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Introduction

Urban centres and peripheries shape the texture and quality of everyday life, our ability to coexist with and benefit from nature, the risks we face, and our resiliency (UN 2019). Here we report on lessons we draw as organizers of and presenters at an interdisciplinary, international, and (necessarily) virtual symposium, 'Centres and Peripheries: Reconfiguring Post-COVID -19 Landscapes', which took place on 5 February 2021, and was funded by the UK Embassy to France in the context of the upcoming UN Climate Change Conference 2021 (COP 26). The symposium examined the dynamics emerging between urban and rural, centre and periphery, at global, regional, and landscape scales. Within an international comparative context, the symposium identified solutions and approaches beyond a narrow focus on the 'smart green city' to bring new focus on the systems and social, ecological, and physical infrastructures of human habitation.

Our focus on configurations of landscapes of urban centres and peripheries was designed to draw in many different perspectives. By urban centres we mean dense, built habitats, metropolitan areas, and places defined as cities. That said, these cities may differ in many ways: Cape Town (SA) and Eindhoven (NL)are both cities, but differ in geographic extent, human population density, architectural styles, infrastructural characteristics, and size and distribution of green (parks, woods) and blue (waterways) spaces within the city. By peripheries we refer to areas beyond urban centres, outside city limits, in the gradients between urban and rural. The periphery of the city may be where we think of the natural world as 'starting'.

A 'centres and peripheries' framing situates urban green and smart development within broader social and environmental contexts. Social scientists may think of these concepts in relation to Marxist theories of extraction and accumulation and the creation of marginality through political projects (e.g. Braudel 1973; Tsing 1994). Historians may think of the origins of urbanization, the historical dependencies of cities on countryside (e.g. Scott 2017), and how this relationship has evolved over time. Ecologists and wildlife biologists may think of core and buffer zones, source and sink habitats, corridors and fragments (e.g. Villemey et al. 2015). In the context of climate change, global pandemics, degradation, threats to biodiversity, socioeconomic inequalities, and other global challenges, we ask how centres and peripheries will be created, perpetuated, and contested going forward.

We often think of urban sites and infrastructures as opposite to nature, in their substance, organization, functioning, and purpose. Yet we can also think of urban spaces as a kind of habitat: one of the 'anthromes' or anthropogenic biomes (Ellis and Ramankutty 2008). While the anthrome concept as originally developed by Ellis and Ramankutty (2008) suggests that cities are unnatural biomes artificialized by high human density and land-use change, it is also possible to conceptualize urban habitats in terms of coevolutionary opportunity and biodiversity. Many species that tolerate and establish in cities also show considerable phenotypic plasticity, as well as genetic adaptations to living in urban contexts (Miranda 2017; Esperon-Rodriguez et al. 2020; Ilyas et al. 2021). Moreover, the NESCent working group et al. (2015) consider the indoor space in cities as a biome in itself –

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the indoor biome – and conceive of it as a novel habitat that has emerged, changed, and diversified across the evolutionary history of humans, leading to coadaptations by many other species, including microbes, fungi, plants, and animals.

Whether we conceptualize the urban habitat and its relationship to rural and natural areas as one of degradation threat or coevolutionary opportunity, as natural or unnatural, we recognize an increasing interest from many sectors of society – ecologists and conservationists, but also architects and urban planners, psychologists and social workers, artists and philosophers – in accommodating a greater diversity and abundance of other species in cities, through blue and green infrastructures, smart green cities, nature-based solutions, and similar concepts (e.g. Pickett, McGrath, and Cadenasso 2013; Ghofrani, Sposito, and Faggian 2017; Artmann et al. 2019; Frantzeskaki 2019). The COVID-19 pandemic has made many people question the costs and benefits of urban life and may represent a leverage point to rebuild smarter and greener.

However, the increasing interest in making space for biodiversity in cities, facilitating urban ecosystem processes, and generating new social relations with the urban habitat raises the question of what the city represents, and to whom. For some species, cities represent a concentration of resources, e.g. for urbanophilic species like crows and foxes (e.g. Palacio 2020). For some species, cities are a suitable home, a productive habitat, or a population source (e.g. Björklund, Ruiz, and Senar 2010; Muratet, Muratet, and Pellaton 2017). Cities may act as, and even be designed as, stepping stones or corridors, sites of passage rather than sites for living (e.g. Lynch 2019). Cities may be zones of innovation, in terms of not only development plasticity and adaptation, but also learning and innovation, for example where birds learn to open milk bottles or crack nuts by leaving them in the path of cars at traffic lights (Reader and Laland 2003). Cities can be sites of nature observation, management and control, for example in gardens and parks, or when citizens become monitors of urban biodiversity (Mason and Arathi 2019). For other species, cities are sites of exclusion, where they cannot find suitable habitat or resources they need to live (e.g. Minor and Urban 2010). Finally, cities can also be population sinks, danger zones, and polluted wastelands (e.g. Treshow 1980; Soulsbury and White 2015). From a socio-economic perspective, cities are also sites of human inclusion and exclusion, opportunity and accomodation, although the way that different socio-economic groups and different species all experience spaces in cities differs. If urban centres are a multitude of contrasting things to humans and other species, then

rural and nature peripheries, which are themselves heterogeneous, cannot represent a single kind of contrast to cities. As different species and social groups move into and across these spaces, do they hold the city together, or divide it along new lines?

Resilience emerged as an underlying theme and goal linking many of the talks. Although we did not explicitly ask our invited presenters to address resilience, the tensions between centres and peripheries were expressed as concern about holding the structures of cities together through making the urban habitat more permeable, connected, dynamic, and adaptive. In the views that emerged from the symposium, cities will avoid collapse not by compartmentalizing and defining themselves more clearly in contrast to nature or the rural, but by blending into other biomes, maintaining and recognizing their depency on networks and socio-ecological systems across geographical spaces at multiple scales.

Here we present our analytical synthesis of talks and discussion from the symposium, in the form of underlying principles for working towards urban resilience, which provide guidance for policy, design, and management. The entire event has been recorded with French–English subtitles and is available to watch at urboretum. org: talks referred to in the text below can be looked up at that address. Here we present a manifesto of six resiliency principles: (1) cities need to work with peripheries to be resilient; (2) look outside the system to spillover systems; (3) grassroots resilience is as important as infrastructural and systemic resilience; (4) be careful to be smart about 'smart green cities'; (5) design for the unpredictable nature of nature; and (6) consider rewriting our narratives about spaces, cities, and landscapes. We expand on these below.

Six resilience principles for post-COVID-19 cities

Cities need to work with peripheries to be resilient

To create greater resilience, we need to resolve the connections or misconnections that cause inequity, and we must encourage diversity and mobility across networks. In practice, this translates into a set of focal issues for managers and decision makers. Rather than trying to create either homogeneity or centralization, focus should be put primarily on, for example, connected habitat mosaics for wildlife (discussed in the 'Coexisting' panel), mobilities for people (e.g. walkability (Sugiyama and Ward Thompson 2008), public transport, 20-minute neighbourhoods) (discussed in the 'Designing' panel), supply chains for resources (discussed by Simone Farresin in his keynote), and environmental flows for waste (discussed by Lesley Green in her keynote). Misconnections cause inequities and other harms

through poorly managed accumulations or penuries, as Jianguo Liu and Lesley Green pointed out in different contexts. When these problems are resolved, geographic heterogeneity can emerge as a driver of diversity and resilience.

Look outside the system to spillover systems

Connections have impacts on other connections but the greatest impact of a change to a system may actually be outside the system (a spillover system, Liu et al. 2018), as was illustrated in different ways by Jianguo Liu, Simone Farresin, and Lesley Green in their keynotes. Pragmatically, this implies thinking about how problems and solutions are framed. As cities have multiscalar connections (Yang et al. 2016), urban design and management should not be confined within the political borders of the city. Cross-boundary collaborations between cities, between city and countryside, between cities and natural resource extraction areas, between cities and protected areas, and so on, will be key to forward-looking urban planning for a resilient national and global system.

Grassroots resilience is as important as infrastructural and systemic resilience

Engagement and participation of communities and individuals in risk reduction strategies can proactively improve resilience in preparation for future risks. Greater equality at the societal level promotes greater resilience. As discussed in several of the sessions ('Connecting', 'Designing', and 'Evaluating' panels), access to good mental health and well-being services and infrastructures, training programmes, and community engagement and participation are critical factors to promote resilience. This can involve bringing these services, infrastructures, and engagement to marginalized communities or isolated groups (e.g. older adults) and better connecting them to other communities.

Be careful to be smart about 'smart green cities'

While smart cities have the potential to create more sustainable urban landscapes, they come with risks for civil liberties and democracy. As Stephanie Hare made clear in her keynote talk, technologies are not neutral and their impact on urban socio-ecological systems must be carefully analysed. The 'Interpreting' panel reminded us that traces and predictions of human behaviour, whether from automated or human surveillance, are arbitrary: what do we choose to highlight and record, and how do we choose to interpret these signs? In the 'Evaluating' panel we heard about excessive data from a governance-oriented eye-in-the-sky perspective, and too little data from the perspective of residents and their concerns. As we were also shown in the 'Designing' panel, smart green cities have not been automatically resilient, but have required analogue human inventiveness to adapt to COVID-19. Modelling, analysis, and control systems need the capacity to adapt to individual difference and changing situations, to provide liberty of expression and behaviour (Ward Thompson 2013), and to safeguard contextual and multiple interpretations and needs. One way to do this may be to build in multiple points for human intervention across centres and peripheries.

Design for the unpredictable nature of nature

Drawing from the same discussions that inspired the previous key point, non-human animals and plants are, like humans, not standardized and inert tools for managers to control and exploit. As Emanuele Coccia pointed out in his keynote, and as the 'Coexisting' and 'Creating' panels mentioned, not only do living things vary within and across species, they also actively shape the natural and socio-ecological process networks we depend on, in multiple ways that cannot be totally controlled, including networks across centre and periphery. As discussed in the 'Designing' panel, the multiple benefits from nature-friendly construction and urban design are real and important. At the same time, in any system involving animal and plant components, such as nature-based solutions (Braubach et al. 2017), designers and decision makers should ensure that there is built-in capacity to deal with variation in behaviour and individual differences among the natural 'tools'. Indeed, we should avoid objectifying and reducing other beings to their instrumental aspects. Rather, as complex living things, they need the freedom to modify their own environments to preserve evolutionary adaptive potential. The 'green' and the 'smart' parts of smart green cities need to be designed for flexibility.

Consider rewriting our narratives about spaces, cities, and landscapes

The narratives that are embedded in our social structures, architectural designs, planning approaches, media, and scientific theories are powerful. Narratives set our expectations for the typical and the normative, and can either open us to certain questions or stop us from learning from past crises and risk exposures, as we heard in the 'Connecting' panel. As we experienced during our 'Creating' and 'Interpreting' sessions, and through the myth presented to us by Emanuele Coccia in his keynote, narratives inform ontologies as well as the texture of everyday life. Investing in and

collaborating with cultural and arts engagements around cities, nature, connections, and diversities are essential means to help the public envision, interpret, find meaning in, and adapt to risks and resilient innovations across centres and peripheries.

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