



The Governance and Politics of Nature-Based Solutions

Filka Sekulova & Isabelle Anguelovski (UAB)

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Abstract

Through the NATURVATION project we are examining the evidence for successful governance, business, finance and public participation schemes for the implementation of nature-based solutions. We also seek to deepen and strengthen our understanding of how and why nature-based solutions are politically contested.

The governance of nature-based solutions is framed by the visions of sustainability of which they are part. **Weak sustainability** approaches tend to regard nature-based solutions through an economic lens and seek to understand their direct impact on development and growth agendas whilst also meeting social imperatives. **Strong sustainability** perspectives put emphasis on the extent to which such interventions can address long-standing patterns of uneven development and the inherent value of nature. The literature suggests that taking issues of **social and ecological inequalities** into account in the governing of nature-based solutions is imperative.

The governance of nature-based solutions is a complex phenomenon, involving multiple social and political actors, premises and visions. Over time the role of state agencies or public stewardship in nature-based interventions in cities has shifted, driven in part by reduced capacities and the growing authority of other actors in urban governing. The withdrawal of **state involvement** in management and financing is a key concern. In some countries a clear gap between state-driven greening projects and commitments to their long-term stewardship is identified. In this context, one of the dominant visions on the governance of nature-based solutions rests upon the idea of **sharing costs and risks** between the private sector and the state. Yet the **mobilization of the private sector** are particularly risky and expensive, leading to forms of social exclusion and the need for the state to guarantee risk. **Volunteerism** is another means through which the stewardship of (urban) green spaces is conducted. Bottom-up projects could create a politics that aims for a radically different, socially just and ecologically sustainable city. There are particularly significant challenges in governing nature-based solution **in the context of gentrification pressures** and persistent uneven landscapes of socio-economic power relations. We find that the use of participatory evaluation schemes with **multiple stakeholders** combined with reflexive forms governance emerges as a key approach to success.



1. Introduction

This working paper aims to bring together key insights on the governance of nature-based solutions (NBS) – such as green/blue spaces, infrastructure and parks - in cities as emerging in the peer-reviewed literature. It contributes to establishing the framework for the empirical and conceptual work undertaken in the NATURVATION project, while looking for gaps, hot spots and on-going debates that require further research. The idea of NBS¹ is now increasingly being used to repackage policy debates on biodiversity conservation, climate change (adaptation and mitigation), and sustainable use of natural resources, air pollution together with public health, social justice and green economic opportunities. Meanwhile to date little empirical research has been directed to identifying successful governance, business, finance and public participation schemes for the extended implementation of NBS. Identifying promising models is a core objective of the NATURVATION project and the current paper contributes to setting the stage towards an extensive empirical work on studying a wide geographical range of NBS projects.

Examples of NBS can range from measures to prevent flooding (such as natural water retention measures, dyke relocation, re-naturing rivers, buffering areas, restoration of wetlands, woodlands, floodplain, re-meandering, de-poldering, set back of estuarine defenses, maintaining dunes, beaches and salt marshes) to responding to heat island effects in cities (through multifunctional green public spaces) and droughts and erosion in rural areas (through sustainable agricultural practices and irrigation systems, reforestation, rainfall water management, torrents and river management). Attention to the expansion of NBS in cities can be situated in the current trend of world urbanization. A study by the European Commission (2015) reports that 73% of the EU population live in cities, and by 2050 this is projected to reach 82%, meaning over 36 million new urban citizens, causing both sustainability challenge and business opportunities for those involved in construction sector. Nature-based solutions are expected to address both issues.

The present document is structured as follows. Section two outlines the methodological approach used for this paper. Section three explores some contrasted and contested visions on the definition of NBS together with their underlying conceptual premises. The following section (fourth) proceeds to summarizing particular aspects and models of governance NBS-like projects identified in the literature. Section five then highlights

¹ Here the terms greening initiatives, naturing cities, green infrastructure and NBS are used interchangeably, although we are aware of the specificities associated with each of these.



the diverse understandings of success as emerging in the different frameworks of NBS governance. Section six brings an equity angle to the discussion on planning, implementation and impacts of urban green interventions, emphasizing their relevance for social and economic justice. The final section identifies a number of research questions and gaps and summarizes relevant insights for the Naturvation project.

2. Methodological approach

The methodology followed for the preparation of this paper was elaborated in collaboration with colleagues from Utrecht University, partners in the Naturvation project. The initial idea of both teams has been to produce one single document, covering two wide themes: innovation and governance aspects of NBS. However, in the end both partners decided to write two different papers, one more focused on innovation and the other one on governance (as presented in DoW). After a series of consultations between teams, we set up the following procedures and steps for preparing the present working paper, that is to:

Step 1: Develop a list of relevant key words

Step 2: Identify relevant references

Step 3: Select and map of papers for in-depth analysis

Step 4: Extract key insights

Step 5: Prepare a working paper

With respect to Step 1, the list of keywords was derived using three general thematic categories with the aim of pinning down: 1) urban geographies; 2) greening or nature-based interventions; and 3) the politics, governance and cultural values/practices associated with them. The search words eventually used are the following, following the order of other categories above:

- urban and city;
- nature, nature-based solution, green infrastructure, community garden, green space;
- govern, politics, justice, controversy, conflict, power, actor, transition

This list of words has been elaborated through consultations with experts on green infrastructure, ecosystem services, urban environmental justice and political ecology. It is a collection of generic terms that catch much of the underlying research in the field of governance/politics/culture of a wide variety of green urban



solutions. The choice of setting a three-tier approach was motivated by reasons of efficiency and the exactness of matches. The alternative strategy consisted in drawing all entries associated with politics and governance in urban context on the one hand, and then of all entries associated with the politics and green interventions on the other. This method, however, resulted in having a too wide range of articles (several thousands), which were not well-targeted and were too time-consuming to process.

The three-tier approach outlined above was applied to Scopus, resulting in 754 hits (Step 2), the oldest dating back from 1979. Older articles did have some relevant insights for the literature review from a political ecology perspective, thus no date limitation was introduced to the search process. A quick check through the list of titles to test their suitability to the lines of literature review indicated that the search had captured the desired content pretty well. One simple test in this regard was to check whether a number of titles which our experts' teams had previously identified as relevant appeared in the list of hits. Most of these were indeed captured by the search. In addition, 14 other titles of recently published (or relevant) articles were suggested by experts in the field.

During Step 3, the abstracts and titles of all selected articles were reviewed and sieved through to arrive at about 40 studies for an in-depth analysis. The basic guideline for arriving at the reduced number of articles has been the extent of their thematic relevance, namely: presence of political, governance or socio-cultural reflections (data/analysis/insights) on greening initiatives/spaces in urban areas. Consequentially, in Step 4, relevant quotes (from the selected studies) were extracted in a table format under categories corresponding to NBS': definition/conceptualization, (including perceptions of their success or failure), governance, and political contestations or justice implications. Most of these categories correspond to the titles of the following sections. In order to draw out multiple perspectives/insights associated with different readings/literatures, the section on definitions and conceptualization (including perceptions on success/failure) of nature-based solutions is dealt with both here and in the review done by Utrecht University team. Yet here these themes receive a more political (ecology)/governance lens.

3. Contrasted and contested visions of Nature-Based Solutions

One the commonly accepted features of NBS is their focus on providing solutions to sustainability challenges, and embodiment of an alternative to grey (material and resource-intensive) infrastructure. Unlike its sister



concepts, (i.e. green infrastructure, or ecosystem-based adaptation) the concepts is pretty open to different interpretations (Potschin et al. 2016). In a recent report by the EC (2015) NBS are defined as "cost-effective alternatives to grey or technology-based infrastructure dealing with biodiversity loss, climate change, and natural disasters and rapid urbanization". Earlier IUCN (2012) framed NBS as "a way of applying the strength, resources, and abundance of nature to global environmental and social challenges". NBS are also broadly formulated as "any transition to a use of ecosystem services with decreased input of non-renewable natural capital and increased investment in renewable natural processes" (Maes and Jacobs 2015). The definitions found in the literature and policy documents can however be clustered into two general categories in terms of the sustainability versions they espouse – weak or strong sustainability. These visions, or premises, are then reflected upon the type of governance scheme or model that accompanies particular NBS.

3.1 NBS in the framework of weak sustainability

While NBS espouse the conceptual framework of sustainability, an explicit articulation of the notion of 'strong' versus 'weak' forms of sustainability is largely missing in its contextual rhetoric (Nesshöver et al. 2017). Belief in the possibility of decoupling economic growth from environmental and social harms, also known as the weak sustainability principle, however, is a central premise underlying the document on NBS produced by the European Commission (2015). They are furthermore framed as attempts to develop "business models that enable economic growth through sustainable urbanization, whilst providing health, well-being and economic progress" (EC 2015). The search for an innovative ecosystems approach that contributes to economic development, understood as "smart, sustainable and inclusive growth and jobs," on the one hand, and (urban) environmental sustainability, on the other, rests at the core of the EC framing of nature-based solutions. So-framed policies on nature-based solutions are furthermore meant to enhance EU competitiveness on the global markets, positioning Europe as a 'world leader' in related research".

The EC approach to NBS is echoed in the frame used by IUCN (2012), where NBS are based upon the "proven contribution of well-managed and diverse ecosystems to enhance human resilience and to provide additional development opportunities for men and women in poor communities". These could be projects that deliver effective solutions primarily to climate regulation, biodiversity loss, and ecosystem restoration through the use of market-based instruments (Fletcher 2014). Likewise, Maes and Jacobs (2015) frame NBS as tools that could help guarantee a 'safe operating space' for humanity, by simultaneously improving local ecological and



social sustainability and guaranteeing long-term productivity. The discourse of decoupling economic growth and productivity from ecosystem deterioration is the underlying leitmotif of this vision, where NBS are perceived as highly productive interconnected natural (sub)systems using renewable energy together with efficient production and recycling systems (Maes and Jacobs 2015). These “ecosystems” are furthermore described as diverse and locally optimal points of equilibrium between productivity, adaptability, and resilience.

One example of a NBS implemented in the framework of weak sustainability is provided in the paper by Hölzel (2017) on the Nauener Platz in Wedding, Berlin. The intervention is an inner-city square surrounded by busy and noisy central arteries (with up to 40,000 vehicles passing per day) converted into a green space. Groups of local residents and people working in the area (with the help of researchers) campaigned and worked on installing “sound islands” to set-back the noise. Yet whether green spaces or parks inserted in zones of heavy car-transit disposing of high-tech sound shields can serve their initial goal as places of relaxation/natural solutions remains an open question (Hölzel 2017). This case embeds some of the inner and outer contradictions associated with creating new NBS in a context of keeping the status quo in a regime of car-dependent and traffic-intensive urbanization; or questions the effectiveness of greening initiatives that are not accompanied by structural changes aiming at sustainable mobility and a reduction of car-use.

3.2 NBS in the framework of strong sustainability

Other visions of NBS stem from a more critical perspective on the capacity of economic development/growth to drive environmental and social improvements in cities. As illustrated by Campell (1996) urban sustainability plans necessarily involve contested negotiations over economic rationales (where cities as primarily places for production, consumption, distribution, and innovation); environmental rationales (where cities are producers of waste and consumers of scarce resources); and equity rationales (where cities are scenes of conflict between different social groups over resources, services and opportunities). Tying all three objectives or rationales, or finding a balance between economic growth, social equity and environmental concerns in the operationalization of NBS would not go without sacrifices or trade-offs— most likely on the side of the latter two (Nesshöver et al. 2017, Eggermont et al. 2015).



Kabisch et al. (2016) notice that even in the context of economic decline cities prioritize the expansion of built-up areas for their positive impact on growth (creating jobs, attracting investments). So far urban greening initiatives, are not, or have not been, as economically productive and profitable as grey infrastructure (i.e. built-up commercial zones) (Kabisch et al. 2016). Some commentators question the appropriateness of neoliberal agendas and corporate partnership in the operationalization of NBS (Fletcher 2014). As argued by Kabisch et al. (2016) applying the so-called ‘growth-obsession’ to NBS could act as a barrier and be counterproductive to the well-being of citizens and the natural environment (D’Alisa and Kallis 2014).

Authors working from this perspective also warn on the limits to what NBS can achieve. In the language of the European Commission, nature-based solutions are seen as a way to increase resilience, human health and well-being (EC 2015). Nevertheless, researchers find that when air contamination reaches high levels, greening strategies (such as increasing tree cover) may not be the best way to solve air quality problems (Baró et al. 2014, 2015). Stated differently, within cities, pollution can be addressed in a more effective way by targeting the sources of pollution (e.g. limiting traffic) rather than increasing pollution sinks (e.g., through restoration of urban green infrastructure) (Kremmer et al 2016). In sum, as Nesshöver et al. (2017) confer, whether NBS go beyond being a ‘green marketing’ communication tool for the positive perception of ‘sustainable management’ will depend on the way these different three types of concerns are dealt with at the level of planning, implementation and management in different scales, contexts and geographies.

3.3 Positioning NBS in the context of multiple overlapping sister concepts

NBS are often juxtaposed to other related concepts and tools. Reviewing literature on climate change adaptation in cities, Brink et al (2016) talk about a sister concept, called ecosystem-based adaptation (EbA). The authors define EbA as the multiple opportunities for the sustainable management, conservation and restoration of ecosystems in order to augment resilience and reduce vulnerability (of ecosystems and people) to climate change. Drawing on this definition of EbA, Brink et al. describe NBS as a concept with transformative potential whose analysis shall incorporate a concern with social benefits, citizen involvement, and consider replication and up-scaling successful local ecosystem-based adaptation.

NBS could also encompass concepts like ‘nature-based interventions’, and ‘ecosystem-based solutions’ (Potschin et al. 2016). The expert group on NBS of the European Commission (ES 2015) also suggest that the



concept builds on closely related concepts, including ecosystem approach, ecosystem services, ecosystem-based adaptation/mitigation, and green and blue infrastructure. Some authors call for establishing a clear link between NBS and its sister concepts as a way to ensure consistency and avoid redundancy (Potschin et al. 2016). Other authors take a somewhat more sceptical position with respect to the framing of NBS (Nesshöver et al. 2017, Kabisch et al. 2016). The first reason for suspicion refers to the perceived sense of vagueness implied by the ‘solutions’ term, which might mistakenly allude that there is a common understanding, or agreement, with respect to the problems and the ways to address them (through NBS), while this is not (always) the case. The second reason is the way nature is framed within NBS, or the impossibility to draw a demarcation as to what is ‘natural’ (given that most NBS include a degree of alteration or designing). Nesshöver et al. (2017) furthermore mention the risk of oversimplification by selling positive ‘solutions’ using a notion of ‘nature’ as something helpful and likeable without properly evaluating their socio-environmental impact.

3.4 Positioning NBS in the political ecology literature

While the analytical stance of most documents discussed so far span between institutionalist approaches, urban planning, ecosystem services and transition studies, one distinct conceptual tradition which is relevant in the context of governance and urban green(ing), is the one of political ecology. Urban political ecology (UPE) provides an integrated and relational approach that untangles the interconnected economic, political, social, and ecological processes that jointly form highly uneven urban socio-ecological landscapes.

In series of articles Heynen (2013, 2015) lays out the scope of urban political ecology by examining what is politically at stake in the uneven, and often crippling, socio-natural power relations at play through the urbanization of nature. This research pays attention to the urban political economy of nature production and transformation, as well as the ways in which broader cultural dynamics lead to explicitly political choices of managing nature (in cities). Another spotlight on UPE brought by Heynen (2015) concerns the idea of “abolition ecology” as an approach to studying urban natures informed by antiracist, postcolonial and indigenous theory, describing the circumstances that produced the uneven urban natures in question. The relevance of these arguments in the context of NBS resides in analysis of (a) the urban political economy relations and dynamics producing NBS in cities, of (b) what type of nature is defined as acceptable (or is being privileged) by policy-makers, planners, designers, and ecologists, and (c) for whom and for which purpose.



A central concern in UPE literature is the unequal distribution of (access to) urban green space/areas, between classes, ethnic/cultural minorities, and different socio-economic groups (Byrne and Wolch 2009, Wolch et al., 2005, Byrne et al. 2009; Abercrombie et al., 2008; Dahmann et al., 2010; Jennings et al., 2012; Johnson-Gaither, 2011; Landry & Chakraborty, 2009; Leslie et al. 2010; Sister et al., 2010). Here, NBS might help address or reproduce inequitable access to urban nature in the short or mid-term – depending on how they are planned, designed and implemented, and on what accompanying policies or tools are put in place by municipalities to ensure a more equal and equitable access to NBS and urban nature (including housing affordability policies).

Within this UPE tradition, adopting a neat or clear definition of green infrastructure - and this may hold for Nature-Based Solutions as well - might be problematic because of the continuous evolution of the term/s, as well as given the (growing) divide in its operationalization (Wright 2011). Consequently Wright (2011) argues that green infrastructure is a contested concept located between different reference frameworks, literatures and politics, and should remain as such. The ambiguities in the definition of green infrastructure could create a common language and facilitate a dialogue by creating a space which has been previously unavailable due to conflicting interests. At the same time, taking-up the concept of cities as “hybrid socio-natural formations” (developed by Swyngedouw 1996), - stressing the inseparability between society and nature, or the integrity and infinite bonding between the two at the level of the city - contradictions, tensions and conflicts, will inherently be present in the trajectories of Nature-Based Solutions.

Nevertheless, one aspect that emerges as a grey field in the UPE tradition is the so-called “methodological cityism” (Heynen 2013), understood as taking cities as a “privileged analytical lens for studying contemporary processes of urban social transformation that are not necessarily limited to the city” (Wachsmuth 2012). It is thus particularly insightful to consider the relationships and flows that exist between the city and the “periphery” – or that have to be produced – to implement NBS projects. The role of peri-urban or rural hinterlands, and their ecological resources and assets, is key for the ability of cities to produce NBS.

4. Governance mechanisms for the implementation and stewardship of NBS

Unsurprisingly, the governance of NBS emerges as a complex phenomenon, involving multiple social and political actors, premises and visions. As a way of ordering the main findings from the literature review, we



structure the forms, or schemes, of governance according to the main actors promoting these - be it public authorities, private/for profit entities, civil society/non-for-profit organizations, academia or grassroots movements. That said, cases of public-only or private-only examples of NBS governance were very few, so the sub-sections with the respective headings below correspond to greening initiatives with the dominant participation, or impulse of one particular type of actor. Meanwhile, the sub-sections on the transitions in the governance and stewardship of green projects/areas/parks bring forward reflections on the current demand or search for experimental and collaborative forms of management, as well as the frameworks underlying them. The section closes with a reflection on the need to insert NBS in a wider framework of governance and forms of urban development, where greening initiatives are having transformative, rather than additive, compensatory or complementary role and function in public policy and planning.

4. 1 Public/state-based forms of NBS governance

Traditionally, and prior to the 80/90s, many urban green initiatives were initiated and governed by state actors. However, over time visions on the role of state, or public stewardship in greening/nature-based initiatives in cities have started to diverge. Reviewing tree-planting initiatives in six major US cities, Young and McPherson (2013) find that despite claims that state alone is not enough to propel changes in urban greening agendas, local public administration (mayors in particular) emerge as the traditional main source of overall vision, planning and management of green infrastructure in town. Nonetheless the approach to the continuous stewardship of urban forests used by public administration in the US is reported to lack continuity (Young and McPherson 2013). There is a potential disconnect between short-term actions/interactions and long-term goals, where changes in public administration could leave particular interventions with no maintenance funds (Nesshöver et al. 2017). In the paper by Young and McPherson, the attempts of the local administration to work with volunteers through planting events, online outreach and public education activities are seen as a one-off measure, which did not result in the establishment of a long-term management of trees in the six cities. The authors compare green with grey infrastructure, arguing that effective delivery of public services in both cases requires stewardship and long-term vision/finance. Given green infrastructure alone cannot provide the (monetary) value it produces, its continuous support through a “dedicated fund” within the city budget is highly recommended (by Young and McPherson 2013). Basset and Shandas (2010) arrive at a similar conclusion when looking at climate adaptation plans at the city level.



In terms of illustrative cases, one state-based approach to greening is Vancouver’s eco-density strategy where inner city population was doubled while quality of life (allegedly) improved (Tillie and Heijden 2015). Adding more parks, trees, green roofs, green walls and children playgrounds, allowing for urban agriculture, floating green, and replacing hard surfaces such as parking lots with green spaces were reported to be the main reason behind the strategy and its success (Tillie and Heijden 2015). A similar project, called the ‘Groenplan’, planned and implemented by the city administration in Rotterdam, aimed at completing a cycling and walking network, together with improving accessibility to water and green space. The key dilemmas which Rotterdam planners faced concern the ways of having ‘the right green in the right place’, and of scaling-up good practices (Tillie and Heijden 2015). At the same time the authors say little about the characteristics of the “right type of green”, or the right type of places for greening, and how these are being perceived by local public authorities.

4.2 From ‘traditional’ urban planning to ‘experimental’ mode of NBS governance

Overall a switch from state-based long-term planning and implementation towards an incremental, improvised, piecemeal approach to governing cities’ greening initiatives is observed in many Northern countries. One of the dominant visions on the governance of NBS rests upon the idea of sharing opportunity costs and economic risks between the private sector and the state, (which certainly is not a phenomenon that is unique for urban greening projects). Some researchers place the governance of NBS in the context of shrinking state budgets for the initiation and long-term management of urban greening initiatives (Perkins 2010). Engaging other actors in the process is seen as a potential win-win solution, where innovation, economic gains and biodiversity protection, or climate change mitigation could go hand in hand. Maes and Jacobs (2015), for example, suggest that subsidies and public funds could support the management of NBS by private entities, whenever long-term societal benefits fail to concur with short-term business interests. Such arrangements are expected to deliver continuous economic growth (in the case of EU) while avoiding “irreversible and unpredictable changes to the global ecosystem” Maes and Jacobs (2015). Furthermore, considering the insurance value of ecosystems in relation to other investments, the European Commission identifies banks and insurance companies as the key actors and potential investors in NBS (EC 2015). A primary objective is thus turning NBS into “bankable opportunities”, and scaling them up to leverage private capital flows (EC 2015).



The redistribution of responsibility for formerly state-driven agenda to corporations, non-profits, and citizens, giving rise to so-called ‘local entrepreneurialism’, as a version of growth-oriented, neoliberal political economy and mind-sets is critically discussed in much of the literature (Ward 2003, Gibbs and Jonas 2000). In this view, some consider that shared forms of governance for green interventions which are inserted within neoliberal growth-centred agendas would still be undemocratic (Perkins 2010). Others identify “strong stakeholders”, or private business (such as housing associations, investors, or developers) with whom a city or municipality has to enter in contractual obligations as a potential barrier to implementing effective and durable NBS rather than as an enhancing agency (Kabisch et al 2016). Making NBS a motor of the ‘green economy’ in urban green planning has also received scepticism (Nesshöver et al. 2017 , Gasparatos and Willis 2015, Brand, 2012). One concern is the insertion of NBS in the framework of weak sustainable development, where social, environmental and economic dimensions are given the same weight in attempts to foster innovation and competitiveness in environmental markets (Nesshöver et al. 2017). Some of the associated risks are of ‘overselling nature (Rodriguez-Labajos and Martinez-Alier, 2013), or of encouraging a perception of ecosystems as entirely-substitutable by other assets used by humans. Other studies argue that powerful socio-economic interests are likely to dominate greening initiatives and be placed above other/social equity needs or priorities (Wright 2011).

The generation of economic value from deprived locations through redesigning parks and the capture of a rent gap is one illustration of the backsides, or failures of the ‘entrepreneurial’ approach (Perkins 2009, Lindsey et al. 2001). As an illustration Perkins gives the example Philadelphia’s Fairmount Park System, described by Brownlow (2006). The park has been re-designed following a growth-oriented strategy (e.g. targeting the competitiveness of nearby wealthy neighbourhoods as attractive places for living and doing business). At the same time African-Americans living close to the non-renovated and unsafe parts of the park did not benefit from the space (*ibid*) and are more vulnerable to displacement.

4.3 Multi-stakeholder forms of NBS governance

In a number of papers, the development and management of NBS is seen as a subject to collaborative governance where policy officers work together with citizens, businesses, and civil society (Kabisch et al 2016, Connolly 2013); or where demands for action are connected with responsible actors and citizens’ involvement and ownership is deliberately sought. Moreover, the partnering of different actors in the governance of NBS



is perceived as a way to reduce barriers/constraints to adopting NBS on a wider scale (Kabisch et al 2016, Frantzeskaki et al. 2014). Reviewing 110 articles on 12 cities on climate based adaptation, Brink et al. (2016) find indeed that the main actor to take action is unspecified in 63% of articles, whereas local government received highest number of references (31%) and citizens and business (as key actors) were quoted in respectively 3% and 2% of the articles. The authors find that while only a few articles deal with stakeholder participation, many of them articles highlight the role of local governments' in engaging citizens in the co-management of ecosystem-services.

This said, short-term subcontracting (i.e. for management of green spaces) to non-profit and private actors is also perceived as a 'stopgap' measure in the face of cut backs on public budgets and as an abandonment of public responsibility in environmental management. In this regard, Perkins (2010) describes how the city of New York has outsource much of its responsibility for the management of NY Central Park thanks to the Central Park Conservancy in order to save on scarce municipal funds. As a result the market-based management of the park is reported to fail in regard to inclusivity criteria, turning Central Park in a quasi-private space (Perkins, 2010).

Yet not all researchers identify a role for civil and grass-root groups, or for beneficiaries, as an actor in the planning of NBS and green infrastructure projects. Ugolini et al (2016) break down stakeholders in three general categories, including: academics, public administration and practitioners. The first is perceived to be a "source of innovation" and "graduates", whereas the second (public administration) and third (private professionals) groups are seen as the ones responsible for formulating and implementing policies 'based on scientific results'. This rather neat vision of planning and decision-making focuses on the circulation of knowledge and improving collaboration between the three groups, whenever resources are available. The effective collaboration (between academia, public administration and business) is also seen as a result of fixing the right stimulus, or having something to offer and exchange. In this regard practitioners (business) are seen as providing practical experience and professionalism, academics – scientific knowledge and expertise, while public administration – experience, data and new problematics. Technical consultancies are then mentioned as the most frequent form of collaboration between the three groups, while social (inequality) aspects of green infrastructure are seen as a field for academics to deal with, while economic ones – by public administration (Ugolini et al 2016)



The importance of citizens' participation in urban settings with limited public space, and the need to promote people-centred, or people-owned, ecosystem-based adaptations is nevertheless increasingly highlighted (i.e., Brink et al. 2016). In their paper, the authors indicate that citizens' inclusion in ecosystem-based adaptation can vary from top-down attempts to managing citizens' behaviour (such as green roof incentives designed by Milwaukee authorities; or tree-planting and educational actions, where citizens received their own small tree to plant and look after); to bottom-up civil self-organisation (such as managing mangrove ecosystems). Additionally, grassroots innovations and transition initiatives are seen as key actors for advocating NBS (providing applied evidence of their benefits) and re-establishing green urban commons (Kabisch et al 2016, Anguelovski 2013).

Planners and environmental management seem to have an increasing interest in incorporating community perceptions and values of green space (Kremmer et al. 2016). In this regard, a number of studies examine the role of procedural, distributive and interactional justice in planning and implementing green spaces. The first type of justice concerns providing a fair chance of local residents, (regardless of age, cultural background, gender or social status) to articulate their needs during the planning and decision process of green infrastructure (Kabisch and Haase 2014). The second one implies considering who uses the green areas and who lives at a walking distance not only to a park but to its entrances (Kabisch and Haase 2014). Interactional justice then deals with the question of whether all visitors (from different age groups and cultural backgrounds) feel free and safe to interact on the premises of the park (Kabisch and Haase 2014, Low 2013).

Civil involvement can be a result of the particular way information on NBS is shared and adopted in a community (Kabisch et al 2016). In this context, Nesshöver et al. (2017) underline the importance of using participatory evaluation as a way to respect the legitimacy of different views on NBS quality (as developed by Rauschmayer et al. 2009), as well as applying multiple perspectives. Kabisch et al. (2016) talk of reflexive forms of governance and collaborative governance arrangements between different levels of the administration, as an appropriate model for NBS. Integrated governance approaches can then be 'measured' by the number of stakeholders/policy officers coming from different sectors involved in planning and implementation of NBS (Kabisch et al. 2016). In sum, multi-stakeholder participation in the governance of green infrastructure is



framed and understood differently in the literature, in function of the broader or narrower understandings on stakeholder diversity applied; or in terms of where initial driver, ownership and financing comes from.

4.4 Entirely bottom-up-forms of NBS governance

The number of green spaces, especially urban community gardens, initiated and managed in a bottom-up fashion is notably increasing in cities in the global North. A number of articles deal with green spaces/infrastructure initiated, managed and governed through grassroots form of organization. This approach often builds on framing/seeing gardening as a type of politics struggling for a radically different, socially just and ecologically sustainable city, or as a new form of intervention in urban politics and planning (Follman and Viehoff 2015). Grassroots greening projects, such as community gardens, can also be sites of conflicting interests between public and private land-use, where the battle for a right to the city and for urban justice is being continuously waged (Schmelzkopf 1995, 2002, Staeheli et al. 2002, Smith and Kurtz 2003, Hassell 2005, Milbourne 2012). For instance, started by a green flash mob, the urban garden NeuLand in Cologne (Germany) is one example. The deeper reasons for the existence of NeuLand are associated with the growing discontent of local residents with their powerlessness in front of the coalitions of private and public developers aiming primarily at profitability of developments (Follman and Viehoff 2015). Unlike other parks and green allotments, where people may seek to retreat from city life, NeuLand is positioned at the heart of the city and its urban politics (Follman and Viehoff 2015). The garden is open to visitors and gardeners, willing to engage with planting. It has a complex governance model with four levels of civil engagements: 1) about 40 occasional gardeners, (who enjoy visiting or working in the garden); 2) about 20–30 highly committed gardeners members of a registered charity, who spend a lot of time on the site and take on more responsibilities; 3) a managing committee of a charitable association created for the management of the garden; and 4) five salaried staff. The individuals involved in NeuLand are furthermore members of a larger citizens' network in South Cologne participating in the planning process of the urban redevelopment area. The spontaneous and determined approach of urban community gardens is interpreted as a new politics of public space, focusing on quality of life, rather than consumption, but also as a “post-modern avoidance of big politics and long-term commitments” (Certoma 2011). Yet, researchers also note that grassroots efforts to build equitable green spaces beyond market logics might become co-opted over time by larger entrepreneurial forms of neoliberal public (environmental) governance (Perkins 2010).



4.5 Industry and private sector-driven forms of NBS governance

Another fraction of the literature on NBS examines greening initiatives predominantly implemented by the private sector. This is particularly relevant for green roofs and facades. A study by Edwards et al. (2014) explores the development of guidelines and certification system for green roofs in Scandinavian conditions, so that more durable and attractive construction solutions can be elaborated. The authors bring forward the example of Vinnova, a Swedish Governmental Agency for Innovation Systems, working for “sustainable growth and social benefits” and undertaking research on the implementation of well-designed and maintained green roofs. Some of the cases they list are the Hornslandet in Stockholm and Greenhouse in Augustenborg, Malmö. The former includes some 150 apartments in houses with green roofs, aiming at becoming a fossil fuel free district by 2030 and generating less than 1.5 tons of CO₂ per person (and year) by 2020. It is built by the Stockholmshem, the nation’s second largest housing company (with nearly 500 properties) owned by the city of Stockholm. Augustenborg, on the other hand, is a project with various elements, among which: a fourteen-story building of about 34 apartments with a rooftop garden; a large greenhouse for growing; twelve terraced houses and an eco-profile school building. Green roofs have however governance issues, including the accessibility or inclusivity of the newly built living zones. Edwards et al. (2014) identify also leakages as a key caveat for all rooftop garden projects. As such projects tend to be more expensive and complex to design and install than traditional roofs, green roofs require costly intensive maintenance, irrigation and drainage systems. A research quoted by the authors finds indeed that up to 40% of green roofs in the US develop “serious problems within one year of installation due to leakage, costing American businesses billions of dollars annually”. Consequently while cities are increasingly developing or sponsoring green roofs, real estate developers also tend to avoid them because of the high risks and costs of their implementation.

In terms of governance arrangements, studying the rooftop garden regulations of Chicago, Basel, Rotterdam, London and Stuttgart Mees et al. (2013) identify three types of governance arrangements in the field. One concerns the division of responsibilities between state and non-state actors, another - the steering strategy guiding the actors implementing and managing the project, and a third one - the policy instruments employed to support the green roof. Mees et al. find that hierarchical arrangements are common at the early stages of the green roof developments, followed by market-based self-regulation where private actors are more prevalent. Private actors here include the entities primarily driven by commercial interests (such as consultants, architects, green roof suppliers), as well as property owners, or individuals. The most active group



so far seems to be green roof developers, who jointly intend to develop economies of scale by bringing down prices and increasing demand (Mees et al. 2013).

At the same time Mees et al. frame green roofs as a problem of non-compensated positive externalities for society at large, which shall be subjected to public support. They lists three major schemes to facilitate and speed-up green-roof replication: coercive, or mandatory; voluntary and subsidies based; and a mix of the two. As an illustration, the city of Chicago provides indirect financial incentives in the form of ‘density bonus’ meaning that developers have the right to build more units per square meter, and get their permission faster if their buildings have green roofs. Basel and Stuttgart, on the other hand, have a mandatory requirement for installation of green roofs on new and renovated buildings, while also stimulating them via a density bonus on a case-by-case basis. Local authorities in London can require green roofs to be considered in planning applications, while Rotterdam provides a subsidy of 30 Euro per square meter, which is expected to cover about half of the installation costs, as well as a demonstration centre.

While few clear illustrations of NBS emerging solely from the private sector can be spotted in the literature, one example of a complex (mostly) private nature-based solution is the EVA Lanxmeer project in the Netherlands (Timmeren et al. 2004). The initiative consists of 200 houses and apartments, ecological office buildings, a biological city farm for local food production, a centre for education and conferences, a plant on biogas, and various permaculture gardens with playgrounds and areas for relaxation, retention and infiltration ponds with and reed beds, woodland and ‘dry-’ and ‘wet’ hayfields. Here, the high implementation cost of the project is born by the individuals purchasing homes in the area.

4.6 NBS in the context of a wider framework of urban development and governance

A number of studies see divestment from dominant solutions, such as grey infrastructure and its optimization or improvement, as one of the necessary conditions that shall accompany NBS politics and policy-making (Kabisch et al 2016). Overall, examples of greening initiatives and spaces which end up influencing municipal policies are scarce or contested. The Million Trees initiative in New York City, for example, is mentioned as a reference case for incrementally influencing state regulation to arrive at one of the best tree ordinances in the US (Young and McPherson 2013). This has nevertheless happened thanks to establishing a permanent volunteer “stewardship corps” to care for their urban forests. The target of planting one million street trees



by 2030 is one of the most purported parts of New York sustainability plan. As noted by Checker (2011), however, the city is simultaneously promoting large-scale developments that destroy hundreds of existing trees, or fostering greening initiatives while facilitating the expansion of large-scale car-based development projects. Checker (2011) furthermore reports that the New York sustainability plan goes along with an unprecedented increase in the number of new residential units, mostly targeted at high-end renters and buyers. The relevant question researchers therefore ask is whether trees can be thought of as part of the city's infrastructure and defended as such; or in a wider sense - could green infrastructure/interventions alter the type of urban development (i.e. focus on economic growth) commonly postulated or it is the dominant (economic) narrative/development model shaping NBS (Wright 2011). This resonates with an essay by Angelo (2017) arguing on the dangers of romanticizing nature as a way to "improve cities", or the nativity implied by beliefs that "nature can fix the social".

5. Successes and barriers in the governance of nature-based solutions

5.1 Criteria of NBS success from an institutional governance perspective

A number of studies find that the most frequent barriers to implementing ecosystem-based adaptations are institutional. These include lack of resources, know-how, tools, unsupportive legal frameworks, such as environmental and building permits, and/or missing property rights (Brink et al 2016). Other barriers identified by Brink et al. are the lack of space in dense urban areas and the possible conflict of interests with other ecosystem services (such as drinking water production, for example).

Another major impediment, identified by Kabisch et al. (2016), concerns the traditional structures of city departments and the "sectoral language", which traps knowledge into "sectoral silos"; or the so-called compartmentalization of professionals with different educational background and different objectives (Brink et al 2016). This is reiterated by Kremmer et al. (2016) who add that the presentation of scientific results in incomprehensible or unusable to formal planners (e.g., publication in non-open-access journals) provides another source of difficulty for incorporating insights from research into planning and policy. At the same time, drawing on findings from the European research project URBES, Kremmer et al. (2016) acknowledge the challenges and difficulties of applying multiple methods and diverse approaches in one simple and large theoretical framework and communicating it clearly to decision makers and planners.



Many of the categories of success, used in institutional settings, are ecological. These include the level of NBS connectivity and 'greenness', focusing on the protection of ecosystems and the improvement of wildlife and biodiversity. The level of multi-functionality is another success criterion embracing measures for climate change mitigation and adaptation as well as the enhanced provision of space for culture, sport and recreation, facilitating local distinctiveness, social inclusion, and a sense of community (Kremmer et al. 2016).

5.2 Factors of success related to multi-stakeholder forms of NBS governance

In greening initiatives with experimental forms of governance, the discussion frequently revolves around issues of continuity. Given the perceived discontinuity between short-term actions and long-term plans or goals of some NBS managed by multiple stakeholders the durability of particular greening project emerges as a common success criterion (Kabisch et al 2016). Another hallmark for governance success is the extent of scalability and diffusion of good practices. This is particularly relevant for (often) privately installed green roofs, also described as a "visible sustainability" by some practitioners. The percentage of roofs in a city which have been converted (or greened), for example, is seen as a major success (Mees et al. 2013). The examples of Basel and Stuttgart where $\frac{1}{4}$ of the eligible roof space has been transformed in (intensive) green roofs are particularly revealing. One of the keys to their success, however, are associated with the intervention of state/hierarchical arrangements and coercive regulation, such as the mandatory requirements of installing green roofs on new buildings, combined with the provision of financial rewards. Nevertheless the positive overall public perception of green politics (focusing on biodiversity in Basel and air quality in Stuttgart) has also played a role for this success (Mees et al. 2013).

One example of an NBS framed as a success in the literature, is the multi-stakeholder Dakpark initiative in Rotterdam. The project involved sessions with diverse range of stakeholders (urban planners, landscape architects, community organizations) for the transformation of an old railway yard, which was blocking access to a river (Tillie and Heijden 2015). Once plans for reforming the yard were announced a diversity of positions were articulated with respect to its design: proprietors were interested in using it for economic activities whereas local residents - in turning it into a park. As a result of the consultation processes, a decision was made to seemingly serve both interests: the creation of employment and of green recreation area. Eventually local residents contributed with ideas for the design and management of the park, which were later used by designers to convert the space into a park located on top of a shopping mall with a river levee on the side



(Tillie and Heijden 2015). The more active residents eventually united within a formal association (called the Dakpark Foundation), which – in the words of Tillie and Heijden - works for “a good, lively and pleasant place in Rotterdam West”. Here success is framed in terms of reconciling both types of interests through the introduction of innovative forms of greening.

There is a debate however on whether NBS interventions should respond to both economic and recreational demands and whether the balance of both demands can be perceived as a success. On the one hand, a number of policy documents highlight the economic gains associated with **increasing local land and property values** as a result of a green intervention as a sign of success (CABE Space 2005, NWDA 2008, McMahon 2009, Collinge 2010). In a similar fashion, several public reports frame the provision of an “enhanced environmental backdrop” of greening initiatives unleashing economic growth by attracting skilled workers and tourists to adjacent zones as a reasonable achievement (Environment Agency 2005, TEP 2005). Yet, others perceive success in terms of achieving exactly the opposite, namely as **keeping and protecting the initial socio-economic network** and features in the neighbourhood. Success here is framed as community involvement and empowerment around greening initiatives. One example is a study on the management of ecosystem-based adaptation in Durban which achieves inclusivity and community involvement (Brink et al. 2016). Another study presented a particular greening intervention as a success because of the coalitions established between the long-term residents, working-class, migrant population and well-off newcomers to defend their neighbourhood (in New York) from water contamination and (further) gentrification (Hamilton and Curran 2013).

5.3 Factors of success related to grassroots forms of NBS governance

In the case of bottom-up greening projects, Follman and Viehoff (2015) report that attracting new citizens to volunteer on a regular basis for the management of a common space (urban garden) is problematic, even when large PR campaigns to promote the project are pursued. Alternatively, leaving maintenance to paid workers runs the risk that those who depend on the garden for their income to initiate projects which support their (individual) income base more than the common interest (Follman and Viehoff 2015). Success for grassroots NBS projects is therefore highly dependent upon issues of participation and continuity.



6. The justice and equity implications of multi-stakeholder NBS

Local residents and community groups might either welcome or contest NBS interventions in their neighbourhood depending on the interventions' ability to (re)distribute ample socio-ecological benefits. Yet, justice, the distribution of benefits and power (between gender, ethnic and cultural groups) and citizen participation in urban greening initiatives have thus far received little attention in the literature on ecosystem-based adaptation and eco-system services/green infrastructure (Brink et al. 2016). Moreover, articles looking at questions of equity and gender tend to perceive residents as a homogenous entity (Brink et al 2016). In contrast, the urban literature on environmental justice therefore provides a distinct pathway and source of data/analysis on the tensions and inequities possibly produced or exacerbated by urban greening initiatives and strategies.

6.1 Could NBS (re)produce environmental inequities?

Overall, a large number of studies, mostly in the US, document historical and present evidence of environmental injustice in the distribution of and access to urban green space. The history of public green space can be traced back to the English aristocracy importing pastoral aesthetics into XVIII century London, creating residential squares, and privatizing or forcibly enclosing space valuable to farmers (Byrne and Wolch 2009, Lawrence 1993). Within this vision, parks were conceived as playing a social control function, disciplining working class, and off-setting social tensions. For instance, the early planning of city parks (such as the Central Park in New York), is said to have enacted elitist ideals of refinement, creating a binary 'moral geography' between parks for privileged white residents and parks for minorities (which are smaller, with fewer facilities and with less municipal support) (Byrne and Wolch 2009). The literature on urban political ecology provides records of "park-making projects" initially contested by urban minorities, (e.g. race riots erupting in Lincoln Park, Chicago and Griffith Park, Los Angeles) for their exclusionary dimensions. In that sense, Perkins (2010) perceives parks as "another version of positive environmentalism" where green space is used to pacify or discipline the potential popular unrest that could threaten capitalist urbanism (also discussed by Jonas and While 2007).

Citing an extensive list of papers, Wolch et al. (2014) conclude that access to green space is still being highly stratified according to income, race, ethnicity, age, gender, (dis)abilities and various axes of difference (Byrne and Wolch 2009), with lower income, minority, older, and female residents suffering from a lower access to



green space in cities. Additionally, planners and park managers seem to fail at considering culturally-specific uses of parks and green areas by specific groups of residents, which is what we called earlier interactional justice. Byrne and Wolch, for example, report that African-Americans enjoy more sociable, formal, sports-orientated urban parks settings, while Whites prefer more secluded nature for rather individual use; Asians are said to appreciate scenic beauty over the functionality of the area, whereas Latinos – to have an appeal for more developed environments with good parking, picnic tables and restroom facilities (Byrne and Wolch 2009).

In another study, Kabisch and Haase (2014) look at the social distribution of green space in Berlin, being one of the greenest cities in Europe with an average of 6 m² park space per inhabitant. Even in Berlin, the biophysical/ecological processes produced by parks are predominantly used by residents living at a walking distance, meaning socially privileged residents. The high density areas of Berlin, characterized by a high representation of immigrants, for example, have disproportionately fewer parks or green areas than other parts. Analysing the potential beneficiaries of Tempelhof, an ex-airport in the central parts of Berlin, converted in a large open-air green area for recreation, Kabisch and Haase found that only 9% of surveyed visitors were immigrants. At the same time the adjacent areas are marked by a high cultural diversity with more than 27% of the residents coming from other countries. Some of the reasons for lower immigrant representation among the beneficiaries that Kabisch and Haase (2014) put forward are the culturally specific uses of un-shaded, open-air green space. Muslim women, for example, may feel unsafe in large open spaces, while residents above 65 years miss tree coverage and sitting infrastructure. Thus if green or natural areas do not meet the culturally and socially defined needs of potential visitors, the authors conclude, they may be less used/effective for recreation (*ibid*, Low 2013). As an example of a bottom-up project in this context, Follman and Viehoff (2015) report that no members from migrant communities or deprived backgrounds have been attracted to the group that actively manages the bottom-up community garden of NeuLand in Cologne (Germany).

Recently, much research has been directed to the process of rendering older urban areas inhabited by lower income population into more liveable and attractive by means of greening projects. The resulting process has been termed ecological, green, environmental, or eco- gentrification (Dooling 2009, Gould and Lewis 2012, Checker 2011, Pearsall 2010). Such green amenities are being called Greenlulus in reference to the planning



literature which calls certain facilities, especially contaminating facilities or industries in low-income and minority neighbourhoods, as LULUs - Locally Unwanted Land Uses (Anguelovski 2015). Environmental gentrification has been reported to create a dramatic change in the available housing and commercial infrastructure which local (lower income) communities rest upon, while creating substantial benefits for private companies, or real estate investors (Wolch et al. 2014). One of the most famous examples of green gentrification is New York's High Line, now replicated in many US cities and even China, (Wolch et al. 2014). Built upon the remains of an elevated train line spur, abandoned since 1980s, the sight was rescued from demolition by local activists who redesigned it as an aerial greenway. Eventually the High Line became one of the popular destinations in New York, attracting millions of visitors each year, together with a variety of birds, insects, and small animals. As a result between 2003 and 2011 property values in the zone increased by 103% and \$2 billion were invested in related property development (*ibid*).

In terms of European studies, a recent article by Haase et al. (2017) reviews a number of greening initiatives such as parks, rooftop gardens or tree-planting initiatives along the streets in Leipzig, Liverpool, London, Hamburg, Bristol, Amsterdam, Copenhagen, and Barcelona, where lower income groups have been either displaced or economically excluded from the area as a result of the higher local housing prices and real estate speculation in areas adjacent to green space. Dynamics of green inequalities are also clearly emerging in Eastern Europe (with examples from Poland and Bulgaria highlighted by Haase et al 2017). The authors conclude that while Nature-Based Solutions are expected to contribute to the overall improvement of the living and health conditions of the urban citizens, evidence on this assumption is still missing. Urban greening might not automatically provide guarantees for social sustainability in cities.

Another often forgotten dimension of justice in the planning and management of greening projects in urban areas is the sense of community and refuge which certain types of natural areas in cities tend to provide. The quest for improved environmental conditions is often related to the emotional need and search for community belonging, protection and safe space (Anguelovski 2013). These areas could have very high intangible value for some individuals, for there they can feel safe to create a small oasis where hegemonic beliefs can be put on a stand-by (also referred by Polletta 1999). Local natural areas – such as social urban gardens - (either bottom-up or not) can strengthen residents' attachment to (and engagement in) their place. Moreover vulnerable groups, or individuals who suffered individual or community traumas, tend to become strongly



attached to the green space they have fought for, especially when they do not personally own it. The sense of having extended family relations or house environment out there in a particular green space as an element of bonding or community-building is particularly strong in (alienated) urban areas and an integral element of some natural sanctuaries in cities (Anguelovski 2013)

6.2 Contestations and responses to environmental inequities

Some community groups organize to address environmental gentrification using a variety of strategies (Pearsall and Anguelovski, 2016). One example described by Hamilton and Curran (2013) is the so-called “gentrifier-enhanced environmental activism” as opposed to “glorifying ‘Green Manhattan’”, and defending economic-ecological win-win situations, where improving environmental amenities are expected to go hand-in-hand with attracting a well-educated and mobile ‘creative class’. Hamilton and Curran (2013) draw upon the case of Greenpoint where a highly contaminated waterway between Brooklyn and Queens (New York) eventually received attention after 30 years of silencing critical voices. Cleaning actions were undertaken after the partial gentrification of Greenpoint, when more vocal population - unwilling to accept the high existing level of water contamination - settled in. Long-term activists from Greenpoint saw the new population of gentrifiers as an opportunity to retake the environmental struggle, while cultivating the resources that the new residents could bring together for achieving a larger political leverage. This is one of the rare cases where a coalition between long-time working class residents and newly settled ‘elite allies’ was established; or where gentrifiers mobilized for the benefit of pre-existing community priorities. Simultaneously attempts were made to mitigate the potential expansion of gentrification processes, framing them as a common cause. Nonetheless, the contamination started to seem out of place only after gentrification started Hamilton and Curran (2013).

As a way to address justice in greening politics, Wolch et al. (2014) argue for a governance strategy titled ‘just green enough’. This vision challenges the understanding of “green” only as pretty or natural-looking (Curran and Hamilton 2012). It stands for designing and sharing green space projects by community concerns, needs, and desires rather than using conventional urban design or purely ecological restoration approaches. Certainly placing market-driven and purely conservationist approaches on hold in order to make space for ‘just green enough’ strategy is particularly challenging and a result of (subject to) community activism (Wolch et al. 2014). Yet, such approaches could protect vulnerable communities and simultaneously enhance fairness and ‘natural’



solutions. One example of such strategy would be the promotion of small-scale scattered green interventions in all types of city districts, rather than larger sights in trendy parts of town that require substantial investments and lead to rounds of gentrification (Wolch et al. 2014). In this relationship, Bertram and Rehdanz (2015) find an inverted U-shaped relationship between urban green space availability and life satisfaction for residents in the central district of Berlin. In other words, a marginal increase in the urban green areas causes an increase in life satisfaction up to a threshold, after which further growth in the size of green areas do not contribute to subjective well-being (although it does push up land prices).

A practical illustration of a “just green enough” strategy is the aforementioned environmental clean-up in areas with working-class population in a way that prevents real estate prices from rising-up and averts displacing long-term populations who suffered the consequences of industrial pollution (Curran and Hamilton 2012). “Just green enough” strategies require acts of careful balancing, built upon collaborations between public authorities and diverse local stakeholders willing to contest powerful real estate interests. This strategy touches base with the recommendations of a recent article by Haase et al. (2017) arguing that socio-spatial inequalities shall be considered at the planning, implementation and monitoring stages of greening projects, engaging different groups, and contrasting viewpoints including tacit community knowledge (Anguelovski et al., 2015). This process furthermore requires multi-actor governance as well as an honest discussion on the existing trade-offs between ecological and social outcomes of a greening projects, as places of encounter for different social groups.

7. Literature gaps and directions for future research with respect to NBS governance

Some of the main research gaps with respect to governing NBS concern the commonalities in the variety of ways in which nature-based solutions are *defined*. A number of questions in this respect emerge from and within the literature are: to what extent do existing greening initiatives shape the common understanding of NBS and their aims (Kabisch et al. 2016); to what extent could existing greening interventions be considered as NBS although they have not been implemented as a response or solution to a particular socio-environmental challenge; do solutions based on imitating nature, or biomimicry classify as NBS equally as urban forests (Potschin et al. 2016)? How NBS definitions emerging within a weak sustainability framework differ from those rooted in principles of strong sustainability in terms of their implementation and governance is another important topic for further work. Furthermore there is an alleged lack of studies comparing



ecosystem-based adaptation/NBS to grey infrastructure. Measurement is also a grey area, as the routine criteria for evaluating ecosystem-based adaptation oftentimes applied are cost and effectiveness, embodied in a weak-sustainability frame of reference.

Another area for further scrutiny concerns the search for **effective models of governance**. Summarizing the findings of a workshop dedicated to NBS attended by multiple stakeholders, Kabisch et al. (2016) identify the design and implementation of NBS to be largely understudied. Other questions that have surfaced in the workshop are: which is the appropriate time scale of NBS implementation; which approaches would be more effective in the long term and which shortly after implementation? How to ensure project effectiveness and according to which criteria? What is the 'right' form of NBS' 'relationship with society'? Likewise, building upon findings from the URBES projects, Kremmer et al. (2016) recommend that future studies focus on the role of institutions in shaping and encouraging demand for ecosystem services - and for the infrastructure (and NBS) supporting them. This is reiterated by Young and McPherson (2013) who believe that more research needs to be directed to successful popular mobilizations in support of greening projects initiated by the state.

A third area that merits extra research concerns **contestations and inequalities**. While a number of studies report episodes of green gentrification associated with the improvement/expansion of parks and urban tree-planting, it remains unclear whether there are certain specific features/types of green interventions leading more clearly to (or exacerbating existing) inequalities; or whether gentrification follows from and through all types of NBS. Some authors draw attention to the power relations and dynamics within stakeholder groups involved in the planning and management of green spaces, (and the types of stakeholder empowerment) as fields that require further exploration. Typical research questions asked here are: who owns the idea of a particular intervention, and who decides upon it; through which processes; who designs the processes; who benefits and who gets excluded? (Brink et al. 2016).

Overall articles on ecosystem-based adaptation tend to be dominated by natural scientific approaches, whose usefulness for decision-making could be limited (Brink et al. 2016). Other lenses that are still under-represented are facets of quality of life and cultural acceptances associated with particular NBS (Brink et al. 2016). A key question to review further here is the type or range of socio-cultural values that people assign to nature, landscape elements, and species (Kremmer et al. 2016).

8. Discussion and conclusion

As a way of tying the discussion together - and bringing in key insights for the Naturvation project - **the discussion on the different conceptual premises** that underpin NBS is a useful starting point. The divergences between the visions of IUCN, EC and certain fraction of academic writing with respect to the challenges that NBS are expected to address (and are capable of addressing) are shaped by differences in their conceptual framing. Some of the relevant questions emerging from these differences are: is it feasible and desirable to rest upon NBS as a source of smart, sustainable and inclusive growth; what are the associated social and environmental trade-offs? Alternatively, is it up to implementing agencies to decide upon the level of substitutability and complementarity between economic and socio-environmental objectives in the implementation and governance of NBS? One example is the Dakpark project, discussed earlier. It remains unclear what are the added environmental and social values of a project that promotes the construction of a shopping mall with a green roof/intervention. Stated differently – to what extent are the socio-environmental cost of the construction and operation of the first off-set or compensated by the socio-environmental benefit or gains of the second? Can Dakpark be defined as a success, in this case? The different literatures would provide a different answer.

Likewise, other governance-related questions which emerged throughout the literature review concern **the different expectations of NBS' impact**. In particular: To what extent do green infrastructure/NBS interventions alter the type of economic development? Or is there a dominant (economic) narrative/ development model that shapes green infrastructure? Or can NBS provide a (partial) cure for the high levels of air contamination associated with traffic intensity? Can NBS projects jump over or avoid existing exclusionary patterns when implemented in a context of rising socio-economic disparities? These questions are especially relevant in relation to the EC ambition of making NBS bankable (aiming at engaging profit-seeking financial institutions as partners), and in the context of perceptions of success understood as increasing land and property values. Some part of the literature leans towards the conclusion that for NBS to be effective additional socio-economic policies need to be pushed through, for example ones ensuring accessible/social housing policies, or reducing traffic in cities. Yet no studies provide evidence that NBS are capable of steering the desired socio-ecological transition in cities on their own.



At the same time, the divergent visions under the NBS umbrella could be an opportunity for bringing different disciplines together. **Seeing NBS as a contested concept**, as opposed to one that is neatly defined, could be a source of strength as it provides a space for a dialogue and innovation. The vagueness implied by the word solutions, (i.e. nature-based solutions to what and for whom?) on the other hand, opens up space for bringing the discussion further, by engaging with a wider range of voices, approaches and narratives. This requires a making more explicit the culturally specific or appreciated forms of NBS, and taking these in consideration when deciding on “having the right type of green”, and “right type of place”.

While it is too early to argue that a particular form of NBS governance dominates, some modes of management emerge as more popular than others. Most surveys do not clearly identify one central institutional, private or civil actor who shall own, promote and manage green areas. **State involvement** in the management of public parks and urban forests, for example, in the context of diminishing public budgets in the UK and the US, is a key concern. In some countries a clear gap, or disconnect between state-driven greening projects and commitments to their long-term stewardship is identified. Some authors find that NBS should have dedicated funds in the city budgets, as otherwise short-term subcontracting could get put at peril long-term societal interests associated with particular green areas.

In the context of budgetary cuts, **popular mobilization and volunteerism** emerges as a big hope for the stewardship of green spaces and parks. Indeed some participants in urban gardens envision bottom-up greening projects as moving beyond the construction of urban green sanctuaries towards engaging with politics that aims for a radically different, socially just and ecologically sustainable city, where a new culture of participation and community engagement is being born and cultivated. Other authors, however, warn on the dangers of the so-called neoliberality imbued in self-organized spaces, as they may cultivate civil withdrawal from state politics. At the same time social and urban gardens struggle to maintain the voluntary commitment of their participants, and to attract the support of a disinterested majority of citizens.

Another aspiration for NBS management and finance is **the private sector**. The few examples of nature-based living spaces and areas which are completely private, on the other hand, tend to be accessible for few upper-class individuals. The projects initiated by the private sector enterprises are mostly in the field of green roofs and facades. These are particularly expensive and risky to install and maintain (given high possibility of



leakages). Nevertheless the successful mass installation of green roofs in towns does not go without a strong state involvement and financing. It also remains unclear whether the benefits of green roofs or facades could compensate the socio-environmental impacts of construction. Alternatively, the development of green roofs/facades may be used as an excuse in the promotion of further construction, urbanization and commercialization of the urban landscape, leading to an aggregate deterioration of environmental and social conditions and to real estate speculation at the cost of the most socially vulnerable groups. Certainly the discussion on the socio-economic benefits and costs of green roofs/facades, and the associated actors here is complex and requires scrutiny from multiple theoretical perspectives.

In this context the dilemma between promoting and creating new parks/NBS in a top-down fashion, versus waiting for these to emerge on the fringes and empty lots of town driven by grass-root forces, one useful approach is the use of **participatory evaluation schemes with multiple stakeholders**, as well as reflexive forms governance (with more engaged and engaging forms of civil participation). This said the literature is ambiguous on who shall be considered a stakeholder in such dialogues, with quite some studies seeing academia, business, practitioners and state officials as the usual suspects or invitees in consultations and dialogues.

Finally, **the distribution of the benefits** associated urban green spaces does not appear to be a central research inquiry for much of the literature on green infrastructure, nature-based solutions, urban ecosystem services and transition. Planning of green areas (such as parks and urban forests) cannot go without consideration of the pertinent economic and social factors (e.g. inequalities), and the uneven landscape of socio-natural power relations. In a large part of the cases (larger) parks have been associated with increasing real-estate prices placing economically vulnerable (low income) part of the population at a disadvantage. In parallel, low-income individuals tend to live in areas with less green space and higher levels of contamination. Green gentrification thus needs to be given an equally large weight as other factors (such as financing, or management) at the very planning stage of NBS. Some case studies to draw lessons from have been highlighted above, such as the establishment of alliances between newly arrived residents in gentrifying areas and local long-term residents around social and environmental issues that concern both groups. The strategy of just green enough, mentioned earlier, is an approach, calling for designing greening projects while taking into consideration community concerns, needs, and desires. One concrete greening strategy that emerges within this perspective is the promotion of small-scale green interventions scattered over various parts of town, rather than larger



green areas that have stronger gentrifying effect. Successful green interventions within this vision would focus less on the visible forms of sustainability or so-called aesthetic value of the landscape and more on the forms of access and distribution of (culturally-perceived) benefits.



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