These narratives will continue to act as a barrier to sustainability transitions unless action is taken to redress the use of hegemonic narratives across private and public sectors and research institutions.

Our study also finds that governance-participation interactions appear tokenistic, utilising these groups for resources to monitor and evaluate NBS, and lack evidence of empowerment of civic society. Consequently, opportunities to help upskill communities to help them develop the capability to actively engage in the management of NBS are missed. We suggest that if these trends continue, the transformative potential of NBS will continue to be undermined and future research adopt an interactional lens to unpack the relationship between just transitions theory, governance-participation, and social and economic inequality. In doing so, research should investigate the role of policy and regulatory incentives could play (including financial instruments) in encouraging powerful actors to centre the design of governance and participatory processes on equity, democracy, and diversity practices. Research should also be undertaken to investigate the intersectional barriers between different coalitions of actors and vulnerable community actors to help us understand why these communities are excluded from the governance or management of NBS and how they can become more empowered as central actors.

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### CRediT authorship contribution statement

**Clair Cooper:** Conceptualization, Methodology, Data analysis & visualisation, Writing – original draft, Editing and full draft. **Niall Cunningham, Louise Bracken:** Writing – review & editing, Supervision.

### Declaration of Competing Interest

None.

### Data availability

The authors do not have permission to share data.

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