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Geographies of uncertainty

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Abstract

The question of uncertainty has generated substantial critical engagements across the social sciences. While much of this literature falls within the domains of anthropology, science studies, and sociology, this short introductory paper highlights how geographical scholarship can also enrich emerging transdisciplinary debates on uncertainty. Specifically, we discuss how geographers engage with uncertainties produced through and reconfigured by some of the most formidable issues of our contemporary moment, including neoliberal transformation, disease and illness, resource conflict, global climate change, and ongoing struggles around knowledge, power, and justice. In conversation with debates in cognate fields, this special issue brings together contributions that grapple with uncertainty through key geographic concepts such as scale, power, spatiality, place, and human-environment relations. This work extends scholarly understanding of how uncertainty arises, is stabilized, and also how people navigate, experience, challenge, and rationalize uncertainty in everyday life. In doing so, we signal the immense potential offered by emerging intersections between human geography and broader critical social science interventions on the question of uncertainty.

1. Introduction: What is (geographical about) uncertainty?

Uncertainty – and its cognates, indeterminacy, liminality, obscurity, confusion, and misperception – increasingly pervade social and environmental problems. They are, for instance, endemic features of neoliberal transformation, health-environment interactions, food (in)security, natural disasters, resource conflict, and global climate change. While the question of uncertainty is not new, it increasingly captivates popular imagination in the context of these highly dynamic, contested, and intractable problems, thereby catalyzing academic interest across the social sciences. Yet despite the pervasiveness of uncertainty in daily life and forms of academic inquiry, few of the contributions associated with this transdisciplinary literature are geographical. As a consequence, this special issue demonstrates new ways that geographers can enrich work in this field, while also highlighting the potential of the concept to reshape approaches to topics, themes, and foci that the discipline actively pioneers.

The articles in this special issue collectively respond to two trends that have historically sidelined the influence of critical human geographic scholarship in transdisciplinary debates about uncertainty. First, while the problem of uncertainty has received substantial attention in academic work across the fields of science and technology studies (STS), anthropology, sociology, and development studies, texts that explore uncertainty through a critical and explicit engagement with geographical concepts are relatively few and far between (we discuss some recent and promising exceptions below). Second, within the discipline of geography itself, the question of uncertainty has largely been interrogated by quantitative and spatial perspectives that have given rise to various taxonomies of incertitude (Kwan and Schwaben, 2018; Kwan, 2012; Griffith, 2018). Fewer geographers, however, use qualitative and ethnographic methodologies to explore how the limits of knowledge become spatially generative, and/or operate as a direct force shaping social life. This is surprising given that the question of uncertainty is increasingly intertwined with contexts and problems that human geographers have long engaged, such as globalization, disease and illness, migration, and ongoing struggles around knowledge, power, and justice. Furthermore, the multiple challenges and/or opportunities created by uncertainties in such contexts arise from and often rework central preoccupations in the subdiscipline of critical human geography; namely, socio-spatial and human-environmental relationships. Approaches from human geographers could therefore help enrich existing work through their perspectives on scale, power, spatiality, place, and human-environment relations.

With all of this in mind, this special issue offers a timely reflection on
geographies of uncertainty and uncertain geographies. We bring together papers that were presented at the 2018 annual meeting of the American Association of Geographers as part of two sessions organized around the question of uncertainty. Our contributors engage with a wide spectrum of qualitative methodologies and empirical case studies in order to examine how uncertainty shapes places and landscapes, social relations, human health, and/or human-environment interactions. While these articles grapple with diffuse subjects, including banana disease, wolf management, pest eradication programs, and human health (HIV, CKDu, and silicosis), taken together they clearly articulate several key themes for future geographic scholarship.

First, we explore how uncertainty is often produced through, and temporarily stabilized by, key geographic axes such as time, space, scale, and regimes of environmental governance. Attending to the ways that uncertainty is experienced as a spatiotemporal condition, and how it frequently compounds across scales of knowledge production, enables the special issue’s contributors to demonstrate how forms of incertitude work through geographic relationships. Crucially, this work takes us beyond established approaches that tend to engage with geography only in so far as it helps situate the production of uncertainty within broader social, cultural and political-economic contexts.

As part of this discussion, we also contribute to recent moves both within and beyond the discipline that theorize experiences of uncertainty from the spatial margins. Beginning from what Claire Herrick (2017) dubs as “non-archetypal spaces of expertise” the papers assembled here reveal other knowledges and practices that teach us how to live with, and in some instances, to make a living from, experiences of uncertainty. In particular, our contributors are in dialogue with wider debates which suggest that responding to uncertainties often requires combining different styles of knowledge. As Scoones (2019a, 29) concludes, bringing together “formal and informal, accredited and lay knowledge, and experiential and conceptual understandings… are central to addressing uncertainties in context through culturally embedded, experiential [forms of] learning” (also see: Shattuck, 2020).

A second intervention of the special issue examines how the production and productiveness of uncertainty can generate geographical outcomes and socio-ecological possibilities. A key point here is that while uncertainty can restructure social and ecological relationships, it does so in highly differentiated ways, often with unanticipated effects. As a consequence, our contributors demonstrate how uncertainty can reinforce exiting fault lines of inequality at the same time that it might generate new forms of social, spatial, and ecological difference.

Third, this collection of articles focuses on how uncertainty is reconfigured through human-non-human dialectics. Drawing on a rich tradition of scholarship within the discipline of geography, our contributors grapple with what Robbins (2012, 234) describes as “the stubbornness and intractability of certain properties of non-human things” such as the fugitive chemistry of suspected toxin(s), unstable viral loads, materially ambiguous and uncooperative agricultural pests, and illegible wildlife. These complex human-non-human interactions pose important challenges to western scientific and regulatory traditions with “huge implications for the practice of science, management and policy” (Scoones, 2019a, 5). Indeed, the frequent failure to classify, record, and regulate unruily human-non-human dynamics opens up possibilities to engage with more experiential forms of learning, diverse knowledges, and democratic responses to the question of uncertainty. In short, these papers speak to Ian Scoones’ (2019b) call to revolutionize “methodologies for science and policy that take uncertainties seriously” by exploring engagements with “experimentalism, citizen participation, transformative action and ‘post-normal’ science.”

Fourth, our contributors raise critical questions about the politics of uncertainty and in particular, how it indexes new forms of account-ability, governance, and regulation. On the one hand, several articles demonstrate how uncertainty is strategically deployed in ways that individuate responsibility for environmental risk. In particular these studies demonstrate how uncertainty is often weaponized to reproduce both the imperceptibility of links between health and environment and the unaccountability of the structural forces that produce them. On the other hand, the papers in this special issue explore the potential of embracing uncertainty as a pathway to open “up a more rigorous, robust, transparent – and democratically accountable – environmental politics” (Stirling, 2018, 120). In sum, the existence of uncertainty is generative of politics and possibilities that can be mobilized for very different political (and geographical) ends.

More broadly, in the context of Covid-19, our intervention comes at a moment of heightened, albeit highly differentiated, experiences of uncertainty and risk. Enduring uncertainties about disease prevalence, testing, spread, and treatment have intensified uneven life opportunities and unjust exclusions, while also reconfiguring patterns of mobility, care, and social reproduction (Neely and Lopez, 2020; Dattani, 2020; Hannah et al., 2020). This crisis has also heralded new forms of intervention, regulation, and governance that are unfolding as this special issue goes to press. Many of the contributions included in this collection speak to similar themes and demonstrate the entanglements of uncertainty and geography in our daily lives.

2. Taking stock: missed opportunities and multiple lineages

In reviewing the broader literature associated with this special issue, we were struck by the marginal position human geography occupies within scholarship on uncertainty in the critical social sciences. This is not to say that human geographers have not recently taken up many of the substantive themes that are of interest in transdisciplinary debates. Indeed, engagements with experiences of liminality, protracted uncertainty and indeterminacy within the subdiscipline have become increasingly wide-ranging in their ambit, investigating questions on migration and refugee resettlement (Loyd, Ehrkamp, and Secor, 2018; Mounitz et al., 2002), development (Chung, 2017, 2020), climate futures and the Anthropocene (Nightingale, 2018), neoliberalism (Anderson et al., 2020), identity and selfhood (March, 2020), and humanitarism (Newhouse, 2017).

“Uncertainty” also appears as a key term in various geographic handbooks and encyclopedias (Brown and Damery, 2009; Stirling, 2018). Within these volumes, scholars argue for greater analytical precision in approaches to uncertainty, differentiating it conceptually from risk, ambiguity, and ignorance (Stirling, 2003; 2018). Other authors reflect more broadly on how uncertainty poses “[1] philosophical challenges [for the discipline] regarding the nature, origins, and value of knowledge, [2] ethical challenges regarding acceptable levels of risk, and [3] political challenges concerning how to act and who has the mandate to decide” (Brown and Damery, 2009, 90). Cutting across all of these contributions, is the promise of geographical approaches to shed light on how these multidimensional challenges vary across space, time, and scale, and how they mediate place-specific and human-environment relations and practices.

However, only a handful of existing contributions within geography explicitly reference transdisciplinary debates on uncertainty. As has been argued elsewhere, and for other topics, “at the most practical of levels, this means that this rich corpus of highly prescient geographical writing rarely appears in keyword database searches” (Herrick, 2016, 672). More broadly, we argue that the relative invisibility of these promising geographic contributions relates to our failure “to develop the
same kind of critical conceptual mass’ that has allowed scholars in science and technology studies (STS), anthropology, sociology and development studies to direct conversations on the production, circulation, and lived experience of uncertainty.

To date, scholars of STS and histories of science, medicine and environment occupy among the most well-cited and influential niches in the literature on uncertainty. For more than two decades, this work has taken pains to: (a) re-embark uncertainty in material as well as social contexts of knowledge practice (Langston, 2010; Murphy, 2004; Roberts and Langston, 2008; Hecht, 2009; Jasanoﬀ, 2004), (b) disrupt stable and binary distinctions between certainty and uncertainty as categories of knowledge (Proctor and Schiebinger, 2008; McGoe, 2012), and (c) examine how uncertainty is reconfigured by struggles over deﬁnition, legitimacy, and responsibility (Brown, Morello-Frosch, and Zavestoski, 2011; Dunit, 2006; Michaels, 2008; Oreskes and Conway, 2010; Zavestoski et al., 2004).

A central and enduring line of investigation turns on how ‘unknowing, ignorance, and imperceptions [about social and environmental problems] are not just accidentally but purposefully generated in the history of knowledge practice’ (Murphy, 2006, 9, emphasis added). This collection of work investigates how uncertainty is often manipulated or manufactured by industry or interest groups with the aim of displacing responsibility and fending off regulation (see Langston, 2010; Michaels, 2008; Oreskes and Conway, 2010; Proctor and Schiebinger, 2008). As McGoe (2012: 4) explains, this well-established body of literature ‘explores how different forms of strategic ignorance and social unknowing…both maintain and disrupt social and political orders, allowing both governors and the governed to deny awareness of things it is not in their interest to acknowledge.’

Work in these disciplines also documents how scientiﬁc uncertainty is strategically marshalled and renegotiated by social movements that organize in response to toxic exposures and environmental crises. This line of analysis has been established in work on medically contested illnesses such as Multiple Chemical Sensitivity, Gulf War Syndrome, and Chronic Fatigue Syndrome, where patient activism and struggles for diagnosis are often grounded in experiences of being denied healthcare, insurance claims, and/or social legitimacy as sufferers. Zavestoski et al.’s (2004; 161) research into Gulf War Syndrome for instance, has argued that these experiences of exclusion often give rise to new collective subjectivities and illness groups which contest ‘what they see as…unresponsive medical [legal, and bureaucratic] system[s]’ (also see Dumit, 2005; 2006; Brown, Morello-Frosch, and Zavestoski, 2011). As Senanayake and King (2019) argue, the intention of this work is to decentralize and potentially democratize knowledge production in response to uncertainty, challenging what counts as risk or harm and who gets to decide the terms and stakes involved.

The allied focus on situated knowledge and regimes of imperceptibility in feminist science studies represents another compelling cluster of scholarship on the question of uncertainty. This includes work that foregrounds the indeterminacy and partiality of knowledge claims that ‘put[s] ambiguity to critical use… through demonstrating how social categories such as woman or man, black or white, straight or queer as well as concepts such as identity and selfhood need not be ﬁxed in order to inform scholarly inquiry of structural and unstructured dynamics of power’ (Hayes-Conroy and Hayes-Conroy 2008, 469; also see: Sedgwick 2008). For example, a recent review article by Loren March (2020) provides a route into the affective and biopolitical implications of living through the renegotiating experiences of disorientation, performativity and embodiment among trans and queer folks who do not conform to the dominant grids available for categorizing bodies. By destabilizing binary identity categories, this work documents how illegibility and in-betweenness are experienced and produced through space. In dialogue with this work, other scholars investigate how uncertainty generates new forms of social difference and subjectivity that reinforce patterns of vulnerability (Auyero and Swistun, 2009; Chung, 2020). Together this work encourages us to think more deeply about uncertainty as a lived and spatiotemporal condition and prompts us to engage with the disorienting and sometimes potentially deadly consequences of being in-between.

Similar debates around the question of uncertainty animate scholars in critical development studies and anthropology, ﬁnding concrete expression in several anthologies and special issues (Samimian-Darash and Rabinow, 2015; Cooper and Pratten, 2014). Much of this scholarship grapples with how uncertainty articulates with narrow, modernist views of progress, development, and technocratic risk management (Scoones, 2019a; Scott, 1998; Ferguson, 1994). This theme is taken up by Paprocki (2019), who investigates how donors and development agencies translate uncertainty about climate change into, narrowly deﬁned, normative visions of development in coastal Bangladesh. These “anticipatory development futures” elevate commercial shrimp aquaculture and the expansion of an urban-based, industrial economy as preferred adaptation strategies in the face of uncertainty, despite signiﬁcant evidence that these adaptation regimes result in environmental degradation, agrarian dispossession and ‘development-induced migrations.’ As Paprocki (2019: 307) argues, these forms of anticipatory governance entail the end of rural livelihoods in the delta, replacing them with a highly stylized (and age old) vision of development where the rural population transitions into an industrial labour force.” This work thus brings debates about uncertainty, governance and accountability into sharp relief, demonstrating how uncertain ecological crises can be claimed and mobilized by donors and development agencies to justify interventions that continue to displace agrarian lives and livelihoods.

This concern is also taken in a different direction by a recent working paper by Scoones (2019a, 5) that draws on uncertainty to challenge “linear, hierarchical, modernist vision of progress… and technocratic managerialism.” By theorizing uncertainty from the margins, he asks: “What more can we learn from alternative (including non-Western) cultures of uncertainty that construct the world in different ways, through different histories, social imaginaries, traditions of thinking, and everyday practices?” (2019, 10; also see: Leach et al., 1999; Scoones, 1994). In doing so, he suggests that pastoralists in Sardinia, Tibet, and Northern Kenya have situated knowledge and experiences of living in limbo that could help upend conventional modes of development, progress, and risk management, and in turn create space for imagining more socially just and ecological sound futures (also see: Street, 2011; 2014; Krali and Schareika, 2010; Amin, 2013; Samimian-Darash and Rabinow, 2015).

While this transdisciplinary literature is vibrant and compelling, it tends to treat geography as context, situating uncertainty within broader ﬁelds of social relations, cultural practices, and political-economic systems. The purpose of this special issue is not to deny the signiﬁcance of these interventions, but instead to explore how key geographical concepts such as scale, spatiality, place, and human-environment relations can deepen and enrich transdisciplinary conversations on the question of uncertainty. We argue that the relative silence of geographers in these debates is a missed opportunity for the discipline, especially given our scholarship on related themes as well as a long history of critical approaches to many of the topics that are at the heart of this literature. Together, this signals the potential for geographical contributions to transdisciplinary debates. We now turn to a discussion of cross-cutting themes in this special issue, to help make some of these contributions more explicit.

3. Towards a geography of uncertainty

In organizing this special issue, we collected a diverse set of papers that, while in active dialogue with innovations in other disciplines, remain intent on documenting how experiences of uncertainty, insecurity, risk, indeterminacy, and illegibility are inherently geographical. Each of the articles in this special issue make original contributions on their own; however, when taken together they collectively address four
core themes for a geography of uncertainty.

First, the contributions illustrate how uncertainty is temporarily stabilized across key geographic axes such as time, space, scale, and regimes of environmental governance. This theme helps demonstrate how uncertainty can be spatially fixed at key moments, either due to necessity, strategy, or through institutional action. Reflecting this concern, Arielle Hesse’s paper examines attempts to regulate respirable crystalline silica, which is carcinogenic dust that is generated through hydraulic fracturing. The expansion of natural gas extraction in the United States has introduced new forms of risk for workers and competing understandings of how to regulate silica exposure. The article is an excellent case study of how the industry attempts to construct illegible geographies in efforts to fend off regulation. By documenting the spatial and temporal flexibility of the worksite, Hesse demonstrates how geography is strategically enrolled to position the hydraulic fracking industry as unknowable and thus, un-governable. In doing so, she demonstrates how the variable spatial and temporal configuration of the industry is used to stabilize uncertainty about particular health risks and outcomes for workers.

While uncertainty can persist and accumulate through spatial relationships, several of the articles also wrestle with how uncertainty comes to be functional or rational at some scales yet is counterproductive at others. As one example, Nari Senanayake examines local attempts to neutralize biomedical uncertainty about Chronic Kidney Disease of Unknown Etiology or CKDu, in Sri Lanka’s dry zone. Given resource constraints and generic treatment regimes, Senanayake argues that the disease that is most frequently enacted through clinical encounters is actually an undifferentiated form of kidney disease that envelopes both regular and mysterious forms of illness (CKD/CKDu). While the absence of diagnostic closure in kidney disease clinics enables important improvisations in the practice of care, it also inadvertently stabilizes uncertainty about actual disease burden at higher scales of analysis. Specifically, she demonstrates how uncertainties about disease states compound across scales of knowledge production and how this then frustrates attempts to map the prevalence of CKDu at regional or national levels.

In a related vein, Jeff Martin details the challenges for wolf management in the U.S. West, documenting how government agencies strategically harness uncertainty to navigate funding cuts and long-standing anti-federal and anti-regulatory sentiment. In a fascinating extension of STS scholarship, Martin explores how illegibility about wildlife populations can be understood as logical in certain domains of bureaucratic management even as it produces new uncertainties and socio-ecological dilemmas at other spatial and temporal scales. On the one hand, a hesitancy to share information on wolf populations can protect mid-level bureaucrats from external political pressures to delist the species from the Endangered Species Act. On the other hand, Martin asserts that illegibility “from above” undermines agents’ ability to effectively intervene around their charges and guarantee wolf conservation over the long durée. Similar to Hesse’s discussion of how the production of uncertainty shapes silica regulation, Martin asserts the production of uncertain data can allow state agencies to displace responsibilities for environmental protection in space and time.

A second theme reveals the productivity or productiveness of uncertainty and how it can be generative of geographical outcomes and socio-ecological possibilities. Papers by Cavallo (2020), Martin (2019), and Senanayake (2019) all document pragmatic, experimental, and improvised practices of survival in contexts of uncertainty, institutional instability, and resource scarcity. For example, farmers in Uganda, mid-level public administrators in the American West, and doctors in the dry zone of Sri Lanka frequently engage in pragmatic strategies to maximize pathways for action in response to multiple and compounding uncertainties.

Farmer experimentation in the face of uncertainty about a deadly plant disease (BXW) is a focus for Sara Cavallo, where improvised knowledge networks partially realign relations of expertise. Specifically, she demonstrates how strategic experimental networks between farmers and scientists utilize a hybrid set of practices that remain rooted in local cultural understandings and social networks. Indeed, Cavallo shows how farmers negotiate differing claims to certainty regarding the disease through a range of tactics that do not fully align with theories of the environmental subject as an extension of state logic. Instead, compounding uncertainties allow farmers to make claims on the state and re-envision agricultural systems in ways that accommodate greater experimentalism, particularly in the face of uncertain plant health risks. Discussion of uncertainty as a strategic resource is also evident in Martin’s analysis of controversial wildlife management in the American West. This paper documents how implicit and pragmatic choices around day-to-day practices and different technologies allow agents to navigate ecological complexity and multiple use mandates.

The production of contingent geographies of care in the wake of Sri Lanka’s kidney disease epidemic is the basis of Senanayake’s paper, which documents how local attempts to manage biomedical uncertainty about disease are socially and spatially generative. Rather than attempting to achieve diagnostic closure in cases of mystery kidney disease, many local clinicians pragmatically suspend diagnosis and instead routinely treat disease-complexes, including different combinations of kidney disease, hypertension, diabetes and cholesterol giving rise to more holistic, contextualized and responsive ecologies of care. More broadly, this work demonstrates how geographic, as opposed to diagnostic, distinctions increasingly structure access to care and state resources. In doing so, she reveals how the island’s kidney disease epidemic has cemented new forms of socio-spatial difference in the dry zone while simultaneously reproducing previously established geographical patterns of neglect.

In an excellent example of how uncertainty about chemical harms generates socio-ecological possibilities, Annie Shattuck explores how the expansion of pesticide use within Northern Laos reconfigures small-scale farming livelihoods within an increasingly globalized agricultural economy. Safe use education dominates this setting, which entails information on safe handling practices, personal protective equipment, and familiarity with the toxicity of pesticides. Yet in grounding this form of knowledge translation with local livelihood practices, the article effectively demonstrates how safe use education elides contextual political economies and hybrid practices that result in lived experiences of uncertainty. This leads Shattuck to conclude that “smallholder farmers are not operating from a complete deficit of knowledge. Rather their knowledge of toxicity and risk is partial, situated in a particular context, laced with uncertainty and inequality, and often gained from embodied experience.” The article thereby offers us a conceptual route through which to consider the entanglements between situated knowledges of risk and socio-ecological possibilities.

A final critical point that emerges from these papers is that while uncertainty can restructure social and ecological relationships, it often does so in highly uneven ways. Indeed, to a large extent, all of the papers in this special issue are concerned with how uncertainty is differentially experienced and embedded in multiple, interlinked struggles that constitute daily life (such as poverty and political marginalization) as well as, individual experiences of resource scarcity, health, and/or disease. Along those lines, Brian King’s article details the ongoing uncertainties with HIV in rural South Africa even within a setting that has drastically scaled-up the provision of care. The widespread provision of anti-retroviral therapy in the Global South has led public health institutions to identify HIV as a chronic condition; however, there remain a wider set of related uncertainties that include ongoing stigma, food insecurities, and unequal bodily responses to treatment. King concludes that given these dynamics, HIV uncertainty and certainty simultaneously co-exist and are co-produced, while remaining materially uneven for those managing their health. Likewise, Cavallo (2020) and Shattuck (2019), illustrate how different forms of government intervention in response to uncertainties about plant disease management and pesticide use can reproduce patterns of socio-spatial inequality, normalizing risk and harm for some bodies and not others. As a
consequence, our contributors demonstrate how uncertainty is frequently enrolled in the production of social, spatial, and ecological difference.

Third, the contributions demonstrate how uncertainty is produced, transformed, and negotiated through a key focus of geographic inquiry: the interactions between human and non-human agents. In collecting these articles, it was not our intention to select case studies that dealt specifically with the non-human. But in reading these contributions together, we are struck that all authors deal in some meaningful way with non-human actors. Whether it is a pathogen or virus, banana, wolf, chemical toxin, or an invasive insect population, all of the articles engage with the ways that the non-human generates uncertainties, and in turn poses important challenges to western scientific and regulatory traditions.

Martin and Sedell for instance, address how dynamic and moving species, either wolves or invasive insects respectively, confound attempts to measure, surveil, and manage. And Hesse and Shattuck emphasize how chemical exposure cannot easily be fixed in space and time, as the pressures from broader political and economic forces, including corporations that want to mitigate their exposure to lawsuit and damages, draw upon uncertainty and personal responsibility to deflect culpability in undermining human and environmental health.

In considering how uncertainty is refracted by human and non-human interactions, there are a few points worth emphasizing. First, Western traditions of bureaucratic rationality, scientific management, and state power all require practices of containment. Whether it is the containment of invasive pests within a particular agricultural region, wolves in a conservation zone, or an infectious disease within an individual body, scientific and bureaucratic management requires that the object of concern to be contained in space and time. The fact that these entities resist attempts at containment and measurement mean they are active participants in the production of uncertainty.

Perhaps most evident of this point is Jennifer Sedell’s paper, which convincingly demonstrates that in terms of invasive pests and agricultural production in California, uncertainty about insect presence/absence cannot be eradicated. As one of her informants explains, the absence of insects in the traps does not prove that they have been eradicated since it is impossible for existing measurement devices to observe the status of pest populations at sub-detectable or low levels. As Sedell notes, the implications for the agricultural industry are significant and political responses are required to restore ‘pest-free’ status for the trade of many agricultural goods.

This theme also takes center stage in Martin’s contribution. Focusing on how and why government agents routinely collect less and/or less precise data about the wildlife under their charge, Martin complicates traditional assumptions of bureaucratic rationality and state power. He skillfully demonstrates how, in the context of ecological complexity, logistical limitations and socio-political conflict, state agents engage in practices of obfuscation to manage risks and exonerate themselves from blame. In dialogue with McGee, 228 (2007; 2012);), Martin demonstrates how this apparent dysfunction is not a breakdown of bureaucratic rationality but rather is “indicative of a rational strategy for managing antithetical demands” in itself.” Instead of precipitating more experimental and adaptive management approaches, Martin demonstrates how the frequent failure to record and manage unruly non-human dynamics can end up reproducing forms of bureaucratic rationality—even when uncertainties are central to managing socio-ecologically complex systems. In doing so, he draws our attention to how “pathogens, for instance, can confuse experimental results without democratic politics, can end up similar to earlier [technocratic] expert modes— even when uncertainties are recognized” (Scones 2019a, 28).

Finally, these papers raise critical questions about the politics of uncertainty and, in particular, how it indexes new forms of accountability, governance, and regulation. Together the special issue invites geographers to grapple with how uncertainty often generates politically opposing ways of problematizing and intervening in human-environment and socio-spatial relationships. For instance, in this collection, several articles demonstrate how materializing health-environment interactions as uncertain have become powerful strategies for affirming ambiguity about toxic and pathogenic exposures, and ultimately, of fending off stricter government regulation (also see: Murphy, 2006). Shattuck (2019) examines farmers’ knowledge of pesticide risk in Northern Laos in the wake of individually focused safe use messaging and enduring uncertainties about chemical harms. By documenting how situated experiences of toxicity articulate with safe use models, she demonstrates that local typologies of safety and harm continue to blame poor, ‘risky’ people for pesticide-related health impacts “instead of the socio-economic situations that require them to take risks” in the first place. Partial knowledge about the impacts of—and responsibility for—chemical exposures in this case, is marshalled to reinforce and legitimate individually based risk management. In the context of rural poverty, uneven access to health care and local inequalities, this approach renders invisible the myriad ways that farmers’ decision making is refracted by other risks, principally the risks of being poor and rural.

The tendency to reinforce individual responsibilities for exposure in the face of uncertainties about occupational health hazards is also a focus for Hesse (2019), where, as argued above, the fossil fuel industry strategically conceptualizes the geographies of hydraulic fracturing as flexible, variable, and unknowable in order to contest government regulation of toxic silica exposures. Specifically, this article reveals how the processes of rulemaking as well as the variable spatial and temporal configuration of the fracking industry helps decentralize and individualize responsibility for exposure. Similarly, King (2019) asserts that the ‘production of uncertainty is relational and dynamic, changing not only with new ‘certainties’ about the virus and treatment protocols, but also the ways in which its management intersects with social and environmental dynamics.” This reveals how the experiences of living with HIV are not uniform and continue to be shaped by a range of factors, such as socio-economic resources, food insecurity, employment, gender, age, and sense of responsibility for others. As a consequence, the special issue makes a powerful case for focusing on how uncertainty generates styles of politics that produce precarity and individual responsibility for managing exposures to multiple social and environmental harms.

A different, albeit related, perspective is explored in other papers where embracing uncertainty is viewed as a pathway to open “up a more rigorous, robust, transparent – and democratically accountable – environmental politics” (Stirling 2018, 2012). This work combines what Scones (2019a, 27) describes as a “transformational vision, [where] notions of justice are central” with a “more patient, sometimes unruly, bottom up approach to defining future pathways,” often focused on adaptive management, incremental learning, and polycentric governance. As one example, Sedell (2020) demonstrates how competing models for understanding invasive pest populations reveal the profound instability of metrics that determine pest absence/presence in California’s agricultural sector. As part of this analysis, she demonstrates how alternative methodologies for visualizing pest presence/absence as well as bottom up diversified farming practices recontextualize pests as neither exceptional nor temporary, but instead, as part of a new normal. Doing so, opens up possibilities for alternative agro-ecological and political arrangements by locating the region’s pest problem not with the insects themselves but in production systems that lack resilience to biological invasions. As a consequence, Sedell reveals how uncertainty about pest presence/absence can precipitate a fundamental re-evaluation of California’s agro-environmental system, and simultaneously transform our relationships to pest populations and how the region produces food. How networks of cross-species relations are productive of ‘new ecological accommodations’ or ‘ways of learning to live endemically with our viral [microbial, and insect] companions’ (Greenough 2012, 295) thus constitute important avenues for future geographic research on the politics of uncertainty.

To a large extent, all of the papers in this special issue push us to grapple with uncertainty as a norm and not an anomaly. In other words,
this work opens up space for engagement with uncertainty as more than a temporary phenomenon but as a “permanent condition” where stability and certainty about socio-spatial and human-environment relationships are often elusive (Brown and Damery 2009, 82). Rather than attempting to ensure a strict boundary between knowledge and its opposite, our contributors encourage us to think more deeply about uncertainty as a lived and spatiotemporal condition. It is these very entanglements between uncertainty, environments, and everyday life that provide the narrative thread uniting this diverse collection of articles. While engaging with a broad range of topics and qualitative methodologies, this work coalesces around these central themes: (1) how uncertainty works through geographic relationships; (2) how uncertainty generates geographical outcomes; (3) how uncertainty is reconfigured by human-non-human dialectics; and (4) how uncertainty raises questions about politics. In doing so, this special issue develops a critical human geography of uncertainty, which not only articulates how the concept is useful for geographers, but also argues that geography can enrich existing transdisciplinary work on the subject with its particular focuses on scale, spatiality, power, place, and human-environment relations.

CRediT authorship contribution statement

Nari Senanayake: Conceptualization, Writing - original draft. Writing - review & editing. Brian King: Conceptualization, Writing - original draft, Writing - review & editing.

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