# Nature for Resilience? The Politics of Governing Urban Nature

Laura Tozer [a], Harriet Bulkeley [b], Bernadett Kiss [c], Andrés Luque-Ayala [d], Yuliya Voytenko Palgan [c], Kes McCormick [c], Christine Wamsler [e]

[a] Department of Physical and Environmental Sciences, University of Toronto Scarborough, Canada
[b] Department of Geography, Durham University, UK and Copernicus Institute of Sustainable Development, Utrecht University, Netherlands
[c] International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden
[d] Department of Geography, Durham University, UK
[e] Lund University Centre for Sustainability Studies, Lund University, Sweden

## Abstract

Transcending initial efforts to make cities 'climate smart' by focusing on the potential of new technologies and infrastructural interventions, various actors are increasingly interested in deploying nature to help achieve urban resilience. In this context, rather than taking resilience as a given property of particular systems or entities, it is important to examine why, how, with what implications, and for whom resilience is being enacted. We examine how and why nature-based solutions are being mobilised as a means for governing the resilience of cities and what this means for the ways in which urban resilience is imagined and enacted by different actors. Recognising that behind different approaches to resilience are diverse ways of valuing nature, we identify four value positions through which nature comes to be understood, given meaning, form, and purpose. Drawing on systematic document analysis and 66 interviews from Cape Town, Mexico City, and Melbourne, we discuss how these four value positions of nature are manifested in nature-based interventions for resilience, as well as the implications both for the politics of resilience interventions and the opportunities for enabling social benefit through nature-based solutions. We find that the integration of intrinsic values for nature opens opportunities for nature-based solutions to enable social benefits through an increased focus on the means through which they are implemented. We conclude that urban-nature-as-resilience interventions serve to embed values and the socio-natures they produce within the city, creating fundamentally different consequences for the forms and politics of nature-based interventions designed to realise urban resilience.

## Keywords

Climate change; Nature; Resilience; Urban; Values

## 1. Introduction

The emergence and embedding of urban resilience has, for over a decade, given rise to a host of new ways of thinking and practicing urbanism in relation to a shifting frontier of risks and insecurities – from forms of social and infrastructural vulnerability to climate change (Wakefield 2018; Burayidi et al. 2019). Drawn from the work of ecologists (Holling 1973), amongst several definitions (cf. Davoudi 2012; Cutter, Ash, and Emrich 2016; Wachsmuth

and Angelo 2018), urban resilience is broadly understood as “the ability of an urban system—and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales—to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity” (Meerow, Newell, and Stults 2016, 45).

Alongside a concern for the central role played by technologies, infrastructures and data in the making of resilience discourses and interventions, attention is now focusing on the ways in which nature is coming to be enrolled in the making of urban resilience (Usher 2018; Finewood, Matsler, and Zivkovich 2019; Wakefield 2019). Accordingly, a growing body of literature focuses on how nature – often in the form of so-called ‘nature-based solutions’ (NBS), ‘ecosystem-based approaches’ or ‘green infrastructure’ – is being deployed to foster both the resilience of cities and resilience for cities across a wide range of state and non-state actors (Ernstson et al. 2010; Kabisch et al. 2016; Bush and Doyon 2019; Pedersen Zari et al. 2019).

Yet for all its apparent common sense desirability, the rise of urban resilience has come under sustained critique (Wakefield and Braun 2014; Burayidi et al. 2019; Wakefield 2020). This critique is principally based on: what actually constitutes urban resilience; how the rolling out of resilience as a governmental project carries with it a particular politics that requires critical scrutiny; and, crucially, which specific imagined socio-natures are reproduced through framing societal problems in resilience terms (Rogers, Bohland, and Lawrence 2020; Smirnova, Lawrence, and Bohland 2021; Wakefield, Chandler, and Grove 2021). The work of human and political geographers has pushed forward research to understand how resilience is encountered and has opened up conversations about the values underpinning resilience that impact the way the concept is constructed (Fainstein 2018; Rogers, Bohland, and Lawrence 2020; Wakefield 2020). Contested values for nature play an important part in environmental politics and contribute to ongoing debates within the

field as to the shared norms and discourses that underpin contemporary understandings of and struggles over the environment (Schulz et al. 2017; Leipold et al. 2019; Stevenson 2019). This has also been highlighted by the recent IPBES Assessment Report on the Diverse Values and Valuation of Nature (IPBES, 2022). Different approaches to environmental value have given rise to disputes concerning the governance of nature, which is thought to have contributed to an impasse in the policy arena (Chan et al. 2016; Wachsmuth and Angelo 2018). Yet despite their centrality to environmental politics, the ways in which environmental values imbue and sustain discourses and practices of resilience has yet to be explored in depth.

Building on the critical scholarship on resilience in human geography and beyond, our aim in this paper is to examine how different values for nature shape the form and politics of urban resilience interventions. Frames about how, why, and by whom interventions seek to contribute to urban resilience are a critical part of the strategic and political work taking place to govern cities in response to climate change (Wakefield 2020; Meerow and Neuner 2021). Here, we draw geographic literature on urban resilience and nature into conversation with literature from multiple disciplines on valuing nature. We intend to advance an approach that supports the examination of the values underlying frames about how, why and by whom interventions seek to contribute to urban resilience in order to contribute to discussions about how to enact NBS that enable social benefits (Woroniecki et al. 2020).

In the following section, we identify four analytical ‘value positions’ underpinning how nature is conceived as having value based on a review of academic literature. We then examine how the different values of nature are manifested in NBS for resilience in three different case-study cities—Cape Town, Mexico City, and Melbourne. Finally, we discuss the implications of our findings in terms of narratives of problems and solutions, particularly related to how they structure opportunities for social benefits to be realised. We argue that urban nature as resilience interventions serve to embed values and the socio-natures they

produce within the city, creating fundamentally different consequences for the forms and politics of NBS designed to realise urban resilience.

## 2. Conceptualizing the value of nature for resilience

Despite its increasing prominence, what resilience is and what it means is subject to considerable debate within both academic and policy circles. Rogers et al. (2020) highlight two prominent resilience narratives: instrumentalist and critical. The instrumentalist narrative draws on a pragmatic approach using resilience as a framework to understand how places can respond to shocks as risks increase. Values are often left unexplored in this literature, which focuses on bridging theory and practice (Rogers et al., 2020). Critical resilience narratives tend instead to question the reliance on a socio-ecological systems conception of resilience (Pelling 2010; Pelling, O'Brien, and Matyas 2015) and focus on the political work that discourses and practices of resilience undertake, their underlying power relations and the consequences for different groups of society. Within human geography, there has been a particular focus on the ways in which resilience operates as a form of governmentality that serves to secure particular forms of neoliberal order and conduct (Joseph 2013; Whitehead 2013). In this context, researchers argue that resilience has become a global urban policy project that reproduces philanthrocapitalism and neoliberal norms locally (Webber, Leitner, and Sheppard 2020).

Further, analysis suggests that the mobilisation of resilience has served to disavow collective and especially state-based responsibilities for addressing vulnerability and responding to climate change and other sustainability challenges. Instead, it places an emphasis on the self-governing capacity of private agents as the means through which risk is to be reduced and adaptation secured (Davoudi 2012; MacKinnon and Derickson 2013). This in turn has raised questions of what is being made resilient, for whom and to what end (Cretney 2014;

Meerow, Newell, and Stults 2016; Sanchez, van der Heijden, and Osmond 2018). From this perspective, transformative forms of resilience are those which not only address changing environmental conditions but do so in a way that fosters social justice through tackling the root causes of vulnerability – either by ensuring those that are excluded have access to the benefits of new interventions or, more fundamentally, through recognition of structural inequalities and attempts to change the workings of power and governance to address them (Manuel-Navarrete and Pelling 2015; Shi et al. 2016).

How, by and for whom resilience is framed and put to work has been shown to matter a great deal. Central to such framings are questions of how and why nature has value or should be valued, which have been matters of long-standing philosophical and political debate (Gavin et al. 2018; IPBES 2022). Values shape how we interpret and act on complex ideas. We follow Rogers et al. (2020, 2) in thinking about values as "directive influences, affective in our consideration of moral agency and the appropriateness of action". Values shift and multiple values are held at once, but still they inform decisions since "individuals or groups use value-laden information to make decisions about the world and how to act within it" (Rogers, Bohland, and Lawrence 2020, 2). Such values can be seen as "guiding principles or abstract goals… expressions of the importance and meanings that are assigned to" nature (Schulz et al. 2017, 2).

While much of the treatment of environmental values focuses on the level of the individual and questions of how values are formed, held, and shape behaviour, here we are interested in exploring how values held in common act as shared ways of understanding society/nature. In this sense, we are interested in the storylines that circulate about the value of nature (Hajer 1995; Dryzek 1997; Bernstein 2000).

Central to the debate about how nature comes to be recognised is the distinction between its *instrumental* and *intrinsic* value (Chan et al. 2016; Pascual et al. 2017). While subject to

considerable philosophical treatment, in summary the instrumental value of nature can be regarded as that which derives from viewing nature (its properties, functions, attributes etc.) as a means through which specific ends (e.g. improved welfare, economic activity) can be achieved: nature is an *instrument* through which other goals can be achieved. Such a perspective not only regards nature as a means to an end, but also implies that it is substitutable—if it is the end goal that matters, nature can be substituted by other means to achieve that end. For example, while an NBS may provide a means through which flooding can be diverted from vulnerable urban locations, this could be substituted by a grey infrastructure system. The value of nature lies in its ability to provide the *best instrument* for this end goal, whether that is judged as a matter of efficiency, effectiveness, legitimacy, or another criteria.

In contrast, the *intrinsic* value of nature is seen as a recognition of the value of nature in and of itself. Nature is, in this perspective, the end goal. Intrinsic value is a particularly complex, and often contested, matter, with debate centring on which entities can hold such values and the nature of intrinsic value itself. Broadly, approaches to intrinsic value include those which regard nature as having value in and of itself, absent of any human form of valuation, and those which suggest that intrinsic value is a *relational* and *subjective* property, whereby certain properties or capacities of nature are regarded as intrinsically (i.e. for their own sake) valuable because they generate what are regarded as morally or ethically good outcomes (e.g. wonder, spirituality, stewardship) (Batavia and Nelson 2017). While a subjectivist position on intrinsic value suggests that such value is generated in relation to society, here value is non-substitutable. The value created by being in a natural landscape regarded as having certain intrinsic properties cannot be replaced by another, nor by the recreation of such a landscape in art, photography or virtual reality, which would each instead have their own intrinsic value.

Such has been the perceived chasm between these approaches to environmental value that it has become the territory of bitter disputes concerning how efforts to govern nature should be conceived. Multiple values co-exist but different policy drivers, interests, or power structures bring some to the fore at particular times. For example, Mace (2014) describes how the dominant global science and policy framings for conservation have changed over time. Mace (2014) discusses the science underpinning these frames, but is less clear about how these frames impact the form and politics of nature-based solutions on the ground. Since the early 2000s, the rise of 'ecosystem service' approaches to narrating and valuing nature have gained significant traction in the policy arena, promising a means through which not only instrumental values, but also those of cultural significance could be captured. Yet the promise of valuation systems that allow different forms of environmental value to be rendered comparable has often been met with concern and sometimes outright hostility from parts of the environmental conservation movement. The concern of the latter is that the emphasis on the substitutability of different kinds of environmental value undermines the very intrinsic properties of nature that should be at the heart of conservation endeavours (Chan et al. 2016; Schulz et al. 2017). For many, the attempt to resurrect the intrinsic value of nature within global policy debates recreates an 'unhelpful dichotomy' and contributes towards the impasse in the governance of nature more widely (Chan et al. 2016; Wachsmuth and Angelo 2018). In seeking a means through which to navigate this impasse, new arguments concerning the value of nature have recently been advanced that attempt to articulate a position in-between the instrumental-intrinsic dichotomy.

The first and perhaps most widespread argument has been the concept of 'nature's contribution to people' (NCP) advanced by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Pascual et al. 2017). As defined by its proponents, NCP encompasses "all the positive contributions, or benefits, and occasionally negative contributions, losses or detriments, that people obtain from nature. It resonates with the original use of the term ecosystem services in the MA (Millennium Assessment) and

goes further by explicitly embracing concepts associated with other worldviews on human–nature relations and knowledge systems" (Pascual et al. 2017, 9). The NCP approach intends to develop the notion of the 'services' that nature provides for society towards a recognition that it is the *benefits* that society derives from nature that have value. The recognition of diverse cultural perspectives and forms of knowledge also, more or less implicitly, means that benefits are not necessarily reducible to singular metrics or commensurable with one another. There is potential here to consider the value of nature as residing in how multiple, different, and sometimes conflicting benefits are realised. Such a perspective may then imply that what is at stake is not only whether or not nature provides a means to an end, but the particular and conditional ways in which that end is achieved. There is an additional value to be derived from using nature as a means to a societal end that cannot be reduced to just the sum of its parts.

Another attempt to find the middle ground between instrumental and intrinsic value has been even more explicit about the *relational value* of nature (Chan et al. 2016; Anguelovski et al. 2020). At the core of the argument is the suggestion that "few people make personal choices based only on how things possess inherent worth or satisfy their preferences (intrinsic and instrumental values, respectively)" but rather that "people also consider the appropriateness of how they relate with nature and with others, including the actions and habits conducive to a good life, both meaningful and satisfying" (Chan et al. 2016, 1462). Here the claim is that it is the kinds of relational value that nature engenders that provides a means through which to navigate the opposite poles of its functional or inherent value. For those working in the tradition of environmental ethics, such a position is regarded as proximate to that of a subjectivist account of intrinsic value, where it is the ethical quality or moral standing of particular forms of socio-nature that are conferred with value, rather than value inherent within nature (Walsh, Böhme, and Wamsler 2021).

We suggest that it is therefore possible to identify four different ways in which the value of nature can come to be recognised (Table 1), some of which are rooted in deep traditions within environmental ethics and conservation politics and others which reflect more recent interests in finding new ground upon which to reconcile different kinds of environmental value. In this paper, we are not so much interested in determining the ethical reasoning or logic in the value positions in Table 1, or whether they have moral standing, but rather to use them as ways to understand how and with what implications nature-as-resilience is framed and realized as a solution to urban challenges.

**Table 1 Four ways to recognize the value of nature in cities**

| Value Positions | Description |
|---|---|
| Instrumental-functional | The value of nature is found in its functional properties that enable particular ends to be met; nature is valued as it provides the most effective/efficient means to reach these ends, and is regarded as substitutable for other means. |
| Instrumental-beneficial | Drawing on the notion that nature's contribution to people can have multiple and diverse benefits, here the value of nature is also as a means to an end (instrumental) but where it is recognised that nature imparts particular qualities to how that end is reached that have value over and above its purely functional character, i.e. there is something 'better' about working with nature than without |
| Intrinsic-relational | The insights from environmental ethics on the subjective character of intrinsic value are combined with the argument for a relational approach to environmental values. The intrinsic qualities of nature are valued because they accord with ethical positions that are seen to be 'good' and 'what is right' in terms of well-being and they generate good qualities in society (e.g. wonder, respect, stewardship, community) |
| Intrinsic-inherent | Nature is seen as an end in itself and can be valued as such independently of societal values. This is a more difficult philosophical position to grasp, but it may relate to notions of nature's inherent resilience. |

Scholarship in geography and related fields has recognised that behind different approaches to resilience are diverse ways of valuing nature, including work on the potential of NBS for transformation and empowerment (Woroniecki et al. 2020), the construction of problems and solutions related to urban resilience and nature (Wakefield 2020), and the politics of financialisation of NBS (Nelson and Bigger 2021). As NBS and related ideas of green infrastructure, urban greening, and ecosystem-based adaptation increasingly gain traction as resilience solutions, opening up questions of their politics is increasingly vital (Wamsler 2015; Anguelovski et al. 2020; Kotsila et al. 2020; Tozer et al. 2020; Woroniecki et al. 2020;

Cousins 2021). The politics of resilience are indeterminate and contingent (Rogers, Bohland, and Lawrence 2020; Wakefield, Chandler, and Grove 2021), both enabling neoliberal forms of intervention that seek to entrain individuals and communities towards ongoing projects of economic development whilst at the same time holding the potential for more radical interventions to emerge (Smirnova, Lawrence, and Bohland 2021). Rogers et al. (2020, pg. 2) argue that a "better understanding who holds particular values, how they can be mobilised, which values are excluded from current forms of resilience-oriented thinking and practice will enable re-searchers to seriously investigate the ontological politics of resilience." We respond to this call by building on geographic scholarship on the politics of nature and resilience to deepen our understanding of how variations in values for nature impact the form and politics of resilience initiatives in practice.

## 3. Methodology

### 3.1 Research design and case study selection

Our aim was to examine how different values for nature shape the form and politics of urban resilience interventions. We examined how the different values of nature are manifested in NBS for resilience in three case-study cities—Cape Town, Mexico City, and Melbourne – in order to analyse the implications in terms of narratives of problems and solutions and how they structured opportunities for social benefits.

Our study employed a multi-disciplinary case-oriented research design (6 and Bellamy 2012). Our aim was not to compare the cases to determine causal factors, but instead to draw data from the three contexts to generate insights related to commonalities. We examined 1) how NBS in these cities drew on the four value positions for nature-as-resilience presented in Table 1 and, 2) how the different ways of valuing nature shaped NBS initiatives and with what consequences. The case cities were chosen for the following reasons. Firstly, all of them are members of 100 Resilient Cities Network (100RC), and

hence are seen as “urban pioneers to spread the resilience movement across the world” (Berkowitz 2016). Secondly, they are known for their advanced use of NBS due to early adoption. These criteria were assessed through the identification of the types of urban challenges addressed using NBS and demonstration of key trends with respect to the effective implementation of NBS by researchers in consultation with local stakeholders. Thirdly, they represent diverse geopolitical contexts, urban conditions and cultures, which offered a rich basis for comparison of and learning about different urban resilience narratives and municipal governance strategies.

Within the three cases, the following NBS were analysed: Atlantis Aquifer Invasive Plant Clearing Water Fund Pilot (Cape Town); The Water Forest and The City of Mexico Water Fund (Mexico City); and The Urban Forest Strategy (Melbourne). These NBS were chosen for being unique and representative resilience measures in each city. They were championed through narratives that foreground their potential to build resilience to climate extremes through social inclusiveness and governance interventions while bringing along multiple environmental, socio-economic and health related benefits.

### 3.2 Methods of data collection and data analysis

Data was collected from secondary and primary sources. To position this study (section 1) and to develop a conceptual framework for analysis (section 2) we reviewed academic literature across a range of disciplines encompassing both long-standing and contemporary debates on the value of nature. The conceptual framework then guided empirical data analysis.

Each case-study took place in 2017 and 2018. Data was collected via literature review of academic and grey sources (including policy documents, media and other case study related materials), a total of 66 semi-structured interviews[1], informal discussions with key actors and organisations involved in NBS related processes or events, and fieldwork visits. Interviewees

[1] Melbourne (23), Cape Town (21), Mexico City (22)

included representatives of knowledge institutes and think tanks, municipal, metropolitan and regional authorities, NGOs, community groups, urban redevelopment, regeneration, planning and housing agencies, utilities (i.e., energy, water and waste), knowledge institutions and research groups, engineering, urban development, design, architecture and other relevant companies, and small and medium-sized enterprises (SMEs). Interview data was audio recorded and transcribed, and complemented through field notes, site photos and short interviewee videos when permitted by respondents.

To conduct a thematic analysis of the empirical data, we developed an analysis matrix using the four positions for valuing nature. The analysis matrix guided the compilation of relevant case data for each city in the form of narratives, bullet points, citations and references to primary and secondary data sources. Since different co-authors were responsible for the execution of the case studies, draft versions of analysis matrices were circulated several times among the co-authors to ensure that empirical data was presented in a consistent way.

Following the analysis process, three case-study narratives were developed sequentially to ensure that they followed a similar logic and contained a comparable level of detail. We compared these case studies using the four value positions conceptual approach in order to analyse how different values for nature shaped the form and politics of resilience interventions and structured opportunities for social benefits. NBS may enable empowerment in principle, but research has found that social benefits for marginalized groups were not automatically enabled (Woroniecki et al. 2020). The case study narratives are presented in section 4 and compared and discussed in section 5.

## 4. Results: Governing urban nature for resilience

This section provides our results by comparing how NBS in Melbourne, Cape Town and Mexico City use the four value positions identified in our conceptual framework to

understand how nature-as-resilience is formed as a solution to urban challenges and comes to be realised.

**Table 2 Comparison of how the four value positions emerge in the cities**

| | Instrumental-functional | Instrumental-beneficial | Intrinsic-relational | Intrinsic-inherent |
|---|---|---|---|---|
| **Melbourne** | Focus on how nature offers a living infrastructure for the city which provides specific functions as well as economic benefits.<br><br>e.g. “Restoring natural systems is often more cost-effective than technological substitutes or building new infrastructure.” (Urban Forest Strategy 2012, 14) | Urban forests and associated ecosystem services with particular importance for overall health and well-being.<br><br>e.g. “Green infrastructure … and ecosystem services are the most efficient tools that cities can utilise to remain healthy, robust and liveable.” (Urban Forest Strategy 2012, 27) | Importance of nature for stewardship, tapping into both technical expertise and citizen knowledge.<br><br>e.g. “The community's sense of place and capacity for change needs to be captured and nurtured to ensure a dynamic approach in managing Melbourne’s urban forest.” (Urban Forest Strategy 2012, 35) | Strategies that seek to enhance biodiversity by restoring or recreating native ecosystems and building resilience of the city.<br><br>e.g. “Biodiversity is intrinsically important in its own right.” (Nature in the City 2017, 7) |
| **Cape Town** | Nature offers overlooked functional value for Cape Town in the form of increased water supply<br><br>e.g. “Clearing of alien invasive plants is a key component of the City of Cape Town's Water Strategy. By removing water-guzzling plants from key parts of the dam catchment, our surface water supply is maximised as more rainwater can flow into the dams” (City of Cape Town 2021) | Positions invasive plant clearing in the watershed to increase water supply as an economic development project for nearby low-income and racialized communities<br><br>e.g. “…this team of women will now become a small business on their own... So the objective is to have five teams there, and it's 50 people. I want all women…They are from the local community, and they are now going to go and change something” (Interview, 2018) | Focus on connecting women entrepreneurs with the intrinsic value of nature by positioning them as ‘stewards’ in order to create better quality, self-sustaining employment<br><br>e.g. “I'm saying to them, you're stewards. You're doing the job, but you've got to got into the communities and sell the message. In your communities. That's the one thing, and I also told them why they are doing what they are doing” (Interview, 2018) | Cape Town is in an overwhelmingly biodiverse region. Many policy documents relating to biodiversity conservation draw a link between biodiversity and enhancing the city’s resilience.<br><br>e.g. The Cape Town Local Biodiversity Strategy and Action Plan 2016-2026 describes this vision: “To be a City within which biodiversity plays an important role, where present and future generations benefit from a healthy and vibrant biodiversity” (City of Cape Town 2016) |
| **Mexico City** | Nature is mobilised as a strategic element towards the provision of water for the city, including through an approach that seeks to make the economic value of water more transparent. | The narrative foregrounds a multiplicity of water-related benefits associated to forest conservation. Action towards the conservation of nature (and thus the maintenance of water flows) is a matter of security—securing both | Interventions towards the protection of nature are seen deeply enmeshed within a socio-cultural context, whereby forest conservation can only happen through the involvement of local communities given not only their | Recognition of the cultural and biodiversity value of the areas to be conserved. Recognition of cultural and emotional attachments to nature and the importance of preserving and continuously re-connecting with it, as illustrated by |

| | | | | |
|---|---|---|---|---|
| | e.g. Nature provides a “natural cistern” (Interview, 2017) | human life and economic activity. Benefits extend beyond these issues as well, including addressing issues of climate mitigation and adaptation, as well as a range of ecological benefits such as biodiversity conservation.<br><br>e.g. “‘Water Forest’ conveys the simple concept that without forest there's no water and without water there is no future for the city” (Interview, 2017) | geographical location but also their culturally-informed understandings of nature. At the local level, such interventions should in turn maintain or positively transform such communities’ livelihoods.<br><br>e.g. “…in the end you have to work with the communities; the reality here is that if the communities don’t get involved, nothing happens, it won’t be a success” (Interview, 2017) | informal references of appropriation and belonging associated to local endemic species (e.g. '*our*' volcano rabbit) |

### 4.1 Melbourne

Since the 1990s, Melbourne has experienced increasing climate extremes, such as heavy rains, floods, heatwaves, droughts and bushfires. The Black Saturday bushfires in 2009 killed nearly 200 people, destroyed thousands of homes, and disrupted power supplies to nearly 500,000 people and the accompanying heatwave led to around other 400 deaths due to heat-related illness (Resilient Melbourne 2016). Only one year later, the city experienced some of the worst floods ever seen in the area (Resilient Melbourne 2016). Overall, climate impacts and associated concerns of citizens and professionals increased considerably between 1995 and 2009, leading to a strategic process of developing a comprehensive policy framework in which nature played a critical role. One important result of this process was the City of Melbourne's Urban Forest Strategy (2012), which is closely linked to other city council policies and strategies.

The vision of the Urban Forest Strategy is to make the City of Melbourne's urban forest "resilient, healthy and diverse" in order to "contribute to the health and wellbeing (…) and (…) the creation of a liveable city" (Urban Forest Strategy, 2012:1). The aim is to achieve this through a systematic provision and maintenance of green space in combination with soft and grey infrastructure approaches in order to adapt to climate change, mitigate the urban heat island effect, create healthier ecosystems, become a water-sensitive city, and engage the community in these endeavours to support long-term sustainability. While soft, grey and green measures are included in the strategy, it also shows an emerging narrative in favour of green infrastructure solutions, particularly due to their "cost effective[ness]" and efficiency for resilience building (Urban Forest Strategy, 2012, 27).

The Melbourne City Council thus mainly uses narratives that draw on the *instrumental-functional* value position to show that nature offers a living infrastructure relying on specific nature functions, such as soil moisture retention, reducing stormwater flows, improving water

retention (e.g. wetlands, raingardens), quality and re-use, increasing shade and canopy cover, reducing nutrient loads, and collecting phosphorus, nitrogen and heavy metals from stormwater through their root systems, lowering the levels of stormwater pollution.

There is a strong economic benefit narrative behind the *instrumental-functional* value position, including through bringing different industries and disciplines together to form a business case for urban forests. Some urban forest benefits are quantified in this narrative. For example, “major economic benefits come through shading buildings in summer, reducing the need for air conditioning, in turn cutting energy costs” (McPherson & Rowntree, 1993 in Urban Forest Strategy, 2012, 14). In addition to quantification of energy cost reduction and carbon sequestration shown above, benefits quantified in monetary terms also include avoiding the cost of infrastructure damage and renewal.

At the same time, the Urban Forest Strategy expresses its importance for overall health and well-being and thus *instrumental-beneficial* values. The urban forests and associated ecosystem services are said to yield benefits for the local community through reducing sun exposure- and heat-related illnesses, improving physical and mental well-being, improving community cohesion, and encouraging outdoor activities (Urban Forest Strategy, 2012, 27). This is important, because “lifestyle-related illnesses are prevalent and 61% of Australian adults are overweight or obese” (Australia Bureau of Statistics, 2011 in Urban Forest Strategy, 2012, 13).

In addition, an *intrinsic-relational* value position can be found in the Urban Forest Strategy, which highlights nature’s importance for stewardship and taps into technical expertise and citizen knowledge by supporting “the community's sense of place and capacity for change” (Urban Forest Strategy, 2012, 35). It is assumed that this ensures long-term planning. The Citizen Forester programme in the Urban Forest Strategy trains and empowers volunteers to grow the urban forest and improve urban ecology by carrying out essential advocacy, monitoring, and research tasks. 10-year neighbourhood-scale plans, another measure under

the Strategy, have been developed through visioning and close collaboration with the community to create a local identity with nature, while tapping into a strong community sense of place. In addition, online mapping through the Urban Forest Visual measure established a municipal tree database. Its 'E-mail-a-tree campaign' allowed citizens to identify with and e-mail trees. Instead of reporting damage as was intended, the campaign evolved into an activity where citizens expressed different forms of human attachments to trees for their intrinsic qualities.

The *intrinsic-inherent* value position also appears in the Urban Forest Strategy as a reference to recreating the aboriginal past of Melbourne's urban forests. Melbourne has been a biodiverse region and the Urban Forest Strategy seeks to enhance biodiversity by restoring or recreating its native ecosystems. In addition, the different policy documents highlight the close link between biodiversity and enhancing the city's resilience: "Increasing the diversity of both native and introduced species will increase the resilience of the city system in the face of an unknown future" (Nature in the City, 2017, 23).

In sum, the Urban Forest Strategy and related measures draw on multiple value positions to create a narrative of a healthy, resilient and diverse city. Instead of taking an approach drawing solely on an *instrumental-functional* value position focusing on climate change fixes through particular functions of nature, the *instrumental-beneficial* perspective adds wider arguments for improved health and well-being of citizens and the entire urban ecosystem. Linking these arguments to *intrinsic-relational* perspectives through different means, the issue of stewardship and local identity building is addressed, with the understanding to support sustainable planning and change.

### 4.2 Cape Town

Cape Town experienced severe drought 2015-2018 and the city came close to running out of water. Discussions about water security have increased in urgency over this time period and, while many of the municipal government's proposed solutions have focused on grey

infrastructure, there is an emerging argument that NBS can improve the resilience of Cape Town's water supply in the face of climate change driven water scarcity. The Atlantis Aquifer Invasive Plant Clearing (Water Fund) project is pilot run by the Nature Conservancy, the US-based non-profit organization, that seeks to increase water supply to Cape Town by removing invasive plant species in an area that recharges Atlantis Aquifer, which is the largest aquifer supplying water to Cape Town. Invasive species use significantly more water than indigenous species and are thought to uptake millions of liters of water from the catchment area annually that would otherwise be added to the city's water supply. The initiative also acts as a job creation and training program by employing women from nearby marginalized communities to do the plant clearing work. The pilot project is feeding into the creation of a Water Fund for Cape Town, which will be a new governance body that convenes various levels of government, industry representatives and other stakeholders to find new ways to fund and coordinate wider efforts to clear invasive plant species as a water supply strategy. The Water Fund model is replicated across the world by The Nature Conservancy.

The Nature Conservancy and partners use narratives that draw on the *instrumental-functional* value position to argue that nature offers overlooked functional value for Cape Town in the form of increased water supply through the Water Fund initiative. For example, The Nature Conservancy describes the Cape Town Water Fund's focus as "the removal of thirsty invasive plants, responsible for the loss of billions of liters of water every year…Wetland and river restoration activities are soon to follow. Studies have shown that restoring watersheds are more cost effective in securing water supply over the long-term than other methods, such as desalination" (The Nature Conservancy 2018). Authorities in charge of water usually have expertise related to engineering and grey infrastructure, which has constrained alien plant clearing as a water supply strategy. A strong narrative shaping the Water Fund is the potential benefits to water supply that would come from clearing alien

species, which means that a significant amount of work is going into quantifying impact and comparing costs to other grey water supply strategies. The development of a business case for nature as water supply (compared to grey infrastructure water supply) is considered essential by everyone involved in creating the Water Fund.

The Water Fund project also draws on the *instrumental-beneficial* value position by positioning alien plant clearing in the Atlantis pilot project as an economic development project for nearby low-income and racialized communities. Nature is seen to be a means to achieve other benefits while increasing water supply – particularly employment and enhanced biodiversity. The project seeks to support the economic development of these communities by offering jobs and skills training. The Atlantis pilot project employs a team from nearby marginalized communities: “It's 11 women; nine of them are single parents, the breadwinners, they're looking after other family members. All of them have other obligations, whether it's parents or brothers or sisters, and they need the job” (Interview, 2018). The Cape Town Water Fund is not just focused on employment during the course of the project, but also seeks to have a larger impact on local economic development by striving to support the creation of social enterprises through skill development. The fact that the work of cutting down invasive trees and pulling invasive plants is labour intensive becomes an instrumental benefit of this NBS. The socio-natural practices of alien plant clearing become employment opportunities for un(der)employed communities. This links to the intrinsic relational value position, since the Water Fund argues that it is the element of stewardship and other techniques of job training that makes it possible for these jobs to be long-term.

Drawing on the *intrinsic-relational* value position, Nature Conservancy representatives argue that the intrinsic value of biodiversity means that those working on enhancing biodiversity are stewards. It is this quality that makes the work of alien clearing meaningful: “I'm saying to them, you're stewards. You're doing the job, but you've got to go into the communities and sell the message in your communities. That's the one thing, and I also told them why they are doing what they are doing” (Interview, 2018). Given that other alien plant clearing

programs have existed in the past and have been criticized for creating poor quality jobs that do little to improve the resilience of communities, this program focuses on connecting women employees with the intrinsic value of nature by positioning them as ‘stewards’ in order to create better quality, self-sustaining employment.

The *intrinsic-inherent* value position is also highlighted through concern for restoring indigenous ecosystems. Cape Town is in an overwhelmingly biodiverse region and this pilot project seeks to enhance biodiversity in the city by restoring indigenous ecosystems. Many policy documents relating to biodiversity conservation draw a link between biodiversity and enhancing the city’s resilience. For example, the Cape Town Local Biodiversity Strategy and Action Plan 2016-2026 includes these points as strategic objectives: “1. Management of biodiversity assets and their contribution to the economy, rural development, job creation and social wellbeing is enhanced. 2. Investments in ecological infrastructure enhance resilience and ensure benefits to society” (City of Cape Town 2015).

Overall, an approach drawing solely on an *instrumental-functional* value position may have focused on maximum alien plant clearing through any means. However, this initiative also draws on the *instrumental-beneficial* perspective to argue that alien plant clearing can provide employment opportunities for un(der)employed communities, and the i*ntrinsic-relational* perspective, since the Water Fund argues that it is the element of stewardship that makes this work meaningful, and therefore opens up possibilities for these jobs to be long-term.

### 4.3 Mexico City

Mexico City (CDMX) has a population of approximately 9 million and the broader Metropolitan Area of the Valley of Mexico (ZMVM) has a population of over 20 million. The city’s urban area lays over an impermeable lakebed and in an enclosed valley that provides no natural outlet for water to flow. Despite significant investment in large-scale water infrastructure (70% of the water comes from overexploited aquifers and 30% is piped in from

increasing distances), water shortages, floods and subsidence continue to plague the city. Here we discuss two water management NBS initiatives that have played an important role in making water the focal axis of the city's Resilience Strategy (CDMX & 100 Resilient Cities 2016).

The Water Forest (Bosque de Agua) is a regional conservation strategy that seeks to protect and restore ecosystems and sustainable livelihoods in ways that range from changing local agriculture practices to instituting new national policies. It redefines the role of land as producer of water, which prioritizes a repurposing of nature over the development of new technologies. The second initiative is the CDMX Water Fund, based on The Nature Conservancy's (TNC) Water Fund model and, in Mexico, promoted by an alliance of stakeholders known as *Por el Agua de la Ciudad de México* (For the Water of Mexico City). The CDMX Water Fund directs investment by institutional and corporate water users towards the protection and restoration of the ecosystems that recharge the main aquifer supplying water to the city.

The *instrumental-functional* value position is strongly present in both initiatives. In the Water Forest, nature is mobilised strategically towards the provision of water for the city. In this framing, nature provides a "natural cistern" (Interview, 2017). The CDMX Water Fund is explicit in its use of an *instrumental-functional* value position by attempting to make the economic value of water more transparent. Mexico City's water supply is complex and externalities associated to water extraction and flow are not included in water pricing calculations. The Water Fund seeks to model economic costs of the entire water cycle and generate business models and decision-making tools that trace and calculate the full costs of different pathways for water provision. As illustrated by the words of a scientific advisor to the project:

> "If we had to pay the real value of water, being pumped from so far, and so on… if we had to pay the real value, I bet you the situation would be entirely different… we wouldn't be wasting water in many others ways. We would be very careful

and we would make sure that if I am paying what I am paying, my neighbour no matter how wealthy, also pays their fair share" (Interview, 2017).

The idea is to demonstrate the cost effectiveness of NBS as a substitute for grey infrastructure for water provision.

The *instrumental-beneficial* value position is also strongly present through the connection to long-term population and economic security for the city, reinforcing the link between security and resilience governance identified by Zebrovski (Zebrowski 2016). As discussed by the project's director, the "Water Forest conveys the simple concept that without forest there is no water and without water there is no future for the city" (Interview, 2017). The narrative within the Water Forest project links water security and economic vitality, foregrounding the extent to which regional industries depend on water. For the CDMX Water Fund, the focus on water security is said to cut across a broad range of domains and significantly expand a narrow focus on water supply. In the words of a staff member at TNC, "the design of Mexico City's water fund coincided with a transition, a re-engineering of water funds in general [from] providing NBS focused on the aspect of water supply [to focusing on] water security [with its] five dimensions: household, urban, environmental and economic security, and resilience focused on water-related disasters" (Interview, 2017). Both initiatives are also expected to have a number of benefits, including lowering subsidence, protecting biologically significant sites, and supporting efforts towards climate mitigation and adaptation.

The *intrinsic-relational value position* is present in the imagined ideal relation between communities and water-based NBS. According to the city's Chief Resilience Officer, "in the end you have to work with the communities; the reality here is that if the communities don't get involved, nothing happens, it won't be a success" (Interview, 2017). The Water Forest has engaged with local communities on livelihoods and has worked with producers of nopal (cactus) and other produce to reduce the use of agrochemicals and protect water quality in aquifers. Targeted communities inhabiting rural settings and areas of high conservation value in the periphery of the city not only depend on water for their livelihood, they are also

seen as occupying a privileged position to advance conservation efforts. Both initiatives see local communities as the primary stewards of nature, seeking financial support to engage interested community members in conservation leadership roles and stewardship activities. In these settings, often related to a culturally-informed understanding of nature characteristic of Indigenous and peasant communities in Mexico, nature is valued given its inherent qualities. Yet, because of the range of actors involved, the NBS initiatives also offer environmental education in consideration of how nature is valued by dwellers of the central and high-density areas of the city away from the sites targeted for conservation and where access to nature is scarce.

For the *intrinsic-inherent* value position, there is recognition of the cultural and biodiversity value of the areas to be conserved. The Water Forest is a region of high biodiversity, with many endemic species; these make for particular cultural attachments to nature and particular species and serve as an important pathway for community engagement. Indigenous leaders interviewed who were tangentially involved in the project highlighted intrinsic values resulting from the presence of cultural and emotional attachments to nature and the importance of continuously re-connecting with it. The cultural values at stake play an important role in encouraging the stewardship and ownership leading to conservation.

By foregrounding strong links between nature conservation and the security risks associated to water scarcity, both initiatives examined in Mexico tended to prioritise the *instrumental-functional* and the *instrumental-beneficial* value positions. However, focusing exclusively on these two value positions could have reduced the scope of the projects, particularly by shaping the coalition of interests supporting the projects in specific directions and limiting meaningful engagement with community stakeholders. A consideration of *intrinsic-relational* and *intrinsic-inherent* value positions opened the possibility to engage with a broader set of values, some of which are culturally-informed and locally grounded, and through that the possibility of broader stakeholder alliances.

## 5. Discussion and conclusions

The resilience concept is increasingly prominent in climate policy discussions and in the context of promoting NBS (Burayidi et al. 2019). Rather than taking resilience as a given property of particular systems or entities, critical narratives of resilience have pointed out the importance of examining why, how, with what implications and for whom resilience is being enacted (Cretney 2014; Meerow, Newell, and Stults 2016). We build on geographic scholarship on the indeterminate and contingent politics of nature and resilience (Rogers, Bohland, and Lawrence 2020; Wakefield, Chandler, and Grove 2021) to deepen our understanding of how variations in values for nature impact the form and politics of resilience initiatives in practice. To do so, we draw on long-standing and contemporary debates on the value of nature across a range of disciplines to identify four 'value positions' through which nature comes to be understood, given meaning, form and purpose. In this final section, we discuss how the different values of nature are manifested in NBS for resilience and the implications for the politics of resilience interventions and the opportunities for enabling social benefit through NBS.

### 5.1 Values for nature shaping the form and politics of resilience interventions

Our results show that urban sustainability challenges and the quest for urban resilience became key driving forces for NBS exploration, implementation, and assessment of benefits in all of the case study cities, reinforcing similar findings (Bush and Doyon 2019; Wakefield 2020). Such challenges included population growth, urbanisation, climate change, water security, water quality, and flooding. In each context, the four identified value positions represented a different way of understanding how values for nature can contribute to urban resilience. We use this approach to analyze how resilience is encountered in a place and unpack how underpinning values construct resilience through policy or initiatives (Rogers, Bohland, and Lawrence 2020).

The *instrumental-functional* value position was mainly reflected in the mobilization of nature as a replacement for grey infrastructure to provide a 'sustainability fix'. In the face of climate

change impacts, trees can be seen as a living infrastructure and offer functions such as soil moisture retention, reducing stormwater flows, improving water retention and quality, or increasing shade and canopy cover (Melbourne). Similarly, the removal of non-indigenous plants can be positioned as a water supply strategy (Cape Town), or forest ecosystems surrounding metropolitan areas can become an essential part of a natural cistern that can replace grey infrastructure for water supply (Mexico City). In all three cases, the cost-effectiveness of each of these measures in comparison to grey infrastructure alternatives was an important argument, highlighting that nature can contribute to resilience by delivering urban functions more effectively than traditional approaches.

The *instrumental-beneficial* value position was also mobilized to highlight the co-benefits of using nature to enhance resilience. Moving beyond specific natural functions, this value position argues for nature as a way to enhance multiple social, ecological and environmental dimensions and associated challenges of resilience. Such challenges included climate change, health, well-being, marginalization of population groups, poverty reduction, economic development, and security, although systematic support for several of the assumed benefits is still lacking or contested (Wachsmuth and Angelo 2018; Woroniecki 2019; Woroniecki, Wamsler, and Boyd 2019; Anguelovski et al. 2020).

In all three cases, the *intrinsic-relational* value position was drawn on to explain why particular means were employed to deliver an NBS. In fact, each of the initiatives identified a need to support specific relationships (or relationality) between people and nature and drew on the concept of stewardship and participation to increase related resilience. In Cape Town, connecting workers with the intrinsic value of nature—positioning them as ‘stewards’—was seen as an approach that creates better quality, self-sustaining employment. In Melbourne, citizens were drawn into relationships with nature through programs and tools that promote the stewardship of nature and ownership of biodiversity protection. Similarly, in Mexico City the methods for ecosystem conservation and enhancement included engaging interested community members in taking on conservation leadership roles and empowering through

stewardship. The intrinsic value of nature was therefore connected to good qualities in society (especially participation and stewardship), which then shaped the means through which NBS are achieved. Altruistic framings of co-benefits from working with nature have also been highlighted as a way that perpetuation of inequalities can be "paper[ed] over" (Nelson and Bigger 2021). Given the contingent politics of resilience, this is not necessarily always the case, however, and our analysis of the impact of underpinning values on the form of interventions sheds some light on opportunities for NBS to enable social benefits.

Finally, we also found that the *intrinsic-inherent* value position played a role in all of the cases, though this was relatively minor and included either as an additional co-benefit or was raised only tangentially by involved actors. In Cape Town, the use of NBS was also motivated by restoring indigenous ecosystems and enhancing biodiversity in the city for its own sake, which is similar to references to the inherent value of biodiversity in Melbourne. In Mexico City, Indigenous leaders highlighted intrinsic values resulting from cultural and emotional attachments to nature, which is an expression of concern for nature conservation that did not mobilize water or security.

### 5.2 Enabling social benefits through nature for urban resilience

Our cross-case analysis demonstrates that multiple co-existing frames about the value of nature are being deployed in parallel to enhance urban resilience. While research in the transnational politics sphere, has often focused on the conflict between different value positions for nature (Chan et al. 2016), our findings show that NBS are supported by drawing on multiple ways of valuing nature simultaneously to address the multitude of implementation gaps and challenges that are encountered. Although resilience is increasingly on the policy agenda in relation to climate change, narratives adopted in the case studies do not only focus on 'climate fixes' using the functions of nature, but also incorporate arguments for broader health and well-being and an intrinsic-relational approach that emphasizes stewardship and local identity building to support sustainable planning

processes (e.g. in Melbourne), suggesting that working with nature towards climate outcomes is also seen as a means through which to realise multiple sustainability goals.

On this basis, we argue that urban-nature-as-resilience interventions serve to embed values and the socio-natures they produce within the city, creating potentially fundamentally different consequences for the forms and politics of NBS designed to realise urban resilience. The *instrumental-functional* and *instrumental-beneficial* value positions for nature supported urban resilience approaches that use nature as a 'climate change fix' without necessarily focusing on the means through which this is achieved and the consequences for (vulnerable) communities (cf. Woroniecki 2019; Woroniecki et al 2019). In particular, the emphasis on the functions provided by ecosystems encouraged a focus on cost-effectiveness compared to grey infrastructure (cf. Brink et al. 2016). Competing on these terms risks that NBS will become another kind of technical solution that does not disrupt the socio-economic inequalities embedded into existing urban infrastructure (Woroniecki 2019; Woroniecki, Wamsler, and Boyd 2019; Nelson and Bigger 2021).

However, where the intrinsic qualities of nature are valued because they accord with moral/ethical positions that are seen to generate good qualities in society (e.g. stewardship, respect for diversity), this shaped an increased focus on the means through which NBS are delivered (e.g. leadership, empowerment, education). We argue that the integration of intrinsic values for nature opens opportunities for NBS to enable social benefits. For example, our analysis shows how the *intrinsic-relational* element has helped to refocus attention on the means through which nature conservation can be achieved, highlighting community participation and stewardship as the best strategy to enact long-term nature conservation. After all, nature and infrastructure are both unruly, which "creates potentials to mobilize that unruliness to progressive ends" (Nelson and Bigger 2021). This increased focus on the means through which NBS are delivered opens opportunities for such interventions to address multiple social, ecological, and environmental aspects and challenges of resilience.

This identified potential for narratives drawing on intrinsic qualities of nature to open opportunities to enable social benefits needs further research, particularly since other findings show that systematic investigations of how NBS should be implemented are rare and current approaches to NBS implementation do not tap into the potential to increase citizen involvement in climate adaptation (Wamsler, Wickenberg, et al. 2019; Wamsler, Alkan-Olsson, et al. 2020). In particular, to what extent can these opportunities be leveraged in order to address structural inequalities "whereby the asymmetric distribution of agency is shifted in favour of marginalised groups" (Woroniecki 2019)? Finally, further research can build on our finding that *intrinsic-inherent* values of nature, where the value is seen as an end in itself independently of societal values, was not well represented across the cases and research can examine the drivers and implications of the emphasis on the other three value positions. Overall, further research can explore whether a more comprehensive and explicit consideration of values in governing urban-nature resilience could help to achieve more equitable NBS.

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