Exploring desired urban futures: the transformative potential of a nature-based approach☆

O. Bina [a], M.D. Baptista [b,c,*], M.M. Pereira [a], A. Inch [b], R. Falanga [a], V. Alegría [d], S. Caquimbo-Salazar [e], D.H.S. Duarte [f], G. Mercado [g], A.T. Valenta [h], A. Vásquez [d], T. Verellen [i]

[a] Instituto de Ciências Sociais, Universidade de Lisboa, Portugal
[b] Department of Urban Studies and Planning, The University of Sheffield, England
[c] Commonwealth Scientific and Industrial Research Organisation, CSIRO, Canberra, Australia
[d] Universidad de Chile, Chile
[e] Pontificia Universidad Javeriana, Colombia
[f] Universidade de São Paulo, Brazil
[g] Swedish University of Agricultural Sciences, Sweden
[h] Urban Lab Torino, Italy
[i] Gobierno de la Ciudad Autónoma de Buenos Aires, Argentina

A R T I C L E   I N F O

A B S T R A C T

Amidst multiple crises and calls for transformative change, the demand to reassess human-nature relationships has increased. Rethinking the future of cities is vital in this process, yet positive urban visions prioritizing nature beyond human-centred perspectives are lacking. To address this gap, we propose a "nature-based desired futures" approach for envisaging and building collective discussion around transformative change. We explore four concepts underpinning (i) why such alternative urban futures are needed (human-nature disconnect and changing urban imaginaries) and (ii) how they might be approached (transformative change and leverage, and the 'education of desire'). This provides the basis for a participatory approach that adapts the Three Horizon method to explore desired urban futures for nature in 2050. Six workshops involving 111 participants linked to 'Conexus', a project on nature-based solutions in European and Latin American cities, explored emerging desired futures, evolving ideas of nature, human-nature relationships, and agency. The approach offers space for reflection creative exploration, and weaving together of new, hopeful, caring, emancipatory stories. Its effectiveness hinges on the mutually reinforcing power of deep leverage, and of structural, systemic, and enabling approaches, to give purpose and direction to the exploration of desired futures.

1. Introduction

We are living in a globally underestimated, polycrisis: 'a single, macro-crisis of interconnected, runaway failures of Earth's vital

natural and social systems that irreversibly degrades humanity's prospects' (Homer-Dixon, Renn, Rockstrom, Donges, & Janzwood, 2022: 2). In these times of complex uncertainty and existential risk (UNDP, 2021), scholars and practitioners are searching for new approaches drawing from the traditions of systems change, transitions and transformations (Scoones, Stirling, & Abrol, 2020), and futures studies (Inayatullah, 2008), including the need to envision desired futures beyond current crises (Levitas, 2017). Each involves challenging the status quo, envisioning alternative possibilities, and identifying pathways towards more desirable and sustainable futures.

In this paper, we combine these fields to understand what it might take to reimagine cities from the perspective of nature and a broader range of human-nature relationships (HN-Relationships) (Díaz, Demissew, & Carabias, 2015). Our work aims: (1) to conceive and design an approach to explore 'nature-based desired futures' as a contribution towards the development of positive urban future visions (McPhearson, Iwaniec, & Bai, 2016) that foreground nature and the need to (re)think HN-Relationships (Elmqvist, Fragkias, & Goodness, 2013; Mansur, McDonald, & Güneralp, 2022), including from the perspective of more-than-human agency (Abram, 2012); and (2) to examine the transformative potential of such an approach. This inquiry was part of the European Horizon 2020 project 'Conexus: co-producing solutions based on nature and ecosystem restoration: transdisciplinary nexus for urban sustainability', which allowed us to design and implement participatory workshops in two European and four Latin American cities around an approach that adapted the Three Horizons method (Sharpe, Hodgson, Leicester, Lyon, & Fazey, 2016). The workshops were designed to invite Conexus members and their stakeholder communities across six cities to explore the idea of nature-based futures *beyond* the instrumental logics of the search for nature-based solutions (Mercado, Wild, & Hernandez-Garcia, 2023).

The next section introduces the concepts and analytical themes guiding our inquiry into nature-based desired futures, followed by a summary of our approach and method. Our findings are then discussed against three questions: (1) What core narratives, imaginaries, and types of change (leverage points, transformative approaches) are revealed in the nature-based futures our participants desired? (2) What HN-Relationships and what agencies are being envisaged? And (3) How fit-for-purpose are the nature futures currently imaginable compared to the scale of the challenges being faced in cities? We conclude by reflecting on the strengths and limitations of our approach and findings.

2. Concepts underpinning nature-based desired futures

Far-reaching urban transformations are now required to advance the agenda of more just and ecologically sustainable cities (Griffith, Maddox, & Simon, 2018; Romero-Lankao, Bulkeley, & Pelling, 2018). This requires new ways to imagine the world we live in, to create intentional changes with the potential to transform urban futures: including imaginaries that move beyond dominant systems and ways of relating to/with nature in cities. Amidst growing cross-disciplinary scholarly interest, in this paper we use four concepts to explore these changes. The first two address 'why': (1) framing the problem, reviewing ideas and policies around human-nature disconnect (HN-Disconnect) as a central preoccupation for urban sustainability in and beyond polycrisis; (2) considering the
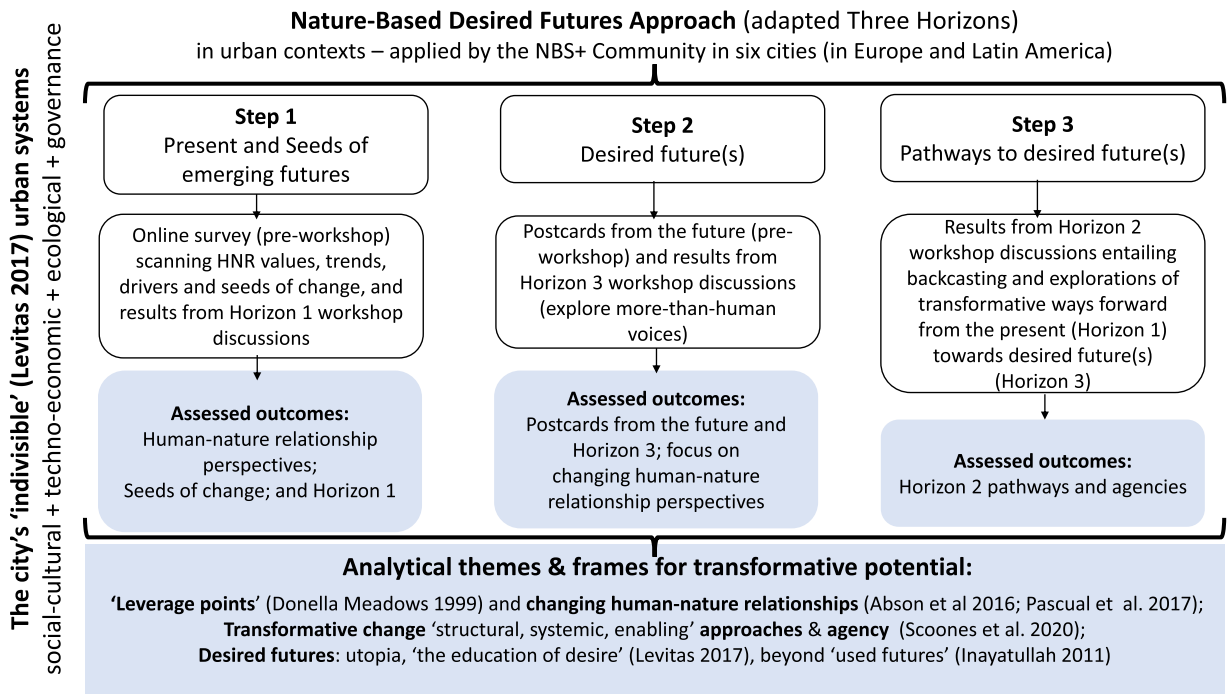

Fig. 1. Overview of the Nature-Based Approach and the Analytical themes and frames
Source: Authors.

implications of this emerging nature-based agenda for transforming urban imaginaries. The second two relate to 'how': (3) discussing notions of transformative change and leverage, and (4) connecting change with utopianism and the 'education of desire' for alternative urban imaginaries and visions of radical change. These core elements underpin our interdisciplinary analytical framework (Fig. 1, next section).

2.1. The root cause: nature and ideas of disconnect

The first element of our framework focuses on HN-Disconnect. As researchers reveal the extent of the damage to the planet and its life supporting systems, we hear ever more urgent invitations to transition and transform the systems driving the crisis (UNDP, 2021). These invitations echo those of the 70 s (Meadows, Meadows, Randers, & Behrens, 1972), 80 s (WCED, 1987) and 90 s (Malaska, 1994) that led to sustainable development becoming a global policy paradigm (UNCED, 1992). So what has changed? A perspective, long held by other-than-western (Kothari, Demaria, & Acosta, 2014; Shiva, 1988), feminist (Merchant, 1980; Plumwood, 1991; Salleh, 1984) and non-aligned western discourses (Latour, 2013; Wahl, 2016; Weber, 2013) around the unfolding crises, is rising to the fore: we need to (re)think nature and human-nature relationships (HN-Relationships) from various onto-epistemological, normative, and methodological perspectives. Different traditions are becoming more relevant in framing the problem, critiquing prevailing expressions of HN-Relationships or human-nature connectedness for their reproduction of a false dichotomy, pointing to ways of knowing and of thinking beyond western notions of human exceptionalism, towards multiple entangled aliveness (Haraway, 2016; Weber, 2013), as well as building on the tradition of political ecology, which goes beyond ideas of coexistence to explore how the social and natural are co-constituted as 'socionatures' (Bear, 2017) by the metabolism of capitalism (Moore, 2015). As Tsing (2016) argues, we live in a world composed by more-than-human sociality that exists with and without human cultures.

A diverse critique of the ways in which culture, gender, power, and social-technical-economic systems contribute to HN-Disconnect (Soga & Gaston, 2023), is increasingly reflected in the analyses and recommendations of international agencies (EEA, 2023; IPBES, 2019; UNDP, 2021) inviting decision-makers to redefine HN-Relationships as a necessary step towards transforming such systems. UNEP's 'Making Peace with Nature' (2021) is a measure of how mainstream this call is becoming, highlighting the need to change, transition, and transform culture and systems towards more sustainable futures (see also: Goudeseune, Solerød, & Aleksandrova, 2020). Although the expression 'HN-Relationships' remains problematic from the perspectives mentioned above, there are attempts to acknowledge diverse understandings of what constitutes nature and its values. Notably, the Inter-governmental Platform for Biodiversity and Ecosystem Services (IPBES) (Díaz et al., 2015 3), has been attempting to synthesise different 'knowledge systems (western science, indigenous, local and practitioners' knowledge)' in defining its three perspectives on intrinsic, instrumental and relational understandings of relationships between people and nature (see details in 'Shifting perspectives on nature').

In this paper we adopt 'HN-Disconnect' as an expression that acknowledges that dominant systems (including urban ones, discussed below) characterised by impoverished and dualistic conceptions of HN-Relationships are a driver of the polycrisis.

2.2. The changing nature of urban imaginaries

Our second concept focuses on urbanisation and its futures, that have become a key target for transformation (Mendieta, 2019). Mansur et al. (2022) note that 'cities consume 75% of the world's resources and account for more than 70% of the global CO_2 emissions', while 'an additional 2.5 billion people are expected to be living in cities by 2050', with urbanisation 'set to reach 1.7 million km^2 by 2050'. Tensions between what is a city and how it relates to nature, go much deeper, however. The modernist architectural movement of the mid-20th century successfully promoted the idea of the city as a rationally planned, standardized and functional machine (Mumford, 1965, cited in: Bina, Inch, & Pereira, 2020: 6), with a lasting impact on urban imaginaries and plans around the world.[1] While competing imaginaries have challenged the city as efficient machine in favour of more organic conceptions from the 'garden city' to contemporary discourses of urban greening (for an overview see: Mansur et al., 2022), the hold of techno-utopianism on urban future imaginaries - where nature and ecological functions are often tamed and subordinated to the functional and efficient organization of the urban environment[2] remains strong (notably through smart cities (Bina et al., 2020)).

Today, the loss of natural areas resulting from urban expansion is further undermining ecosystems on whose health all life depends (IPBES, 2019). Thus, cities have become a key arena where the relationship between humans and more-than-human (Abram, 2012) natures will be decided, both due to their demand for ecosystem services, and their environmental impacts (Elmqvist, Fragkias, & Goodness 2013). Ubiquitous NBS policies have been promoted as one (largely inadequate) response to this (Mercado et al., 2023). More broadly, we suggest that the polycrisis may be nudging us towards a potentially promising moment of opportunity, where distinctions between the urban and the rural, and 'the Artificial' and 'the Natural' (Øverland, 2023) in our understanding of the past, present and future of cities is being challenged. Calls for rethinking nature and HN-Relationships could release urban imaginaries from the constraints of the techno-utopianism that has often contributed to HN-Disconnect. Indeed, a decade ago, Elmqvist et al. (2013) warned that urbanisation called for 'a reconciliation between human development and biodiversity. Populations and assemblages of

---

[1] Notably through the prominent in the works of Le Corbusier, a Swiss-French architect, and urban planner, and his 1929 publication: "The City of Tomorrow and Its Planning".

[2] Mumford critically explored the origins of the city and the idea of techno-utopia and of the city itself as machine, highlighting 'a strong strand of anti-urban sentiment, where cities and urban life in extreme, technologically advanced societies are frequently represented as sites of alienation' (Mumford, 1965, cited in: Bina et al., 2020: 6).

species that evolve under urban conditions may well represent what holds for much of Earth's terrestrial biodiversity in the future' (2013: 722). Since this warning was raised, a consensus is emerging that the health of the planet depends significantly on transformative change towards sustainable coexistence between rapidly growing cities and the natural world (Griffith et al., 2018; Iungman, Cirach, & Marando, 2023; Mansur et al., 2022).

This research therefore responds to a need for new urban imaginaries capable of foregrounding nature and advancing plural perspectives on urban HN-Relationships (Elmqvist et al., 2013; Mansur et al., 2022) in order to widen the spectrum of possible (and desirable) urban futures. We therefore explore the potential for imagining nature-based urban futures to reduce the disconnect and address the many threats from the polycrisis by reformulating HN-Relationships, through and beyond the narrowness of prevailing NBS agendas.

2.3. Transformative change, leverage, and agency

Having argued why we might need nature-based urban futures, let's turn to how. Our third element explores 'change'. In line with the tradition of leverage points from systems thinking (Meadows, 1999; West, Haider, Stålhammar, & Woroniecki, 2020), transformative change means new paradigms, new ways of thinking, acting, and relating to one another and to the worlds we share, humans and more-than-humans together (Abson, Fischer, & Leventon, 2017). This has promoted the science and policy of transition and transformation, which from a sustainability perspective refers to large, often long-term systemic changes of social-technical-ecological systems (Meadows, 1999; Scoones et al., 2020). The field has been expanding rapidly since the 2000s providing a common platform to bridge diverse disciplines, and science-policy practices (Loorbach, Frantzeskaki, & Avelino, 2017). Scholars from transition theory (Geels, 2002), systems change (Abson et al., 2017; Meadows, 1999) and futures (Raskin et al., 2002) engage with what *drives* and *leverages* 'change', and whose *agency* can be effective in triggering it (Fazey, Schäpke, & Caniglia, 2020).

Our research combines inputs from systems theory, transitions and futures studies with a critical understanding of agency and HN-Relationships, to define transformative change and its potential. We draw particularly on the work of Donella Meadows to explore 'leverage' for transformative change, combined with Abson and colleagues' (2017) insights into reconnecting humans and nature as one key 'realm of leverage' and the three complementary approaches to understanding and advancing transformations proposed by Scoones et al. (2020), which focus on the human whilst while also offering a valuable bridge to broader understandings of agency.

Meadows (1999) proposed a hierarchy of 12 intervention points for leveraging change from 'deep' (highly effective) to 'surface and mid-level' (more limited) (Table I-Supplementary Material), arguing, 'that the transformational capacity of a given intervention would depend on the characteristics of the system properties that a given intervention acts upon—with some interventions likely to cause transformational change, while others will only induce minor changes in outcomes' (Abson et al., 2017: 31). She considered cities as an example of complex systems for the application of leverage since they are composed of a wide range of social-cultural (e.g. ways of life, social arrangements, community networks, education and knowledge systems), techno-economic (e.g. transport, infrastructure, housing, economic), ecological (e.g. environmental, public green and blue infrastructure) and governance (e.g. public administration, planning) systems.

Deep leverage questions goals, values, paradigms and worldviews, and relational and cognitive dimensions underpinning human action and human systems. By exploring ways of knowing urban natures and how they might be transformed, our inquiry focuses on the three 'deep' leverage points, relating to: *Leverage.3)* The goals of the system, *Leverage.2)* The mindset or paradigm out of which the system-its goals, structure/rules, delays, parameters- arises, and *Leverage 1)* The power to transcend paradigms (Meadows, 1999), which are viewed as important dimensions of transformative change (Abson et al., 2017). We complement the focus on deep leverage with Scoones and colleagues' (2020) understanding of transformations operating through three interconnected approaches, which highlight the interdependence between what Meadows has defined as deep, mid-level and surface leverage for change:

- 'structural approaches', referring to fundamental changes in the way production and consumption is governed, organized and practiced by societies;

- 'systemic approaches', referring to intentional change targeted at the interdependencies of specific institutions, technologies and constellations of actors to steer complex systems towards normative goals; and;

- 'enabling approaches' focused on fostering the human agency, values and capacities necessary to manage uncertainty, act collectively, identify and enact pathways to desired futures.' (Scoones et al., 2020: 66).

Abson and colleagues further connect strands of these agendas by focusing on HN-Relationships and connectedness to nature in order to open a pathway to transformation based on the ways we (dis)connect with nature and how that shape deep leverage points, which in turn act on the world and its *indivisible* systems, through collective and individual actions. Taken together, these three approaches all point to the value of collectively reflecting on possible pathways towards alternative futures, and the importance of scanning for deep leverage points in complex systems.

Further to this, we sought to expand the scope of individual and collective agency linked to these three approaches to include more-than-human agency: an expression introduced by Abram (2012) to refer to other biological beings including animals, plants, fungi, as well as non-animate natural systems or entities, such as mountains, rivers and all ecosystems. In the context of the call for a renegotiation of HN-Relationships in cities and when combined with critical understandings of socionatures (Bear, 2017), the acknowledgment of more-than-human presence is intimately connected with the need to revisit the very roots of the concept of agency (Latour, 2013). Thus, we sought to work with an expanded (plural) understanding of agency in relation to 'leverage' and 'transformative approaches', in line with scholars (Pearson, 2021: 186, 194) who suggest 'Inviting More-Than-human Stakeholders' can be a transformative practice that can help to shift '[f]rom anthropocentrism to attentively, imaginatively, and ethically including more-than-human perspectives in processes of knowledge co-creation', as an enabler of insights capable of mobilizing a range of levers

of change, including: empathy, ethics, inspiration for innovation (biomimicry), and attention to nature's rights. This aligns with the increasingly mainstream discourse discussed above, and with the work of Abson et al. (2017) who identify re-connectedness between humans and nature as a key realm of potential leverage and of transformation.

2.4. Desired and used urban futures

The fourth element of our inquiry is about 'desire' as key to opening narratives and imaginaries to positive alternative futures in and against prevailing pessimism about the future.[3] In their exploration of worldmaking, Vervoort and colleagues (2015: 69) stress that 'normative' or 'transformative' imaginaries and scenarios 'can help mitigate the disempowering assumption that societal actors will have to adapt to a set of consensually "plausible" futures' (see also: Aguiar, Collste, & Harmáčková, 2020).[4] Despite wide-spread acknowledgement of the potential for urban areas respond to the polycrisis, Inayatullah (2011) finds that 'cities are creating futures without challenging the deep inequities' and that, while acknowledging notable exceptions, 'the [urban] system as a whole remains demonstrably pathological'. This is partly linked to persistent imaginaries of cities as (dysfunctional) machines (Bina et al., 2020). Scholars note an absence of positive future visions needed in many cities (McPhearson et al., 2016; more generally, see: Bai, van der Leeuw, & O'Brien, 2016),[5] particularly of imaginaries that foreground nature and plural perspectives on HN-Relationships (Elmqvist et al., 2013; Mansur et al., 2022).

Ideas of transformative change and desired futures are interconnected through a reciprocal relationship that drives and guides change. Both involve challenging the status quo, envisioning alternative possibilities, and finding pathways towards more desirable, sustainable futures: (1) desired futures thinking provides a framework for imagining, articulating, exploring, and strategically pursuing transformative change, providing guidance and inspiration; (2) transformative change efforts inform and shape the construction of desired futures, whilst also (3) identifying means and ends for working towards the realization of visions. In relation to *urban* imaginaries these ideas can be associated with traditions focused on the capacity of utopian thinking to 'educate desire' through exploration of alternative worlds (Cugurullo, 2018).

Following Ruth Levitas (2017), '[w]here there is no vision, the people perish'. The long association between cities, utopia and desire therefore has a potentially significant and under-appreciated role to play in enabling new urban imaginaries capable of responding to the polycrisis. In line with Miguel Abensour's definition of the utopian function as the 'education of desire', the process of imagining 'also enables people to learn to want differently, by thinking and feeling… into an alternative world' (Levitas, 2017 19). Meadows too felt the urgency and power of desired futures and of the use of envisioning to develop these. Soon after the watershed UN summit in Rio (UNCED, 1992) she asked: '[e]ven if information, models, and implementation could be perfect in every way, how far can they guide us, if we know what direction we want to move away from but not what direction we want to go toward? ' (Meadows, 1994: n.a.). Failure to widen the realm of possibilities to what is desired will result in limiting ourselves at best to the possibility of plausible (Vervoort, Bendor, Kelliher, Strik, & Helfgott, 2015), adaptive, or the wide range of 'used futures' (Inayatullah, 2008) or 'common visions' (McPhearson et al., 2016: 35), such as 'smart', 'green', or 'sponge' cities - all of which suffer from the limitations of narrow worldviews (for example, regarding smart cities see: Bina et al., 2020; and for persisting narratives: Galafassi, Daw, & Thyresson, 2018).

Bringing together these four core elements of our framework, the next section describes our approach to exploring 'nature-based desired futures to 2050', designed to foster imagination and desire for alternative urban natures, and to consider how structured collective reflection on H-N relatedness might foster awareness of transformative possibilities and leverage points through which they can be realised.

3. Nature-based futures: approach and method

3.1. Designing a participatory process for the 'NBS+ Community'

Our nature-based futures approach was designed for six of the cities in Latin America (Bogota, Buenos Aires, Santiago, Sao Paulo) and Europe (Lisbon and Turin) involved in the EU funded project Conexus. These participatory workshops were intended as an opportunity '[t]o jointly explore nature-based futures that support [the] wellbeing of all life', engaging 'a range of perspectives and plurality of voices in exploring desired futures for nature (and life), in and of, the city/region X', and to promote 'learning and seeds of transformative change through a richer and more connected understanding of nature and life's potential in-of-for the city/region X' (Bina, Inch, Baptista, Pereira, & Falanga, 2023 3). By exercising collective imagination we aimed to identify elements of alternatives in the present, and pathways towards desired futures. Our initiative focused around a broad community of scholars, practitioners, and

---

[3] In this paper we use these two definitions: 'Narratives' as primarily focusing on storytelling, emphasizing the temporal and causal connections between events. They are concerned with constructing meaning and communicating perspectives through stories. 'Imaginaries' are seen as collective frameworks of beliefs, symbols, and images that shape our shared understanding of the world. They encompass cultural and social practices and influence actions and aspirations.

[4] As illustration, Mangnus and colleagues (2021: 6) note: '[t]he fact that so many people think that the future of mobility is all about self-driving cars, for example, might say just as much about corporate power to shape imaginations of the future as it says about what is a plausible future, let alone a desirable future'.

[5] The study on seeds for a positive Anthropocene is often cited as one, still rare, example (Bennett, Solan, & Biggs, 2016).

engaged civil society actors involved in or adjacent to NBS work in the six cities (hereafter 'the NBS+ Community').[6] Overall, we engaged a total of 111 participants (see Supplementary Material D and E). Given the specialized focus of our participants, we consider the data and results to reflect the ideas of the NBS+ Communities rather than representing the six cities. The main reason for focusing on this community was to encourage broader reflection on the urban nature futures they are involved in creating, pushing beyond the sometimes narrow and instrumentally focused strictures of nature-based 'solutions' (Mercado et al., 2023). Findings discussed here therefore reflect the desired futures of the range of experts and stakeholders involved, directly or indirectly, in the design and implementation of NBS in the six cities.

3.2. Three Horizons and three-step approach

Our three-step approach (Fig. 1) was inspired by the Three Horizons method (Sharpe et al., 2016), characterized by the dynamic relationship between *understanding* of present worlds and *creating* representations of desired future states. It is especially suited to contexts of high uncertainty and complexity, where existing knowledge is not sufficient to realise desired futures, and fits with growing interest in normative and positive scenarios and visioning to promote deliberate societal transformation (Harmáčková et al., 2022; Schaal, Mitchell, Scheele, Ryan, & Hanspach, 2023).[7] We also looked at the experience of IPBES (2016) in developing positive nature visions with stakeholders and experts focused on nature's contributions to people (Díaz et al., 2015; IPBES, 2017), which experimented with the Three Horizons to produce detailed scenarios capable of reversing the decline in biodiversity.

Overall, our approach to 'nature-based desired futures' entailed four steps (Fig. 1):

- **Step 0) Preparation**: a pre-workshop survey provided a description of present 'trends' that are shaping futures, 'drivers' of change and 'seeds' pointing to emerging possibilities and the future potential of the present moment (See survey and results for Step 0 in Supplementary Material B and F). Participants were also invited to write a postcard to their present self from 2050 to encourage more imagination immersion in desired futures and to encourage reflection on lived experiences, embedding complexity, and capturing less tangible and measurable desires and change (See Supplementary material C). Material from the surveys was used to help facilitators initiate discussions when needed.

- **Step 1) present futures:** 'To brainstorm and categorise problems and issues related to broad themes in the present';
- **Step 2) desired futures:** 'To jointly explore nature-based futures that support wellbeing of all life' **Step 3) pathways to desired futures:** analysing results from Horizon 2, entailing backcasting and explorations of transformative 'strategies, pathways and actions' building forward from the present (Bina et al., 2023 7-9).

Fig. 2 offers a detailed timeline of each step in practice. Due to local circumstances, resources and the constraints of Covid-19, some workshops were held online (Buenos Aires), one mixed (Santiago de Chile), and others in person (Bogota, Lisbon, Turin, São Paulo). Adaptations were thus also dictated by the need to choose steps and tools that could adapt to both online and face-to-face modes of working, as well as to resource and time differentials allocated to the workshops across the six cities. Discussions for stages 1–3 were held in small groups, with further brainstorming and exchange of ideas across groups in plenary sessions between each step.

We also invited groups to use the workshops to explore the possibilities of combining more-than-human perspectives by inviting participants to imagine the alternative worlds of 'keystone' aspects of the local environment in transformed urban futures. For a preliminary reflection on HN-Relationships the survey drew on IPBES' (2019) heuristic tool that helps visualize, describe and embrace plural preferences for the future of nature according to three sets of values and cultural understandings – Nature for Nature, Nature for Society, and Nature as Culture (Pereira et al., 2020b; Harmáčková et al., 2022).

Data analysis, based on thematic analysis and subsequent coding explored workshop materials from the perspective of our three guiding questions and analytical framework. First, we conducted an in-depth thematic analysis aiming to identify core themes, insights, and challenges from our NBS+ Community. We converted data into an excel sheet: as illustration, for Step 2, this process led to a total of 62 entries being extracted from the material (postcards, workshop Horizon 3 session and final reports produced as a follow-up), amounting to 3780 words, representing all six cities. The entries were reviewed to identify common themes and produce brief descriptions of each (see text in *italics* in the white rectangles of Fig. 3). Second, the entries were coded using keywords that reflected the analytical frames summarized in Fig. 1. The coding process was performed by two authors then verified by a third person and revised by a fourth author for consistency.

---

[6] Nature-based solutions (NBS) have rapidly taken centre stage in the realm of approaches and methods to transition towards a more sustainable coexistence. References to the transformative potential of changing HN-Relationship are increasingly relevant to debates, hopes and even claims of NBS as a means 'to shift from an unsustainable status quo to jointly address the underlying drivers of the climate and biodiversity crises' (Welden, Chausson, & Melanidis, 2021 2).

[7] Like all methods, Three Horizon also has limitations and potential shortcomings. A common critique is their limited scope and narrow focus in the analysis which does not include broader social, economic, and political factors that may be contributing to the problem and limit its scalability into global contexts (Pereira et al., 2020a). Moreover, Three Horizon approaches may rely on assumptions and biases, particularly when it comes to developing Horizon 3 – the vision of the future (Nalau & Cobb, 2022). These can limit the scope of the vision especially if the process in not participatory or fails to ensure that all participants have an equal opportunity to contribute (Nalau & Cobb, 2022), ultimately undermining the method's potential to identify meaningful change (Pereira et al., 2020a).

	2021 PREPARATIONS — Exploratory online Meetings (1-3 per city) Defining workshop and local participants	2022 STEP 1 – PRESENT SEEDS OF EMERGING FUTURES	STEP 2 – DESIRED FUTURES / STEP 3 – PATHWAYS — The two steps took place the same day in most of the cities	FOLLOW-UP — Online Debriefing Meetings with local organisers — Strengths and weaknesses discussed	CITY REPORTING — Final workshop reports for each city intended for record, feedback, and an opportunity to discuss lessons learnt with participants.
Bogota	October 2021	Survey sent one week before workshop	In-person, March 2022	Email exchange to discuss final report	
Buenos Aires	October 2021		Online, May 2022	June, 2022	&
Lisbon	October 2021		In-person, April 22	May, 2022	DISSEMINATION OF APPROACH — Factsheet designed for dissemination available https://www.conexusnbs.com/resources
Santiago	October 2021	Results provided background for the actual workshop session	Hybrid, January 2022 / Online, April 2022	May, 2022	
Torino	October 2021		In-person, June 2022	Email exchange to discuss final report	
Sao Paulo	December 2021		In-person, June 2022	July, 2022	

Fig. 2. Timeline of the application of the Nature-Based Approach in six cities
Source: Authors.

4. Results and discussion

Below we present a summary of results in relation to our analytical frames. We address how our workshop participants understood key changes and narratives associated with desired futures, changing ideas of nature, HN-Relationships and agency, and the
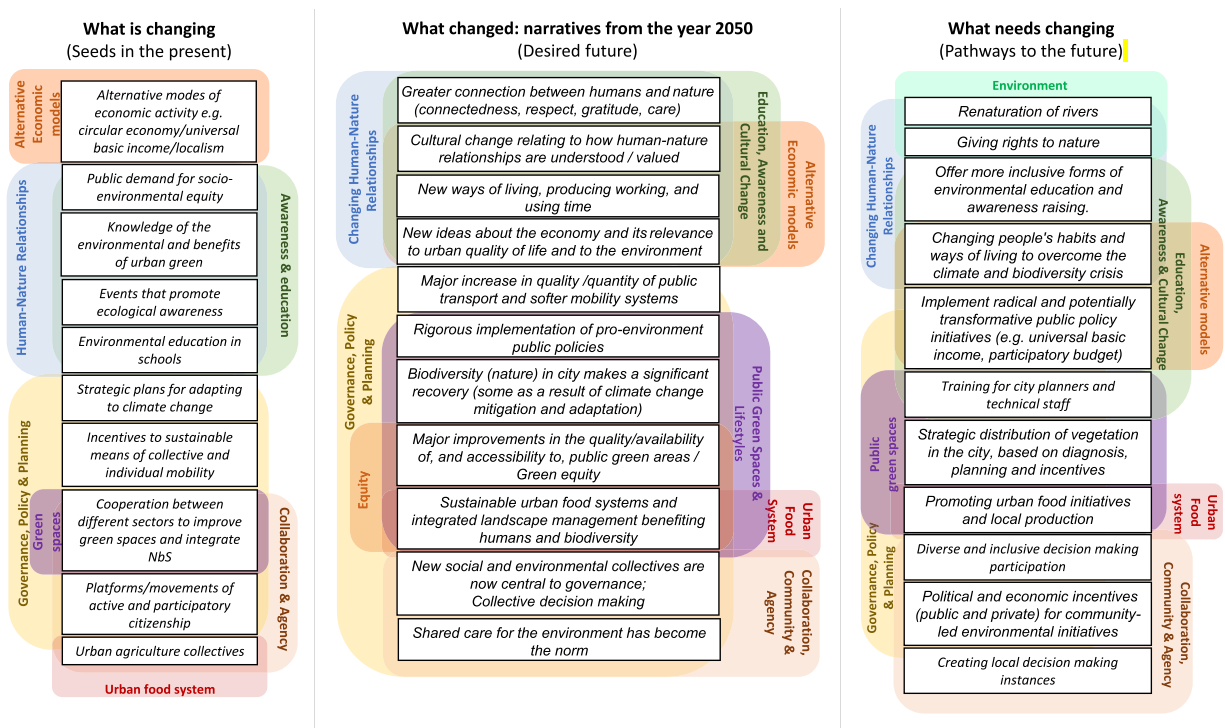

Fig. 3. Common themes (white boxes) and leverage types (shaded tabs) from all cities
Source: authors based on material from all Steps detailed in Fig. 1.

transformative potential of a nature-based approach to urban futures.

4.1. The journey to 'a nature-based desired future'

The entries extracted from the material for each step gave a rich account of what *is changing* in the present (seeds[8]) and what *needs to change* starting now, defining pathways towards desired futures. They also provided accounts of what '*changed*' looking backwards from the perspective of desired futures articulated for 2050. Fig. 3 captures the main themes and leverage types for each step of the journey, echoing the sequence and logic of the Three Horizons method.

4.1.1. Narratives of change: imaginaries of leverage and desired transformations

Overall, in envisaging 'nature-based desired futures' for urban contexts, the NBS+ Community highlighted a consistent range of themes and leverage points (Fig. 3). Our analysis of the insights and rich storytelling of the 111 participants, identified nine core narratives:

- Stories of humans and nature in the city
- Stories of cultural change & alternative economic models
- Stories of cultural change, equity & food
- Stories of changing awareness, community, and agency
- Stories of education and changing awareness
- Stories of public governance, collaboration, and community
- Stories of green public spaces, equity and changing lifestyles
- Stories of policy and planning
- Stories of rivers rising.

A description of each can be found in Supplementary Material G, while the central column in Fig. 3 provides details of the common leverage points that underpin them. Combined, they suggested a rich range of ways in which 'the city [c]ould become a model of socio-ecological sustainable urban living, inspiring other cities around the world to follow suit' (Supplementary Material G).

We noted that seeds identified in Step 1 (present futures) often set the tone for things to come. As illustration, the label 'education, awareness, and cultural change' (Fig. 3, green tabs) shows how deep leverage points identified as 'events that promote ecological awareness' in the present (*seeds*), frequently evolved to become an acquired level of awareness that contributed – often thanks to education – to deeper cultural change in participants' *desired futures*. The *pathway* to such desired futures frequently focused on behavioural change, inclusive education and better training for policy-makers and citizens.

Having identified these core narratives across the three steps, we sought to ask what types of change (leverage points, transformative approaches) were imagined within these nature-based desired futures? To answer, we focussed first on the material for Step 2, 'desired futures'. Based on our coding, we identified 15/62 entries focusing on deep leverage; 19/62 entries combining deep and midlevel leverage, and 28/62 entries combining midlevel to surface leverage. Four common themes in Fig. 3 align with deep leverage ideas frequently focused on a desire to radically reframe values, beliefs and worldviews linked to society's priorities (what matters most in life), from notions of power, equity and justice to quality of relationships and sense of identity and place: '*Changing human-nature relationships*' and '*Education, awareness and cultural change*' often overlapped in terms of the type of desired futures they signified, with both also dependent on the development of '*alternative economic models*'.

The ideas discussed under these themes frequently implied a radical questioning of the foundations of dominant socio-economic systems, in line with debates about transformative change discussed in the introduction. They point to a range of linked and widely held criticisms of globalised economies, patriarchal systems of power, exploitation, inequity, and exclusion. For some participants this was linked to critique of (capitalist) growth dependency and the impacts of consumer cultures on socionatures. Like most leverage threads, this was visible as a 'seed' in the present, often discussed as a necessary response to rising socio-economic '*inequality*' (see Supplementary Figure I). A fourth theme that related to these shifts was '*collaboration, community and agency*', which captures a set of common stories concerning the emergence of new social and environmental collectivities becoming a key mechanism of local governance and collaborative decision making, promoting and enabling shared care for public and green space and the environment more generally. These ideas frequently drew on 'small is beautiful' traditions of environmentalist thinking, sometimes invigorated by newer sources of thinking about circular economies or doughnut economies (Wahl, 2016). Together, these four elements align with the notions of 'structural' and 'enabling' approaches to transformation identified by Scoones and colleagues (2020) and suggested a broadly shared desire for radical change, linked to recognisable narratives about alternatives and the leverage points through which they might begin to be realized.

As visions shifted to detailing more practical and physical elements of the desired future, they appealed more to midlevel and surface leverage points which scholars - including Meadows (1999) herself - have long associated with the majority of policy-making (for example: Raskin et al., 2002; UNEP, 2012). This results in reduced capacity to transform systems and the root drivers of the crises

---

[8] Seeds are defined as: 'current positive and inspiring initiatives that hold potential to shape a more just, prosperous and sustainable future. They can be initiatives (social, technological, economic, or social– ecological ways of thinking or doing) that exist, at least in prototype form, and that represent a diversity of worldviews, values, and regions, but are not currently dominant or prominent in the world' (our Survey).

that trigger the need for change, but is arguably the level at which most of the NBS+ community operate most frequently. Three common themes in Fig. 3 align with midlevel and surface leverage points (representing the remaining 47 out of 62 entries). First, '*governance, policy-making and planning*' which embraced a wide range of policies, measures and regulations envisaged by the participants as critical building blocks of their desired future. '*Public green spaces and lifestyle changes*', mobility systems, and '*urban food systems*' were the most common physical changes in urban form that were considered to both result from, and enable, deeper changes. For example, the desire for significant improvements in the quality and availability of public green areas, and their wide accessibility were widely imagined as a result of governance shifts, driven by changes in values and worldviews: '[we] work less hours per day'. However, the discussions also suggested that access to green space and exposure to nature would themselves lead to changing values and desire for different lifestyles: '[w]e live in a quieter way, where everything makes more sense, children play in the street' or where '[t]here is less noise, more oxygen, more smell of earth and flowers'. Equity was a key underlying quality for these transformed services (for example, free public transport and equality of access to green space). These guiding values linked to imaginaries of '*alternative economic models*' that operate at more structural levels and where there was arguably sometimes a disjunct between desire for full scale systemic transformation and participants' accounts of (or faith in) the leverage points through which this might be enabled.

Overall, our analysis suggests that (1) in terms of leverage the commonalities in the 'nature-based desired futures' our participants articulated revealed significant engagement with what Meadows positioned as the most effective leverage point categories (deep followed by midlevel); and (2) in terms of approaches to transformation by Scoones et al. (2020), these three elements focus on 'systemic' approaches while constantly linking to elements of structural and enabling approaches. Thus, the NBS+ community found itself repeatedly confronting the entangled nature of leverage and of transformative approaches, identifying the need for change whilst often struggling to define clear pathways.

4.1.2. Backcasting from Imagined Futures to Present Possibilities

The final step of the journey to 2050 (Fig. 3, 'What needs changing'), adopted a traditional backcasting process adapted to the simplified structure of our approach. Inayatullah (2008) highlights that imagining a desired future allows us to align the challenges we face in our daily life with our vision/images of a new future, creating better strategies and conditions for change. Our guidance provided several prompts for this final step, inviting participants to be as concrete and specific as possible, especially in terms of 'who, what and how', allowing participants to think of short- and long-term actions, as well as the types of agencies involved (see next section). The aim was to produce more detailed reflection on the forms of leverage and processes of transformation required to realise desired change.

Perhaps unsurprisingly, ideas showed strong continuity and commonality with regards to the types of leverage involved. They again included a transformative role for enabling approaches like '*Education, Awareness & Cultural Change*' connected to '*Changing HN-Relationships*' (e.g "more active learning by doing in and with nature") and improving management and planning of '*Public Green Spaces*' practices (e.g. "[…] specialisation courses that favour the exchange of cross-cutting knowledge and the development of different green technologies"). Perhaps reflecting the focus of the NBS+ community, the most prominent actions across all cities were frequently related to systemic approaches associated with '*Governance, Policy and Planning*'. The State was assigned an important leadership role through public policies that promote alternatives, from the systemic (better integrated planning of green space) to the more structural (universal basic income). Public sector governance was also expected to enable '*Collaboration, Community & Agency*', creating inclusive spaces for decision-making, and allowing social movements and citizens the time, space, and resources to evolve as thriving communities and to take control of their own spaces and initiatives. The active role of civil society was seen as essential in promoting a shift in values, with social movements and cooperatives influencing decisions, pressuring for change and creating the conditions for wider cultural change (e.g. "with more support for communities to take control of their own green space's communal gardens, parks, forests and farms began to appear everywhere").

Finally, there was a continuity in identification of the structural change and deep leverage points targeting '*Alternative economic models*'. Some suggestions aligned with the idea of stepping out of the dominant system altogether. With participants explicitly referring to ideas about beyond-GDP economics, degrowth and economies focused on well-being based on, "the awareness that the race for progress is no longer sustainable", or "creating and accepting ways of life outside the typical constraints of the capitalist system". Here again, however, detailed discussion of how the transition towards alternative models might be accomplished proved more difficult, and there was considerable variation in the extent to which participants were willing or able to engage with this scale of structural and systemic transformation.

In considering pathways back from their preferred futures towards the present, our participants therefore identified a further range of possible leverage points with transformative possibilities spanning the structural, systemic and enabling approaches identified by Scoones et al. (2020).

4.2. Shifting perspectives on nature, HN-Relationships and agency

In setting out the main concepts for this research we identified nature and HN-Relationships in cities as a major area of concern, especially in the realm of agency, relevant to both theoretical and practice-driven debates. Through our second research question we have sought to understand how our NBS+ Community conceptualised and valued HN-Relationships, and what agencies they projected into their desired futures.

4.2.1. Towards more relational perspectives on HN-Relationships

In the pre-workshop survey, participants were asked to reflect on their current 'views on human and nature relationships'

(discussed in the 'Concepts' section) and to rank the three perspectives taken from Pascual, Balvanera, and Díaz (2017) and the framework developed by Pereira et al. (2020b): 'Nature for Nature' (intrinsic value of nature), 'Nature for Society'' (instrumental value), and 'Nature as Culture' (relational value) (see Survey). Valid results were collected for four of the six cities, with between 10 to 22 responses per city. From our sample 50% ranked the model based on 'nature as culture' first, 37% selected 'nature for nature' and 13% 'nature for society'. Our participants therefore expressed a preference for the richer and deeper relational dimensions implied by 'nature as culture' or 'nature for nature', even though most are directly or directly linked to the field of NBS - generally associated with more instrumental 'Nature for Society' perspectives.

During the workshops, however, we noted two interesting shifts. First, when the NBS+ Communities engaged with discussions around 'The Present' the discussion seemed to shift towards a 'Nature for Society' perspective, (Fig. 4, left), possibly reflecting the pull of present realities and dominant policy narratives. Secondly, as participants shifted again to consider their desired nature-based futures in 2050 (Step 2), a richer range of perspectives re-emerged that was more (Fig. 4, right), consistent with a 'Nature as Culture' perspective, emphasising the relational intertwining of nature and society, the need for a more fundamental re-shaping of cultures, values and mindsets and emphasis on making space for 'Nature for Nature' by reducing human 'interference'.

We also identified tensions that have a long tradition in environmental and sustainability discourses, and which reveal the politics generated by the false dichotomies of 'environment-development' and 'human-nature' onto-epistemologies. For example, in several instances during the workshops our NBS+ Communities entered a space where they considered perceived trade-offs between the urgency of addressing social justice and the relative privilege of caring for nature, suggesting that 'social injustice' should take priority (see critique of NBS policies and practice: Welden et al., 2021). This questioning was more tangible in our Latin American workshops, but not exclusive to them. In the European workshops inequality and injustice were equally central to the debates, though more often considered as a critique of dominant socio-economic systems, and less likely to be seen as conflicting with nature.

While we are unable to resolve the dilemma, it is significant that the workshops helped to voice, and thus make visible, tensions over beliefs and values, and possible alternative ways of seeing this perceived dualism. Another means by which the workshops sought to draw out alternative perspectives was by inviting participants to consider HN-Relationships from the perspectives of more-than-human agents, and the discussions this generated shed further light on H-N relationships.

4.2.2. More-than-human voices and changing agencies

Conceived primarily as a device to help shift away from anthropocentric ideas about the future and to creatively consider the needs of nature, consideration of the perspectives of more-than-human entities was intended to stimulate the imagination and empathy of participants to explore what desired futures of 'Nature for Nature' might look like (shift *emerging* in Fig. 4).

More-than-human entities and critters were often imagined to be accepting -or even desiring- of relationships with humans, seemingly confirming a 'pull of desire' (Raskin et al., 2002: 55) among participants to reconnect with nature (Table 1 below). And yet, there were also concerns raised, reflecting the persistence of dichotomous views of nature and techno-cultures, with some expressing
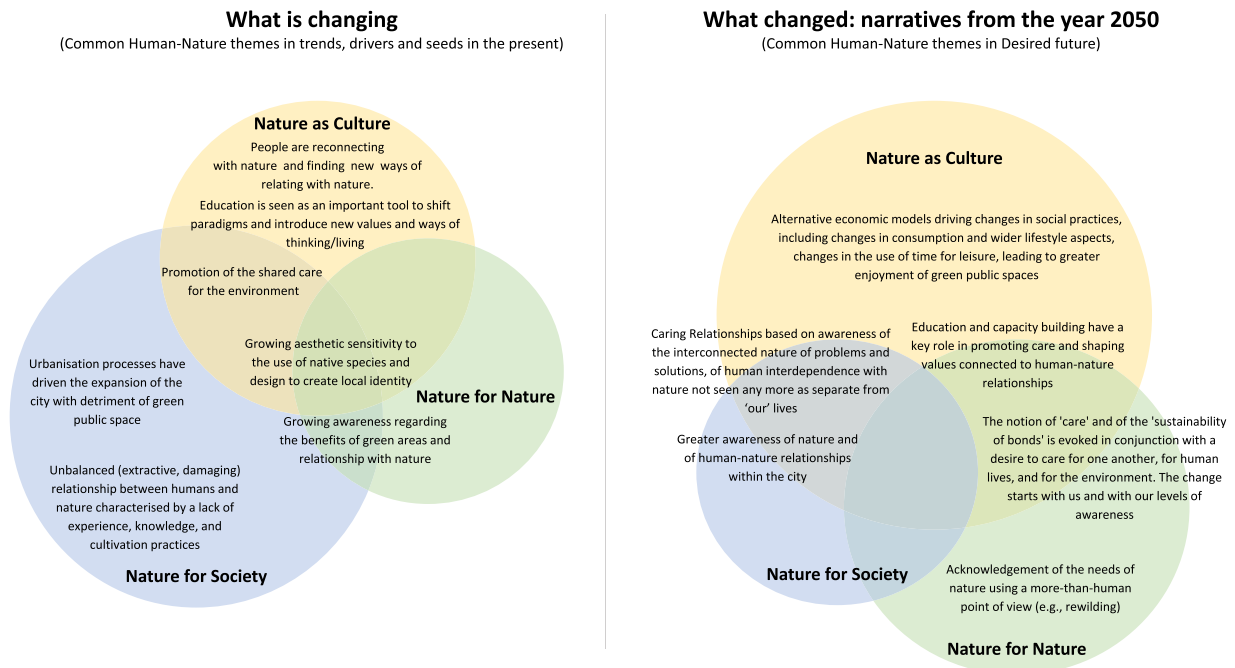
Fig. 4. Shifting human-nature relationships and values between the present and future (typologies echo IPBES Nature Futures Framework)
Source: authors, based on material from Stage 1: survey and workshops Horizon 1, and Stage 2: postcards and workshops Horizon 3 (all cities). Circle size indicates prevalence of the perspectives in each stage.

fears around human safety in a landscape shaped by nature for nature. Others, however, noted that history had shown technology's limits and the need to now respect nature because "nature always wins. We are good at discovering and inventing things, but we still cannot deprive ourselves of nature, because we cannot imitate it".

Interestingly, for some of our participants this exercise prompted a shift towards the landscape scale, enabling consideration of the wider connectivity of the urban within natural ecosystems, and freeing discussion from the constraints of urban design and urban form.[9] For example, consideration of rivers delivered this transformation of perspective with great efficacy in the case of Lisbon, São Paulo, and Turin. The stories rivers were seen to tell generated a series of rich reflections that combined deep leverage, with the ethos of enabling approaches (see: The 'Story of rivers rising' in Box 1, Supplementary Material). Another example was reference to mountains in Turin and Santiago de Chile. Thinking from the perspective of a future mountain also highlighted stark realities of the climate change impacts being lived in the present, "mountains are happy with the return to the cycle of seasonality, with snow having returned to the peaks and thus the ability to maintain glaciers".

The conversations sometimes linked back to the ever-present concern with management and governance implications, which was expressed both as enabler (e.g. "we found a way of coordinating top-down efforts with bottom-up initiatives and the result is a network of natural spaces that allow a whole range of native fauna and flora to flourish and move through the city…they say that pumas move across some peripheral parts of the city by night"), and as potential problem, wondering whose responsibility it would be "to care for them" or how it would feel to have "pumas as neighbours"?

Inviting storytelling from the perspectives of more-than-humans is a notoriously complex activity, requiring 'both emotional and cognitive attunement' (Jönsson, Lindström, & Ståhl, 2021: 3). A full consideration of this perspective would have required more time than was available, not least because the idea was not easily embraced by many participants whose daily lives are taken up with more immediate concerns, rendering this exercise alien to their shared contexts and discourses. For example, one group of participants exploring "bees" soon realised the complexity of socio-ecological feedbacks and even greater implications for urban planning and urban form, leading them to conclude they "could not handle it".

Our second research question also concerned the forms of agency participants identified as key to the positive transformation of nature futures. Although debate between materialist and idealist conceptions of agency remain important, our work has drawn on bodies of scholarship that stress how renegotiating nature and HN-Relationships in cities, when combined with critical understandings of socio-natures, has potential to trigger deep leverage (Abson et al., 2017), and suggest changing agencies as a central pillar of any transformative change process. Our workshops combined understandings of agency mobilised in the present (seeds and drivers from Step 1), in desired futures (Step 2) and in pathways (Step 3) to identify five types of agency. Table 1 reveals the challenges they face in pursuing (transformative) change with examples from the discussions.

What we found echoes common typologies of agencies and related types of actions, such as those discussed in the study on change agent narratives of sustainable futures by Riedy and Waddock (2022) which identified -inter alia – '[c]ollective actors comprising all beings, nature, and the natural environment, as well as individual species as representatives of nature'. 'Citizens, platforms and communal actors' (often combined with 'younger generations') were the most frequently represented in our material, reflecting our participants' preference for change that emerges with or through community support. As noted above, a crucial challenge was realising that for most pathways identified, the social structures and agency required to activate change lie partly (or even wholly) beyond the participants' communities of practice. Discussion in the workshops frequently appealed to 'policy-makers, planners and leaders', as well as to what Riedy and Waddock called 'antagonists': 'an impersonal current system; and people benefiting from that system who oppose change' (2022: 10). These are key agencies in systemic and structural approaches, yet, our participants at times found it harder to identify positive agency capable of leveraging transformative change at these levels. This led to a focus on enabling approaches which many participants envisaged as a complementary but more accessible force for change. Hence there was a strong preference for communities as well as younger generations as agents, suggesting a need, and desire, to reshape the locus of agency, creating futures within which citizens can exercise meaningful power to shape their collective futures. The last type of agency refers to 'nature and more-than-humans', reflecting its emerging presence in the NBS+ Community narrative discussed above, even if still a less familiar terrain.

Ultimately, the purpose of imagining desired futures and related paths is precisely to inspire and make visible new possibilities, the alliances they will require and the obstacles that need to be faced. While workshops discussions explored all three approaches to transformative change, when the focus was turned explicitly towards agency, the emphasis naturally tended to fall on the on enabling approaches. Hopes were placed in moves to empower individuals and communities to take action on their own behalf', representing a generally 'optimistic and directly activist stance', and a focus on processes and capacities linked to individually smaller actions 'which reflect the values and visions mobilized by agents', and the leverage of 'cultural change' and of 'a hopeful, caring, emancipatory stance on transformation' (Scoones et al., 2020: 67–68).

4.3. The approach: limits and strengths

Our final question invited a reflection on the transformative potential of the nature futures.

The findings arising from the six workshops suggest the approach has the potential to open space for critical reflection and creative exploration of the kinds of transformation all participants agreed are now required.

---

[9] Such shift is also central to recent critical reflections around NBS policy and practice (Tozer et al., 2022).

Table 1

Types of agency imagined to shape and deliver 'Nature-Based Desired Futures'.

Common types of agency	Description	Challenges faced	Examples and related actions
All of us	All of human beings, as active agents that influence nature	Personal beliefs and development.	"we", "human beings", "us".
Citizens, platforms, communal actors	People from all walks of life, keen to promote changes and explore alternatives	The mainstream 'solutions' of the dominant system(s); the cultural pressure against certain ideas or solutions; the (lack of) political will to promote certain ideas/solutions.	"responsible and socially active management of green space", "Environmental education", "Relinking solutions with the development of the natural environment", São Paulo's "Urban Kindness" initiative, "Citizens' sharing and co-participation in the management and maintenance of solutions adopted to increase the city's climate resilience", "Citizen demand to increase and improve green areas." "(…) a civil society movement organised in defence of public green areas in São Paulo capital.", "Platforms/movements of active and participatory citizenship: citizen involvement in the discussion and resolution of local problems of the city; awareness, conviviality, trans-thinking; creation of an organised (citizens'), coherent and informed position towards government institutions (public consultation or petition, for example)"
Young generations	Younger generations that are being taught to live with nature	Personal beliefs and personal development; fighting the system and mainstream solutions	"Education and attention to environmental sustainability with a focus on the local context.", "Adoption of NBS in schools, so as to contribute to the education (also) of adults (parents, families and school staff) through children and young people", "Implement a vision of environmental education for society", "Young people in decision-making "
Policy-makers, planners and leaders	Leaders that promote initiatives to bring change	Fighting the system and mainstream solutions	"Institutional programmes, such as the Project *Ligue os pontos*. The implementation of PlanClima and the 4 Plans; Planpavel, [etc.]", "Planning instruments vision and a future ecological Constitution.", "More laws that defend green spaces and the environment."
Nature and more-than-humans	Green and blue infrastructures, ecosystems, biodiversity, animals/species	Limited recognition and/or acceptance of the value and importance of nature as an agent of change	"Thriving Nature", "urban gardens", "green areas", "biodiversity and biocultural diversity", "climate change and seasons", "native species", "animals" (e. g. fish, birds, migratory birds, pumas, insects), "parks", "nature", "rivers", "soils", "water", "mountains" "ecological connectivity".

Source: authors drawing on material from all Stages (all cities)

The act of weaving together new, hopeful, caring and emancipatory stories was challenging but generative. As the analysis presented here has illustrated, our workshops produced multiple narratives that all hinged on the mutually reinforcing power of deep leverage and of the ways the three transformative change approaches, might combine to outline pathways for developing a shared sense of purpose and direction towards desired futures. The stories of humans and nature in the city that they developed were not always consistent or considered sufficient to meet the scale of the systemic changes many agreed are now required. However, they gave voice to shared desires for recognition of the relational entanglements underpinning HN-relationships, the complexities these pose for projects of transformation as well as the urgent need for action to overcome unjust and unsustainable socio-natures. Even if the agency to activate leverage points was sometimes felt to be lacking, the emphasis across the workshops on stories that foregrounded cultural change and alternative economic models demonstrated widespread understanding of the deeply rooted structural transformations implied by new HN-Relationships, including a clear focus on justice and equity.

Taken together, the nature-based desired futures captured in the results (summarised in the overview of common themes, leverage types, pathways (Fig. 3) and agencies (Table 1)) suggest a rich understanding of the transformative change many amongst the NBS+ communities working around the CONEXUS project agree is needed. The presence of promising seeds of desired futures in the present highlights these communities' sense that current action can contribute to potentially transformative change. They also point to a strong belief in the capacity for education and improved understanding H-N Relationships to leverage change and empower a wide range of agent, capable of acting for more desirable urban nature futures.

The stories, images and ideas our participants developed reflected their engagement with a rich repertoire of contemporary thinking about nature-based, environmental alternatives. In this, the collective product of our workshops resonated with the work of others who have sought to develop 'ideas (memes) for stories that guide humanity into the future' (Riedy & Waddock, 2022: 3). Common themes include envisaging a life in harmony with nature, achieving a high level of social justice and sustainability, focusing

on local community and on participatory governance. The focus on learning the intrinsic value of nature and allowing more space for nature within the urban to shape new socio-natures also resonate with Mansur et al.'s (2022) vision summaries of their own Urban-NFF study. In adapting, a developing repertoire of ideas about possible future urban natures to their respective urban contexts, our NBS+ communities were able to move beyond the unthinking replication of used futures, towards a more critical and imaginative engagement with HN-relationships and possible pathways towards their transformation.

Overall, the four dimensions of the analytical frame (Fig. 1) helped both in the design of the nature futures approach, and in the analysis of its application within the NBS+ Community. In emphasising the education of desire, our approach aimed to stretch our participants imaginaries beyond the possibilities suggested by seeds and other drivers of change in the present. Hence, while recognising the positive, mutually reinforcing nature of these diverse exercises in futuring, we concur with Galafassi et al. (2018) on the need to 'engage and integrate richer forms of knowledge and experience to trigger creativity and imagination of transformative pathways', and with Riedy and Waddock (2022) who reiterate the limits of abstractness in inspiring audiences towards transformative agency. This is especially important if we are to unseat the dichotomies that underpin dominant ideas of the city (artificial-natural, culture-nature, human-nature) that have played a foundational role in shaping the contemporary polycrisis.

The experience of the workshops provides support for our starting assumption about the value of participatory exploration of desired futures as a step towards emancipation from otherwise self-fulfilling prophecies and 'used futures' (Inayatullah, 2008), that frequently entail the disavowal of shared fears of dystopian-style collapse in the polycrisis. In practical and methodological terms, our collective explorations also confirmed well known patterns whereby identifying the seeds, trends and drivers for change in the present was relatively straightforward for our 111-strong NBS+ Community. However, when dared to imagine positive visions for their cities' future in 2050 or to discuss more-than-human perspectives, participants felt creatively challenged.

Time was often limited, and when this was the case, some participants admitted that they had difficulty letting go of everyday concerns to imagine other possible worlds (or in some cases to see the value of doing so without an immediate, instrumentally-defined 'outcome'). In post-workshop reflective discussions, some local organisers felt more could have been done to foster spaces of imaginative possibility, including by offering participants more time or by moving discussions into natural spaces to spur creative thinking. As one participant put it: "we need more dreamers" and it is "difficult to invite people to do so [to imagine desired futures], online, in an office, and with people who are deeply into the current difficulties, obstacles, etc." Facilitation and pre-workshop preparations helped, yet still fell short of meeting the needs of a multi-disciplinary and multi-cultural cohort. The use of potentially disruptive devices, such as inviting more-than-humans to co-desire alternative urban futures to widen the idea and scope of agency could be further explored and tested in response to these challenges. Despite the limited time and the practical (and emotional) difficulties in engaging with this part of our approach, we found that this invitation helped participants to question the perception of 'nature' as a mere, soulless, background for humanity's (urban) project (Latour, 2013), enriching discussions on entangled urban socio-natures and sometimes triggering promising shifts in perspective.

5. Conclusion

The aims of our inquiry were to conceive and design an approach for the exploration of 'nature-based desired futures' as a contribution towards bridging the identified gap in terms of positive urban future visions that foreground nature, and to promote more critical reflection about the (re)thinking of HN-Relationships required to realise positive transformations. In doing so, we sought to examine the transformative potential of approaching these questions through collective reflection on desired futures.

It is important to acknowledge that a series of exploratory workshops in themselves are not a vehicle for directly exercising the kinds of leverage or transformation discussed in the paper. However, in creating space for critical and creative exploration of desired urban nature futures, our NBS+ communities were invited to step back from their day-to-day practices to collectively reflect on the nature futures they want and need. An important part of these workshops was the breaking down of personal, cultural, professional/academic, and disciplinary boundaries, through the *encouragement* of inspiration and the *permission* to dream. Exercising the collective imagination about desired futures allowed participants to think and build elements of alternatives to the present and identify (sometimes) detailed transformative paths and agencies to realise these futures. The direct results of the workshops were a series of reports on desired urban nature futures that was shared with participants and considered in the ongoing NBS-work being conducted through the Conexus project. The indirect results are harder to track, but include heightened awareness of the value of ongoing, collective reflection on the entangled nature of structural and systemic change, and on how the gap between current trajectories and perceptions of desired futures can and should be closed.

Our experience shows that the active practice of nature future-making, although not easy for many of those involved, has considerable potential for generating critical reflections on current realities and the identification of opportunities for agents to enhance leverage amidst ongoing struggle towards systemic transformation of HN-relationships. This includes the potential of 'more-than-human sociality' (Tsing (2016)) for expanding the boundaries of desired urban futures, not least in connecting futures studies with the burgeoning science on how we can communicate with plants and other-than-human animals to combat the felt loss of connectedness (van Dooren, Kirksey, & Münster, 2016; Gagliano, Ryan, & Vieira, 2017).

We have sought to contribute to the space of desired futures and respond to the demand for positive urban visions that can foreground different conceptions of socio-nature relatedness. As voices of alarm and urgency become more strident, creative exploration of nature-based desired futures may be one way of building communities of practice committed to transformation through and beyond the contemporary polycrisis; hastening the demise of what is now dying and working to create new forms of socio-natural relatedness, open to what seeks to emerge and thrive, plural and messy, but thoroughly alive.

CRediT authorship contribution statement

O. Bina: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **M. D. Baptista:** Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing, Investigation, Methodology. **M.M. Pereira**: Formal analysis, Data curation, Investigation, Visualization. **A. Inch**: Conceptualization, Methodology, Writing – review & editing, Investigation. **R. Falanga:** Methodology, Validation, Writing – review & editing. **Alegria V. Alegría:** Methodology, Visualization, Writing – review & editing, Validation. **S. Caquimbo-Salazar:** Methodology, Validation. **D.H.S. Duarte:** Methodology, Validation, Writing – review & editing. **G. Mercado:** Project administration, Visualization, Methodology, Validation. **A. T. Valenta:** Methodology, Validation. **A. Vasquez:** Methodology, Writing – review & editing, Validation. **T. Verellen:** Validation, Methodology, Writing – review & editing.

Declaration of Competing Interest

We wish to confirm that there are no known conflicts of interest associated with this publication.

Acknowledgement

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.futures.2024.103362.

References

Abram, D. (2012). *The spell of the sensuous: perception and language in a more-than-human world*. Vintage.

Abson, D. J., Fischer, J., Leventon, J., et al. (2017). Leverage points for sustainability transformation. *Ambio, 46*, 30–39. DOI 10.1007/s13280-016-0800-y.

Aguiar, A. P. D., Collste, D., Harmáčková, Z. V., et al. (2020). Co-designing global target-seeking scenarios: A cross-scale participatory process for capturing multiple perspectives on pathways to sustainability. *Global Environmental Change, 65*, Article 102198.

Bai, X., van der Leeuw, S., O'Brien, K., et al. (2016). Plausible and desirable futures in the Anthropocene: A new research agenda. *Global Environmental Change, 39*, 351–362. https://doi.org/10.1016/j.gloenvcha.2015.09.017

Bear, C. (2017). In D. Richardson, N. Castree, M. F. Goodchild, & A. Kobayashi (Eds.), *Socio-Nature. In International Encyclopedia of Geography: People, the Earth, Environment and Technology*. Oxford, UK: John Wiley & Sons, Ltd.

Bennett, E. M., Solan, M., Biggs, R., et al. (2016). Bright spots: seeds of a good Anthropocene. *Frontiers in Ecology and the Environment, 14*, 441–448.

Bina, O., Inch, A., Baptista, M., Pereira, M. and Falanga, R. (2023) Guidance for Nature Futures Workshops, Working Document (revised), EU funded project CONEXUS grant agreement no. 867564, University of Lisbon and University of Sheffield, ULisboa repository http://hdl.handle.net/10451/56074 (accessed:29/12/3).

Bina, O., Inch, A., & Pereira, L. (2020). Beyond techno-utopia and its discontents: On the role of utopianism and speculative fiction in shaping alternatives to the smart city imaginary. *Futures, 115*, Article 102475. https://doi.org/10.1016/j.futures.2019.102475

Cugurullo, F. (2018). The origin of the Smart City imaginary: from the dawn of modernity to the eclipse of reason. In C. Lindner, & M. Meissner (Eds.), *The Routledge Companion to Urban Imaginaries*. London: Routledge.

Díaz, S., Demissew, S., Carabias, J., et al. (2015). The IPBES Conceptual Framework—connecting nature and people, Current Opinion in Environmental. *Sustainability, 14*, 1–16.

EEA (2023) Exiting the Anthropocene? Exploring fundamental change in our relationship with nature.

Elmqvist, T., Fragkias, M., Goodness, J., et al. (2013). Stewardship of the biosphere in the urban era. In T. Elmqvist, M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald, M. Schewenius, M. Sendstad, K. C. Seto, & C. Wilkinson (Eds.), *In Urbanization, biodiversity and ecosystem services: Challenges and opportunities* (pp. 719–746). Springer.

Fazey, I., Schäpke, N., Caniglia, G., et al. (2020). Transforming knowledge systems for life on Earth: Visions of future systems and how to get there. *Energy Research & Social Science, 70*, Article 101724. https://doi.org/10.1016/j.erss.2020.101724

Gagliano, M., Ryan, J.C. and Vieira, P. (2017) The language of plants: Science, philosophy, literature, U of Minnesota Press.

Galafassi, D., Daw, T. M., Thyresson, M., et al. (2018). Stories in social-ecological knowledge cocreation. *Ecology and Society, 23*. https://doi.org/10.5751/ES-09932-230123

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy, 31*, 1257–1274.

Goudeseune, L., Solerød, M., Aleksandrova, M., et al. (2020). Handbook on the use of biodiversity scenarios, BiodivERsA-Belmont Forum report. *5281/zenodo* (p. 3979340). DOI: 10,.

Griffith, C., Maddox, D., Simon, D., et al. (Eds.) (2018) Urban Planet: Knowledge towards Sustainable Cities, Cambridge University Press, Cambridge.

Haraway, D. (2016) Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene, e-flux Journal, September, https://www.e-flux.com/journal/75/67125/tentacular-thinking-anthropocene-capitalocene-chthulucene/ (Accessed: 2/1/23).

Harmáčková, Z. V., Blättler, L., Aguiar, A. P. D., Daněk, J., Krpec, P., & Vačkářová, D. (2022). Linking multiple values of nature with future impacts: value-based participatory scenario development for sustainable landscape governance. *Sustainability Science, 17*, 849–864.

Homer-Dixon, T., Renn, O., Rockstrom, J., Donges, J.F. and Janzwood, S. (2022) A call for an international research program on the risk of a global polycrisis, Cascade Institute, 2022–2, version 1.0, https://cascadeinstitute.org/technical-paper/a-call-for-an-international-research-program-on-the-risk-of-aglobal-polycrisis/ (accessed: 12/12/22).

Inayatullah, S. (2008). Six pillars: futures thinking for transforming. *Foresight, 10*, 4–21.

Inayatullah, S. (2011). City futures in transformation: Emerging issues and case studies. *Futures, 43*, 654–661. https://doi.org/10.1016/j.futures.2011.05.006

IPBES (2016) The methodological assessment report on scenarios and models of biodiversity and ecosystem services, Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany, https://ipbes.net/sites/default/files/downloads/pdf/2016.methodological_assessment_report_scenarios_models.pdf (accessed: 2/2/20).

IPBES (2017) Visions for nature and nature's contributions to people for the 21st century. Report from an IPBES visioning workshop held on 4–8 September 2017 in Auckland, New Zealand, NIWA SCIENCE AND TECHNOLOGY SERIES Number 83, available at: http://www.niwa.co.nz/naturefutures.

IPBES (2019) Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, (Eds) E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo. IPBES Secretariat, Bonn, Germany.

Iungman, T., Cirach, M., Marando, F., et al. (2023). Cooling cities through urban green infrastructure: A health impact assessment of European cities. *The Lancet, 401*, 577–589. https://doi.org/10.1016/S0140-6736(22)02585-5

Jönsson, L., Lindström, K., & Ståhl, Å. (2021). The thickening of futures. *Futures, 134*, Article 102850. https://doi.org/10.1016/j.futures.2021.102850

Kothari, A., Demaria, F., & Acosta, A. (2014). Buen Vivir, degrowth and ecological Swaraj: Alternatives to sustainable development and the green economy. *Development, 57*, 362–375.

Latour, B. (2013) Facing Gaia, Six lectures on the political theology of nature', Gifford Lectures on Natural Religion, https://www.ed.ac.uk/arts-humanities-soc-sci/news-events/lectures/gifford-lectures/archive/series-2012–2013/bruno-latour (accessed: 2/5/19).

Levitas, R. (2017) Where there is no vision, the people perish: a utopian ethic for a transformed future. In CUSP essay series on the Ethics of Sustainable Prosperity, No 5, 27 June, https://www.cusp.ac.uk/themes/m/m1–5/#1475182667098–0328ae0f-4bcbf2c7–159e13d8–96cc (accessed: 1/2/18).

Loorbach, D., Frantzeskaki, N., & Avelino, F. (2017). Sustainability transitions research: Transforming science and practice for societal change. *Annual Review of Environment and Resources, 42*, 599–626.

Malaska, P. (1994). Progress, nature and technology in late-modern transition. *Futures, 26*, 529–541. https://doi.org/10.1016/0016-3287(94)90134-1

Mangnus, A. C., Oomen, J., Vervoort, J. M., & Hajer, M. A. (2021). Futures literacy and the diversity of the future. *Futures, 132*, Article 102793. https://doi.org/10.1016/j.futures.2021.102793

Mansur, A. V., McDonald, R. I., Güneralp, B., et al. (2022). Nature futures for the urban century: Integrating multiple values into urban management. *Environmental Science & Policy, 131*, 46–56.

McPhearson, T., Iwaniec, D. M., & Bai, X. (2016). Positive visions for guiding urban transformations toward sustainable futures. *Current Opinion in Environmental sustainability, 22*, 33–40.

Meadows, D.H. (1994) Envisioning a sustainable world. In Third Biennial Meeting of the International Society for Ecological Economics, October 24–28, 1994, San Jose, Costa Rica, www.sustainer.org/pubs/Envisioning.DMeadows.pdf (accessed: 9/9/08).

Meadows, D.H. (1999) Leverage points: Places to intervene in a system, Sustainability Institute Hartland, VT, http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/ (accessed: 22/5/15).

Meadows, D. H., Meadows, D. l, Randers, J., & Behrens, W. W., III (1972). *The Limits to Growth; a report for the Club of Rome's project on the predicament of mankind.* Universe Books New York.

Mendieta, E. (2019). Edge City: Reflections on the urbanocene and the plantatiocene. *Critical Philosophy of Race, 7*, 81–106. https://doi.org/10.5325/critphilrace.7.1.0081

Mercado, G., Wild, T., Hernandez-Garcia, J., et al. (2023). Supporting nature-based solutions via nature-based thinking across European and Latin American cities. *Ambio*, (1), 79–94. https://doi.org/10.1007/s13280-023-01920-6

Merchant, C. (1980). The death of nature: women, ecology, and the scientific. *Revolution*. San Francisco: Harper Collins.

Moore, J. W. (2015). *Capitalism in the web of life: ecology and the accumulation of capital.* Verso.

Nalau, J., & Cobb, G. (2022). The strengths and weaknesses of future visioning approaches for climate change adaptation: A review. *Global Environmental Change, 74*, Article 102527.

Øverland, E. F. (2023). Sustainability and futures, moving beyond "The Natural" and "The Artificial". *Futures*. , Article 103102. https://doi.org/10.1016/j.futures.2023.103102

Pascual, U., Balvanera, P., Díaz, S., et al. (2017). Valuing nature's contributions to people: the IPBES approach. *Current Opinion in Environmental Sustainability, 26-27*, 7–16. https://doi.org/10.1016/j.cosust.2016.12.006

Pearson, K.R. (2021) Imaginative leadership: A conceptual frame for the design and facilitation of creative methods and generative engagement. In Co-Creativity and Engaged Scholarship Palgrave Macmillan, pp. 165–204.

Pereira, L., Frantzeskaki, N., Hebinck, A., et al. (2020a). Transformative spaces in the making: key lessons from nine cases in the Global South. *Sustainability Science, 15*, 161–178.

Pereira, L. M., Davies, K. K., den Belder, E., et al. (2020b). Developing multiscale and integrative nature–people scenarios using the Nature Futures Framework. *People and Nature, 2*, 1172–1195.

Plumwood, V. (1991). Nature, self, and gender: Feminism, environmental philosophy, and the critique of rationalism. *Hypatia, 6*, 3–27.

Raskin, P., Banuri, T., Gallopín, G., Gutman, P., Hammond, A., Kates, R. and Swart, R. (2002) Great Transition: The Promise and Lure of the Times Ahead, A report of the Global Scenario Group, http://www.gsg.org/gsgpub.html (accessed: 10/9/10).

Riedy, C., & Waddock, S. (2022). Imagining transformation: Change agent narratives of sustainable futures. *Futures, 142*, Article 103010. https://doi.org/10.1016/j.futures.2022.103010

Romero-Lankao, P., Bulkeley, H., Pelling, M., et al. (2018). Urban transformative potential in a changing climate. *Nature Climate Change, 8*, 754.

Salleh, A. K. (1984). Deeper than deep ecology: The eco-feminist connection. *Environmental Ethics, 6*, 339–345.

Schaal, T., Mitchell, M., Scheele, B. C., Ryan, P., & Hanspach, J. (2023). Using the three horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity. *Sustainability Science*, 1–19.

Scoones, I., Stirling, A., Abrol, D., et al. (2020). Transformations to sustainability: Combining structural, systemic and enabling approaches. *Current Opinion in Environmental Sustainability, 42*, 65–75.

Sharpe, B., Hodgson, A., Leicester, G., Lyon, A., & Fazey, I. (2016). Three horizons: A pathways practice for transformation. *Ecology and Society, 21*.

Shiva, V. (1988). *Staying Alive: Women, Ecology and Survival in India.* London: Zed Books Ltd.

Soga, M., & Gaston, K. J. (2023). Global synthesis reveals heterogeneous changes in connection of humans to nature. *One Earth, 6*, 131–138.

Tozer, L., Bulkeley, H., van der Jagt, A., Toxopeus, H., Xie, L., & Runhaar, H. (2022). Catalyzing sustainability pathways: Navigating urban nature based solutions in Europe. *Global Environmental Change, 74*, Article 102521. https://doi.org/10.1016/j.gloenvcha.2022.102521

Tsing, A. L. (2016). *The mushroom at the end of the World: on the possibility of life in capitalist ruins.* Princeton University Press.

UNCED (1992) The Rio Declaration on Environment and Development, United Nations General Assembly, New York, http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=78&ArticleID=1163 (12/2/08).

UNDP (2021) Human Development Report 2021–22. Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World, United Nations Development Programme, New York.

UNEP (2012) GEO Global Environment Outlook 5 - Environment for the future we want, United Nations Environment Programme, New York and Geneva.

UNEP (2021) Making Peace With Nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies, Key Messages and Executive Summary, United Nations Environment Programme, Nairobi, https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/34949/MPN_ESEN.pdf.

van Dooren, T., Kirksey, E., & Münster, U. (2016). Multispecies studies: Cultivating arts of attentiveness. *Environmental Humanities, 8*, 1–23. https://doi.org/10.1215/22011919-3527695

Vervoort, J. M., Bendor, R., Kelliher, A., Strik, O., & Helfgott, A. E. R. (2015). Scenarios and the art of worldmaking. *Futures, 74*, 62–70. https://doi.org/10.1016/j.futures.2015.08.009

Wahl, D. C. (2016). *Designing regenerative cultures.* Triarchy Press.

WCED. (1987). *Our common future.* Oxford University Press.

Weber, A. (2013) Enlivenment. Towards a fundamental shift in the concepts of nature, culture and politics, Heinrich böll Foundation, Series Ecology Volume 31, Berlin.

Welden, E., Chausson, A., & Melanidis, M. S. (2021). Leveraging nature-based solutions for transformation: Reconnecting people and nature. *People and Nature, 00*, 1–12. https://doi.org/10.1002/pan3.10212

West, S., Haider, L. J., Stålhammar, S., & Woroniecki, S. (2020). A relational turn for sustainability science? Relational thinking, leverage points and transformations. *Ecosystems and People, 16*, 304–325.