



Designing for Mindfulness and Global Public Health: Where Inner Awareness Meets the External Environment

Burçak Altay¹ · Nicole Porter²

Accepted: 26 February 2024
© The Author(s) 2024

Abstract

In this paper, we offer a commentary on Oman’s article “Mindfulness for Global Public Health: Critical Analysis and Agenda” from the perspective of external environments, be they natural or built spaces. Utilizing the 14 domains of mindfulness and public health identified by Oman, we examine how spatio-environmental concerns are aligned, or have potential synergies with, these dimensions. We consider spatial and environmental qualities and relationships, for example, the presence of nature or a sense of safety, as supportive for public health and formal mindfulness practice, synthesizing a growing evidence base within environmental psychology and design literature. We highlight particular points of alignment, namely the impact of environments on mental health, stress, and attentional qualities. Potential synergies are evident where these domains seek to increase resilience and the sustainability of our planet, communities, and individuals, and through the increasing emphasis on designing places that offer inclusive access to, and direct involvement in, the creation of belief (spirituality) and culture-specific interventions. Although these domains offer the potential for greater holistic research and practice, more interdisciplinary research is needed to bridge gaps and bring this potential into the mainstream.

Keywords Mindfulness · Public Health · Restorative Environments · Contemplative Spaces · Inclusive Design · Sustainable Design

In his expansive paper, Oman asks “can mindfulness contribute to building the needed planetary, societal and individual resilience” that the world needs in the face of complex socio-environmental challenges, framing this question from a global public health viewpoint (2023). Oman concludes that there are several fundamental ways in which the mindfulness movement aligns with public health aims and approaches, even though “mindfulness is conspicuously absent from most global and public health literature and practice” (2023).

In this commentary, we frame the same question from the perspective of the physical environment, which is likewise conspicuous in its absence from most mindfulness literature, apart from invitations to find a “comfortable” and “quiet” place for formal mindfulness practice (Teasdale et al., 2014, p. 35). Just as Oman identifies nascent synergies between mindfulness and public health, we invite readers to reflect on the unfulfilled potential of interventions that intentionally integrate mindfulness approaches with environments to improve health and well-being. This way, we want to contribute to the insightful commentaries that Oman’s broad paper has prompted that delve into specific issues. These include mindfulness links to epidemiology, with possibilities of mindfulness to transform the health of populations (Levin, 2023), and explorations of the specific content, as well as cultural/workplace/religious contexts and settings of mindfulness-based programs (MBPs) and practices (Knabb & Vazquez, 2023; Palitsky et al., 2023; Sedlmeier, 2023, Sutton, 2023, Wang, 2024).

We hypothesize that sensitivity to particular environments, when designed with inclusive approaches, could support greater implementation of mindfulness and its

✉ Burçak Altay
burcak@bilkent.edu.tr

Nicole Porter
nicole.porter@utah.edu

¹ Department of Interior Architecture and Environmental Design, Faculty of Art, Design, and Architecture, Bilkent University, Bilkent, Ankara 06800, Turkey

² Multi-Disciplinary Design Division (MDD), College of Architecture + Planning, University of Utah, Room 326B, 375 S 1530 East, Salt Lake City, UT 84112, USA

public health benefits. Furthermore, we posit that mindful human–environment relationships could contribute to more resilience at the scale of the individual, the community, and the planet. First, we offer operational definitions of the physical environment and the design professions engaged in its formation. We then introduce the environment as a third domain alongside mindfulness and public health within Oman’s (2023) 14-point axial framework and summarize how these three areas of activity intersect. Next, we focus on prominent alignments between environment, mindfulness, and health: prevention orientation, mental health, stress, and attentional environments. After this, we identify how design can support the health of diverse populations by being inclusive of the spiritual dimensions of human–environment interactions, as well as attending to physical, neurological, and socio-cultural differences. Zooming out in scale, we then explore how notions of resilience and multi-level interventions operate within sustainability science and design, noting the increasing convergence of inner transformation (contemplative practices) and outer transformation (relationships with external environments based on pro-environmental behavior and interdependence). We conclude by proposing a holistic research agenda encompassing mindfulness, health *and environment*, offering an expanded scope for integrating all three domains to increase well-being and public health at multiple scales.

Situating Mindfulness and Public Health Within Physical Environments

The physical environment, or “environment” for short, here encompasses both built and natural spaces and places. The complex tapestry of interwoven natural processes, features, human structures, and land uses dynamically operates across scales, from a single room up to entire regions and biomes. Also being quantifiable as *spaces*, environments also hold important individual and collective meanings and associations as *places*. Acknowledging the qualitative dimensions of place becomes important when considering the relations between people and environments—which in turn aligns with the relational quality of mindfulness as a way of engaging with the world and oneself.

The modification of environments is governed by manifold institutional structures, organizations, and people, with innumerable spaces being built and evolving organically over time in concert with human agency, for better or worse. Within this context, a range of “environmental design professions” (Lawson, 1990) including architecture, landscape architecture, town planning, and interior architecture plays a role in theorizing, designing, implementing, and evaluating environments, in terms of their salutogenic or pathogenic qualities. Evidence-based design, a “process

of basing decisions about the built environment on credible research to achieve the best possible outcomes” (Center for Health Design, 2023), seeks to determine the influence of environments on health and well-being, using this knowledge to inform future policy and design interventions.

How does the environment and its design relate to mindfulness and public health concerns? When calling for greater integration of mindfulness into public health, Oman (2023, Table 3) identifies 14 axes or domains with ranging degrees of alignment. Could the environment be a fifteenth axis in this framework? Passing references to environmental considerations appear in Oman’s analysis which hint at this possibility, for example noting the practice of “minor modifications to the physical environment” where MBPs are delivered, such as workplace or educational settings (Oman, 2023). Consequently, we believe the environment is more than just an additional axis within this schema, as most of the 14 domains identified by Oman overlap with built and natural environmental design considerations. Therefore, we expand Oman’s schema (Table 1) to offer a three-way comparison between mindfulness, public health, *and* environmental design.

A detailed review of all 14 axes is beyond the scope of this commentary. For conciseness, in the following discussion, we synthesize Oman’s 14 domains into four main themes where the most prominent and promising alignments with environmental design arise: mental health, well-being and environments (A1, A2, A3 in Oman’s schema); embodied cognition and environments (A9, A10, A12, A13); inclusivity, equity, and environments (A9); and resilience, sustainability, and environments (A5, A7).

Mental Health, Well-Being, and Environments: Reducing Stress, Restoring Attention, and Supporting Flourishing

Oman notes a shift from focusing on physical health toward approaches that address mental health and flourishing within public health discourse, highlighting alignments between public health and mindfulness, especially in axes A1, A2, and A3. Environmental designers and planners similarly focus on improving physical health by addressing pathogenic environments, for example by improving sanitation, air quality, adequate housing provision, and safe streets. Just as public health has expanded to more holistically address well-being, in recent decades research and practice increasingly turned to the impact of the environment on mental well-being, which we discuss in this section.

Interest in the role of psychosocial surroundings (natural and urban) on people’s well-being and behavior emerged in the 1960s (Devlin, 2018): Environmental psychology (also

Table 1 Summary comparison along 14 axes (Oman, 2023), identifying whether environmental design orientations or activities (summarized in the right column) encompass the same orientations or activities as public health and mindfulness (as reproduced in the left columns)

Axis of comparison	Public health	Mindfulness	Public health–mindfulness relationship	Does environmental design encompass these specific orientations/activities?
A1 Prevention orientation	Yes	Yes	Aligned	Yes—promoting/supporting health (salutogenic design)
A2 Mental health important	Yes	Yes	Aligned	Yes—linking mental health and place, nature, psychology
A3 Stress influence recognized	Yes	Yes	Aligned	Yes—as per A1, A2, A8
A4 Multi-sectoral intervention	Yes	Yes, with caveats	Largely aligned	Partially—multi-scale environmental interventions at site–neighborhood–city scales
A5 Resilience orientation	Yes	Yes	Largely aligned	Yes—both physical resilience and values/sustainability mindset
A6 Epidemiologic foundations solid	Often	No	Mindfulness lags	No—limited evidence-based design
A7 Multi-level interventions used	Yes	No	Mindfulness lags	Partially—multi-scale environmental interventions at site–neighborhood–city scales
A8 Addresses attentional environment	Lags	Lags	Both lag current need	Yes (in theory)—linking mental health and place, nature, psychology through attention restoration theory
A9 Concern for equity	Yes	Mixed	Partially aligned	Yes—inclusive design/design for all, mostly focused on the physical
A10 Cultural adaptation common	Yes	Rare	Mindfulness lags	Partially—with place-based user-centered approaches
A11 Administrative adaptation and community partnership	Some	So far so good	Mindfulness has pending challenges	Partially—with co-design and partnership approaches
A12 Attends to religious factors	Lags	Lags	Both lag current need	Partially—spirituality, embodiment and sense of place at specific sites
A13 Supports professional/societal intercultural and interreligious competence	Lags	Lags more	Both lag current need	Partially (in theory)—designers to respond to cultural and religious diversity; not standard practice
A14 Employs branding	Yes	Yes	Both utilize, refinement needed	Partially—design skills may support communication

referred to as people-environment studies and environment-behavior studies) aims to create environments that support people. Research disseminated through the longstanding organization Environmental Design Research Association (EDRA) and journals such as *Environment & Behavior* and *Journal of Environmental Psychology* has influenced the design of physical environments. One example of psychologically informed design practice is the *WELL Building Standard*, a worldwide building certification program that is “a vehicle for buildings and organizations to deliver more thoughtful and intentional spaces that enhance human health and well-being” (International WELL Building Institute, 2023).

Stress theory influences environmental psychology and design approaches, just as it shapes mindfulness and public health literature (Oman, 2023). Empirical research

has explored the qualities of spaces and their varying impacts on people’s stress response specifically, and quality of life overall. Initially, studies identified negative environmental attributes that cause stress, such as noise, crowding, uncomfortable temperatures, and air pollution (Evans, 2011). Subsequently, prominent theories have focused on positive environmental attributes, primarily those of natural settings. Stress recovery theory (Ulrich et al., 1991), the theory of supportive design (Ulrich, 1991), and attention restoration theory (Kaplan, 1995) explain how environments can permit or even promote recovery from stress while supporting attention regulation and increasing well-being (Herzog et al., 2003; Kaplan, 1995; Ohly et al., 2016) both indoors and outdoors.

Oman defines attentional environments (A8) as “features of the sociocultural environment that affect attention and

attentional habits” (Oman, 2023); we suggest this definition can be broadened to include qualities of the physical environment that affect attention. In particular, attention restoration theory posits that when our forced or directed attention leads to fatigue through over-exposure to attention-demanding tasks, we can recover our attentional capacity by immersing ourselves in certain types of physical environments (Kaplan, 1995; Ohly et al., 2016). Four particular attributes of environments facilitate this: environments enabling a state of soft fascination, i.e., those demanding effortless attention; giving the person a sense of coherence and wholeness; being away from spaces where habitual (effortful) activities are performed, therefore allowing the person to naturally relinquish worries and mental demands; and being compatible with the person’s goals (Kaplan, 1995; von Lindern et al., 2022).

Noting the similarities between meditation and attention restoration theory, Kaplan (2001) hypothesized that restorative environments could complement the active role of meditation, stating “meditation shares the goals of restoration, namely, to foster tranquility and allow the mind to rest and regain its capacity to focus” (p. 499–500). The relationship between environments and formal mindfulness meditation training has been studied in various contexts. For example, practice is supported by showing new meditators slideshows of natural scenes before meditation training (Lymeus et al., 2017) or conducting MBPs in a natural setting (Lymeus et al., 2019). For people suffering from stress-related illnesses, conducting meditation/awareness exercises alongside garden activities increased their sense of belonging, safety, and freedom (Sidenius et al., 2017a). Nature-based interventions which integrate mindfulness/awareness theory and practices from Mindfulness-based Cognitive Therapies (MBCTs) have been introduced to people with depression: These interventions have been shown to decrease distress and increase restoration and are thus recommended as a means of supporting standard care procedures for depression (Hyvönen et al., 2023; Salonen et al., 2022). Lymeus et al. (2022) utilized the natural environment in mindfulness training within the course ReST (restoration skills training) finding “the practice approach in ReST uses adapted mindfulness instructions that help participants connect with sensory impressions from the environment and draw on supporting restorative processes” (p. 2). Similarly, since 2011, the purpose-designed Nacadia® Therapy Garden, part of the University of Copenhagen, has been evaluated in numerous studies where nature-based therapies, including nature-based mindfulness, have been conducted (Figs. 1 and 2). These studies provide an ongoing evidence base demonstrating how specific landscape settings, for example forests, water elements, seating, meadows, and productive garden areas, work in concert with therapeutic programs to improve health outcomes (Sidenius et al., 2017b; Stigsdotter, 2013).

Most recently, in their review of restorative environment research, von Lindern et al. (2022) discuss health interventions conducted at the intersection of MBPs and restorative environment practice, concluding that “bringing skill and nature-based approaches together could offer additional possibilities for understanding and facilitating mindfulness and restorative states and for understanding the ways in which individual-level and environmental resources more generally could interact to produce salutogenic outcomes” (p. 380). Considering this in the context of our highly urbanized global population, Macaulay et al. (2022) propose a theoretical framework that connects the restorative potential of natural environments with mindfulness for those with constrained nature exposure within cities. They suggest that mindful engagement in nature involves perceptual sensitivity, decentering, and non-reactivity, therefore increasing restorative potential and nature-connectedness. They recommend research that supports “applying theory from mindfulness and environmental psychology literatures to the built environment in the context of constrained urban nature” to “[advance] the discussion beyond mere exposure to nature, to draw attention to the impact of agency and engagement in nature” as part of contemporary urban living (p. 8).

Environmental designers, as well as professionals within the public health and mindfulness community, need to be sensitized, through their formal education as well as ongoing practice, to the potential salutogenic qualities of place and nature if they are to plan, create, and evaluate restorative environments. Inquiries into the potential of mindfulness practices to cultivate empathic understanding, creativity, and well-being among design students/practitioners remain limited but are growing (Altay, 2023; Altay & Porter, 2021; Andrahennadi, 2019; Christian, 2018). Through further interdisciplinary and collaborative research, MBPs can be applied within professional training for environmental designers (as they are for medical students, for example), to accommodate sensitivity to the physical environment and foster mindful awareness of nature and space to design with these relationships in mind.

To summarize, there is potential for research at intersections of mindfulness, public health, and the physical environment converging in the areas of (a) strengthening the *MBP-restorative skills intersection*, utilizing the interaction with the physical environment to cultivate attentional efforts for beginners and long-term practitioners alike, and (b) expanding research on the impact of restorative qualities of the physical environment in *specialized settings* that have been already researched (residential, healthcare) and less researched (educational, spiritual, office). These concerns are also implied in the commentaries by Sedlmeier (2023), who calls for attention to the specific contexts, practice sets, and outcomes of diverse MBP “package” deliveries, and Sutton (2023) who notes the importance of the workplace



Fig. 1 Nacadia Therapy Garden Plan. (Source: Courtesy of Ulrik Sidenius, as reproduced in Sidenius et al., 2017b)

settings—such as individual and communal—for mindfulness practices. For example, future studies may investigate, if there is a difference in the mindfulness/attentional effort of people within specialized settings (such as workplace or educational environments) when these possess different spatial qualities, especially restorative qualities.

Embodied Cognition and Environments: Attuning to Spirit and Meaning

Oman's overall argument, which appears as a consistent thread in axes A9, A10, A12, and A13, is that health interventions must be responsive to the diversity of human cultures, experiences, beliefs (including spiritual/religious beliefs), and institutional contexts where they are developed and delivered, which other commentaries also expand upon (Knabb & Vazquez, 2023; Palitsky et al., 2023; Sedlmeier, 2023, Wang, 2024). In design, being sensitive to the diverse range of embodied experiences and meanings associated with physical environments aligns with this orientation toward contextual responsiveness. Oman observes

the necessity to attend to cultural factors (A10) and religious factors (A12), in both mindfulness and public health domains. These two concerns can be traced in the architectural discourse that foregrounds the embodied subjective human experience as we make sense of and give meaning to it.

Recent developments in neuroscience, and the approach of neurophenomenology as proposed in the seminal work of Varela et al. (1992), provide a theoretical basis for understanding the evolutionary richness of embodied human-place relationships. Accordingly, subjective experience is at the core of comprehending the workings of the mind and our interrelations with the *world*; we constantly recreate the world through enaction. In this sense, the distinctions between the body and the space around it are artificial, as our minds and bodies are always in an active encounter with our physical, cultural, and social context (Robinson, 2015). Physical environments carry value for individuals and communities beyond the mere satisfaction of survival needs, as they are domains of meaning-making, situated in temporal and cultural contexts (Johnson, 2015). Provided that the physical environment is produced by, and is a product of



Fig. 2 View of a secluded area for strolling, sitting and gardening in the Nacadia Therapy Garden. (Source: Photograph courtesy of Ulrik Sidenius)

this engagement, then, its qualities should be at the forefront of health and well-being.

The empirical evidence and research provided by neuroscience and cognitive sciences concerning the environment address the importance of relationships between people and places and the multidimensional richness of these interactions (Spence, 2020). Historical buildings that have been meaningful for people across cultures were able to address the multisensory sensitivities of their inhabitants, where the sense of visual, auditory, and haptic systems worked together simultaneously to make sense of the environment. Thus, there is a need to be mindful of the multisensory perception of space, and designing space for sensory congruence, with the understanding that the atmosphere of a space is experienced holistically, not compartmentally.

The deeper meanings given to places through embodied experiences, whether in religious or secular contexts, is also acknowledged within the context of transcendental or contemplative architecture and landscape. Such environments possess the ability to generate emotions and

relational dimensions beyond themselves, offering the awe of the present moment (Bermudez, 2015). They may also facilitate a slowing down and a disruption of automatic pilot. The unifying role of human experience, which may indeed transcend boundaries, cultures, and religions, is evident in extraordinary architectural works that offer such rich and impactful qualities (Fig. 3).

The architect and writer Juhani Pallasmaa, who advocates that architects create places that appeal to all of the senses, described:

The artistic and architectural experience of spirituality, detached from deliberate devotional purposes seems to arise from a nameless and unintentional mental origin, the individual existential experience, which is initiated by a sensitized encounter of the self and the world through the artistic work. This experience arises from the experiential holiness of life itself and a deep existential recognition of one's own being (2015, p. 21).



Fig. 3 Examples of secular and religious buildings designed by Tadao Ando Architect and Associates that utilize qualities of light, landscape, and geometry to evoke contemplative experiential states. Clockwise from top left: Meditation Space Unesco, Paris, France (photo credit Tadao Ando); Benesse House Museum, Nashima, Japan

(photo credit Tadao Ando); Church of the Light, Osaka, Japan (photo credit Mitsuo Matsuoka); Water Temple, Awaji, Japan (photo credit Tadao Ando). (Source: Courtesy of Tadao Ando Architects and Associates, Ando, T. (n.d.). *Projects*, <http://www.tadao-ando.com/>)

Empirical studies on the impact of contemplative spaces on human well-being (Bermudez, 2015; Bermudez et al., 2017; Olszewska et al., 2018; Ouellette et al., 2005) have sought to identify the mechanisms underpinning these human-place interactions. Olszewska et al. (2018) recently studied and identified the physical attributes of contemplative landscapes, identifying the distinct features of landscapes that were characterized as *contemplative*. In a study focusing on the built environment, Bermudez et al. (2017)

measured the influence of exposure to *ordinary architecture* (generic buildings) and *timeless architecture* (contemplative buildings) on the brain activation patterns of their research subjects, finding that those “presented with images of ordinary vs. contemplative buildings, arrived at significantly different phenomenological states with distinct neural correlates that find parallels in the differences between meditative and ordinary mental states” (p. 133). The encounter with contemplative architecture seemed to

reduce the inner dialogue of the participants, enhancing the embodied experience of the present moment. In their recent study, Chen et al. (2022) focused on how the physical space influenced mindfulness practices in a Buddhist monastery in the UK. Findings revealed that in addition to the environmental qualities of “quiet,” “solitude,” and “nature,” practitioners pointed toward “blessings” and the “three jewels” as enhancing their practice within the monastery, showing the impact of religious elements supporting contemplative experience.

Organizations such as the Architecture, Culture and Spirituality Forum (ACSF, 2023) and Academy of Neuroscience for Architecture (ANFA, 2023) promote the understanding and implementation of design that cultivates spiritual and contemplative qualities. ACSF advocates for an understanding of the cultural and spiritual aspects of the built environment that transcend ethnic, racial, and religious boundaries. ANFA aims to expand our understanding of the built environment and design based on advances in neuroscience and cognitive science research.

Regardless of emerging interest and research in this domain, both the focus on multisensory design (Spence, 2020) and the religious and spiritual potential of the physical environment (Bermudez, 2015) remain marginal within design practice. Across the majority of architectural discourse and practice, priority is given to the technical and material dimensions as opposed to the emotional and experiential dimensions (Barrie et al., 2015). Crosbie (2015) suggests that the main reason for the absence of the spiritual/sacred within the architectural profession is its un-quantifiable nature, as opposed to the quantifiable knowledge that the architectural profession and programs can easily rest upon. He calls for increased engagement and discussion regarding the sacred dimension.

To summarize, Oman’s recognition of a need for intercultural, interreligious, and intercontemplative skills can expand toward and embrace the environmental design professions, where multidisciplinary collaboration may inquire into (a) an *embodied multisensory engagement* with the environment as it fosters sense of presence, connection, and meaning, and (b) the rich human experience situated in local religious and cultural contexts, that at the same time helps us *re-connect to our common human existence* that is beyond the physical boundaries. For example, future studies may explore universal as well as culturally specific spatial qualities (such as light, solitude, natural elements) that people perceive as enhancing their multisensory experience and/or providing meaning to their present-moment experience. Study outcomes can then inform environmental designers to create tailored solutions that afford contemplative richness and positive connection, whether in religious or secular contexts.

Inclusivity, Equity, and Environments: Embracing Design-for-All

For Oman, the concern for equity (A9) in public health focuses on racial/ethnic minorities and people with socioeconomic disadvantages within the population, whereas by contrast these populations are underrepresented in mindfulness approaches. In this section, we reflect on concern for equity within the environmental design professions as manifest through the inclusive design movement. A range of inclusive design approaches, including barrier-free design, accessible design, universal design, and design-for-all, seek to ensure disadvantaged populations have equal access to physical environments and experiences. The main objective of universal/inclusive design, since it emerged in the 1960s, was to provide environments, products, systems, and services that could be accessed—independently and without any need of assistance—across different scales ranging from cities, buildings, interiors, products, and interaction design (Mace et al., 1991). This has resulted in a shift from designers viewing people with varying physical abilities as “them” toward viewing everyone within the wide spectrum of abilities and ages which includes all of “us” (Clarkson & Coleman, 2015).

The paradigm of inclusivity was embraced rapidly and integrated across a range of practices and policies, with the establishment of guidelines, case studies (Presier & Ostroff, 2001), standards, and legislation concerning the equitable accessibility of public spaces, transportation, and residential environments. Bendixen and Benkzton (2015) highlight the recent developments of design-for-all as applied in Scandinavia, where the concept has been incorporated within educational institutions, joint projects, non-profit organizations, and governmental policies that prioritized accessibility of the built environment, resulting in increased applicability and expertise at many levels. Fletcher et al. (2015), on the other hand, state that the legislative dimensions of accessibility in the form of codes and regulations in the USA, which was a very positive outcome of the movement in the earlier years, have now narrowed down the applications of accessibility for certain disabilities (physical mobility and visual impairment) for the architectural profession, missing the opportunity to fuse greater inclusivity within the design process.

Over the years, the field needed to bridge the gap between research findings and implementation, so that designers could incorporate relevant data within their design processes amid financial- and time-related constraints (Clarkson & Coleman, 2015). This need led to the formulation of a rich palette of universal design/inclusive design tools and methods, also referred to as *human-centered design tools*. Supporting different phases

of the design process, these methods aimed to increase the collaboration of designers and end-users: moving from *design-for* to *design-with*. Participatory design processes cultivate designer empathy across a wide range of tools (Giacomin, 2014; Martin & Hannington, 2012). These include ethnographic research procedures, empathic design methods, as well as case studies, and evidence-based procedures (Zallio & Clarkson, 2021).

Recently, Lim et al. (2021) highlighted the need for inclusive design research and practice to account for psychosocial inclusivity in addition to physical accessibility and barrier-free design. They have defined psychosocial inclusivity as “the provision via design interventions of equal or equitable opportunities for a better quality of life for as many people as possible, considering both psychological and social factors” (p. 17). Accordingly, social, cognitive, emotional, and value-oriented needs and expectations of diverse users in various contexts should be empirically investigated to inform inclusive design. The expansion of focus calls for the integration of psychosocial issues (already the focus of environmental psychology) to the lens of inclusivity, calling for design education, research, and practice (applications) sensitive to human diversity in a holistic manner. Fletcher et al. (2015) also advocate inclusive design to be considered a powerful dimension of social sustainability. They urge designers to embrace tools, methods, and practices to appropriately respond to the challenges of the present and the future. Likewise, Zallio and Clarkson (2021) suggest an inclusive mindset be adopted by architects, who should go beyond the minimum accessibility requirements posed by regulations to embrace the concepts of “inclusion, diversity, equity, and accessibility” (forming the acronym IDEA) within their design projects. The gap between the services provided in practice and the journey (experience), capabilities (skills), and needs of diverse populations can be closed with the adoption of co-design and participatory tools embedded in design processes: moving from a top-down to a bottom-up approach where users are an integral part of the design process.

To summarize, while the built environment professions still have a long way to go to apply inclusion, diversity, equity, and accessibility (IDEA) concepts to co-create places where all can flourish, there are strong implications of widening the lens of inclusivity that can be integrated into mindfulness and public health domains. These center around, but are not limited to (a) an *inclusive mindset* to embrace physical and psychosocial inclusivity across domains founded on designer education and research, (b) expanding *applications of inclusivity* with multi-sectoral and multi-scale collaboration, and (c) sharing *methods of inclusive processes* (user-centered tools) which utilize co-design practices that can support and cultivate an inclusive process. If we work together in an inclusive way, interdisciplinary collaboration

that synthesizes inclusive methods of engagement between practitioners/researchers across public health, mindfulness, and designer professionals can offer new means of co-creating interventions with diverse stakeholders.

Resilience, Sustainability, and Environments: Interconnectivity of People and Planet

We live on a finite planet, the fate of which is intertwined with our own health, perceptions, and actions. In this section, we reflect on the axes of resilience orientation (A5) and multi-level intervention approaches (A7), which Oman identifies as being necessary if public health and mindfulness interventions are to effectively respond to diverse and interdependent socio-environmental challenges and contexts. A parallel discourse within environmental design and planning engages with these approaches. At the heart of designing for healthy and life-sustaining futures is the awareness that environments, communities, and individuals all depend on each other as part of a dynamic interdependent system. This awareness points toward public health and mindfulness interventions which are attuned to, and nourished by, physical places that support life and its ability to flourish at multiple scales.

Oman concludes that “mindfulness and public health are largely aligned” in their attunement to resilience; so too does the design and management of the environment necessitate attuned responses to the complex environmental challenges and threats of our time such as biodiversity loss and climate change. While technological problem-solving offers some solutions to environmental issues, physical change does not occur in isolation but rather relies on the agency and adaptability of people whose values and behaviors determine environmental policy and actions (or inaction). The expansion of mindfulness discourse into the territory of planetary resilience and environmental awareness signals a shift in how we can relate to the environment, suggesting paths of resilience and sustainability that are grounded in deeply held inner awareness of ourselves and the physical places we co-exist with. Highlighting this interconnectedness, van Gordon et al. noted that “The nature of mindfulness is such that it stimulates the meditation practitioner to not only be aware of the happenings in the body, mind and environment, but to investigate and extract wisdom from the natural and man-made features that they encounter” (2018, p. 1658).

The work of several leading mindfulness researchers, advocates, environmental psychologists, and sustainability scientists is exploring the transformative potential of the synergy of mindfulness and environment at policy and behavioral levels, sometimes referred to as the “inner and outer transformations” of mind–body–heart

awareness (Wamsler et al., 2021; Wamsler et al., 2018). The mission of the recent International Conference on Environmental Mindfulness (ICEM) to “inspire a dialogue on how mindfulness can help address future environmental challenges” reflects this growing area of interdisciplinary research, with topics including “mindfulness and pro-environmental behaviors” and “mindfulness and sustainability” (ICEM, 2023). This discourse considers individual inner/outer transformations, as well as asserting that widespread mindful change can underpin more systemic, collective transformations at the global scale needed to reconnect to our individual and collective values, which support us in addressing planetary macro-scale challenges (Bristow et al., 2022).

Experiences of nature have been linked with increased environmental awareness and values (Pretty et al., 2017); where mindfulness interventions are intentionally situated in nature-based settings, this presents a potential combination of mindful present moment awareness and environmental awareness, both of which can support pro-environmental behavior. The potential to address outer problems through inner awareness as cultivated through interactions with the environment has been observed by environmental design and planning professionals too: As landscape architect Udo Weilacher notes “The question as to whether we can overcome ecological and social crises is primarily a question of human behavior [...] this realization has led to calls for an adequate design language [that can] contribute to heightening our perceptivity” (Weilacher, cited in Porter, 2016, p. 16). As Kabat-Zinn (2013) observed:

All life is fascinating and beautiful when the veil of our routinized thinking lifts, even for a moment [...] flowers and mountains and the sea are such great teachers [because they] reflect your own mind [...] When you observe things through the lens of mindfulness, whether it be during formal meditation practice or in daily living, you invariably begin to appreciate things in a new way because your very perceptions change (p. 219).

The intentional inclusion of mindful perception, resilience, and environmental considerations as a form of public health intervention—where health includes physical, emotional, and environmental health at both individual and collective scales—is well aligned with Oman’s description of “multi-level” interventions. More work is needed to assess the intersection of MBPs and ordinary physical settings of daily life, from the micro scale of a single workplace to the meso scale of a neighborhood, and ultimately macro scale of the whole city or landscape. The analogy of public health interventions targeted at cardiovascular health is useful to illustrate this holistic preventative health approach and relate it to the potentially expanded context of MBPs.

The Heart Foundation—a global charity dedicated to heart health—is known for its preventative public health campaigns to increase physical fitness. They have also invested in research and guidance to target urban design and planning level interventions, encouraging professionals to design cities that enable people to lead active lifestyles, for example by establishing safe streets and green spaces for cycling and walking (Heart Foundation, 2023). This demonstrates how public health interventions like exercise campaigns (or MBPs) need to be supported by compatible physical contexts, as well as the institutional contexts they are operating within. Similarly, Lymeus (2022) calls for mindfulness-based interventions targeting the individual level to address the values regarding larger-scale concerns by re-thinking cities and urban design as a whole. To widen the scope of health benefits for a wide population in the long term, it is critical to integrate mindfulness in the everyday lives of people, considering both the natural *and* the built environment; both specialized meditative settings *and* other functional settings; and both formal practices *and* daily activities (Lymeus, 2022). This is a fruitful foundation for sustainable cities.

In summary, the interdependence of well-being and environment—including the environment’s capacity to support mindful presence and connection to self and world—operate across multiple scales: from the micro (individual spaces and people), meso (communities and the buildings/networks of spaces parks/neighborhoods they share), and the macro scales of whole cities and planetary systems. To expand the development of places, policies, and behaviors that reflect this interdependence, we require (a) further research and practice to link inner awareness (contemplative practices) to outer awareness of person-environment relations, values, and behaviors and (b) broadening the mindfulness/restorative space research and practice to include a wider urban/ neighborhood/ community scale to increase applicability and impact beyond individual restorative spaces as part of wider sustainability agenda. Longitudinal studies that monitor behavior and decision-making among individual decision-makers and wider communities who are engaged in MBPs are needed to verify if mindfulness practices result in actual behavioral and policy change that supports multi-scalar resilience.

Conclusion

We propose that a holistic, interdisciplinary research agenda and practice, encompassing mindfulness, health, *and environment*, offers an expanded scope for realizing the increased multi-scalar resilience that these three domains seek. This commentary has identified several broad ways in which the culturally and psychologically

attuned design of environments can support mindfulness and well-being. Theories from environmental psychology (especially related to attention restoration) and evidence-based design examples suggest that particular environments, including a range of built and natural environment types and qualities, can support the implementation of mindfulness and its public health benefits. The human–environment relationships that can be cultivated through mindful practice offer the potential to extend inner transformation (awareness) to outer transformation (values and actions directed toward the environment), thus contributing to the mutual health of people and the planet. To address this broadened conceptualization of mindfulness and environment, such an interdisciplinary research agenda will need to explore several questions, which we have articulated throughout this discussion.

At this time, the potential of design to provide the qualities that afford safety, restoration, nature connectedness, accessibility, cultural resonance, and spiritual connection, with a sensitivity to human diversity, is found in theory but has room for a much wider implementation. When adopting a global perspective—as Oman and other commentators do—the environmental imperatives and design orientations we have highlighted here remain far from being mainstream. Unfortunately, it would be overstating the current state of affairs to suggest that accessible restorative environments (for example quality urban green spaces) and culturally responsive places (for example buildings that reflect the beliefs and socially determined needs of local populations) are the norm. We only need to look at the attention-depleting sensory overload bombarding most urban dwellers, the ongoing exploitation of nature, or the relentless homogeneity of placeless generic built environments, to see that much more work is needed to create and protect places that support human and planetary flourishing. Integrating insights and approaches from mindfulness, public health, and the environmental design professions offers a path to follow as we pursue this goal.

Acknowledgements The authors would like to thank the anonymous reviewer and Christian U. Krägeloh for their valuable comments on a previous version of the paper. The authors would also like to thank Ulrik Sidenius and Tadao Ando Architects and Associates for granting permission to reproduce images.

Author Contribution Both authors contributed equally to conceptualization, methodology, original manuscript preparation, editing, and revisions.

Funding Open access funding provided by the Scientific and Technological Research Council of Türkiye (TÜBİTAK).

Declarations

Conflict of Interest The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Architecture, Culture, and Spirituality Forum. (2023). *Home*. Retrieved October 04, 2023, from <https://acsforum.org/>
- Academy of Neuroscience for Architecture. (2023). *Home*. Retrieved October, 04, 2023, from <https://anfarch.org/>
- Altay, B. (2023). Creating mindful spaces: Educational practices for interior design. *Journal of Interior Design*, 48(4), 215–222. <https://doi.org/10.1177/10717641231206642>
- Altay, B., & Porter, N. (2021). Educating the mindful design practitioner. *Thinking Skills and Creativity*, 41, 100842. <https://doi.org/10.1016/j.tsc.2021.100842>
- Ando, T. (n.d.). Projects. Retrieved September 29, 2023, from <http://www.tadao-ando.com/>
- Andrahennadi, K. C. (2019). Mindfulness-based design practice (MBPD): A novel learning framework in support of designers within twenty-first-century higher education. *International Journal of Art and Design Education*, 38(4), 887–901. <https://doi.org/10.1111/jade.12272>
- Bermudez, J. (Ed.). (2015). *Transcending architecture: Contemporary views on sacred space*. Catholic University of America Press. <https://doi.org/10.2307/j.ctt130h9f6>
- Bermudez, J., Krizaj, D., Lipschitz, D. L., Buelerd, C. E., Rogowskad, J., Yurgelun-Todd, D., & Nakamura, Y. (2017). Externally-induced meditative states: An exploratory fMRI study of architects' responses to contemplative architecture. *Frontiers of Architectural Research*, 6(2), 123–136. <https://doi.org/10.1016/j.foar.2017.02.002>
- Barrie, T., Bermudez, J., & Tabb, P. J. (2015). Introduction. *Architecture, culture, and spirituality* (1st ed.). <https://doi.org/10.4324/9781315567778>
- Bendixen, K., & Benktzon, M. (2015). Design for all in Scandinavia - A strong concept. *Applied Ergonomics*, 46(B), 248–257. <https://doi.org/10.1016/j.apergo.2013.03.004>
- Bristow, J., Bell, R., & Wamsler, C. (2022). *Reconnection: Meeting the climate crisis inside out*. The Mindfulness Initiative and LUCSUS. Retrieved November 24, 2023. www.themindfulnessinitiative.org/reconnection
- Centre for Health Design. (2023). *About EBD*. Retrieved 02 December, 2023, from <https://www.healthdesign.org/certification-outreach/edac/about-ebd>
- Chen, A., Porter, N., & Tang, Y. (2022). How does Buddhist contemplative space facilitate the practice of mindfulness? *Religions*, 13(5), 437. <https://doi.org/10.3390/rel13050437>
- Clarkson, P. J., & Coleman, R. (2015). History of inclusive design in the UK. *Applied Ergonomics*, 46(B), 235–247. <https://doi.org/10.1016/j.apergo.2013.03.002>
- Christian, C. (2018). Contemplative practices and mindfulness in the interior design studio classroom. *Journal of Interior Design*, 44(1), 29–43. <https://doi.org/10.1111/joid.12134>

- Crosbie, M. J. (2015). The sacred becomes the profane. *Architecture, Culture, and Spirituality*, 1, 59–70. <https://doi.org/10.4324/9781315567778>
- Devlin, A. S. (Ed.). (2018). *Environmental psychology and human well-being: Effects of built and natural settings*. Academic Press. <https://doi.org/10.1016/C2016-0-01435-3>
- Evans, G. (Ed.). (2011). *Environmental stress*. Cambridge University Press.
- Fletcher, V., Bonome-Sims, G., Knecht, B., Ostroff, E., Otitigbe, J., Parente, M., & Safdie, J. (2015). The challenge of inclusive design in the US context. *Applied Ergonomics*, 46(B), 267–273. <https://doi.org/10.1016/j.apergo.2013.03.006>
- Giacomin, J. (2014). What is human-centred design? *The Design Journal*, 17(4), 606–623. <https://doi.org/10.2752/175630614X14056185480186>
- Heart Foundation. (2023). *About*. Retrieved December 01, 2023. <https://www.healthyactivebydesign.com.au/about>
- Herzog, T. R., Maguire, C. P., & Nebelet, M. B. (2003). Assessing the restorative components of environments. *Journal of Environmental Psychology*, 23(2), 159–170. [https://doi.org/10.1016/S0272-4944\(02\)00113-5](https://doi.org/10.1016/S0272-4944(02)00113-5)
- Hyvönen, K., Salonen, K., Paakkolanvaara, J., Väkeväinen, P., & Korpela, K. (2023). Effects of nature-based intervention in the treatment of depression: A multi-center, randomized controlled trial. *Journal of Environmental Psychology*, 85, 101950. <https://doi.org/10.1016/j.jenvp.2022.101950>
- International Conference on Environmental Mindfulness. (2023). *Home*. Retrieved December 02, 2023, from <https://www.environmentalmindfulness.org/>
- International Well Building Institute. (2023). *Home*. Retrieved December 2, 2023, from <https://www.wellcertified.com/>
- Johnson, M. J. (2015). The embodied meaning in architecture. In J. Pallasmaa & S. Robinson (Eds.), *Mind in architecture: Neuroscience, embodiment, and the future of design* (pp. 33–50). The MIT Press. <https://doi.org/10.7551/mitpress/10318.001.0001>
- Kabat-Zinn, J. (2013). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain and illness [ebook edition v3.1]*. Bantam Books.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169–182. [https://doi.org/10.1016/0272-4944\(95\)90001-2](https://doi.org/10.1016/0272-4944(95)90001-2)
- Kaplan, S. (2001). Meditation, restoration, and the management of mental fatigue. *Environment and Behavior*, 33(4), 480–506. <https://doi.org/10.1177/00139160121973106>
- Knabb, J. J., & Vazquez, V. E. (2023). Decentering mindfulness: Toward greater meditative diversity in global public health. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02203-7>
- Lawson, B. (1990). *How designers think: The design process demystified* (2nd ed.). Butterworth-Heinemann. <https://doi.org/10.1016/C2013-0-04512-4>
- Levin, J. (2023). Being in the present moment: Toward an epidemiology of mindfulness. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02179-4>
- Lim, Y., Giacomin, J., & Nickpour, F. (2021). What is psychosocially inclusive design? A definition with constructs. *The Design Journal*, 24(1), 5–28. <https://doi.org/10.1080/14606925.2020.1849964>
- Lymeus, F. (2022). The city mindful: Commentary on “Mindful engagement, psychological restoration, and connection with nature in constrained nature experiences.” *Landscape and Urban Planning*, 222, 104403. <https://doi.org/10.1016/j.landurbplan.2022.104403>
- Lymeus, F., Lindberg, P., & Hartig, T. (2019). A natural meditation setting improves compliance with mindfulness training. *Journal of Environmental Psychology*, 64, 98–106. <https://doi.org/10.1016/j.jenvp.2019.05.008>
- Lymeus, F., Lundgren, T., & Hartig, T. (2017). Attentional effort of beginning mindfulness training is offset with practice directed toward images of natural scenery. *Environment and Behavior*, 49, 536–559. <https://doi.org/10.1177/0013916516657390>
- Lymeus, F., White, M. P., Lindberg, P., & Hartig, T. (2022). Restoration skills training in a natural setting compared to conventional mindfulness training: Sustained advantages at a 6-month follow-up. *Frontiers in Psychology*, 13, 763650. <https://doi.org/10.3389/fpsyg.2022.763650>
- Macaulay, R., Lee, K., Johnson, K., & Williams, K. (2022). Mindful engagement, psychological restoration, and connection with nature in constrained nature experiences. *Landscape and Urban Planning*, 217, 104263. <https://doi.org/10.1016/j.landurbplan.2021.104263>
- Mace, R. L., Hardie, G. J., & Place, J. P. (1991). *Accessible environments: Toward universal design*. Centre for Universal Design.
- Martin, B., & Hannington, B. (2012). *Universal methods of design*. Rockport.
- Ohly, H., White, M. P., Wheeler, B. W., Bethel, A., Ukoumunne, O. C., Nikolaou, V., & Garside, R. (2016). Attention Restoration Theory: A systematic review of the attention restoration potential of exposure to natural environments. *Journal of Toxicology and Environmental Health*, 19(7), 305–343. <https://doi.org/10.1080/10937404.2016.1196155>
- Olszewska, A. A., Marquez, P. F., Ryan, R. L., & Barbosa, F. (2018). What makes a landscape contemplative? *Environment and Planning B: Urban Analytics and City Science*, 45(1), 7–25. <https://doi.org/10.1177/0265813516660716>
- Oman, D. (2023). Mindfulness for global public health: Critical analysis and agenda. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02089-5>
- Ouellette, P., Kaplan, R., & Kaplan, S. (2005). The monastery as a restorative environment. *Journal of Environmental Psychology*, 25(2), 175–188. <https://doi.org/10.1016/j.jenvp.2005.06.001>
- Palitsky, R., Lyons, M. J., & Kaplan, D. M. (2023). Beyond hub-and-spoke adaptation: Religiously and culturally responsive implementation of mindfulness for global public health. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02276-4>
- Pallasmaa, J. (2015). Light, silence and spirituality in architecture and art. In J. Bermudez (Ed.), *Transcending architecture: Contemporary views on sacred space* (pp. 19–32). Catholic University of America Press. <https://doi.org/10.2307/j.ctt130h9f6.7>
- Porter, N. (2016). *Landscape and branding: The promotion and production of place*. Routledge.
- Presler, W. F. E., & Ostroff, E. (2001). *Universal design handbook*. McGraw-Hill Robinson.
- Pretty, J., Rogerson, M., & Barton, J. (2017). Green mind theory: How brain-body-behaviour links into natural and social environments for healthy habits. *International Journal of Environmental Research and Public Health*, 14(7), 706. <https://doi.org/10.3390/ijerph14070706>
- Robinson, S. (2015). Nested bodies. In J. Pallasmaa & S. Robinson (Eds.), *Mind in architecture: Neuroscience, embodiment, and the future of design* (pp. 137–160). The MIT Press. <https://doi.org/10.7551/mitpress/10318.001.0001>
- Salonen, K., Hyvönen, K., Paakkolanvaara, J.-V., & Korpela, K. (2022). Flow with nature treatment for depression: Participants’ experiences. *Frontiers in Psychology*, 12, 768372. <https://doi.org/10.3389/fpsyg.2021.768372>
- Sedlmeier, P. (2023). What mindfulness, and for whom? And why might it work? *Mindfulness*. <https://doi.org/10.1007/s12671-023-02218-0>
- Sidenius, U., Stigsdotter, U. K., Poulsen, D. V., & Bondas, T. (2017a). “I look at my own forest and fields in a different way”: The lived experience of nature-based therapy in a therapy garden when suffering from stress-related illness. *International*

- Journal of Qualitative Studies on Health and Well-Being*, 12(1), 132470. <https://doi.org/10.1080/17482631.2017.1324700>
- Sidenius, U., Nyed, P. K., Lygum, V. L., & Stigsdotter, U. (2017b). A diagnostic post-occupancy evaluation of the Nacadia® Therapy Garden. *International Journal of Environmental Research and Public Health*, 14(8), 882. <https://doi.org/10.3390/ijerph14080882>
- Stigsdotter, U. K. (2013). Nacadia healing forest garden, Hoersholm Arboretum, Copenhagen, Denmark. In C. C. Marcus & N. A. Sachs (Eds.), *Therapeutic landscapes: An evidence-based approach to designing healing gardens and restorative outdoor spaces* (pp. 198–205). John Wiley & Sons Ltd.
- Spence, C. (2020). Senses of place: Architectural design for the multisensory mind. *Cognitive Research: Principles and Implications*, 5, 46. <https://doi.org/10.1186/s41235-020-00243-4>
- Sutton, A. (2023). Cultivating global health: Exploring mindfulness through an organisational psychology lens. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02228-y>
- Teasdale, J., Williams, M., & Segal, Z. (2014). *The mindful way workbook: An 8-week program to free yourself from depression and emotional distress*. The Guilford Press.
- Ulrich, R. S. (1991). Effects of interior design on wellness: Theory and recent scientific research. *Journal of Health Care Interior Design*, 3(1), 97–109.
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11(3), 201–230. [https://doi.org/10.1016/S0272-4944\(05\)80184-7](https://doi.org/10.1016/S0272-4944(05)80184-7)
- Van Gordon, W., Shonin, E., & Richardson, M. (2018). Mindfulness and nature. *Mindfulness*, 9(5), 1655–1658. <https://doi.org/10.1007/s12671-018-0883-6>
- Varela, F., Thompson, E., & Rosch, E. (1992). *The embodied mind: Cognitive science and human experience*. MIT Press. <https://doi.org/10.7551/mitpress/6730.001.0001>
- Von Lindern, E., Lymeus, F., & Hartig, T. (2022). The restorative environment and salutogenesis: Complementary concepts revisited. In M. B. Mittelmark, G. F. Bauer, L. Vaandrager, J. M. Pelikan, S. Sagy, M. Eriksson, B. Lindström, & C. Meier Magistretti (Eds.), *The handbook of salutogenesis* (pp. 371–388). Springer. https://doi.org/10.1007/978-3-030-79515-3_35
- Wang, D. C. (2024). Christian mindfulness and global public health: A commentary and agenda. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02290-6>
- Wamsler, C., Brossmann, J., Hendersson, H., Kristjansdottir, R., McDonald, C., & Scarampi, P. (2018). Mindfulness in sustainability science, practice, and teaching. *Sustainability Science*, 13(10), 143–162. <https://doi.org/10.1007/s11625-017-0428-2>
- Wamsler, C., Osberg, G., Osika, W., Hendersson, H., & Mundaca, L. (2021). Linking internal and external transformation for sustainability and climate action: Towards a new research and policy agenda. *Global Environmental Change*, 71, 102373. <https://doi.org/10.1016/j.gloenvcha.2021.102373>
- Zallio, M., & Clarkson, P. J. (2021). Inclusion, diversity, equity and accessibility in the built environment: A study of architectural design practice. *Building and Environment*, 206, 1–11. <https://doi.org/10.1016/j.buildenv.2021.108352>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.