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EDITORIAL

Climate justice and the built environment

Sonja Klinsky[1] and Anna Mavrogianni[2]

Highlights

Climate justice is explained and explored in relation to how decisions about the built environment in the climate context intersect with human wellbeing. Key features in the built environment are identified that impact upon climate injustice. Specific processes, decisions and actions are identified to reduce these injustices and to reduce current gaps both in knowledge and practices. A conceptual and practical context is provided for integrating concerns about climate justice into research and decision-making about the built environment by addressing four underlying questions: 1. What is climate justice and why is it a significant issue? 2. Why is the built environment important in addressing climate injustice, and why is climate justice essential for the built environment community to consider? 3. What processes can be used to reduce inequities and injustices in the built environment? 4. What roles might the academic community, governmental entities, and practitioners in construction, design and real estate, have in facilitating deeper integration of climate justice? A capabilities approach is proposed to systematically uncover and address underlying patterns of injustice. A multi-valent approach involving distributive, procedural and recognition justice can be harnessed to constitute a justice framework. A process of change is needed to: (i) reframe, reposition and extend current built environment research to engage with wider issues of justice, (ii) build and make accessible the evidence base for the identification and mitigation of inequities in climate risk exposures, vulnerabilities, and effective and equitable adaptation pathways and (iii) define responsibilities for different actors.

Keywords: adaptation; built environment; cities; climate justice; equity; human development; poverty; resilience; social justice; vulnerability

1. Introduction

It is widely acknowledged that questions of justice are embedded in every aspect of climate change, and that ongoing and future anthropogenic climate change will exacerbate inequities worldwide. Cumulative global emissions have been dominated by processes of industrialisation from the Global North, leaving limited atmospheric space for similar processes in the Global South if atmospheric concentrations are to be kept below levels that would lead to a 1.5 or 2°C change in global average temperature. Simultaneously, global climate change impacts including sea level rise and increases in the frequency and severity of extreme weather events are also uneven across and within countries (IPCC 2018). Both extreme events and slow onset impacts can harm infrastructure, present significant financial challenges to communities, and generate a myriad of health and wellbeing implications. Such health impacts can include immediate threats to life, changes in long-term conditions including asthma and heat-related stress, challenges to mental health, and shifts in disease vectors (Watts *et al.* 2019). Climate change will also function as a 'risk modifier' in the built environment, exacerbating inequalities and inequities associated with indoor environmental exposures, such as excess indoor temperatures, indoor air pollution, contaminated water, allergens and mould (Vardoulakis *et al.* 2015).

This special issue presents climate justice studies by seven groups of researchers. The papers, which were selected from 36 submitted abstracts, describe work conducted in Australia, Germany, Kenya, Poland, the UK and the US (**Table 1**). They describe a range of approaches for understanding the manifestations of climate injustice in the context of the built environment and identify specific processes, decisions and actions that can be taken to reduce these injustices.

[1] Arizona State University, School of Sustainability, Tempe, AZ, US. ORCID: 0000-0002-9450-1249

[2] University College London, Bartlett Faculty of the Built Environment, Institute for Environmental Design and Engineering, London, UK. ORCID: 0000-0002-5104-1238

Corresponding author: Anna Mavrogianni (a.mavrogianni@ucl.ac.uk)

Table 1: Articles in this special issue 'Climate Justice: The Role of the Built Environment', *Buildings and Cities* (2020), 1(1); guest editors Anna Mavrogianni and Sonja Klinsky.

Authors	Title	DOI
S. Klinsky & A. Mavrogianni	Climate justice and the built environment	10.5334/bc.65
M. Baborska-Narozny, M. Szulgowska, M. Mokrecka, A. Chmielewska, N. Fidorow-Kaprawy, E. Stefanowicz, K. Piechurski & M. Laska	Climate justice: air quality and transitions from solid fuel heating	10.5334/bc.23
N. Willand, T. Moore, R. Horne & S. Robertson	Retrofit poverty: socioeconomic spatial disparities in retrofit subsidies uptake	10.5334/bc.13
C. Schünemann, A. Olfert, D. Schiela, K. Gruhler, & R. Ortlepp	Mitigation and adaptation in multifamily housing: overheating and climate justice	10.5334/bc.12
Z. Hamstead, P. Coseo, S. AlKhaled, E. F. Boamah, D. M. Hondula, A. Middel, & N. Rajkovich	Thermally resilient communities: creating a socio-technical collaborative response to extreme temperatures	10.5334/bc.15
M. Patrick, G. Grewal, W. Chelagat & G. Shannon	Planetary health justice: feminist approaches to building in rural Kenya	10.5334/bc.18
S. Axon & J. Morrissey	Just community transitions? Social inequity, vulnerability, and unintended consequences	10.5334/bc.14
U. Passe, M. C. Dorneich, C. Krejci, D. Malekpour, B. Marmur, L. Shenk, J. Stonewall, J. Thompson & Y. Zhou	Urban modelling framework for climate resilient energy use decisions in low-resource neighbourhoods	10.5334/bc.17

Despite this breadth, the special issue also reveals some gaps both in our knowledge and practices. Accordingly, it aims to initiate a process of change and discussion that will ultimately break disciplinary silos in order to: (1) reframe, reposition and extend current built environment research to engage with wider issues of justice; and (2) build the evidence base for the identification and mitigation of inequities in climate risk exposures, vulnerabilities, and effective and equitable adaptation pathways.

This editorial places these papers in context and provides a starting point for more fully integrating concerns about climate justice into research and decision-making about the built environment. It was motivated by considering four underlying questions of direct relevance to those in the built environment community:

- What is climate justice and why is it a significant issue?
- Why is the built environment important in addressing climate injustice, and why might climate justice be essential for the built environment community to consider?
- What processes can be used to reduce inequities and injustices in the built environment?
- What roles might the academic community, governmental entities, and practitioners in construction, design and real estate, have in facilitating deeper integration of climate justice into work on the built environment?

Building from these underlying questions, this editorial considers the major dimensions of climate justice, and maps some of the ways in which decisions about the built environment in the climate context intersect with human wellbeing. Using a capabilities lens (Sen 1999, 2005) combined with a multivalent approach to justice, it then proposes a framework to help those in the built environment community more systemically locate their work within the scope of considerations about justice in the climate context. The end of this editorial issues key challenges for the academic community, construction and real estate sectors, governments and communities.

2. Dimensions of climate injustice

The central claims of climate injustice involve four key interconnected dimensions. The first is that there are vast disparities in causal responsibility for greenhouse gas (GHG) emissions that have cumulative driven climate change. The US alone is responsible for 26% of all cumulative emissions since the industrial revolution, and the EU is similarly responsible for 23%. Meanwhile, despite having much larger populations, India's total cumulative emissions are only about 3% of the global total, while even China is responsible for only 12% (Gütschow *et al.* 2016). These disparities become even more stark when considered on a per capita basis. Cumulative emissions are particularly relevant from a built environment perspective because these accumulated emissions result from the creation and use of hospitals and roads, railways, housing, schools, factories, office towers, *etc.* While emissions themselves are invisible, the benefits they have yielded are distinctly embodied in daily life, have accumulated unevenly, and cannot be ignored in any discussion about the built environment and climate justice. Historical responsibility for climate change has been a central part of

all debates about climate justice (Agarwal & Narain 1991; BASIC Expert 2011; LaRovere, Valente de Macedo, & Baumert 2002) and is unavoidable, especially in light of its intersection with other dimensions of climate injustice.

The second and third dimensions of climate injustice are inextricably entwined: (1) climate impacts are unevenly distributed as is (2) vulnerability to these impacts due to pre-existing patterns of privilege and marginalisation (Field *et al.* 2014; Tschakert *et al.* 2013). Low income, socially and economically marginalised communities, individuals suffering from chronic diseases or social isolation, older and young people, and vulnerable populations will be disproportionately affected by climate change due to their limited ability to adapt (Baker 2012), and these variables operate within domestic and international spheres. Many of those with least resources will face the most intense climate impacts, and insufficient climate action will negatively affect the achievement of the United Nations' (UN) Sustainable Development Goals (SDG) promoting the wellbeing of people in developing countries and low income and marginalised communities within wealthy countries (UN 2015). For instance, when Hurricane Katrina (2005) hit New Orleans 1200 people died. The highest proportion of victims were people aged 65 and over; African Americans were significantly over-represented amongst the victims across all age categories (Sharkey 2007). Moreover, African Americans were less likely to have returned to New Orleans as they had proportionally experienced more intense housing losses (Fussell, Sastry, & VanLandingham 2010), a permanent migration which represents profound and uneven loss. The depth of inequality from extreme events is intensified even further in countries with fewer resources. A relatively comparable storm with Hurricane Katrina in the Philippines, Typhoon Haiyan (2013), left at least 6300 dead. Six years afterwards, socioeconomic inequalities amongst survivors continued to shape the nature of recovery (Madianou 2015).

The asymmetry of inequities in vulnerability between and within societies is a particularly sharp form of injustice. Many of those who are most vulnerable have contributed least to climate change and many of the processes fuelling systemic inequalities are tied to the accumulation of wealth and privilege that resulted in climate change in the first place (Cameron 2012; Haines *et al.* 2007: 200; Islam & Winkel 2017). Industrialisation and infrastructure development of parts of the world has been supported through exploitation in others. For instance, fossil fuel development in its current form across North America would not be possible without the expropriation of Indigenous territories through settler colonialism (Whyte 2020). The relationships between industrialisation, colonialism, slavery and global capital accumulation (Malm 2013) are not neatly linear but they are deeply entwined. Acknowledging these connections may be essential for designing strategies capable of moving towards more just arrangements at a fundamental level. These interconnections have long been articulated by climate justice activists (CJN! 2004; ICJN 2002) but remain only tentatively recognised in broader scholarship, although this is changing as people come to more deeply interrogate the causes and potential strategies for ameliorating climate injustice (Cameron 2012; Grear 2014; Saad 2017; Whyte 2020).

The fourth justice dimension is that temporal, social and spatial distance separates the causes and effects of climate change. Those who have benefited from emissions and those who are most harmed are segregated from each other by social or physical distance and time. This generates new problems for decision-making and accountability. People outside of a given jurisdictional boundary, those inside a boundary but who are not recognised (*i.e.* those without documentation or citizenship, or those experiencing systemic discrimination), or those who are not yet born may be excluded by decision-making representatives and analysts as they are not held directly accountable to them. The widespread exclusion of those who are most vulnerable within jurisdiction-specific decisions almost by definition presents profound challenges for procedural justice. How should future people or those who reside outside of any particular jurisdictional boundary—neighbourhood, city, country, region—be recognised or represented in decision-making? There is good reason that philosopher Stephen Gardiner has long since identified climate change as a 'perfect moral storm' (Gardiner 2006).

Actors in any given system have specific rights and responsibilities, and some may hold moral claims against others for failing to uphold their responsibilities. While observations of inequities are important, a focus on justice opens up consideration of both the underlying processes by which inequities are generated and the responsibilities different actors have within this. A climate justice approach can provide an analysis which is *actionable* based on understanding whose rights and responsibilities are at play in any given situation and how they are related. Examples of this might include not only identifying why particular people are unusually vulnerable to a specific climate impact, but who has specific responsibilities to address these vulnerabilities. Such responsibilities can be based on some causal connection through climate change or some other pre-existing relationship (such as systemic discrimination) or because of roles which come with specific obligations, such as a government's obligation to provide essential services, or a contractor's obligation to ensure the long-term safety of a building. In the built environment context, key actors with responsibilities might include individual people or categories of people, such as residents and clients, designers, service providers, contractors and builders, along with decision-makers representing all levels of collective organisations, such as local to national governments, corporations, and civil society organisations.

3. The built environment and climate injustice

Due to the pace of climate change and the urgency of efforts to avert it, interrogation of the intersection between justice, the built environment and climate change is a timely arena of enquiry. The built environment is where most people work, live and play; it is literally built into the fabric of society and will be central to both climate mitigation and adaptation to climate impacts. From a mitigation perspective, the built environment is a significant contributor

of GHG emissions globally, which makes it a key sector to include in any mitigation efforts. As of 2016, residential and commercial buildings accounted for 17.5% of GHG emissions globally (WRI 2020). From an adaptation perspective, many climate impacts occur at the level of cities, neighbourhoods or individual buildings, making the built environment a central locus for adaptation planning and decision-making. In both contexts, three key features underpin the inherent relationship between climate injustice and the built environment; (1) long time-frames involved; (2) the embedded accumulation of privilege and disadvantage within the built environment; and (3) the tight synergies between broader health and societal benefits with climate-friendly approaches to the built environment. Each is briefly considered below.

3.1. Long timeframes

Decisions about the built environment are particularly important in the climate context due to the longevity and path dependency of the building stock and infrastructure. Built infrastructure lasts for a long time: any decision taken now will continue to shape surrounding decisions for many years—50, 100 or more. The diversity in building stock turnover rates needs to be considered as part of any climate change adaptation or mitigation pathway. Whilst the building stocks of 'mature' economies are characterised by slow demolition and replacement rates (Power 2008), those of growing economies (*e.g.* India, China, Africa) have much shorter building life expectancies and will be building rapidly over the next 10–20 years. By way of illustration, the average building lifespan in China is estimated to be 25–35 years as opposed to 70–175 years across European countries (Marsh 2017; Sandberg *et al.* 2016; Wang, Zhang, & Wang 2018). In addition, decisions about the types of housing, industrial centres or neighbourhood design result in commitments to particular forms of energy and ways of life that are difficult to shift and, thus, result in a diversity of social, economic, energy, resources, and physical path dependencies. Taking a climate justice approach to questions about the built environment can inform efforts to avoid maladaptive responses to climate change and lock-in measures that will play out for a longer period of time, and to promote decision-making that seeks to move towards a more just society in which all can flourish (Kelman 2020).

3.2. Embedded accumulation

The interaction between climate change and pre-existing patterns of cumulative privilege and disadvantage that have been embedded in the built environment raise questions about the extent to which adaptation or mitigation decisions will reduce or increase the inequalities already being experienced across societies. A growing body of literature has been highlighting the urgent need to broaden the focus from the 'vulnerable' in society to include critical reflection about systemic inequalities and structural vulnerabilities (Tschakert *et al.* 2013). This is particularly important for the built environment sector where decision-making processes are multilayered, interconnected and complex. A wide range of different actors is usually involved (national, regional and local governments, clients, designers and contractors, service providers, communities), often with conflicting agendas and priorities. The potential for pre-existing inequities to deepen climate impacts in all countries is increasingly well documented across a wide range of dimensions immediately related to the built environment including heat stress (Byrne *et al.* 2016); access to public open space and shade coverage (Mitchell & Chakraborty 2015; Kolosna & Spurlock 2019; Smith & Henríquez 2019; Wilson & Chakraborty 2013); and access to essential services (Gibson 2019; Hale 2019), to name a few.

3.3. Wellbeing and built environment synergies

The creation of sustainable local communities, low-carbon buildings and active transport are expected to have wider health and social benefits. As stated in the Marmot Review (Marmot *et al.* 2010), social inequalities in health should be tackled alongside climate change, and these two aims are 'entirely compatible'. A series of *Lancet* papers published in 2009 (Friel *et al.* 2009; Markandya *et al.* 2009; Smith *et al.* 2009; Wilkinson *et al.* 2009; Woodcock *et al.* 2009) explored the potential for climate change *mitigation* policies to result in public health improvements, thus strengthening the case for the socioeconomic benefits of climate change mitigation policy (Deng *et al.* 2017; Gao *et al.* 2018; Haines *et al.* 2009; Milner *et al.* 2020; Vardoulakis *et al.* 2015). Similarly, public health-focused climate change *adaptation* strategies at the urban level, such as urban shading, and spaces that encourage physical activity and social connection, have been shown to have appreciable co-benefits, such as improvements in social capital, mental health improvements, reduced obesity and cardiovascular disease (Cheng & Berry 2013).

Many have argued that there are important synergies between the previously disconnected targets of climate change driven policies in the built environment sector and energy poverty reduction, and that these should be more strongly linked in both research and policy (Tozer 2020; Ürge-Vorsatz & Tirado Herrero 2012). There is a significant body of evidence demonstrating that, if developed and implemented appropriately, GHG emissions reduction strategies in the building stock have the potential to reduce underlying social and health inequalities, and help eradicate poverty. Energy efficiency improvements in low income housing, such as thermal insulation, has been found to improve indoor thermal conditions, perceived health and sense of wellbeing, and doctor/hospital appointments for respiratory conditions (Howden-Chapman *et al.* 2007). Although high energy efficiency standards, such as Passivhaus, may be routinely dismissed as non-affordable, recent research has demonstrated the potential to reduce construction costs through multi-objective optimisation, thus increasing their feasibility as a social housing option that could help reduce fuel poverty (Forde *et al.* 2020). However, it has been emphasised that, for climate change mitigation policies to avoid

unintended consequences in relation to existing inequalities, a 'pro-poor' approach needs to be adopted (Markkanen & Anger-Kraavi 2019).

An example of a programme that has placed systemically marginalised communities at the centre of its planning in order to purposefully reap synergistic benefits from climate action is the Portland Clean Energy and Community Benefits Fund (PCEF). Community led and governed through a social norm of consensus and frontline leadership, this initiative addressed immediate community needs through a broader climate justice lens that included the creation of a consistent and long-term funding source for renewable energy, energy efficiency, green infrastructure and jobs training projects (Mondainé & Lee 2020).

Despite these potential synergies, several concerns about injustice stemming from both mitigation and adaption have emerged. For instance, in the mitigation context, although retrofitting is clearly an important element of increasing energy efficiency and alleviating fuel poverty, the potential for retrofit access opportunities and associated benefits are unevenly distributed due to differences in income and wealth or to the landlord–tenant relationship (Camprubí *et al.* 2016; Gillard, Snell, & Bevan 2017; Schaffrin 2013; Teli *et al.* 2016). Similarly, winter energy poverty and climate policies may have regressive implications for low income households (Mallaburn & Eyre 2014). As global temperatures increase and overheating risk becomes an increasing concern, several authors have also highlighted the need to identify and quantify summer fuel poverty in temperate climates (Escandón, Suárez, & Sendra 2019; Sánchez-Guevara Sánchez *et al.* 2017; Tabata & Tsai 2020; Thomson *et al.* 2019). Vulnerable households are often likely to live in a dwelling prone to overheating located within urban heat islands with poor green and blue infrastructure, and have limited cooling means, *e.g.* limited ventilation due to outdoor air pollution, noise, unsafe conditions or poor building design (Romero Lankao & Qin 2011). Heat events and air pollution disproportionately affect disadvantaged groups on the basis of income, age, ethnicity and marital status (Willers *et al.* 2016). The potential for greening efforts—including increasing green space and updating building energy efficiency—to drive gentrification and displacement of low-income households is another theme that has increasingly been recognised within this nexus (Cole *et al.* 2017; Wolch, Byrne, & Newell 2014).

Justice concerns have also emerged from discussion about climate adaptation in the context of the built environment. The most pressing of these has been exclusionary adaptation, *e.g.* adaptation planning that excludes informal settlements or communities with limited political power (Henrique & Tschakert 2019). Similarly, interest in green infrastructure both as a mitigation and adaption measure has been attended by concerns that the benefits may serve only some populations and, such as gentrification, result in the displacement of vulnerable people (Anguelovski, Irazábal-Zurita, & Connolly 2019; Turan 2018).

This special issue recognises the twin potentials that the built environment holds: the built environment can intensify injustices but also potentially address them in the climate context.

This editorial combines the capabilities approach with a multivalent focus on justice in order to develop a framework that could be used by researchers, practitioners and decision-makers to identify both potential climate justice concerns that emerge in the context of the built environment and actionable points of intervention that could help move towards more just arrangements.

4. A capabilities approach

Identifying systemic justice concerns and finding intervention points can be challenging. An abstract level of claims about justice may miss concrete opportunities for change. But focusing solely on concrete details can also flatten the analysis and fail to uncover underlying patterns. One of the benefits of focusing on the built environment from a climate justice approach is the centrality of this sector to core concerns of human safety, mobility and basic wellbeing.

Concern with human flourishing is at the heart of all the dimensions of climate justice identified above. The notion of capabilities provides a useful starting point for making the implications of climate justice claims more visible in actual decision-contexts. The capabilities approach starts with the recognition that human flourishing requires the ability to access and benefit from a range of opportunities and resources. While the exact manifestation of capabilities may vary and has been the subject of some debate (Nussbaum 2011; Sen 1999), a capabilities approach can be useful for identifying how concrete decisions about the built environment in the context of climate change could enhance or threaten human wellbeing. The Human Development Index (HDI) is one rough metric built on this notion and can be helpful at identifying broad trends, but focusing more in-depth on specific capabilities may have some benefits, particularly from the perspective of individuals and decision-makers having to make decisions. **Table 2** provides a few examples of how mitigation and adaptation strategies in the context of the built environment interact with commonly cited capabilities. Each strategy contains both opportunities and challenges for justice. For instance, while a positive adaptation strategy might include proactive decisions about how to protect residential areas from extreme events or long-term climate impacts, the failure to do this, or to do this for some and not others, or possibly why some communities are vulnerable in the first place while others are not, raise concerns about injustice.

Table 2 makes clear the built environment can enable or inhibit capabilities for people to flourish. If investigated through a justice lens, deeper levels of the challenge are revealed. What capabilities have some secured access to through use of atmospheric space—manifest as things such as access to schools, hospitals, transportation systems, office buildings and safe homes—that have been denied to others? How does differential experience of benefits and burdens occur? Which capabilities, and for whom, are put at risk through particular climate impacts? How do climate

Table 2: Examples of the interactions between climate change mitigation and adaptation strategies in the built environment and human flourishing capabilities.

Built environment support for capabilities	Climate change mitigation strategies	Climate change adaptation strategies
***Health:* 'A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity'** (WHO 1948)		
The capability of health in the built environment context includes not only the provision of adequate protection from harmful pollutants, thermal extremes, noise and safety hazards, both indoors and outdoors, but also the provision of services that allow people to accomplish their desired tasks safely and efficiently without physical or mental distress, and to promote physical and mental health and wellbeing (IWBI 2016; Perdue, Stone, & Gostin 2003). Recognising the inextricable link between human health and a healthy environment, ensuring people enjoy health, includes all large-scale environmental protections from the regional to the urban to the building scale		
Outdoor environmental quality at multiple scales (global to neighbourhood): including control of greenhouse gas emissions, all pollutants of air, water and land	Minimise environmental costs (proximate and distal) of all infrastructure	Protect proximate and distal landscapes and built environment from climate change impacts (*e.g.* heatwaves, droughts, floods, storms *etc.*) without intensifying climate change, reduce sources of outdoor air pollution through appropriate policies
Indoor environmental quality including air, sound and light quality, physical integrity	Ensure low-carbon building does not compromise indoor environmental quality	Enhance access to spaces of high indoor environmental quality; ensure efforts to enhance indoor environmental quality do not impose stress on outdoor environmental quality (proximate and distal)
Outdoor thermal adequacy	Seek to reduce outdoor thermal stress imposed through the built environment, including microclimatic characteristics	Protect or enhance mechanisms for low-carbon outdoor thermal comfort
Indoor thermal adequacy	Recognise potential implications of mitigation policy on indoor thermal adequacy	Enhance access to domestic low-carbon thermal comfort control; ensure efforts to enhance indoor thermal comfort do not negatively affect outdoor thermal comfort and/or generate additional greenhouse gas emissions
***Physical safety:* Capability to live, work and participate in public life safely**		
This includes not only the existence but also the affordability of access to physically safe spaces for living, working and public life for all		
Home	Building and operation practices that provide high-quality, low-carbon, affordable housing	Minimise vulnerability of permanent and temporary residential areas to extreme climate events and long-term impacts
Care settings (*e.g.* care homes and extra-care homes)	Building and operation practices that provide high-quality, low-carbon care provision	Minimise vulnerability of care settings to extreme climate events and long-term impacts
Work/school/public life	Building and operation practices that provide high-quality, low-carbon infrastructure for employment, education and public life	Minimise vulnerability of workplaces, schools and public institutions to extreme climate events and long-term impacts
Accessibility and mobility	Implementing low-carbon, safe and accessible mobility services; reduce non-human-powered mobility needs overall	Ensure low-carbon transportation infrastructure, including human-powered mobility systems, is accessible and designed to function through extreme climate events and long-term impacts
***Cultural vitality:* Capability to sustain a thriving cultural life**		
Cultural vitality requires attention to both the experience of individuals and the potential for collective experiences to be nurtured		
Public spaces	Building high-quality, low-carbon public spaces (including protecting adequate green space) designed to nurture public and cultural life	Ensure protections and inclusive access for public space in order to meet the diversity of needs this space addresses in the face of extreme climate events and long-term impacts

(Contd.)

Built environment support for capabilities	Climate change mitigation strategies	Climate change adaptation strategies
Sacred sites and cultural amenities	Avoid damaging sacred or culturally significant sites or amenities when developing low-carbon infrastructure; reduce emissions related to sacred sites or cultural activities	Develop meaningful strategies for managing the irreversible loss of sacred or culturally significant sites (including landscapes)
***Essential service infrastructure:* Capability to benefit from basic services essential to maintaining personal and social life**		
At a minimum, essential services would ensure all people can enjoy adequate, accessible, and safe water and sanitation (including human and non-human waste systems), food systems and public health		
Water and sanitation	Ensure low-carbon, safe and adequate water and sanitation services	Protect and/or redesign water and sanitation services for resilience in the face of extreme climate events and long-term impacts; guarantee the health and safety of water and sanitation workers even in the face of climate impacts
Food systems	Invest in human and material infrastructure to reduce greenhouse gas emissions of food systems through the entire supply chain	Protect and/or redesign food systems infrastructure (including for subsistence production) for resilience in the face of extreme climate events and long-term impacts
Public health	Ensure adequate low-carbon and accessible public health, including minimising transportation needs	Ensure public health infrastructure (and access to it) is protected from extreme climate events or long-term impacts

change impacts interact with pre-existing patterns in society that have resulted in disparities of access to material and immaterial resources and opportunities? To what extent is access to some capabilities for some being secured at the cost of access to capabilities for others?

Explicit attention to questions about the distribution of capabilities and the means by which they have emerged lays the groundwork for the next big question: what opportunities exist in the context of the built environment for decisions to be made that would be less likely to result in or perpetuate profound disparity in human capabilities? Pursuing climate justice almost certainly requires changing the status quo since many existing systems have fed into or could exacerbate injustices which immediately brings up questions about political power and decision-making processes. For example, in the face of rapid urbanisation, climate change, and already stretched public service sectors, guaranteeing water accessibility for all may require reducing investments in privileged neighbourhoods in order to increase investments in systematically disadvantaged areas. However, this type of decision would be likely to face political pressure from those who have benefitted from the existing structure and who carry significant political power (Baeza *et al.* 2019).

Recognising the political nature of climate justice dilemmas de-normalises unjust arrangements and can reorient scholars, practitioners, decision-makers and community members towards the mechanisms that initiated and that perpetuate systemic injustice. A growing number of scholars have explicitly started to include in-depth attention to the political processes both supporting and inhibiting change towards more just arrangements in the built environment context (Bulkeley, Edwards, & Fuller 2014; Meerow & Newell 2019; Ziervogel *et al.* 2017).

Despite the growing attention to issues of climate justice within the built environment community, this literature is diverse and rarely shares common notions of equity or justice or even defines these terms. As seen in the suite of papers in this special issue, and in the literature broadly, there are many possible ways of integrating justice concerns into the built environment. However, due to the diversity of points of interaction between the built environment and climate change, ongoing discussions about (in)justice in any given domain are not always linked to each other or to broader questions of creating more just social arrangements in an era of climate change. Similarly, even when providing in-depth technical insights, many studies do not link such observations directly to issues of justice, and the majority of studies quantifying climate change impacts on energy use, comfort, health and wellbeing do not provide detailed consideration of the social aspects that magnify risks for health and wellbeing across and within countries (Cheng & Berry 2013; Vardoulakis *et al.* 2015). It is unsurprising that there remain some disciplinary boundaries between empirical and normative work in this area. However, all major decisions in the built environment in a context of climate change have normative implications. Failing to identify and explore these explicitly misses an opportunity to examine how the built environment has shaped inequities or injustices in the climate context, and how this sector could be used to reduce potential injustices moving forward.

This editorial uses the notion of a multivalent approach to justice (described below) as a strategy for connecting many points of evidence about particular inequities to develop a cohesive and more powerful line of argument about how the built environment sector could support efforts towards climate justice.

5. Multivalent justice

Any number of justice frameworks have been used to help scholars, practitioners, decision-makers and community members identify and pursue opportunities to move towards more just arrangements in the context of the built environment. For instance, many scholars—including those in this special issue (Baborska-Narozny *et al.*; Schünemann *et al.*; Willand *et al.*)—have done in-depth analyses of the distributive implications of decisions in this context as a way of making visible the often invisible or overlooked disparities experienced by different individuals or groups of individuals. Others have invested energy in asking questions about the types of metrics being used to guide policy making, pointing out that how such metrics are designed may in themselves present justice concerns (Axon *et al.*). Another strategy has been to look at decision-making processes as a key element of justice in this context, recognising that who is at the table has crucial implications for likely outcomes (Hamstead *et al.*; Passe *et al.*; Patrick *et al.*). All these strategies help us better identify existing injustices and, hopefully, imagine and implement ways of addressing these.

This editorial suggests a multivalent approach to justice that includes distributive, procedural and recognition justice (Fraser 2001; Schlosberg 2007) may be a useful way to integrate lines of analysis in the justice arena. A multivalent approach to justice has been used in several climate related contexts (Klinsky 2015; Klinsky & Winkler 2018; Walker 2011) including in relation to energy poverty (Walker & Day 2012). A preliminary framework is presented below which scholars, practitioners and decision-makers could use to identify and address justice concerns within the built environment context:

- ***Distributive justice*** concerns are the most commonly raised in the climate context and involve any claim based on how benefits and burdens are divided across multiple stakeholders. This includes the division of costs and opportunities across renters and property owners within a city or claims about the distribution of vulnerability to particular impacts, such as heatwaves.
- ***Procedural justice*** involves all claims about fair, transparent and inclusive decision-making. As with distributive justice, procedural justice claims are relevant to all climate change decision contexts. For instance, procedural justice could include the integration of undocumented residents in decision-making about adaptation infrastructure or the involvement of communities in national and international negotiations about profound losses (*e.g.* territory or sacred sites). As already noted in the adaptation context, if processes are not actively designed with vulnerable populations, then exclusive adaptation could result, which reinforces rather than reduces pre-existing inequalities (Meyer *et al.* 2018). Participatory system dynamics approaches are increasingly adopted in built environment research in recent years to facilitate the mapping of complex interactions between key actors and stakeholders (Eker *et al.* 2018).
- ***Recognition justice*** emerges in the seemingly mundane but critically important decisions about policy framing and analysis. It asks how particular people or groups of people are made visible or invisible in a decision context. Who are seen as relevant stakeholders? Which characteristics or specific needs are included in models or frameworks for making climate relevant decisions? For instance, it has been argued that migrant workers and those in the informal sector have been systematically rendered invisible through state policies, which risks exposing them to even greater climate risks (Chu & Michael 2019). Others have pointed out how concepts such as urban sprawl or resilience have included or excluded key considerations during their evolution (Borie *et al.* 2019; Wilson & Chakraborty 2013). For researchers, recognition justice requires reflection about the operationalisation of concepts and analytic processes. Examples would include decisions about how to include non-monetary losses (such as the loss of culture, health or life); the extent to which data disaggregated by gender, ethnicity or any other potential for marginalisation are collected and used in climate planning; or the time horizon built into any analyses as this dictates who is 'seen' as relevant both historically and into the future.

A multivalent approach to justice provides a practical framework for identifying potential injustices and linking them to decision-points that could be used to reduce these injustices. **Table 3** outlines a simple checklist framework for analysts or practitioners to start integrating climate justice into the design and communication of research in the context of climate change and the built environment.

To further demonstrate how the proposed framework could be employed by researchers and practitioners in the built environment field, two worked examples are provided in **Table 4**. Similarly, although it did not use this framework explicitly, the PCBF is a good example of a recently implemented programme that integrates procedural, recognition and distributive justice aims within a climate justice lens (Mondainé & Lee 2020).

This framework allows for a process of moving from observations of inequities to analyses of why these happened and how decision processes could address them. In so doing, it also places responsibility on academics to acknowledge the considerable power that resides in research to frame an issue. Choices about which issues to focus on, which disparities to draw attention to, or which metrics to use are not mere technicalities but determine which and whose harms and benefits will become visible. Scholars can use this framework to systematically connect their work to that of others who may be looking at different manifestations of climate injustice, but that may involve similar causal patterns.

Table 3: Framework for built-environment practitioners and researchers to enable the integration of climate justice into decision-making processes.

Justice dimension	Core questions
Distributive	Are there differences in the distribution of a particular benefit or burden (including risks)? If so, across what dimensions are these differences manifest (*i.e.* income, gender, age, race, location, country, time, other social identifiers *etc.*)?
	Are these patterns connected to any other patterns of difference in wellbeing or access to resources?
	Where did these disparities come from? Are there processes by which privilege and disadvantage accumulated? Are some being protected from risks at the expense of intensification of vulnerability for others?
Procedural	How have decisions been made that influence the distributions being noticed?
	Who is involved in decision-making, and in what capacities now and over time?
	Have some actors had stronger voices in this process than others? How did this occur?
	What would need to be put in place to change the capacity for all actors to have a voice in this process?
Recognition	What benefits/burdens have been included/excluded in the study or were included/excluded in the decision context being examined? Has analysis included means for observing both processes and outcomes of decision-making?
	Have the appropriate data been collected to enable meaningful comparison across groups?
	Which groups of people or aspects of people's lives are captured by the metrics being used in the decision or study context, and which ones are left out? Are there assumptions built into the metrics being used that systemically privilege and/or devalue particular people or aspects of people's lives?
	How does this decision or analysis deal with both past accumulation and future needs?
	How does this decision or analysis deal with jurisdictional boundaries and the potential for those outside these boundaries to be affected by this decision?

Table 4: Examples of integration of the climate justice framework into the building and urban decision-making processes.

Core questions	Building-scale example: energy retrofit in housing	Urban-scale example: summer outdoor thermal comfort
Distributive justice		
Are there differences in the distribution of a particular benefit or burden? What dimensions are these differences manifest (*i.e.* income, gender, age, race, location, country, time, other social identifiers *etc.*)?	Have differences in access to retrofitting across any socially relevant indicators in this context been checked for? In addition to the usual factors, retrofit decisions often differ across social housing and private funding schemes	Have differences in access to comfortable outdoor spaces across any socially relevant indicators been checked for? Neighbourhood heat vulnerability hotspots may have developed over time so should be examined explicitly
Are these patterns connected to any other patterns of difference in wellbeing or access to resources?	In a retrofitting context this may including looking at intersections with income and rental/homeownership patterns	Common intersections to examine include race, income and health status with geographical proximity to safe green space and safe and affordable mobility to green/public space
Where did these disparities come from? Are there processes by which privilege accumulated as well as disadvantage? Are some being protected from risks at the expense of the creation of more vulnerability for others?	Common drivers to examine might include rental/home ownership and systemic accumulation of disinvestment in low income or racialised neighbourhoods. Also may need to investigate overlap with social benefit policies generally	Important to examine the geographical distribution of housing in relation to green/blue infrastructure investments and open public spaces across different income bands

(Contd.)

Core questions	Building-scale example: energy retrofit in housing	Urban-scale example: summer outdoor thermal comfort
Procedural justice		
How have decisions been made that influence the distributions being noticed?	How have funding mechanisms (private or public), rental regulations, building codes, or energy efficiency policies been enacted over time?	Have there been lock-in decisions such as fixed grids, redlining or other segregation policies, risk accumulation due to jurisdictional boundaries or jurisdictional priority setting over time?
Who is involved in decision-making, and in what capacities now and over time?	What actors have been involved with these policies, and what have the mechanisms been for public engagement and representation?	What actors have been involved with these policies, and what have the mechanisms been for public engagement and representation?
Have some actors had stronger voices in this process than others? How did this occur?	Particularly important groups to look at comparatively might include tenants and landlords; disadvantaged *versus* privileged residents; industry lobby groups *versus* community organisers	Residents of lower income and/or racialised neighbourhoods are often under-represented in planning decisions due to structural/institutional injustice. Examining how such communities have been engaged in all planning processes may be important
What would need to be put in place to change the capacity for all actors to have a voice in this process?	Occupants need to be afforded a voice in retrofit uptake decisions. This could be achieved through a regulatory framework that empowers tenants (*e.g.* the UK's Energy Act, Minimum Energy Efficiency Standards)	Bottom-up citizen influence on decision-making could be fostered through participative platforms (*e.g.* climate citizen assemblies at the borough level).
Recognition justice		
What benefits/burdens have been included/excluded in the study or were included/excluded in the decision context being examined? Has analysis included means for observing both processes and outcomes of decision-making?	This might include looking at outcomes such as thermal comfort, household spending patterns or aggregate health outcomes. Examining process might require specific investment in process tracing, document analysis or other means	This would include looking at neighbourhood-level thermal comfort; accessibility patterns; and perceived safety and inclusion. Examining process might require specific investment in process tracing, document analysis or other means
Have the appropriate data been collected to enable meaningful comparison across groups ?	What data exist and what is missing? New data may need to be collected to capture all drivers of potential differences	What data exist and what is missing? New data may need to be collected to capture all drivers of potential differences
Which groups of people or aspects of people's lives are captured by the metrics being used in the decision or study context? Which ones are left out?	This might include incorporating people's economic context (costs, budgeting, prioritisation); behaviour and desires for living; household coping mechanisms or opportunity costs, habits and perceptions of energy use into analyses	This might include people's individual vulnerability factors along with social norms, practices, habits and perceptions of urban heat risk, the use of existing public space, and desires for public space
Are there assumptions built into the metrics being used that systemically privilege and/or devalue particular people or aspects of people's lives?	For instance, do assumptions about 'standard'/normative/rational energy use behaviour and retrofit uptake decisions fit this context or do they miss opportunity costs or lived realities of some?	Common assumptions about use of public space based only on proportion of green coverage and proximity to one's home may devalue some people's use of/desire for green space
How does this decision or analysis deal with both past accumulation and future needs?	Has the accumulation of privilege/disadvantage been included in this analysis? If so, how has this or could this be done?	Has the accumulation of privilege/disadvantage been included in this analysis? If so, how has this or could this be done?
How does this decision or analysis deal with jurisdictional boundaries and the potential for those outside these boundaries to be affected by this decision?	How have long-term energy and emission patterns and limitations been included in decision-making? How have other resource demands and their implications beyond jurisdictional boundaries been considered?	How are broader implications of green space provision factored into climate action plans or other regional visions? If public space is to serve as a water management scheme as well, how are downstream users represented?

6. Contributions to knowledge of this special issue

With the intent of facilitating greater integration between work on the built environment and climate justice, this special issue brings together a set of studies (**Table 1**) aiming to frame built environment sector-related aspects of climate change within a climate justice concept framework. Several themes emerge from this body of work. As discussed above, distributive justice in the climate and built environment context may refer to *costs* (Baborska-Narozny *et al.*), *opportunities* (Willand *et al.*) or climate *vulnerability* distribution (Axon *et al.*). Baborska-Narozny *et al.* quantify the costs of a transition from solid fuel heating to other heating fuel types for disadvantaged households in Wroclaw, Poland. Such policies are mainly driven by combined carbon emissions and air pollution reduction policy targets. Unfortunately, they may lead to the unintended consequence of increasing fuel costs for lower income residents of social housing, where solid fuels are more common, thus further contributing to fuel poverty and magnifying existing inequalities. Similar concerns about the *cost* implications of energy transitions on low income communities are expressed by Axon *et al.*; their mixed methods study evaluates the impact of the implementation of a biomass energy system in low income housing near Liverpool, UK. The authors highlight the need to shift the focus from energy efficiency *metrics* primarily rooted to environmental and economic drivers to a more holistic consideration of just, community inclusive processes that do not amplify underlying inequalities. Willand *et al.* introduce the concept of *retrofit poverty,* a household's opportunities to access retrofit funding, as a distributive justice issue. Opportunities to improve the energy and thermal performance of one's home are not equally distributed across households. Through the analysis of home energy certificate data for the residential stock of Victoria, Australia, the study found that energy retrofit uptake was lower in areas with higher proportion of renters and lower income households. The authors stress the need to consider the ways in which market-based retrofit subsidies work; whilst they might result in comfort improvements, energy and carbon savings, the fact that these may not be enjoyed equally by all income groups can exacerbate underlying disparities. Schünemann *et al.* assess the effects of thermal retrofits on winter and summer thermal comfort, and associated energy use and carbon emissions, in typical multifamily housing units in Germany. They emphasise the importance of co-creating climate adaptation solutions with the inhabitants. For instance, particular attention needs to be paid to dwellings that rely on occupant controlled natural ventilation strategies for cooling. If ventilation strategies are not appropriately implemented, residents who have limited adaptive capacity will experience an increasing risk of summer indoor overheating as the climate becomes warmer, which will increase their *vulnerability* to climate change.

Other papers in this special issue explore the nexus of *procedural* and *recognition climate justice* in the context of built environment decision-making (Hamstead *et al.*; Passe *et al.*; Patrick *et al.*). Hamstead *et al.* investigate the socio-technical and governance challenges that urban communities face as a result of extreme heat events. They use actor–network theory as the basis for the development of a decision-making framework for urban planning decisions in Arizona and New York. This framework recognises the justice aspects of climate change adaptation policy actions in order to build urban environments and communities that are well prepared for periods of excess heat. Another decision-making framework that embeds socio-technical information and capabilities for heat resilient urban environments is presented by Passe *et al.* focusing on disadvantaged neighbourhoods in Iowa. It is envisaged that such human-centred frameworks will facilitate the integration of human behaviour, socio-demographic and urban neighbourhood characteristics in socially just climate adaptation planning. Patrick *et al.* adopt an ecofeminist approach and uses a case study in rural Kenya to discuss the development of a conceptual and practical framework for the design of integrated solutions that tackle planetary health injustices; building design is presented as a tool that could promote equity, justice, health and climate change adaptation.

7. Current challenges for the built environment

Several specific areas for further work emerge from this special issue, relating particularly to how the broader built environment community might contribute to a more just future in the context of climate change. We invite stakeholders involved in this sector to consider how they might fit within these specific challenges and arenas of activity.

7.1. Governance and advocacy

- Governing bodies need to *clearly establish and formally recognise existing commitments to protect vulnerable people in the context of climate change*. There may also be a role for professional associations, education and training institutions, and regulatory authorities to ensure professionals are explicitly aware of their role and responsibilities for guaranteeing human rights and the capabilities of all people even in the context of climate change. This includes obligations for the protection of all human rights, as well as to the non-discriminatory enjoyment of public services, including those provided through disasters and public health emergencies. Existing commitments upon which such obligations could be explicitly connected include the UN Declaration of Human Rights, commitments to the SDGs, and, where relevant, commitments to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). Notably, particularly in the context of UNDRIP, this includes respecting free, prior and informed consent from relevant Indigenous populations for all infrastructure development on their traditional lands and territories.
- *Feasible and equitable pathways need to be implemented for the provision of healthy, low-carbon, climate resilient outdoor and indoor environments for vulnerable population groups in a changing climate*. This will require the use of evaluation methods for planning and implementation that can capture the range of justice issues, including

those that manifest through inequities in climate risk exposures, vulnerabilities, and adaptive capacity relevant to any project. It will also feature strong participatory efforts to ensure that the needs and concerns of those who are most vulnerable are integrated into decision-making. The multivalent framework presented above (**Table 2**) could be one such evaluation tool that is designed to be very flexible, although others could also be used depending on the situation.

- *Authorities need to regulate climate risks that impact beyond their jurisdictional boundary. Built environment activities benefitting those in their own jurisdictions must not impose harm on those beyond their boundaries (e.g. through supply chains or other forms of risk displacement).* Working with networks of jurisdictions may be one strategy for this. There may also be a role for professional associations to mandate their members' actions to account for all climate risks regardless of jurisdictional boundaries.
- Governing bodies (including regulatory authorities or professional associations where relevant) need to *establish redress processes* for vulnerable people. If a failure to meet obligations and responsibilities occurs, then a recourse to seek justice is necessary.

7.2. Documentation and analysis

- There is a pressing need to systematically map existing currently fragmented research on *climate risk exposures and vulnerabilities* by socio-demographic features both across and within countries, and their implications on social inequalities/inequities and human development in the context of ongoing and future climate change. Gathering documentation of inequities is already starting to occur in this sector, which creates a baseline upon which further work could build. There is a clear call for researchers and for governing bodies at all levels to cooperate to conduct quality analyses, which includes generating and providing appropriately disaggregated high-quality data.
- In light of the systemic nature of injustice underpinning many inequitable outcomes, there is currently insufficient data and analysis on the *systemic barriers* to access and implementation challenges of interventions for vulnerable populations. For example, many authors (Cayla, Maizi, & Marchand 2011; Gillard *et al.* 2017; Schaffrin & Reibling 2015) have pointed out that a deeper understanding of individual needs, behaviour patterns and energy use practices in buildings across different income groups, and their relationship to contextual factors (*e.g.* welfare regimes, housing systems *etc.*) is required. This would include research that quantifies the adaptive capacity of different socio-demographic groups (based on age, gender, ethnicity, income, health status, social deprivation index *etc.*) to lessen the adverse impacts of climate change, and that critically identifies the root causes of these inequalities.
- There is also a need for researchers and governing bodies to actively *make analyses of risk exposures and of systemic barriers publicly available* in order to support meaningful participation in further decision-making. To accelerate the impact of research outcomes, outputs tailored to specific key audiences (policymakers, built environment and public health practitioners, citizens) will need to be co-created through knowledge exchange. Institutions that support and incentivise researchers (including through non-monetary forms of recognition), including universities and funding bodies, also have a role to play in ensuring that such information is made readily available.

7.3. Training and capacity-building

- Academic and training programmes charged with training professionals involved in planning, designing and implementing built environment projects should *ensure all trainees are equipped with awareness of inequities and social injustices* generally and particularly in the context of climate change. Further integration of justice concerns into this sector will be hampered without foundational understanding of the core issues across all relevant professions.
- The environmental health and wellbeing discourse must *further integrate the built environment into assessments of social and health* inequities. Health and social assessments, particularly in the context of climate change require interdisciplinary thinking between researchers working in the areas of built environment, health, social justice, industry, policymakers, non-governmental organisations (NGOs) and communities. Such interdisciplinarity work requires conceptual, financial and institutional support. There is a role for all relevant institutions, professional associations, and funders to support such integration.

Climate change will inevitably pose a range of pressures on existing systems that already result in inequities. Stakeholders in the built environment sector have significant roles to play in moving towards a more just future to protect the vulnerable and ensure their wellbeing. Although the principles of climate justice may be new to some in the built environment, the scale and urgency of this responsibility is a mainstream issue for our buildings, infrastructure, towns and cities to remain viable, useable and adaptable. The design, operation, maintenance and use of built environment must afford protection to society—both now and in future. In light of current and predicted climate change, it is vital that decisions and actions do not hurt or disadvantage those most vulnerable within a society and those societies that will be negatively impacted, now and in the future. This special issue helps to initiate a discourse about the research, guidance and actions that will be needed. Further research and policy analysis contributions to this journal are welcome.

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Competing interests

The authors have no competing interests.

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