



# The Great Indoors: Research frontiers on indoor environments as active political-ecological spaces

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## Abstract

In this progress report we call for nature-society geographers to give greater attention to indoor environments as active political-ecological spaces. Nature-society geographers often treat such spaces as fixed and unnatural. Yet a growing body of research attests to the active role played by sites ranging from homes to factories to shopping malls in the production of nature, scale, and environmental citizens. Furthermore, environmentalist and public health projects have increasingly targeted indoor spaces for scrutiny and action, yet these projects and scientific literature typically lack a critical geographical perspective on scale, space, power, and nature. We argue that exploring indoor environments is necessary to fully encompass socio-natural assemblages that include flows of energy and knowledge, embodied subjects, technologies of power and resistance, and a variety of non-humans.

## Keywords

consumer geographies, embodiment, enclosure, environmentality, households, indoor environments, political ecology

## I Introduction

In recent years, indoor environments and their inhabitants have become a category targeted for scrutiny and regulation for their potential impacts on sustainability and human well-being. Health officials estimate that Americans now spend 90% of their time indoors, and have promoted ‘healthy schools’ and ‘healthy homes’ programs to help curb toxic exposures there (Ott and Roberts, 1998). The World Health Organization has named poor indoor air quality a top health threat in developing countries, spurring the formation of a global Partnership for Clean Indoor

Air. Advocates hoping to abate greenhouse gas emissions examine energy consumption in homes, workplaces, and other buildings; green building associations and government weatherization campaigns embody this trend. Businesses market ‘eco-friendly’ cleansers, appliances, and

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building materials to a public sensitized by discourse on indoor environments. These political projects attempt to reshape not only indoor spaces, but also the conduct of their inhabitants – often engendering social resistance.

As such projects have drawn broad attention to physical spaces from homes and schools to offices and factories to prisons and shopping malls, nature-society geographers have begun to raise questions about the place of the indoors in environmental politics. Like other ‘new’ political ecologies that have emerged in the past decade – addressing First World, urban, and embodied natures – recent research on indoor environments expands nature-society thought into new terrains. Although more modest than these other new political ecologies, this literature nonetheless reveals indoor environments as active political-ecological spaces and opens new avenues for interrogating theoretical constructs such as power, nature, place, and scale. It is our purpose in this review to show that thinking explicitly about society and nature indoors can shed light on important but often-neglected issues at the human-environment interface.

We begin this essay by outlining the significance of existing knowledge about the indoors as active political-ecological spaces. We then suggest five practical and theoretical contributions that a nature and society research agenda enfolding the indoors might make, based on a diverse body of geographic literature and related work. Here, we also call attention to the shortcomings of previous studies that do not adequately address indoor environments. Following this we use two examples from ongoing research to further explicate these potential contributions. One project focuses on interventions intended to improve indoor air quality in rural India through the provision of redesigned cookstoves. The other examines the ecology of pest management practices by housing and public health agencies in the USA. We conclude by suggesting further pathways along which nature-society geographers

might venture into these diverse and intensely lived-in spaces.

On the one hand, the essay argues that (a) geographers have too often omitted indoor spaces from nature-society analyses, thereby perpetuating oversimplified and geographically muted conceptions of nature and space. As Nathan Sayre (2005) has discussed, when the characteristics of social and ecological processes that transcend scales (ontological moment) are omitted from observation, analysis and theory building (epistemological moment), then geographers are left with an incomplete picture of spaces – such as the indoors – and their interactions with broader social and environmental processes. On the other hand, this essay articulates (b) five explicit pathways by which geographers have brought notions of scale, nature, place and power more explicitly to bear on the study of indoor spaces; and illustrates (c) how these five contributions will enhance the visibility of indoor spaces by integrating previously occluded spaces, activities, subjectivities, and natures. Furthermore, by interrogating political projects aimed at the indoors, such as those described above, geographers may expand our policy critiques and practical recommendations.

Indoor environments encompass a wide array of spaces enclosed or partially enclosed by human-built structures. A concern for enclosure is already familiar to political ecologists who examine technologies and power relationships involved in demarcating areas for conservation and production (McCarthy, 2001, 2004). Similar issues associated with the privatization and contested production of nature arise in indoor spaces. The physical walls that enclose such spaces suggest impermeability, but, as with outdoor spaces, assumptions of complete enclosure are fallacious. Inside and transcending the bounds of any building are networked social, economic, and ecological systems that engage human bodies, animals, plants, and microbes both welcome and unwelcome; air, water, and their pollutants; and building materials, infrastructure, and furnishings.

Both illusions of impermeability and misconceptions about the fixity of indoor environments may inhibit nature-society geographers from examining them. Amid quotidian experiences of these environments it is easy to overlook their active role in political and ecological processes. This problem parallels geography's past neglect of the home, a gap that feminist geographers have worked to correct. Cindi Katz (1994: 67) has thus criticized the 'artificiality of distinctions drawn between . . . the field and the "not field"', while, as Mona Domosh (1998) has suggested, these places are frequently considered far too familiar to be part of the 'field' for nature-society geographers. It is perhaps because of the pervasive fallacy of enclosure and the privileging of the Great *Outdoors* that we have seen only limited exploration of indoor environments. But what Susan Smith has noted about housing applies equally to other indoor environments: 'culture dissolves into nature as forcefully through the fabric of the home as it does in the outside world' (Smith, 2004: 89–90).

Human geographers *have* long written about the so-called 'built environment' (a category with ambiguous boundaries), and behavioral geographers have examined perceptual issues in spaces ranging from classrooms to hospitals to offices. While this literature acknowledges a relationship between indoor spaces and social networks, some studies have attempted to 'read-off' cultural traits from features of the indoor landscape (Lawrence, 1982) and the domestication of nature there (Tuan, 1984). Such an approach may treat indoor spaces and the things in them as passive and self-contained – the 'static stock of things' that Braun (2005) has problematized – rather than having the potential to *reshape* nature and social relations. Yet indoor spaces teem with life, and are vital sites for the production and reproduction of nature, scale, and environmental citizens. They also articulate with technologies of power while engaging in flows of matter, energy, capital, and knowledge.

Perhaps the most tangible argument for deeper interrogation of indoor environments is that many humans spend the majority of their lives physically occupying such spaces. While the percentage of time spent indoors is presumably lower in agrarian societies than in industrialized ones, human bodies worldwide are entangled with physical and social conditions in homes, factories, schools, prisons, and hospitals. The medical historian Christian Warren (2004) has probed the health implications of the 'migration' of American life into the indoors over the past century, and similar questions may be asked of transitions in industrializing societies. What will be the consequences for nature, health, conservation, and development of the enclosure of new indoor socio-natures in the global South? Furthermore, as pollution regulators and other state experts target indoor environments for intervention across societies, how will they wield power through these spaces and the humans and non-humans in them? These projects and the health and environmental discourses they construct reify indoor landscapes as coherent and discrete ontological units. It is this tendency for indoor spaces to be isolated and targeted within policy that motivates our analysis. As Nikolas Rose suggests, 'one needs to ask how, and in what ways, and to what extent the rationales, devices, and authorities for the government of conduct in the multitude of bedrooms, factories, shopping malls, children's homes, kitchens, cinemas, operating theatres, classrooms and so forth have become linked up to a "political" apparatus?' (Rose, 1996: 38).

Greater attention to indoor environments by geographers reveals a paradox. On the one hand, the scale of indoor environments is similar to other geographical and ecological scales; it is ontologically incoherent as nature, information, politics, and power flow freely in and out (Purcell and Brown, 2005; Swyngedouw, 1997). And yet the permeable nature of the indoors and its lack of fixity make indoor spaces particularly relevant for geographers examining the

human-environment interface. As Sayre (2005) notes, it is the social, political, and ecological processes and interactions, within the context of their social production, that should drive geographical inquiry. Yet few analyses acknowledge the indoors as a site where social and natural worlds continually collide, where indoor spaces are connected to external natures and institutions through acts of passive residence and active resistance. If, as others have suggested, indoor spaces such as the home are to be evaluated within the context of their social reproduction and connection to discourses of control and marginalization (Blunt and Dowling, 2006; Fannin, 2003; Marston, 2000), then political ecologists should use their insights on discursive power, place making, and subject formation to assess the production of the indoors through various environmental, health, and building policies.

It is important to emphasize that we do not view the indoors as a coherent species of space to be systematically circumscribed and categorized. Indeed, it is precisely the fluid and open nature of indoor environments – *because* they are not isolated, discrete spaces – that means they warrant further study. Nature indoors is shared and ephemeral, constantly blending with nature out of doors. And yet numerous political projects focused on the indoors perpetuate this fallacy of enclosure, the notion that indoor spaces may be physically and socially isolated from the world at large. It is this fallacy that geographers are well equipped to interrogate.

Although nature-society geographers have questioned the privileging of ‘wild’ natures by increasingly addressing humanized environments, recent edited collections on urban environment and society have given little attention to the myriad indoor spaces found in cities or their connections to circulating flows of nature, capital, and power (Heynen et al., 2006; Isenberg, 2006; Rosen and Tarr, 1994; Swyngedouw and Heynen, 2003). Essays surveying key advancements and lacunae in political ecology have also said little if anything explicitly about the indoors as

active political-ecological spaces (Braun, 2005, 2008; Castree, 2004; King, 2009; Rangan and Kull, 2009; Walker, 2003, 2005, 2006, 2007; Zimmerer, 2006, 2007).

The explicit attention these spaces have received has tended to come not from nature-society geographers, but from other critical human geographers – feminist geographies of the home and social reproduction (Blunt and Dowling, 2006; Domosh, 1998; Marston, 2000), studies of power and space (Rose, 1996), children’s geographies (Ansell, 2009), labor geographies (Aguilar and Herod, 2006; Leslie and Butz, 1998), and retail geographies (Crewe, 2000; Goss, 1993). Outside of geography, however, there has been more coherent treatment of indoor spaces *as environments* – in the fields of science, technology, and society (Guy and Shove, 2000; Kempton and Lutzenhiser, 1992; Shove, 2003; Sorenson et al., 2000), history and sociology of medicine (Murphy, 2006; Mitman, 2007; Rosner and Markowitz, 1987; Sellers, 1997; Senier et al., 2007; Tomes, 1998), and environmental history (Gottlieb, 1993; Hoy, 1995; Price, 1995; Scharff, 2003; Strasser, 2000; Washington, 2005). Taking the indoors seriously will require heeding the advice of anthropologist Anna Tsing, who challenges political ecologists to continue expanding our sense of ‘what counts as “the environment”’ (Tsing, 2001: 4). While the field of geography has been adept at going inside forest, agricultural, urban, and even corporeal spaces, indoor environments remain considerably less theorized. In the section that follows we bring together existing geographical work on the indoor environment, citing both productive engagement and instances where indoor spaces are neglected.

## II Contributions of indoor environments to nature-society research

Here we identify five contributions that studies of the indoor environment can make toward rendering these lived-in spaces more visible within

nature-society geography. These five areas are by no means the only potential contributions that will come to light as more geographers venture indoors, but they are among those that derive from, and can in turn readily advance, geographic questions about scale, nature, and power.

### *I The social production of indoor environments*

Bringing nature-society geography indoors extends studies of the social production of scale and nature into little-explored environments. Critical geographers are well aware of the active production and contestation of scale (Marston and Smith, 2001; Norman and Bakker, 2009; Rangan and Kull, 2009; Swyngedouw, 1999; Swyngedouw and Heynen, 2003). Feminist geographers in particular have illuminated the ways in which the home has been produced as, among other things, a private space and a site of gendered labor and social reproduction (Marston, 2000). Furthermore, geographers have thoroughly shown that nature is not a pre-given category distinct from societal influences (Brown and Purcell, 2005; Castree, 2002; FitzSimmons, 1989; Heynen et al., 2006; Sayre, 2005; Smith, 1998). Given these insights, it is surprising that critical nature-society geographers have written so little about indoor environments. The making of the indoors is much more than a straightforward act of enclosure, but rather represents the dynamic ways the state, capital, citizens, and non-humans impose, renegotiate, and resist boundaries between indoor and outdoor spaces. The physical walls and other technologies that bound and order indoor spaces, furthermore, heighten the illusion that such micro-scales are pre-given and distinct from nature outdoors. This illusion contributes to the relative invisibility of spaces like factories and homes that are nonetheless politically and ecologically engaged. In neglecting these spaces we understate their fluidity with other scales along with their active, relational character.

While political and cultural ecologists have examined the household scale within studies of resource struggles, they have generally not regarded the home or other buildings as physical environments that matter in broader ecological processes. Zimmerer (2004), for example, has called for 'finer resolution' analysis of the ways household members' livelihoods, practices, decision-making, and power relations interact with broader patterns of resource use and development policies. Such processes are of course vital, but left out is a whole set of ecological factors, perhaps reflecting a misconception that the indoors stands apart from nature.

One of the few studies that has taken seriously the materiality and social production of indoor spaces is Stefan Buzar's examination of energy sector reforms, inadequate infrastructure, and energy efficiency in impoverished homes of Macedonia. Buzar 'conceptualises the home as a relational space situated at the intersection of a multitude of social and spatial webs' (Buzar, 2007: 1910) that produce domestic environmental conditions. By examining the physical space of the home, he concludes that low, post-heating warmth levels are a legacy of both inflexible housing construction decisions during socialist modernization regimes and, later, rising poverty and inequality levels during post-socialist expansion. By undertaking more studies like Buzar's, geographers could better theorize articulations between households and the broader political economy of development and environmental management.

Indoor 'relational spaces' are all too frequently severed from the network of institutions and policies that influence their very production and management – both by social processes themselves, and in geographers' interpretations of them (Sayre, 2005). Feminist geographers have argued a similar point regarding the home: that the social relations and representations that produce the household scale mask its fluidity and dynamism (Oberhauser, 1997). The enclosure of indoor spaces – like that of fenced

areas – is often accompanied by their production as ‘private’ terrains. Enclosure also abets illusions of private control over resources such as water. As Kaika (2004, 2005) has pointed out, notions of indoor order and privacy have shaped modernization projects that purport to seal off the household from nature and the public realm. In Kaika’s examination of plumbing and water, management of nature at the physical limits of the dwelling unit belies connections among households, nature, and the broader community. Other indoor practices also purport to privatize nature, such as the creation of landscaped ‘islands’ within exclusive shopping malls and resorts (Wilson, 1991: 108) or the veiling of corporate ‘biotech’ uses of nature inside laboratories, hidden from the scrutiny of regulators and activists (Urbanik, 2007). Thus there are political consequences to the representation of indoor space as private and divorced from nature, requiring greater critical attention from geographers.

Housing, of course, is one of the most lived-in indoor environments. Feminist geographers such as Blunt and Dowling (2006) conceive of the ‘house-as-home’ framework to connect the materiality of the dwelling with ideologies about the home as a place and scale. They show that the construction of the home as a separate, private scale has been tied up with the invisibility of social reproduction and women’s labor, and to state interventions targeted at women’s bodies and daily routines (Domosh, 1998; Marston, 2000; Oberhauser, 1997; Williams, 2004). The assumption in many industrialized societies that domestic labor is a private activity has become fixed into the landscape through urban designs and domestic technologies (Miller, 1991; Strasser, 1982; Watkins, 2006; Wright, 1981). Crabtree (2006a, 2006b) is one of a few geographers to examine the consequences of gendered production of space for socio-natural environments, and *vice versa*. She explores eco-feminist housing initiatives in Australian cities that attempt to reconstitute shared domestic

environments and social reproductive activities. The programs challenge received notions of scale as they transform everyday spaces and their use, with the aim of improving sustainability and alleviating domestic labor burdens. Further studies of dwellings as indoor environments can build on the ‘house-as-home’ framework in light of political-ecological insights pertaining to environmentality, biopower, and sustainability studies.

## *2 Indoor nature and the embodied subject*

The body is another relational scale in which nature-society geographers have shown growing interest (Guthman and DuPuis, 2006; King, 2009; Mansfield, 2008; Mayer, 2000), and the fact that human bodies spend so much of their time indoors speaks to the need for more explicit treatment of these spaces as environments. Indeed, it is often through indoor environments that broader ideologies and processes – such as racism, economic restructuring, consumerism, and globalization – become embodied. The examples of tuberculosis in prisons and homeless shelters, and lead poisoning in homes, illustrate this well (Hanchette, 2008; Wallace and Wallace, 2003). The body is not merely nested within local or indoor scales; rather, both the body and the indoors are ‘firmly situated within the complex technical, discursive and productive landscapes of late capitalism’ (Braun and Castree, 1998: 14). Political ecologists have increasingly come to view indoor environments and human bodyscapes therein as part of a reinvented and contested nature (Darier, 1999; Martin, 1998). In this section, we focus primarily on health and disease, but these are not the only issues that lie at the intersection of embodiment and the indoor environment (Grosz, 1998). In other sections we elaborate on the ways indoor environments also serve as technologies through which to assert control over bodies and conduct.

Public health authorities show growing interest in indoor environments, but their interventions

into health problems that originate in buildings have often been marked by tensions over who bears responsibility for health in these spaces, and also limited understanding of the ways indoor environments interact with the outdoors and with broader forces. Nature-society geographers stand to add a critical edge to such discussions of indoor environmental health. For instance, Van Wagner (2008) blames 'neoliberal discourses of efficiency' in part for weakening protections against contagion in hospital environments, while Ali and Keil (2008) have shown that sites such as Hong Kong's Metropole Hotel became crossroads for the microbial expressions of landscape change and globalization. Unfortunately, however, other contributors to Ali and Keil's volume on globalization and infectious disease refer only briefly to interior landscapes such as hotels, homeless shelters, and jet airliners that nonetheless played major roles in the spread or containment of pathogens. This shortcoming underscores the need for more explicit attention to indoor spaces. For example, geographers could contribute meaningfully to debates over the use of DDT against malaria mosquitoes indoors in sub-Saharan Africa by illuminating the ways in which both humans and non-humans penetrate the bounds of homes and the human body (Dar-es-Salaam Declaration, 2009; World Health Organization, 2004).

Recognizing the effects of indoor spaces upon health also raises questions about the production, promulgation, and use of scientific knowledge in these seemingly sound and orderly environments. Layfolk as well as health experts increasingly suspect that some buildings create ecologies with unpredicted effects on health. Murphy (2006), for example, examines the rise and contestation of Multiple Chemical Sensitivity, a debilitating condition that patients claim is related to the myriad poorly understood substances that suffuse buildings where they live, work, and study. Many physicians and insurers, meanwhile, question the very existence of this condition. Medical sociologists have examined

concerns about risk in the application of cleaning agents among users such as homemakers and school custodians (Altman, 2008; Senier, 2007). Such studies recall warnings leveled by Rachel Carson (1962) and Wendy Chavkin (1984) about chemical usage indoors.

Furthermore, the fallacy of enclosure conceals the many actors implicated in the creation and mitigation of illnesses that arise from indoor exposures. The designation of the home environment as a private responsibility has become problematic as health researchers have called for more targeted state interventions in household environmental health threats (Krieger and Higgins, 2002). Meanwhile, factory environments in many emerging economies remain impervious to health protections in spite of the threat of workplace exposures (Frey, 2003). It is therefore a matter of environmental justice that we recognize the entanglements of indoor socio-natures within regional and global webs of political decision-making and economic policy (Buzar, 2007; Gottlieb, 1993).

### *3 Animating indoor technologies and natures*

Some behavioral studies of the indoor environment represent non-humans indoors as molded to human cultural preferences (Lawrence, 1982; Tuan, 1984). Some recent studies, however, have animated elements of the indoor landscape usually treated as fixed and given. This contribution extends our discussion of corporeality, because human bodies form assemblages with non-humans in indoor space. Smith (2004: 89) has observed that 'various bodily characteristics, capabilities and impairments ... may be differently enabled and disabled by' the material features of housing. Such relationships also assemble on factory floors, in classrooms, or at the mall. Treating non-humans, technologies and structural accoutrements as more than Braun's 'static stock of things' presents opportunities to 'weav[e] mice,

mites, and moulds into woods and wools, through airways and organs, between bodies, onto scientific instruments, and into political imaginations' (Smith, 2004: 90). Put another way, if Timothy Mitchell's (2002) mosquito could speak it might tell of the ways it and its microbes have hailed the refashioning of home environments with bed nets, residual pesticide sprays, and adoption of cooking technologies that repel insects. Animating non-human actors in indoor environments is therefore consistent with recent calls to rematerialize geographical studies (Whatmore, 2006) through the consideration of 'assemblage geographies' (Robbins and Marks, 2010).

While indoor architecture and technologies may reorder their immediate environs, they can also influence broader policies and ecologies. William Osei (1996), for example, has suggested that household architectural features along with available cooking technologies in sub-Saharan Africa work in concert to influence not only culinary practices and bodily health but also familial interactions, heating regimens, household energy budgets, pest eradication measures and agricultural product preservation. These conditions in turn alter forms of government policy intervention for certain households and villages. Thus, studies of indoor non-humans – living beings and technologies alike – may animate these spaces as productive starting points for explicating human-environment relations more generally.

Indoor environments operate as sites of both effect and affect when considered in the context of actor-network theories on society-technology relationships (Brown, 1981; Lutz, 2006). On the one hand, indoor technologies are wielded as a response to conditions such as mosquito infestations and woodfuel availability, spurring the installation of bed nets and the implementation of modified heating regimes. On the other hand, and through processes of reverse adaptation (Birkenholtz, 2009; Latour, 2004; Simon, forthcoming), these technologies reorder the world

around them. Once in place, elements of the indoors shape social relations, institutional policies and ecologies. New 'smokeless' stoves in India, for example, not only influence the daily lives of mosquitoes and household members but also the rise of smoke-free state pest eradication programs. Animating the indoors thus reinforces how 'it is not only social actors working on nature, but bits of nature producing social action' (Shaw et al., 2010: 387).

Nature-society geographers should draw further from STS scholarship, as this literature can help us address social change, ideas of nature, and knowledge associated with indoor technologies. Elizabeth Shove (2003) has argued that policy interventions that call for reduced indoor energy use have merely targeted consumption itself without grappling with the ways technologies have heightened human expectations of comfort, cleanliness, and convenience in indoor environments. Indoor technologies have created a new sense of what is normal. Taken-for-granted technologies like those associated with urban infrastructure also bolster the illusion of a purified modernity with nature as its Other, even as technologies produce new types of hybrids (Edwards, 2003). Other research has emphasized the ways consumers and citizens understand technologies such as thermostats and the relationships between technology use indoors and the larger environment (Kempton and Lutzenhiser, 1992).

These studies of indoor socio-natures emphasize that non-humans there are not merely domesticated, but are co-constitutive of these spaces. That is, non-humans participate in the material and discursive making of the indoors, just as in other spaces. Tuan's (1984) examination of 'pets' assumed that domestication of animals and plants represented unidirectional acts of human control over nature, in service of human cultural desires. More recently, geographers have drawn upon actor-network methodologies (see Castree, 2002) to stress instead both the other-ness of these beings and their agency

in remaking place (Hitchings, 2004, 2007; Power, 2008; Smith, 2003). Others have shown that non-humans abet the rigid separation of indoors and outdoors, such as in recent studies of indoor climate control across several societies, from Singapore to the UK, where air conditioning has become the norm. Humans' 'routine encasement' in controlled climates is seen as preferable to the fluctuating outdoor climate because it inhibits bodily incontinence – perspiration – and because of beliefs that heat stifles worker productivity (Ackerman, 2002; Hitchings and Lee, 2008). But research has revealed grave consequences of air conditioning for human bodies: a sense of disconnection from seasonal change, universalizing notions of corporeal comfort, and unhealthy exposures to substances that circulate within tightly constructed buildings (Cooper, 1998; Hitchings, 2009; Mitman, 2007; Murphy, 2006; Shove, 2003). Furthermore, energy used to cool the indoors also contributes to outdoor warming. In short, technologies intended to order and stabilize indoor space have created a variety of unintended leakages, and have also contributed to the control of bodies and their affective capacity within broader urban spaces (Grosz, 1998). Studies of indoor spaces can also illuminate socio-natural assemblages engaged in processes ranging from weatherization (weatherproofing) to air filtration to vermin exclusion.

#### *4 Indoor environments as conduits of power and sites of governance*

Greater attention to indoor environments can also build upon the work of Michel Foucault, and upon geographical studies of governance, by elucidating how various powers are exerted through these spaces. From occupational health regulators to building code enforcers to corporations marketing 'green' or 'healthy' products, numerous institutions seek to actively define and manage indoor environmental quality (Cidell, 2009; Imrie, 2007; Sellers, 1997; Tomes, 1998).

Heightened knowledge of the indoors by the state, market, and civil society also opens possibilities for wielding power over citizens and nature through surveillance and control. As Nikolas Rose suggests, compelling opportunities remain to examine how conduct within diverse indoor spaces – from kitchens to classrooms – becomes 'linked up to a "political apparatus" comprised by government and other authoritative body rationales' (Rose, 1996: 38).

Studies of indoor environments can invigorate debates about the beneficence of efforts to govern conduct there. Chris Sellers (1997) notes the variegated structures of governance vying to control indoor spaces, using the case of occupational health. He argues that state interventions into factories and homes should be welcomed as a means of neutralizing corporate powers that expose the body to health risks. Yet government campaigns that ostensibly improve indoor health conditions may also attempt to systematically reshape the conduct of 'others' such as immigrants (Poovey, 1995), and to modernize indoor environments through coercion and surveillance. The state inserts a variety of technologies into indoor landscapes as part of efforts to modernize and standardize distinct populations. Susan Craddock (2000, 2001) has described overt programs of control over human bodies through indoor space in her examinations of tuberculosis sanatoria for poor, immigrant women and quarantine in San Francisco's Chinatown after its 1907 bubonic plague outbreak. Rachel Weber (2002) shows how urban renewal surveys became instruments of power, using health as a pretext for controlling living environments in communities of color. Meanwhile, prisons across the globe discipline incarcerated people's bodies but cultivate deadly strains of tuberculosis that afflict these prisoners (Farmer et al., 1999). Efforts to claim or allocate sovereignty over the body and its indoor environs suggest that, far from being easily domesticated, such ecologies have been sites of constant struggle.

Conceptions of environmental citizenship expand as individuals are expected not only to know and manage nature ‘out there’, but also in the most intimate of spaces. Theories of green governmentality have suggested that power is exerted not by the rule of law but rather through the construction and acceptance of new knowledge about nature and human relations with the non-human world (Agrawal, 2005). Indoor environments serve as sites for controlling, monitoring, and producing environmentally responsible human collectives through regulatory controls of the population’s reproduction, health, and well-being (Foucault, 1990). New power/knowledge formations create space for ‘the construction of certain truths and their circulation via normalizing and disciplining techniques, methods, discourses and practices that extend beyond the state and stretch across the social body’ (Rutherford, 2007: 293). A small number of scholars has charted a line of indoor political-ecological inquiry that, from drug testing to childbirth, articulates how power flows through indoor spaces to manage the environments within which embodied subjects reside (Darier, 1999; Fannin, 2003; Luke, 1997; Martin, 1998). For example, Thomas Osborne (1996) has shown that drains linking homes to modern sewer systems in nineteenth-century London served to extend discourses of human sanitation and hygiene into the city’s individual households. Furthermore, Lanthier and Olivier (1999) identify the important role medical discourse plays in creating and normalizing knowledge around the relationship between lived spaces and the body. Such knowledge produces a framework for disciplining individuals to adopt ‘healthy living environments’. They show that the boundary between body, home, and environment is made fluid through the continuous bombardment of information purporting environmental threats to the body. Campaigns urging hand-washing and use of antibiotic products in schools, shopping centers, on public transit, and at home during outbreaks of respiratory illnesses – which are

believed to thrive in crowded and poorly ventilated indoor spaces – exemplify how bodies are disciplined in indoor environments (Hoy, 1995). When these threats permeate indoor environments and the body itself, self-policing ensues as subjects adopt an acute and yet mundane ecological self-awareness. Whereas much environmental literature so far has focused on the production of environmental citizens with respect to outdoor resources such as forests, numerous opportunities remain to interrogate and theorize the process of governing indoor nature and cultivating indoor environmental citizens, particularly given the proliferation of health and sanitation regulations.

Power also flows *through* indoor spaces by mobilizing individuals in order to advance ecological stewardship and sustainability ideologies. For example, spurred by films such as *Affluenza* and *No Logo* environmentalists have cited households as both a source and salve to the problem of over-consumption. Al Gore’s (2009) *Our Choice* exemplifies this trend by emphasizing spaces such as homes and office buildings as the most plausible and effective locus for environmental change, particularly for slowing anthropogenic global warming trends. Similarly, recent economic stimulus bills in the USA have prioritized weatherization and ‘green’ renovations in schools, workplaces, and homes as means toward job creation and environmental sustainability. Although Cidell (2009) does not emphasize the power wielded by green building standards, there is surely valuable work to be done here as the movement for sustainable construction and renovation spreads. In each case, and as Luke (1997) notes, indoor environments serve as sites for disciplining subjectivities in order to cultivate an environmental citizenry. These citizens are then inclined to manage, solve, and take responsibility for regional and global environmental concerns. On the other hand, grassroots examples like that explored by Crabtree (2006a, 2006b) ostensibly represent the articulation of more politicized efforts to redefine

and make explicit environmental citizenship by transcending received notions of scale.

### **5 Fluid indoor/outdoor boundaries**

A closer examination of indoor environments also creates opportunities for exploring material interconnections among indoor, outdoor, and distant landscapes. A burgeoning body of literature has begun to illustrate that the connection between indoor and outdoor spaces can only be fully articulated and comprehended when adequate attention is granted to indoor environments. Scholars have recently recognized the household as an arena for interrogating consumption practices and their broader environmental consequences. Bulkeley and Gregson, for example, suggest that in order to achieve waste reduction goals, 'policy needs a far closer engagement with the household, the primary unit of consumption'. This will involve opening 'the black box that is the household and engage with household practices' (Bulkeley and Gregson, 2009: 930) in order to better conceptualize methods for realizing waste reduction targets. Such engagements with consumption also consider what Princen et al. (2002) describe as the separation of consumption practices from their environmental implications. The notion of 'distancing' suggests that material connections among households, shopping malls, and industrial or extractive landscapes, and our inclination to measure and assess these connections, are muted by the vast social and physical gulf separating consumption and production activities.

Retail spaces play an influential role in consumption, and socio-natural environments there often conceal the environmental effects of consumers' actions, even in the growing number of shops that offer 'green' products. Price's (1995) examination of the Nature Company argues that the chain offers retail environments that simulate a comforting and apolitical nature. Similar claims have been made for retailers of

outdoor-recreation equipment which arouse consumers with sensory stimulants and glossy images of wilderness recreationists while simultaneously concealing the environmental degradation outdoor equipment leaves at sites along its global chain of production (Simon and Alagona, 2009). In these contexts indoor environments function as sites of consumption that are at once connected to, and severed from, regions of resource extraction and manufacturing.

Users of indoor spaces also deliberately alter biophysical flows between indoor and outdoor environments, for example, by adopting individual and communal practices that reconstitute the role of buildings in socio-natural processes. Sharon Moran (2008) details families' decisions to adopt alternative technologies such as composting toilets and grey water systems as household-scale interventions in the water cycle. Moran suggests such alternative water management practices reflect householders' shifting consciousness in which they aim to creatively re-engage the domestic sphere with local ecological systems. Just as water flowing through domestic environments encounters technological interventions, so too do natural resources residing at the interface between indoor and outdoor areas. Russell Hitchings, for instance, explores the manipulation of thermal environments at the boundary of enclosed and open spaces. According to Hitchings, householders apply heating and cooling technologies to standardize ambient temperature ranges around homes. Gardeners' increasing interest in patio heaters throughout the UK reflects their inclination to understand garden spaces 'as extensions of their home'. While patio heaters have been condemned as wasteful and self-indulgent, Hitchings suggests such beliefs point to historically rooted social norms over what constitutes acceptable indoor and outdoor living conditions. 'Certain sets of expectations', Hitchings argues, 'may very well be creeping out from the indoor environment, as the garden gradually becomes repositioned as a room that consumers should

treat in the same way as they would any other' (Hitchings, 2007: 345). Furthermore, Cidell's (2009) study of green building standards argues that such credentials encourage awareness of the hybridity of the built environment by urging builders to consider the interface of indoor and outdoor natures materialized in their projects. Interventions like those described by Moran, Hitchings, and Cidell reflect changing material and ideological engagements with the indoor-outdoor interface.

Management practices can also lead to unintentional flows of nature, including toxins, between indoors and out. In Paul Robbins's examination of the factors influencing lawn chemical transgressions into the household, he observes that 'the most frequent encounters between human beings and other life forms ... occur in the most mundane places: the kitchen, the bathroom and the backyard' (Robbins, 2007: xiv). Indeed, humans and our pets serve as vectors linking indoor and outdoor environments: '[lawn] chemicals that hitchhike with us indoors' eventually make their way onto floor and counter surfaces creating high exposure rates for 'toddlers, infants and small children, who are disproportionately sensitive to the possible effects of these chemicals' (p. 66). Meanwhile, Avertino Barreto has warned of toxins flowing in the opposite direction; he suggests that DDT sprayed for malaria mosquitoes inside homes in Mozambique could contaminate soils and water bodies if severe flooding washes the chemical out of buildings (cited in Saunders, 2007). These examples highlight the benefits of investigating indoor spaces in order to encompass the full life cycle of chemicals, consumer products, and natural resources; otherwise, vital segments of their spatial reach remain invisible.

### **III Indoor air pollution prevention in Maharashtra, India**

In this section we use two examples of ongoing research on the Great Indoors to paint a fuller

portrait of the ways the contributions above fit together in practice. Here, we briefly articulate how existing scholarship has engaged each topic area and how opportunities remain for nature/society geographers to use concepts of nature, power, place, and scale to critically intervene and expand our understanding of indoor spaces. Around the developing world, many domestic and international programs have sought to eliminate smoke from indoor cooking environments in rural areas through the distribution of cleaner burning stoves. Studies of stove replacement programs have largely fallen into one of two categories. They either isolate the indoor environment in order to focus on the health implications of indoor air pollution (see, for example, ICMR, 2001; Smith, 2000; World Bank, 2002) or they examine the effectiveness of administrative frameworks and institutional policies shaping stove replacement projects (for example, Hanbar and Karve, 2002; NCAER, 2002; Pohekar et al., 2005; Rehman and Malhotra, 2004). Although important findings are generated within these studies, further insights may be generated by examining how indoor environments, embodied natures, notions of smoke utility, household cleanliness, and community responsibility are actively produced and struggled over by individuals and institutions operating at various scales and with unequal access to social and political resources. This case describes how the application of geographical approaches to issues of scale, place, nature, and power generate new insights and a markedly fuller understanding of indoor air quality management.

A critical examination of programs in Maharashtra, India, highlights how the process of managing private cooking spaces is quite frequently a very public, even global, endeavor that enrolls the participation of numerous interest groups. Equity issues have arisen around these programs as internationally funded market approaches to distributing smokeless *chulha* (cookstoves) replace state subsidy-based initiatives. A two-fold rise in the cost

of commercially disseminated improved *chulha* has resulted in differential access to stoves and prevented many poorer households from acquiring such devices (Simon, 2009). By positioning rural cooking environments within their broader political economic context we can better understand why particulate matter and other domestic biomass effluents become embodied disproportionately within certain households.

Indoor environments are constituted by more than just the policies of development agencies. Household members and domestic architectural features actively mediate policy outcomes (Osei, 1996). The structural porosity of many thatched siding homes defies the logic of enclosure that motivates indoor air quality intervention. Because many porous structures utilize smoke for warding off insects or curing locally grown agricultural products, these households are compelled to reject clean technologies. Meanwhile other households may implement creative smoke alleviation measures by fashioning vents for smoke to escape in the wall directly above *chulha*. Through these actions, households can avoid paying high stove prices or puncturing valuable metal rooftops. In this sense households wield the functionality and malleability of domestic architecture as a mechanism for resisting development intervention and managing indoor air quality in household-appropriate ways.

These acts of resistance, however, are rarely uniform across villages, and decisions in one household may contradict the health and sanitation objectives of others. The study of indoor spaces shows how seemingly private decisions frequently have public implications leading to conflicts over how to control and manage indoor environments. For example, in the State of Maharashtra, the *Sant Gadge Baba Swatchata Abhiyan* or Clean Village Campaign offers cash prizes to villages demonstrating commitment to increasing village cleanliness through pollution reduction measures. A crucial

parameter for allocating awards is the percentage of households possessing smokeless cooking devices. As some households pursue alternative smoke alleviation measures or reject mitigation altogether, clashes have ensued, with non-participating households experiencing intimidation and threats of social and political exclusion (Simon, 2009). Examining indoor environments brings into sharper relief the tension that exists when managing private spaces becomes a public concern. Indoor air quickly transitions from a privately managed, enclosed resource to a common pool resource fraught with many of the political fissures typically accorded to public land disputes.

Indoor cooking environments are also sites through which powerful interest groups seek to advance institutional ideologies (Simon, 2009, forthcoming). During early stages of dissemination, the Government of India promoted the fabrication of fuel-efficient wood-burning stoves reflecting pervasive state anti-deforestation policies that blamed rampant forest loss on rural fuelwood collection rather than large-scale land clearings for livestock and agriculture (Pandey, 2002; United Nations, 2000). The State exerted policy agendas by treating domestic practices as both a source and potential salve for deforestation across India (Hanbar and Karve, 2002). Similar examples operate today as international agencies and their domestic counterparts mobilize indoor environments to combat climate change. Household-scale interventions aimed at modifying rural cooking technologies and practices are justified as a crucial step in the fight to reduce global greenhouse gas emissions (Bond and Sun, 2005; Bumpus and Liverman, 2008; Smith et al., 2000). As these examples suggest, indoor environments in Maharashtra and beyond have served as sites for institutions to exert control over ongoing environmental debates. In so doing, these institutions may take control away from households by marginalizing the decision-making capacity of women and other domestic actors.

## IV The ecology of indoor insects in US cities

New public health programs targeted at ‘structural pests’ such as German cockroaches exemplify the need for critical reflection by geographers. These programs focus on pests and the pesticides used to control them because the former are linked with allergies and asthma, while some of the latter are suspected causes of birth defects and neurological damage (Landrigan et al., 1999; Needham, 2005; Rosenstreich et al., 1997). Indoor pest control exemplifies the inequitable embodiment of indoor ecologies, as low-income children are disproportionately exposed to opposing risks from roaches and roach-killers. But environmental health programs and studies deserve the label of ‘apolitical ecologies’ (Robbins, 2004) because of their failure to situate infested and polluted households in socio-natural networks.

Most notably, critical nature-society geographers could contribute to better thinking about domestic pests and public health by criticizing received assumptions about scale. Discussions of insects in homes often assume that pests are merely a private responsibility, brought on by individuals’ lax housekeeping practices (Brown, 2007). Rigid conceptions of scale seem to underlie one common presupposition: that the solution to infestation lies in the individual application of pesticide products (Murdock, 2002). Yet an indoor political-ecology approach would deny the fixity and discreteness of the scale of the home. Furthermore, the do-it-yourself pesticides that fill convenience-store shelves in many low-income neighborhoods by their very existence represent infestation in the home as a private problem to be solved through individual control of nature. Indeed, residents of low-income housing report heavy reliance on such sprays and aerosol bombs (Carlton et al., 2002; Sorgan et al., 2002). Thus indoor ecologies also link with geographies of consumerism, retail, and pesticide marketing. These

purportedly modern control technologies and application practices that reify the private-ness of home have actually contributed to domestic insect populations’ tenacity.

The social production of indoor environments as ‘public’ or ‘private’ spaces intersects with the agency of non-humans; it is in part these non-humans’ transgressions that reveal the dynamism of the household scale. The entwined histories of insects, chemicals, and buildings exemplify what Noel Castree (2002) has called the ‘lively and unpredictable agency’ of non-humans. Landlords and public housing managers began using DDT and related pesticides in 1945 just as state and corporate developers withdrew more capital from urban housing stock. Although housing laws had promised state support for healthy living spaces for low-income people, responsibility for the home environment was increasingly devolved to poor households (Williams, 2004). As post-war disinvestment allowed affordable housing stock to decay, uncaulked fixtures and open wall voids both permitted roaches to enter buildings and provided refuge for roaches fleeing highly repellent pesticides that contractors and housing staff applied in individual units. Surviving roaches helped spawn pesticide-resistant populations that pervaded housing projects and cities across the USA (Ebeling et al., 1965; Wood, 1980). Thus state neglect and practices targeted at the scale of the home have produced ecologies that exceed individual residents’ management capacities (Biehler, 2009).

In recent years, healthy housing advocates have begun to introduce low-toxicity Integrated Pest Management methods in low-income communities as a means to reduce pest and pesticide exposures (Kass et al., 2009). Viewing these urban IPM programs through a political-ecology lens reveals that they purport to make residents into citizen-managers of their own bodies and domestic environments by producing and transmitting knowledge about the home. In some cases, programs spur resistance as

residents observe that the state fails to improve its own management practices. In other words, healthy housing programs targeting only the scale of the household miss broader issues of housing market failures and environmental injustice. But some advocacy programs, recognizing affective aspects and local knowledge of nature in the home, have instead helped residents forge hybrid practices by adapting the methods taught to their own capabilities and experiences (Greenberg, 2003). Some even help empower residents to make demands of housing authorities and housing courts (Safer Pest Control Project, 2002).

## V Conclusion

This essay has described key contributions of geographers and other scholars who have begun to illuminate indoor environments as active political-ecological spaces. We have also outlined shortcomings within geographical research as it pertains to treatment of the indoors. Most importantly, we have articulated five overlapping ways in which nature-society geographers may stand to benefit from more rigorous engagement with indoor spaces. Our goal has not been to merely examine the indoors as a new, understudied, and discrete object of analysis. Instead, we have endeavored to show how these spaces are connected to broader social and ecological systems, and that acknowledging these linkages can enhance pre-existing studies and engender new geographical questions. Rather than aim solely to describe human-environment interactions indoors, we suggest that the indoors can help us explain human-environment relations.

Two case studies illustrate the benefits of extending our analytic sights into spaces such as schools, homes, factories, clinics, and shopping malls. It is geography's strengths around the issues of scale, nature, power, and place that can generate more productive engagement with the indoors. Up to now, many political ecologists have reified indoor/outdoor dichotomies and

notions of enclosure by ignoring or isolating important evidence from indoor spaces that may transform the scope of research findings, policy critiques, and practical recommendations. Research within geography can benefit from more rigorous engagement with indoor environments as relational spaces that are closely connected to broader ecologies and political economies of environmental governance and development.

Moreover, indoor environments should be treated as lively and animated spaces containing both human and non-human modalities of nature that interact under the mediating influence of indoor technologies. Put differently, we argue for engagements with both the ecology *of* indoor spaces and the ecology *in* indoor spaces. This distinction connotes recognition that indoor spaces do not enclose the socio-natures in which they are entangled. Ecologies *in* indoor spaces seldom stay there; rather, they transgress the bounds of the office building, shop, or home through the physical movement of ecological systems, and through the assemblage of institutions and individuals vying to control the governance of those systems. Indeed, it is precisely their fluid and interconnected condition – the ecology *of* indoor spaces – that should stimulate further interest from geographers.

Nature-society geographers who examine the Great Indoors will face methodological questions – and perhaps discomforts – similar to those brought forth by feminist geographers investigating the home. The same conceptions of space that represent enclosed indoor environments as discrete also give them unique meaning for the people who spend their time there. For this reason, geographers studying the indoors should be all the more aware of the way human subjects inhabit and represent environments that are normally enclosed or hidden. Ann Oberhauser (1997) has reflected on the heightened awareness of 'the terrain of the researched' and one's position in it when one enters the home, and this goes as well for schools, clinics, factories, and the like.

In closing, and in keeping with this call for reflexivity and anti-essentialism, we urge researchers to recognize the multiplicity of socio-natures found in the Great Indoors as we extend inquiries into these spaces. Feminist scholars' efforts to bring domestic space into the purview of academic geography sparked debates about whether the home is an oppressive space or a haven, often colored by the subject positions of the researchers themselves. Of course, the political implications of the home depend on the situation and the subject. A similar debate may unfold with respect to the variety of spaces, subjects, non-humans, and flows encompassed by indoor ecologies. Emanating from this study, further research may identify indoor spaces that are: burdened as the ultimate destination of neo-liberal strategies of devolution, while other spaces come under strict state discipline; sites of dangerous bodily exposure, while others offer escape from pollution; spaces where nature is privatized and locked tightly away, while others are permeated by transgressive flows of life. Indoor socio-natures are neither stable and fixed nor any more uniform than landscapes in the Great Outdoors.

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