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REVIEW ARTICLE



Human Dimensions of Air Quality: Introduction to the Special Issue

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ABSTRACT

Poor ambient air quality is one of today's greatest environmental health risks. However, unlike water, wildland fire, or wildlife, comparatively less human dimensions scholarship has focused on air resources. The papers in this special issue highlight how people across varying cultures, geographies, and identities create and relate to varying air quality conditions. In doing so, the issue challenges dominant perspectives of air pollution as a purely material entity and argues for the need to attend to the socio-cultural and political dimensions that define, create, or mitigate poor air quality.

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Introduction

Poor ambient air quality affects 99 percent of the global population, posing one of today's greatest environmental risks to global human health and wellbeing (Bazyar et al. 2019; Ebenstein et al. 2017; WHO 2022). Anthropogenic air pollution from mobile, area, and point source emissions, along with smoke from wildland fire and dust transport from land use and land cover change, degrades air quality in remote wilderness (Zajchowski, DeSocio, and Lackey 2019) and urban settings (Zhu et al. 2019). Resultant cascading ecological health impacts from local, regional, and transboundary emissions are well documented (e.g. Rosseland 2021), as are human health impacts (e.g. Butt et al. 2017). However, comparatively less scholarship focuses on the human dimensions of air quality or the myriad ways in which individuals, groups, and societies experience, interact with, and make decisions about collective air resources (Calvillo and Garnett 2019; Cupples, Guyatt, and Pearce 2007; Cupples 2009; Lu 2020; Mostafanezhad and Evrard 2021). The papers in this special issue offer a deeper understanding of these human dimensions by highlighting how humans across varying cultures, geographies, and identities relate to air resources. In doing so, the issue challenges dominant perspectives of air pollution as a purely material entity and argues for the need to also attend to the socio-cultural and political dimensions that define, create, or mitigate poor air quality.

This special issue focuses on transdisciplinary social science research that integrates and expands current understandings of the complex affective, cognitive, and behavioral

relationships humans have with air quality. Within protected areas, the management of air resources continues to evolve due to shifting policy mandates as well as different social, cultural, and economic practices (Clifford 2021; Parsons and Daniel 1988; Zajchowski, Lackey, and McNay 2019). This is despite the value visitors place on clean air and scenic views (Kulesza et al. 2013) and the impacts of degraded air quality (Gellman, Walls, and Wibbenmeyer 2022; Keiser, Lade, and Rudik 2018). In urban, exurban, and rural settings, emerging work on the “political-economic geography of air” (Choy 2012, 27) examines how air quality is differently understood, experienced, and governed (Adey 2014; Bickerstaff 2004; DuPuis 2004). Human geographer Julie Cupples (2009) demonstrates how air pollution is as much a cultural issue “as it is a question of the amount of harmful particulate matter in the environment” (208). Thus, across settings, knowledge of the underlying social, cultural, and psychological drivers and barriers to realizing ‘good’ air quality remains deserving of further inquiry and synthesis.

Air Quality as a Boundary Object

Take, for example, the pivotal role of nation states in sculpting their citizens’ relationships with air quality through The Air Quality Index (AQI). The AQI is a common tool used across nations and is based on an algorithm of combined measurements of several pollutants that provide data for a graduated scale of thresholds. Yet, different nation states have different thresholds: China and the U.S., among the world leaders in air quality research, communicate public health risk from poor air quality differently to their citizens (Figure 1). In the case of particulate matter (PM) concentrations, thresholds elicit divergent public health warnings across these two geographies. ‘Good’ PM_{2.5} conditions in the U.S. range from 0 to 12 µg/m³, while in China, ‘Good’ air quality ranges 35 to 75 µg/m³. Further, the ‘Good’ particulate matter range in China is split between ‘Unhealthy for sensitive groups’ (35.5–55.4 µg/m³) or ‘Unhealthy’ (55.5–150.4 µg/m³) in the U.S. Outside of these two nations, in the UK, an AQI of 161–240 is considered ‘High,’ while in India, an AQI of 101–240 is deemed ‘Moderately polluted.’

As these examples illustrate, air pollution is a particularly mobile “boundary object” (Leigh-Star 1989), a shared referent, represented by a range of signifiers, that is often differently interpreted and made meaningful across cultures. Boundary objects are

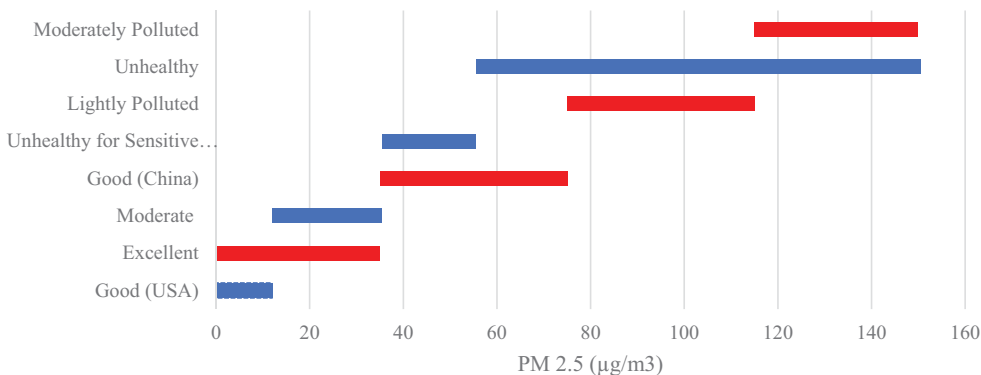


Figure 1. Comparison of PM_{2.5} thresholds between China and the United States of America below 150.5 µg/m³. Note: Blue = USA; Red = China.

critical for bringing policy makers and others together to develop and enact change. Conversely, in absence of collaborative decision-making, a lack of consensus over the meaning of air pollution and its range of materialities (e.g., PM, haze, smog) is negotiated in the lab, on the streets, and around the policy table across, both between and within nation states.

At present, air pollution is made meaningful through shared infrastructures, such as artifacts, representations, and technologies, and has status across epistemic communities (Leigh-Star 1989). How residents, social activists, scientists, industrial workers, and tourists, among others, understand air pollution is mediated by the performative nature of its' representations. Visual representations such as AQI apps enroll air pollution into practices of methodological standardization (Calvillo and Garnett 2019). Yet, differences in standardization, such as those evoked by the U.S. and China PM thresholds comparison, or even updates to existing thresholds (US EPA 2023) trigger numerous theoretical and applied questions: How do people respond to the divergent semantic framing of these objectively similar categories of PM? More broadly, how and why do we differently experience, understand, and legislate air quality across geopolitical borders? How do our cultural and social norms influence our understanding of air quality conditions?

Social scientists are increasingly addressing these and related lines of inquiry. Scholars also focus on how differential access to air resources shapes social relations, especially across demographics, such as race, religion, and gender (Collins and Grineski 2019) and socio-economic status (Choy 2012; Wong et al. 2008). For instance, political ecologists examine the materiality of air pollution and its unequal distribution across several spatial scales and temporalities (Graham 2015; Mostafanezhad 2021). Political and behavioral economists outline the willingness-to-pay for air resources (Boyle et al. 2016) and the purchase and use behavior across commodities (Bayer, Keohane, and Timmins 2009; Boso, Oltra, and Hofflinger 2019; Guo et al. 2020; Li and Kamargianni 2017). Geographers account for the role of diverse air quality measurements, standards, and techniques in reinforcing and/or challenging socio-economic inequality (Graham 2015). Additionally, norms (Zajchowski et al. 2019), risk perceptions (Mao et al. 2020), risk communication (Koenigstorfer 2018), values (Dunlap et al. 2000), and decision-making automaticity (Verplanken and Wood 2006) are useful lenses from social and cognitive psychology through which to approach questions surrounding human production, consumption, and governance of air resources. Such scholarship raises new questions regarding how the revaluing of air quality resources form new socio-ecological relations.

The Special Issue

The papers in this special issue advance our understanding of air quality through empirical and theoretical demonstrations of its human dimensions. Their authors account for how individuals, groups, and societies create, interact with, and respond to varying levels of air pollution and their political, economic, and socio-cultural drivers. In doing so, the authors critically address how and with what socio-ecological implications air quality comes to be understood as a resource to be protected (or in the case of Huang's 2021 work, acquiesced to). Groundbreaking in scope, it offers the first social

science account of the human dimensions of air quality from a range of disciplinary backgrounds and geographical contexts.

In this issue, Huang (2021) and O’Leary et al. (2023) highlight the politics of environmental justice and how the slow violence of public health risks are unevenly distributed across social groups. Coal is the leading cause of air pollution deaths in China (Wong 2016) and one of the largest sources of poor air quality globally. Huang (2021) demonstrates how coal workers in China make sense of coal’s contribution to China’s chronic air pollution problems. Coal workers’ multiple alliances to their employers, families, and communities mediate their understanding of the role of coal in air pollution production and its related health hazards. These alliances also contribute to their ontological security and trust in policy making authorities to protect their wellbeing, thus limiting environmental justice mobilization in the community. The implications of Huang’s findings extend well beyond China, as coal workers’ livelihoods have become a touchstone for contemporary American politics. In Minneapolis, O’Leary et al. (2023) demonstrate how the murder of George Floyd and his utterance, “I can’t breathe” reflects broader patterns of racial injustice in the US. They demonstrate how the COVID-19 pandemic and exposure to poor air quality unevenly affects racial minorities and low-income communities. Social media, such as Twitter posts, reflect these inequalities in a range of predictable and extraordinary ways. By outlining the breathing politics of Minneapolis, the authors illustrate how race and class intersect with public health risks and socio-environmental hazards.

This focus on environmental justice is similarly evident in contributions within the special issue related to wildfire smoke. Treves and colleagues (2022) explore the role of clean air centers (CACs) in providing refuge to individuals experiencing the impacts of wildfire smoke in northern California. Documenting and comparing the experiences and perspectives of practitioners involved in staging CACs and the vulnerable community members for whom they are designed, the authors provide evidenced-based opportunities to improve centers for future smoke events. While Treves et al. (2022) cast a wide net of public servants, advocates, and vulnerable community members to inform their research, Hardenbrook, DeMarco, and Rose (2022) focus specifically on people experiencing homelessness in Salt Lake County, Utah. Through representing the experiences of this population, the authors highlight a phenology of air pollution in the Salt Lake Valley, inclusive of winter inversions and summer wildfire smoke. And, as one of their unsheltered participants reminds readers, regardless of the season “there is no escaping [air pollution], not in my tent, not here, not there.” So, the common guidance to “stay inside” during poor air quality days is socially construed, much like the broad national differences in AQI thresholds.

National level policy also features in Matczak et al.’s (2023) exploration of the implementation a particular state-led program in Poland, the Clean Air Priority Program (CAPP). The authors detail how CAPP aims to reduce air pollution from single-family homes, influences various stakeholders in the Polish market, and how the program is related to societally relevant themes in Poland (e.g., climate crisis, inequality reduction). The authors argue that the program may have helped reduce single-family home residents’ reliance on coal as a fossil fuel, but, ironically, may have increased reliance on another fossil fuel: natural gas. The climate crisis, along with external pressure and new

norms, may have sped up the reception and implementation of the program. This broad national policy analysis is followed by Zanoocco et al. (2022), who assess whether U.S. residents' stated support public safety power shutoffs varies depending on the level of exposure to poor air quality during wildfires. Oregon residents were surveyed, and as expected the level of exposure related positively to the stated support for shutoffs, controlling for age, gender, income, and education. This makes the authors conclude that public support may be highest during times of wildfires and in areas where wildfires are common. Such support may be important for the creation of healthy, safe, and sustainable communities, led by both local and state authorities.

The final contribution within the special issue explores the similar role of the availability heuristic to informing risk perceptions (Tversky and Kahneman 1973), in this case related to wood smoke pollution from heating and cooking in Coyhaique, Chile (Boso et al. 2022). Like many of the articles with the issue, the authors also posit that wood smoke exposure is also determined by sociodemographic factors. Specifically, they posit that "fuel poverty," in part, determines the higher level of exposure to wood smoke from those with low socioeconomic status due the relative affordability of firewood. So, much like the wage workers interviewed in Huang (2021) or Treves et al. (2022) or individuals experiencing unsheltered homelessness in Hardenbrook, DeMarco, and Rose (2022), socio-economic status dictates differential exposure.

Conclusion

In sum, despite innovative policy analyses and recommendations represented by Zanoocco et al. (2022), Matczak et al. (2023), and Treves et al. (2022), the special issue highlights that the complex cognitive, affective, and behavioral relationships humans have with air quality is inextricably linked with issues of social-cultural context. And, while the physiological responses to air pollution, once exposed, are more democratized (e.g. Zajchowski and Rose 2020), the socio-cultural context of the population in question (e.g. Huang 2021) mediates their cognitions (Zanoocco et al. 2022), emotions (Hardenbrook, DeMarco, and Rose 2022), and behaviors (Boso et al. 2022). These findings suggest the continued importance of both situated research efforts of the human dimensions of air quality to understand contextualized experiences, as well as broader comparative efforts across governance structures, biogeophysical settings, and cultural milieu.

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