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Seeking Shelter: How Housing and Urban Exclusion Shape Exurban Disaster

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Abstract

From extreme weather to infectious disease, disasters now arrive in ever more rapid succession, combining with and compounding one another with increasing complexity and potential for crisis. In this context I suggest a particularly important site for analysis and intervention: the chronic lack of affordable housing and broader processes of exclusion now prevalent in cities around the world. These dynamics, I argue, help drive increasing movement to and development in interface zones between urban, rural, and undeveloped areas. In so doing, they also are implicated in a range of "exurban disasters", including wildfires and infectious disease, and in the broader crises these disasters generate for vulnerable populations. The article develops this relational argument across three moments. First, I posit contemporary dynamics of housing crisis and urban exclusion, which prevent people from finding adequate shelter in cities, as key drivers of displacement and settlement across various framings of urban interface zones — from the Wildlands Urban Interface [WUI] to the peri-urban fringe. I then explore how the increasingly forced settlement in these zones — themselves destabilized by prior processes of settler colonialism, neoliberal land-use planning, and climate change — contribute to both environmental and health related disasters. Here I focus on two contemporary cases: catastrophic wildfire in the WUI of California, and the emergence of zoonotic diseases like COVID-19 in peri-urban regions of China. Finally, with a focus on California, I explore how, once health and environmental disasters land and combine within a single location, inadequate housing increases the likelihood of multiple forms of exposure and susceptibility — e.g. to toxic smoke, respiratory ailments, and COVID. In conclusion, I argue for increased focus on the role of housing crises and urban exclusion in both the origins and outcomes of disaster. More scholarly and political work is needed that bridges city and hinterland, linking disaster research to critical approaches in housing studies and urban political ecology, together with wildfire ecology, epidemiology, and environmental stewardship.

Keywords: Affordable Housing; Urban Exclusion; Wildlands Urban Interface; Disaster; Sustainability.

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1 Compound Crises: Where to Begin?

It is no longer possible to consider the sociology of disaster in the singular, if it ever was. In a world that is increasingly unequal, precarious, and climate changed, disasters seem to multiply and spiral like ash falling from the sky on the outskirts of a wildfire, layering atop and combining with each other in uncontrollable and unimaginable ways. This thought struck me repeatedly living in Santa Cruz, California in the long hot summer of 2020, in which a catastrophic wildfire season, complete with showers of falling ash, mass evacuations, and the loss of 1000 homes, landed atop the COVID-19 pandemic and quarantine, which itself had landed atop our ongoing affordable housing crisis — as a result of which this small city is among the least affordable in a state that is the least affordable in the United States.[1] The housing crisis, meanwhile, had for years manifest itself through, deeply rooted socio-economic, environmental, and health disparities along lines of race, class, and immigration status — disparities which, facing the racial, nativist, and politically divisive animus of the Trump administration, were reaching a particularly dire tipping point.

Falling ash over a California home, August 2020

In the face of these new spiraling crises of fire, disease, and unaffordable housing, inequalities became "preexisting conditions", determining who had access to care and aid; who lived in cramped, multigenerational homes prone to viral spread; who was more likely to be a renter, lack insurance, and lose everything in a fire; and who worked "essential" jobs without protection from either COVID-19 or the toxic, ash-filled air.

This multiplicity adds dizzying complexity to the sociology of disaster's central tenet: that disasters and risk are socially produced. Whether immediate triggers are man-made or "natu-

1. For details on the Santa Cruz housing crisis, see the No Place Like Home website at https://noplacelikehome.ucsc.edu/en/ and report (Greenberg et al., 2021)

ral", we know disastrous events interact with and are rooted in historic and spatial inequalities of race and class, legacies of colonialism and capitalist urbanization, and compounding forms of inequality and dispossession. These forms are themselves integrated within socio-ecological systems, impacting groups and places in highly uneven ways. In previous work on the impacts of the 9/11 terrorist attack in New York City and Hurricane Katrina in New Orleans, I and my co-author extended this premise to two disasters with distinct triggers. Combining analysis of the uneven urban development that preceded the events with the "uneven redevelopment" that followed — from emergency aid to long-term rebuilding — we saw how disasters became "crises", particularly for those marginalized both before and after them (Gotham & Greenberg, 2014). I saw then, as now, how contingent yet consequential such escalating and unequal crises can be. Disasters are moments of radical rupture, with the potential to expose deep structural inequities in the status quo, forge novel coalitions, and marshal the broad public response needed to bring about far-reaching change (Greenberg, 2017). At the same time, powerful groups benefiting from this status quo coalesce to reinforce it, if not launch new modes of disaster capitalism. Out of intervention come new forms of urban development, which we dubbed *crisis-driven urbanization*. The question is whether this urbanization will rectify or perpetuate underlying inequality and risk, mitigate or exacerbate the potential for crises in the future.

We face these dilemmas today, only now on multiple fronts simultaneously, as disasters fall one atop the other, producing crises that become coupled in time and space. A range of theorists, from ecologists to philosophers, have referred to these variously as "concatenated" and "compounding" crises, noting how, in our increasingly interconnected, unequal, and unstable age, crises proliferate and link, with potential to propagate new ones (Biggs et al., 2011; Phillips et al., 2020; Taiwo, 2020). It may thus seem that this increasing complexity, what Donna Haraway calls "wicked problems," militates against comprehension, let alone intervention. How do we grapple with the underlying conditions that propagate *multiple* crises, from wildfire to disease, within cities and beyond them? How do we trace their relationships, and respond strategically, lest conditions spiral further out of control? Where to begin?

The experience of summer 2020, read against broader dynamics of compounding crises and the challenge of intervention, leads me to propose one strategic starting place: *housing*. By this I mean the chronic lack of adequate and affordable shelter, and with it the ability to create and protect a home, and the inequitable, exclusionary urban processes that produce this lack. Such processes include the commodification and financialization of housing and land; the underproduction of housing for the rural and urban poor; the exclusion of the non-wealthy, non-white, lower caste, and other marginalized people from housing markets in urban areas; the forced movement of excluded groups to sprawled or informal settlements within and beyond the city; and the consequent deterioration in housing security, living conditions, and socio-ecological sustainability on a wide scale (Madden & Marcuse, 2016; Rolnik, 2019; Aalbers, 2016; Schwartz, 2014; Roy, 2019; Yiftachel, 2020). The more I study disaster events, the more I find these housing and urban dynamics playing a central role — one that becomes only more urgent as disasters multiply, concatenate, and take on crisis proportions.

In saying this I do not wish to suggest that housing and urban exclusion are the only or even preeminent issues driving this crisis-torn moment. Indeed, one should also address the larger scale historical phenomena that shape local housing markets and regional development, including neoliberal deregulation and financialization, post- and neo-colonial struggles for land and sovereignty, underlying race and class inequalities, and destabilizing effects of climate change — themes I will also touch on here. However, as an initial area of focus, I would argue inade-

quate housing and urban exclusion play a singular role in the origins and outcomes of disasters and are a particularly crucial place to start. Moreover, this role is by now "pluriversal", on the rise in a variety of modalities and contexts in most regions of the world, and across quite distinct forms and sites of "disaster."[2] Thus, placing the "urban housing question" at the heart of disaster studies can open up vital approaches for analysis and intervention.

To this end, I will argue for the central consideration of the role of housing crisis and urban exclusion in disaster studies, and suggest this be addressed both in terms of the origins and outcomes of disaster. I will posit this argument across three important conjunctural moments:

1. *Housing crises, and the exclusion of large numbers of people from the urban core, play an increasing role in pushing people to settle outside of cities, generating marginalized residential development in interface zones between urban, rural, and/or "wildland" areas*.[3] Push factors include processes of gentrification and displacement (Marcuse, 1986) as well as "banishment" and "displaceability" tied to ethnicity, race, or other forms of marginalized difference (Roy, 2019; Yiftachel, 2020). Multiple factors converge to lay the ground for exurban development, from indigenous expropriation and expulsion, to rural rezoning and redevelopment, to the pull of "frontier" imaginaries. With such processes common to cities around the world, housing crises and urban exclusion may be seen as key contemporary drivers in historical processes of exurbanization.

2. *As residential development in interface zones puts people, housing, and infrastructure in greater contact with nonhuman nature — from forests to farm animals to soil microbes — it also helps to generate environmental and/or health disaster*. This can occur through human disruption of ecosystems and habitat, as well as human and animal exposure to pathogens. Researchers in a range of fields have begun addressing this in zones variously referred to as the Wildlands Urban Interface [WUI], wildlife-livestock-human interface [WLHI], and peri-urban fringe (Allen, 2003; Hassell et al., 2017; Radeloff et al., 2018). Unifying these approaches, I look at two key examples: a) wildfires in the WUI of California — where humans and housing play an outsized role in the incidence and severity of fires, and b) emerging infectious disease [EID], including zoonoses like COVID in the WHLI of rapidly urbanizing parts of China — where human-animal contact generate and spread disease.

3. *Once exurban disasters occur, housing conditions and urban exclusion play a role once again, exacerbating disaster impacts, allowing multiple disasters to compound one another, and generating crises for those most vulnerable throughout the region*. From housing shortages and rent gauging, to overcrowded and unsafe living conditions, to homelessness — housing problems increase the likelihood that environmental and health disasters generated in interface zones will have devastating impacts in cities as well. These problems are compounded by forms of exclusion along lines of race and citizenship, as well as pre-existing health disparities. Thus, we see multiple disasters landing upon localities in urban and exurban areas alike, interacting in new ways, combining flying ash and novel viruses in already marginalized communities.

2. On "pluriversal politics" see Escobar, 2020.

3. Land use designations include "wildland" or "wilderness" given their relative lack of development and human presence. However often can serve to erase histories of human settlement and land use, sometimes to the present day, especially by indigenous communities.

Ultimately, inadequate housing means the inability to protect ourselves and find shelter from the proverbial storm. Meanwhile, these storms are becoming more numerous and dangerous — in large part due to the search for shelter in urban hinterlands, with its destabilizing, disaster generating effects. Thus, we can argue that the origins and outcomes of the major public health and socio-environmental disasters of our time are linked in fundamental ways to the lack of sound, sufficient shelter in healthy, inclusive cities.

2 Housing Crisis, Urban Exclusion, and Exurbanization

Multiple issues result from housing crises. In a recent study of the affordability crisis in Santa Cruz County, which is among the most extreme in California and the world, I and my co-PIs conducted a large scale survey of area renters and identified four leading issues: rent burdens, overcrowding, substandard or unsafe housing conditions, and "forced moves", i.e. eviction and displacement of people from homes, neighborhoods and cities altogether (Greenberg et al., 2021). Such issues, in turn, have their own socio-environmental impacts. Among the most significant of these when manifest on a regional scale is the fourth one, that of urban displacement.

In the broadest sense, displacement is a result of being forced to move. This can include formal or informal evictions, or simply being compelled to leave one's home for reasons beyond one's control. Oren Yiftachel's (2020) definition of displacement as "the involuntary distancing of residents from full right to the resources and opportunities of their metropolitan region" (p. 154) is helpful in that it also emphasizes *what is lost* in the process of this displacement, with "distance" here understood in spatial as well as social, economic, and legal terms. In the foregoing, I will use *urban exclusion* to encompass this broader understanding of the act of physical dislocation and marginalization, as well as loss or lack of access to vital resources, in particular shelter and collective forms of support and provision, which adequate and affordable housing in cities and villages can uniquely provide.

This raises the question: What generates this exclusion? The process may be rooted in affordability itself, with displacement understood as a predictable outcome of inequitable, unregulated housing markets, and urban neoliberalism more broadly. Such analyses predominate in the global north, and in analyses that link processes of the reinvestment in and gentrification of the city with the displacement and disempowerment of renters and the precariously housed, particularly communities of color subjected to previous rounds of segregation and exclusion (e.g. Lees et al., 2017; Samara, 2014). In our study, we noted the interaction between displacement and the array of issues renters face, i.e.: once rent burden, overcrowding, or major problems with housing become too extreme, people are forced to move, sometimes only to find similar issues awaiting them in their new home (Greenberg et al., 2021). In this sense, we understand both those priced and pushed out of homes, neighborhoods and cities through gentrification, landlord action, and eminent domain — what Peter Marcuse calls "direct displacement" — as well as the exclusion of those who would otherwise move to an area to be near jobs, family, and school but are prevented from doing so due to high cost and lack of supply of adequate housing which he refers to as "indirect displacement" (Marcuse, 1986; Slater, 2009).[4] To the latter can be added, in the U.S. context, the role of real estate, banks and federal and local governments in practices such as redlining, exclusionary zoning, and predatory

4. Such an analysis underlies the geographic distinction made by the Urban Displacement Project at UC Berkeley between zones of "gentrification" and "exclusion." See https://www.urbandisplacement.org/ and the distinction between displacement, gentrification, and exclusion: https://www.urbandisplacement.org/san-

inclusion, designed to exclude non-whites and generate profit from racially segregated housing markets (Rothstein, 2017; Taylor, 2019).

We can contrast this northern, market-oriented approach to displacement and segregation with one set in motion by settler colonial and other state-centric relations. Framing "displacement" in a "southeastern" vs "northwestern" geographic and epistemological context, Yiftachel (2020) argues that in much of the world, ideas of the "displaceability" of individuals or populations are produced through various forms of nationalism and/or identity regimes, which then "interact with the exigencies of globalizing. capitalism to generate new types urban citizenship." In this case displacement "may take the form of physical eviction and expulsion; may manifest in home demolition and denial of services; may suspend rights and create 'gray spaces' of temporary living; or deny residents use of urban material and cultural resources" (p. 155). Scholars addressing the displaceable status of villagers in China, where the most rapid urbanization in the world is occurring, add that both "overt displacement by state-led development" and "in situ marginalization and dispossession without physical uprooting" should be recognized as violations of the "right to the city" (Shih, 2016). Writing from Los Angeles, Ananya Roy offers the concept of the "banishment" of marginalized and/or racialized groups through targeted policing, eviction, deportation, and other forms of forced mobility, thus showing the relevance of the concept of displaceability for cities of the North as well (Roy, 2019).

Combining concepts of direct and indirect displacement, segregation, displaceability, and banishment enables us to see the role of the state alongside the market in excluding people from cities, and the role of urban exclusion within broader histories of uneven socio-spatial development, settler colonialism, and racial discrimination. Within this broader framework, we can also see the phenomena of urban exclusion on the rise globally (Lees, Shin, & Lopez Morales, 2017; Rolnik, 2019; Roy, 2019; Sassen, 2014; Yiftachel, 2020), and as one of the defining features of contemporary urbanization, and targets of urban social movements.

With increasing numbers pushed or priced out of cities and towns, or blocked from entry in the first place, has come the explosion of precarious, exurban populations and development. Clearly demographic shifts are not the only driver of this development. Henri Lefebvre anticipated the unending spread of the "urban tissue" across the surface of the planet in the 1960s, with emphasis on the role of urban infrastructure in linking rural and urban environments, from mines to factories, factory farms to warehouses, making the life of the growing city possible (Lefebvre, 1968). Indeed contemporary scholars of "planetary urbanization" caution against focus on population counts so often used to measure the magnitude of the "urban age", at the expense of material dimensions that exceed classic urban boundaries (Brenner & Schmid, 2014). While empirical and theoretical problems in quantifying urban population are important to recognize, and while I will not attempt to address them here, the proliferation of socio-ecological disasters due to the physical presence of human population, their housing and infrastructure, in exurban interface zones makes grappling with these social and demographic questions nonetheless quite urgent.

To take on this examination we should also recognize that the exurb by now troubles imaginaries of the "lily-white" and exclusive suburb.[5] Such forms persist, as do disproportionate

francisco/sf-bay-area-gentrification-and-displacement

5. These stereotypes are prevalent in the U.S. and British context, whether the bucolic "garden suburbs" that arose as a reaction to the nineteenth century industrial city, or the sprawling, middle class suburbs that spiked post-WWII era — both of which were explicitly segregated by race and class e.g. as described by Peter Hall. Important critiques of the economic and environmental cost of servicing and protecting famously wealthy and exclusive suburbs at the expense of proximal inner-city neighborhoods have helped reify the idea of fixed

federal subsidies for homeowners, gated enclaves and resorts. Yet ours is also a "post-suburban" age, typified by "an increasing complexity of structural form and daily life in the periphery of cities" (Connolly et al., 2021, p. 248), and with this, increasing demographic diversity and concentrated disadvantage in these spaces. As the urban core has been selectively reclaimed, redeveloped, and gentrified, the ex-urban has been increasingly marked by socio-spatial marginality and inequality, much like the "inner city" and "ghetto" of the past century. Thus, newly common ex-urban development types include van encampments and farmworker barracks, mobile home parks and new iterations of working-class commuter sprawl. Demographic and development shifts intertwine to produce the "suburbanization of poverty" (Kneebone & Garr, 2010). In the context of the San Francisco Bay Area, this has taken on starkly racial dimensions, with the "re-segregation" of larger city-regions, due to the outmigration of low income African American, Latinx, and Asian American populations from the urban core to far-reaching exurbs (Schafran, 2018; Urban Displacement Project, 2019).

There is more work to be done to understand the relationalities between urban housing crisis and exclusion on the one hand and exurbanization on the other, including the full range and relative weight of the push/pull factors that both force and attract people to live outside the city. Push factors include the political and planning decisions that both constrain housing options in cities and lay the ground for them in exurbs. This ground laying, itself, often has a long and violent history, including expropriation of land from indigenous groups, rural villages, or earlier generations of informal settlement. Over time, it may involve clear-cutting, draining wetlands, and other means of creating developable land; new mechanisms and markets for the financializing and insuring land and housing; and the political and legal means of rezoning rural or wild lands for residential use.[6] These processes produce and exploit major rent gaps between city and hinterland — which of course can go in either direction, depending on the swing of uneven development. After decades of extreme urban gentrification and exclusion has come a new scale of relative affordability in the exurbs, even while parts remain exclusive, or are gentrifying themselves.

Added to this push is the pull of "living close to nature", which as Raymond Williams (1973) and scholars of suburbia have long reminded us is a desire deeply rooted in Western culture, as well as one stoked by frontier imaginaries, persistent anti-urbanism, and marketing. In my review of U.S.-based literature on the dangerous growth of the WUI in recent years, I found little else to explain causality beyond this seemingly obvious desire. Yet, I would argue, push factors have always been inextricably tied to pull factors when it comes to exurban development. And as green gentrification has made cities both desirable and unaffordable, the former are likely superceding the latter. In much of the world people would choose city over hinterland, if they had this choice (even with reversals currently occurring amongst pandemic-era teleworkers).

Among the outcomes of these processes is the production of relatively cheaper, less regulated, marginal and/or abandoned zones outside cities, in which those excluded from the city and facing few housing options have in recent decades increasingly settled — whether under duress, by choice, or some combination of the two. And it is this settlement that brings me to

race and class characteristics of urban vs suburban space. See e.g. the case made for "letting Malibu burn" by Mike Davis (1995).

6. Many recent literatures converge here. Two examples: On the role of insurance in enabling the development of disaster-prone landscapes, particularly those facing flood risk in the coastal U.S., see Elliot (2021). On the role of zoning and land use regulation on the "making of Lyme disease" in the exurbs of northern Virginia, see Kaup (2018).

the topic of disaster at hand. For by driving exurbanization, housing crises and urban exclusion have also helped drive up the likelihood of a range of disasters — as people and housing push their way farther into more biodiverse, climate changed, and hazardous "wild lands".

3 Exurban Disasters

Exurban development, from commuter suburbs to informal settlements, brings with it a host of new social, ecological and health risks. Important research has focused on this issue in regards to climate impacts. Building on a generation of critical planning research on the environmental perils of sprawl (e.g. Wilson & Chakraborty, 2013), a new literature unpacks the contradictions of "sustainable" urban planning that disregards affordability, and insodoing drives the very sprawl it sought to vanquish. From greenbelts to transit oriented developments to brownfield reclamation, we find most sustainability interventions have been equity- and housing-deficient engines of gentrification (Checker, 2011; Agyeman, 2013). They've also generated increased car use and greenhouse has [GHG] emissions — both by those who can afford the new luxury green city, and by those priced and pushed out to lower cost, car-dependent exurbs (Chapple et al., 2007; Pollack et al., 2010). Thus, ironically and tragically, we see larger carbon footprints in the "greenest" of urban regions intensifying risk of climate-related disasters (Aldana Cohen, 2017; Anguelovski et al., 2016).

Tracing exurban housing development and population shifts allows us build upon knowledge of GHG emissions to consider a broader range of socio-environmental impacts and disaster risk associated with exclusionary urbanism. Bringing the analysis down to earth, so to speak, we can examine the degree to which this development and population growth is rendering these remote areas *themselves* more disaster-prone. For, by bringing people in closer proximity to climate-changed ecosystems, and multiple species and pathogens in closer proximity to humans, these areas generate a number of new risks. In what follows I will focus on two: increased incidence and severity of wildfire, and of emerging infectious disease.

The effort to "ground" disaster and displacement research in this way is complicated by the challenge of what to call the ground itself. As processes of urbanization have continued to explode the boundaries of "the city", frameworks for conceptualizing the "urban hinterland" have exploded with them (Brenner, 2016; Angelo, 2016). Depending on disciplinary and geographic vantage point, the area has been defined in ways that emphasize one or another interface along the "urban-suburban-rural-wildlands" land-use gradient. In the post-WWII U.S., city and regional planners focused in on the troubling rise of "exurbs", then envisioned as far flung, amenity-rich developments taking over rural areas, tied via ever-expanding commute-sheds to urban job centers (Berube et al., 2006; Taylor, 2011), with planning studies now mapping the infrastructural legacies of successive eras of "sprawl" in the U.S. and globally (Barrington-Leigh & Millard Ball, 2015; Schneider & Woodcock, 2008). Urbanists and planners in the Global South concerned with expansion of informal settlements on the "peri-urban" fringe, have emphasized the porous interface between the rural and the urban, particularly as regards its implications for public health (Allen, 2003; Wandl & Magoni, 2017). Adding to this analysis, epidemiologists concerned with the proliferation and spread of EID, emphasize the capacity of informal urbanization, alongside rural to urban migration, to densify the "wildlife-livestock-human interface" across which zoonoses and other pathogens can travel (Hassell et al., 2017; Ahmed et al., 2019). Foresters, fire managers, and fire ecologists also center interface geographies, in this case the now widely used Wildlands Urban Interface [WUI], measured by the degree of housing density within or alongside "wild", undeveloped areas — with "housing"

here measured in terms of formal, census-mapped settlement patterns (Radeloff et al., 2018; Stewart et al., 2007).

On its own, each of these approaches might be deemed a "chaotic concept", referring to "a single or unitary phenomenon [yet] encompassing a wide range of [...] realities, actors, and causal processes." As Duminy and Parnell note, such chaos is par for the course in new "urban sciences", fueled by access to big data, from GIS to remote sensing to machine learning, yet divorced from urban social science more broadly (Duminy & Parnell, 2020). The goal here is to bring back urban social sciences and political ecology — with their mix of methods, recognition of relational geographies between rural and urban areas, and critical historical approaches that take into account legacies of uneven development, including the colonial and expropriation of indigenous lands and abandonment of traditional land use and stewardship practices. This can help us understand some of the causal processes behind these new hinterland formations, such as those rooted in housing crises and urban exclusion, as well as their outcomes in the spiraling disasters we now face.

4 Wildfire at the Interface

As defined by foresters and fire ecologists, and as mapped by geographers, the Wildlands Urban Interface [WUI] is now designated the fastest-growing land use type in the conterminous United States (Martinuzzi et al., 2015; Radeloff et al., 2018), and is on the rise globally (Modugno et al., 2016), with both WUI population and housing growing exponentially since the 1990s. With the growing incidence and destructiveness of wildfire in an age of climate change, and as correlations have been drawn between these fires and WUI growth, increased attention is paid to mapping and analyzing the WUI in particularly fire-prone climatic zones such as the U.S., Australia, the Mediterranean. Nowhere in this zone is WUI growth more pronounced than in California, where one in three households now live in the WUI, three times as many as in any other U.S. state, giving those of us here a perilous front row seat on the phenomenon. WUI expansion occurred contemporaneously with the affordable housing crisis and waves of displacement from urban areas nationwide. The extensive WUI literature, however, has not addressed this relationship, and indeed has paid scant attention to causality at all. Rather emphasis has been placed on the effects of WUI growth on wildfire, examining these effects in relation to other factors and within the longer historical arc of changes to regional and planetary fire regimes.

Humans have played an integral role in fire ecology for as long as we've settled on the planet. In the case of indigenous California, as in traditional, anthropogenic fire regimes around the world, this role involved setting intentional, periodic, small-scale fires to propagate plants, enable grazing and hunting, and prevent naturally-occurring fire from becoming catastrophic (e.g. Anderson, 2006). Yet the last two centuries have seen a profound shift: the rise of anthropogenic fire that is decidedly *nonbeneficial* (Syphard et al., 2007; Pyne, 2019). This shift from "good fire" to "bad" itself was driven first and foremost by fire suppression, which allow dry vegetative fuel to accumulate. In U.S. and Australian contexts, these policies originated with colonialism and the brutal expropriation of indigenous lands, and continued with fire management regimes aiming to "protect" forests for the purposes of leisure and logging. In other contexts — Southern Europe, the Middle East, and Latin America — fires were traditionally set by small farmers in mountainous, fire prone areas, yet many left these arduous plots after WWI, abandoning their lands to become overgrown. With climate change, these accumulated fuels were vulnerable to hotter, dryer, and longer fire seasons, and more likely to cause larger,

more devastating fires. Now, landing atop this fire-prone situation is exponential WUI growth, bringing population, housing, infrastructure, and new more incendiary fuels and firebrands into or adjacent to these poorly maintained, climate changed natural areas.

It is now estimated that over 95 percent of "wildfires" in California are caused by humans — with common ignitions due to power lines, car gas tanks, escaped fires, flammable materials in housing itself, and arson — all of which are attributable in whole or part to WUI growth (Syphard & Keeley, 2015 & 2020; Kramer et al., 2019). Indeed recent regression analysis find WUI growth *an even more important factor than climate change* in the severity of these fires (Syphard, 2019). 18 of the 20 largest fires on record in California have come since 2000, with six in the top ten occurring in just the last three years (Calfire, 2020). For all these, the WUI has played a decisive role.[7]

In 2017 the Tubbs Fire, at the time California's most destructive, burned 5,500 houses and cost 22 lives in outskirts of the sprawling city of Santa Rosa, and was caused by a private electrical system adjacent to a residential structure. This record was obliterated in 2018 with the Camp Fire in Butte County, set by faulty power lines near housing, which burned over 10,000 homes in the city of Paradise and surrounding WUI towns, causing the loss of 85 lives. Then in August 2020, following an historic heat wave, freak thunderstorms caused 10,800 lightning strikes and ignited 367 simultaneous fires throughout Northern California. While these small blazes were natural in origin, they soon converged, growing "so fast and so vast that Cal Fire didn't even give names to the largest ones as it usually does, resorting to acronyms" (Frank, 2020). This included the SCU Lightning Complex in Butte, Plumas, & Yuba Counties, the LNU Lightning Complex in Solano and Sonoma Counties, and our own fire to the north and east of Santa Cruz, the CZU Lightning Complex Fire. This rapid growth in the fires' size, severity and destructiveness can ultimately be attributed to human causes, lightning strikes notwithstanding. As preeminent fire ecologist Fred Keeley put it in a recent interview, each fire season we are now seeing a "perfect storm", with "everything [...] coming together at once," including the heat, drought, and tree die-off of a changed climate; the legacy of fire suppression; and what to him was most significant and novel, the expansion of the WUI, particularly in the areas where the fire was most catastrophic (Isaacs-Thomas, 2020).

While attention to the role of increased WUI housing in generating these disasters is welcome, less clear is *where this WUI growth came from in the first place*. Keeley explained this simply as "population growth" — ie the increase of the state population by six million since 2000, which, as if by osmosis, lead to "more people pushed out into areas of urban sprawl, of dangerous fuels, increased ignition sources, increased potential for people getting killed, an increase in the electric grid" (*Ibidem*). Analysis is lacking of the causal social processes driving this sprawl, and consideration of its link to the housing crisis happening in urban areas right next door. My scan of WUI literature reveals similar limitations: in the minority of cases in which causal explanation is offered, assumed drivers are population growth or amenity driven lifestyle decisions, without evidence.[8] More complex motivation is captured by investigative journalists covering post-wildfire struggles across California, frequently featuring communities that moved for affordability reasons, and now are on the verge of or experiencing homelessness (e.g. Anguiano,

7. CalFire data goes back to 1932. As they note: "There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times."

8. The same is true for literature on exurbia. As cultural geographer Laura Taylor notes: "These authors ask where exurban places are in the US, when they emerged, and what their extent is. The remaining questions — how exurbs come to be and why — need more work..." (Taylor, 2011, p. 329)

2020; Healey, 2020).

Based on this, and preliminary research in the interface areas of the Santa Cruz Mountains and low-lying hills of the South County, my hypothesis — which I and colleagues aim to test in further research — is that migrants who moved to these areas for lifestyle reasons have been joined in ever greater numbers over the last two decades by those who've been pushed or priced out of rapidly gentrifying cities and suburbs in the region. People do often find home, create community, and find meaningful connection to nature in the hinterland, even under inhospitable and unsafe conditions. But increasingly they do so under conditions not of their own choosing, and at mounting personal and environmental cost.

5 Emerging Landscapes of Disease

Epidemiologists, researchers in public health and international development, scholars in emerging fields of landscape political ecology and Anthropocene studies, all are also doing groundbreaking work on the growing role of exurbanization and interface development on disaster, in this case in terms of the emergence and spread of disease. Of particular concern are emerging infectious diseases [EIDs], which are the result of pathogens that move from non-human vectors to humans and change their clinical presentation when they move into human hosts for the first time (Hassell et al., 2017). This creates novel diseases that are challenging to treat and that, under the right conditions, can spread so rapidly before treatment is found as to become pandemics.

The study of the relationship between urbanization and infectious disease courses through human history, with a decided emphasis on the figure of the "slum" and other dense inner-city neighborhoods. Cities are "promiscuous social spaces" in which people "literally and figuratively [bump] up against each other in smaller spaces and larger numbers" than in prior, less dense forms of settlement (Wald, 2008, p. 14). The earliest recorded pandemics from ancient times through the 1700s were associated with and often named for the cities where they spread. The origin of epidemiology, public health, and urban planning are bound up with the fear and reality of contagion in the nineteenth and early twentieth century industrial city. Global city formations and networks of the 1990s, it is argued, ushered in the contemporary pandemic period (Harris Ali & Keil, 2008; Reyes et al., 2013).

Yet as health geographers now note, urban promiscuousness alone cannot explain this relationship. Rather, as Connolly et al. (2021) note, new focus is needed on the changing spatial form and extent of urbanization, and its relation to biodiverse non-urban areas, i.e. "the socio-ecological flows and disruptions leading to an increased incidence of infectious disease *in peri- or suburban areas*" (p. 248, emphasis mine). Specifically, EIDs become increasingly likely in new interfaces where humans and their domesticated animals come into contact with pathogens that historically lay undisturbed in undeveloped areas. This contact can occur via water, food, or air, as well as living vectors like bats, rodents, mosquitos, or ticks. It occurs most commonly through the development of housing in these environments, and/or the excavation of materials in them to be used to construct housing and related infrastructure elsewhere. Thus, as in the WUI, we see housing development associated with habitat fragmentation and ecosystem disruption on a massive scale, increasing the likelihood of unintended and disastrous consequences.

These dynamics force us to question our spatial imaginaries once again. With suburbanization in the 1960s and 1970s, the Western belief in "epidemiological transition" caught hold, i.e.: of a societal shift from infectious to chronic diseases as the major cause of human mortality

and morbidity. Chronic diseases on the rise, like heart disease and obesity, were attributed to individual lifestyle choices — e.g. the sedentary, car-centric, and consumerist life of the suburbanite, which could be treated through diet and exercise. Overall the future for human health looked bright, thanks to suburban quality of life. It soon emerged the opposite was true. This was both in the sense that dense urban areas with adequate housing and social support were actually the healthiest settlement type (Freudenberg et al., 2005) — a point which contemporary urbanists argue holds true even in the COVID era (Florida, 2020), and in that suburbs, exurbs and informal settlements, with their continued and precarious expansion into the hinterland, have helped bring infectious diseases back with a vengeance.

Indeed, with extended urbanization since the 1980s, we've seen a *tripling* of the number of infectious disease outbreaks per decade, ushering in what some now call a new "pandemic age" (Connolly et al., 2021; Harris Ali & Keil, 2008; Smolinski et al., 2003). "New diseases" include those once isolated to non-humans now able to spread to new geographical areas and human hosts, as well as those that are entirely novel (Mayer, 2000). Recent examples include: yellow fever, the Marburg virus, the Ebola virus, Lyme disease, hepatitis C, HIV/AIDS, and West Nile virus (Drexler, 2002; Garrett, 1994). We've also seen "old" infectious diseases believed eradicated through vaccination campaigns, such as tuberculosis, reappear and spread once again under the right exurban conditions.

Not surprisingly, the most significant EID outbreaks have been in the most rapidly urbanizing regions of the world (Alirol et al., 2011). As Harris Ali and Keil (2008) trace, both SARS and Ebola originated in urbanizing hinterlands of China and Africa before travelling to and spreading in and between major cities such as Hong Kong and Toronto or Freetown and Monrovia, respectively.

As with the WUI, I would argue that the EIDs and the interfaces across which they travel are fundamentally housing questions. As we see with wildfire, the most significant factor driving the spread of disease is "*the degree of contact*" (Smolinski et al., 2003), itself a function of where people live, work, play, and commute daily, and how these spaces are designed and distributed. Whereas such contact zones may once have occurred primarily in the heart of swelling industrial cities, they now extend outwards into the peri-urban interface. From the perspective of epidemiologists, these dynamics, wherever they occur, affect the degree to which we are disrupting ecological systems and thus increasing risk for people. As Hassel et al. (2017) note, in describing zoonosis: while other factors on the animal side play a role, "it is the anthropogenic influence on ecological systems that dictates the level of risk that operates at the interface between humans and animals in zoonotic disease emergence" (p. 55).

Careful tracing of this disruption and contact across multiple interface zones help us disentangle the role of urban process and housing in a variety of ways. For instance, the onset of novel corona viruses of the last two decades — including SARS, MERS, Asian swine flu, and now COVID-19 or SARS CoV-2 — can be traced to bats, which infected animal hosts that were brought to exotic animal markets in China's central and eastern urban regions, at which point humans were infected. It is now thought that these bats, however, originated in the massive, biodiverse cave complexes in southwestern Yunnan province (Best, 2020; Fan et al., 2019). The caves are made of karst, which over the same period was heavily mined to make the cement to build the new sprawling Chinese cities. Disrupted bat populations fled to other cave complexes, to intermix and exchange pathogens with bats throughout China, including in the caves of Hibbei Province on the outskirts of Wuhan. Wuhan, a sprawling Central Chinese city of 11 million, locally known as the "thoroughfare of China" (Huifeng, 2020, cited by Connolly et al., 2021), has nearly doubled its geographic scale, population, and average building size in

the previous decade (Best, 2020). Like in most Chinese cities, millions of displaced migrants from the countryside do essential jobs in Wuhan yet are denied urban citizenship, and thus access to adequate health care, education, or housing in the core urban areas. Migrants living in the outskirts near the exotic markets where animals and bats intermingle, and often traveling between regions, were also among the first infected by COVID. Thus, in the Chinese case as elsewhere, we see housing production and urban exclusion entangled with both the creation of new human-nonhuman interfaces, and the spread of novel diseases.

In what follows, I trace the impacts of these exurban disasters as they spread across the broader urban region, and as they themselves come into contact in new ways. Here again housing and urban inclusion are crucial, now in their capacity to protect us from infection and toxic air.

6 How Exurban Disasters Become Regional Crises

In Fall 2020, two agencies published distinct maps of health risks in California. One was from the California Environmental Protection Agency, with red zones showing the state's worst air quality following the state's unprecedented wildfire season. A second was from the state's health department, and marked in yellow the cases of COVID-19 after six months of the spread of the pandemic in the state. As anxious Californians overlapped the maps, we found certain areas where these twin perils could not be escaped, concentrations of orange from inner city neighborhoods in Los Angeles to the agricultural belt of the Central Valley to the exurban rings of south Santa Cruz County.

These zones of convergence are also home to majority poor and working-class communities, disproportionately communities of color, and communities with numerous underlying risk factors. Scholars in health justice emphasize factors rooted in lack of access to adequate healthcare, jobs that put people in harm's way, and legacies of racial segregation and discrimination (Benfer, 2015). Connolly et al. (2021) show how, under conditions of extended urbanization, factors of demographic mobility, infrastructural linkages, and uneven governance play particular powerful role across the urban exurban divide. To these frameworks I would add the risk of inadequate housing and urban exclusion, arguing such conditions play an outsized role in reproducing health and environmental inequities. This was particularly so with the converging disasters of COVID and the California wildfires, which required people have the personal space to protect themselves and their families from both airborne pathogens and toxins.

We see the swirl of these multiple factors in the air of the California Central Coast region where I'm based. The region has historically been and remains highly segregated along race and class lines. Working-class mostly Latinx population, are concentrated in what's called locally the "south county", around the city of Watsonville — itself a legacy of an earlier era of exclusionary and segregationist housing policy, and now also due to the relative affordability of housing there.[9] They live disproportionately in cramped and overcrowded rental housing — our survey found 40% of renters in Watsonville were overcrowded, double the rate for those in majority white city of Santa Cruz to the north (Greenberg et al., 2021). These conditions are also now determined to be a leading vector of the pandemic in Santa Cruz County. This is also due to the fact the population disproportionately commute hours to service jobs in "north

9. This figure is also more than ten times higher than the official count of 3% captured in census surveys, due to the fact that many of these surveys undercount renters and those in precarious situations, including the many mixed status Latinx families we surveyed.

country" or agricultural jobs further south and east. Given governance failures in developing mass transit (fueled by powerful NIMBY opposition to train service to connect the region), we've seen an explosion in the use of crowded vanpools for the commuting workforce. These trends continued unabated during the pandemic and wildfire, as the majority of South County workers were designated "essential"; obliged work in conditions in which they were exposed to potential contagion, toxic air, or both; and obliged to continue their now potentially contagion-spreading commute. Thus, those who contract the virus at work can bring it home more easily to their co-workers and families, including elderly and vulnerable relatives. As noted in a recent interview with the lead Santa Cruz County health officer,

> COVID-19 can quickly spiral into a nightmare scenario when combined with overcrowded multigenertational households full of frontline workers who don't have the space or resources to quarantine [...] Prohibitive housing costs mean it's "not uncommon" for 10 or more people to live in the same household in South County — often several generations in one home (Cruz, 2021).

In addition, a majority of renters in Watsonville complained of "major problems with their housing" (Greenberg et al., 2021). This includes living in spaces that are poorly ventilated, many with preexisting air quality issues due to mold, and with the inability to screen toxins already in the air due to pesticide drift from farm fields or exhaust fumes from proximity to traffic clogged highways. In recent years these conditions have been exacerbated by increasing amounts and duration of wildfire smoke. As we've come to learn, this smoke is a toxic cocktail of metals and carcinogens from burnt cars, petroleum products, and building materials. It is particularly dangerous for low income children and the elderly, who may now be developing chronic health problems as a result of smoke conditions from the summer, the multiple years in which annual smoke days have doubled due to the longer fire season, and the fact that their families can't afford expensive air purification systems in their homes (Sengupta, 2020).[10] Adult workers, meanwhile, particularly those with asthma, are also susceptible.

As early studies in China indicate, weakened respiratory condition due to previous exposure to wildfire smoke makes us more susceptible to, and likely to face extreme symptoms of, COVID-19 (Henderson, 2020). Thus, we're now beginning to see "syndemic" impacts (Singer et al., 2017), with the interaction of chronic respiratory disease, COVID, and underlying social conditions. Respiratory problems are exacerbated by wildfire smoke. Poor outdoor and indoor air quality tends to reduce exercise, and thus exacerbate chronic diseases like obesity, heart disease, and diabetes.[11] All of these conditions then heighten rates of morbidity and mortality from COVID-19.

COVID disparities for Santa Cruz county are now among the most extreme in California. *Latinos concentrated in South County represent 30 percent of the county population yet 62 percent of infections, while whites, concentrated in North County, represent close to 70 percent of the population, with just 20 percent of cases*.[12]

10. Marshall Burke, Stanford economist, and his colleagues found that, across California, as the number of smoke days has risen over the past 15 years, the impact is so extreme that all state gains in cleaning air from conventional sources of pollution are being reversed. (Burke et al., 2021)

11. I am indebted to my colleague James Battle, who studies diabetes and "syndemics," for this insight.

12. Data represents known cases of COVID-19 among residents of Santa Cruz County by date reported to the Communicable Diseases Unit from health providers or electronic lab reporting. Data extracted from the California Reportable Disease Information Exchange Nov 18, 2020.

This raises the question of why these conditions persist — on the job and commute, and at home. In our tenant survey, we found a significantly smaller number of Latinx vs white respondents reporting housing violations, such as persistent mold; in subsequent interviews, we found many of those not reporting were undocumented or part of mixed status families, and worried complaints could lead to loss of their housing, or worse, deportation (Greenberg et al., 2021). With the anti-immigrant agenda of the Trump administration, as well as ever-intensifying gentrification pressures, Latinx families found themselves to be particularly "displaceable" in California cities. Beginning in the 2017, legal-aid agencies in Santa Cruz County and throughout the state began reporting eviction threats against undocumented tenants by landlords as a means to void leases and raise rents — in which landlords "often mentioned Trump by name" (Caps, 2017).

Come 2021, 1,000 units of housing in Santa Cruz County were destroyed by fire, and hundreds more damaged — a devastating loss for this small community, and one that worsened the local housing shortage and demand for shelter. Meanwhile workers from Silicon Valley continued to move to new and often hastily reassembled homes in the area, pushing the post-fire market to new heights (Monroy, 2021). Thus, tenants who might consider speaking up about their housing conditions faced the very real risk of being evicted, compounded by the risk of infection should they join the growing ranks in cramped emergency shelters — as public health officials scrambled to retrofit gyms, hotels, and county buildings as best they could to enable social distancing. And if shelter beds were taken, there came the possibility of joining the homeless encampments then expanding throughout Santa Cruz County and across the state, in DIY campsites along the highways and river banks of the exurban fringe.

7 Conclusions

It has been generative for me to reflect on the role of urban housing questions within the sprawling interdisciplinarity of disaster studies. It has reminded me that, like urban scholarship more broadly, disaster studies produce their own epistemological center/periphery divisions — between the natural and social sciences, materialist and interpretive approaches, as well as "northwestern" and "southeastern" positionalities, among others. From epidemiology, fire ecology and urban and regional planning, to traditional environmental stewardship and ethno-botany, to critical and postcolonial urban studies and environmental health justice, it is my hope that a bridge-building analysis of disaster can be forged by centering the pluriversal need for adequate shelter, and the spiraling implications of this housing for both people and ecosystems. As such, I would argue that the study of housing crises and urban exclusion become central to broader efforts to advance a transdisciplinary and engaged urban political ecology of disaster.

I have attempted some preliminary work along these lines here, exploring the role of housing and urban exclusion across different conjunctural moments of disaster, shaping both their origins and outcomes. In terms of origins, this includes, first, their role in driving exurbanization, from informal settlements to sprawl, together with the historic factors that lay the ground for this development. We then see the complex impacts of this exurbananization, and its capacity to generate multiple kinds of disaster. The movement of people, housing, and infrastructure across the interface of urban, rural, and wilderness areas — whether referred to as peri-urban fringe, wildlife-livestock-human interface, or WUI — is recognized as a, if not *the* cause of the major socio-environmental and health disasters of our times, due to increased human-nonhuman interaction alongside the ongoing disruption and fragmentation of habitat and ecosystems, disruptions which themselves interact with and contribute to larger scale dy-

namics like climate change. I have discussed wildfire and pandemic, and their combination; we might in future explore the role of the interface zones in floods, droughts, and other climate related disasters afflicting us and our planet. Finally, housing and urban questions become vitally relevant again in the aftermath of disaster, shaping outcomes for vulnerable populations, and potentially turning disasters into crises. Through the case of compounding crises of COVID-19 and wildfire smoke Santa Cruz County, we see how inadequate housing makes it impossible to protect oneself and others from airborne pathogens and toxins, and how in turn, this leads to starkly unequal outcomes along lines of race, class, and residential geography.

Such understanding can then inform research on interventions. What would it mean to center housing within disaster research and response, and do so at each of these moments, and with broader urban/exurban regions in mind? How might we intervene simultaneously in advancing urban inclusion and limiting the growth of the disaster-prone interface?

Perhaps now, with the unprecedented scale and intersection of these crises, this is one of those moments of radical rupture when these ambitious questions can be asked, and when the ideas housing and right to the city activists have been advocating for for a generation can become common sense. In the U.S. context we're beginning to see evidence of this. In response to the pandemic, we've seen the use of the national stimulus to extend eviction moratoria and provide supportive housing for the homeless, with the recognition by the Centers for Disease Control that lack of adequate and affordable housing is fundamentally a "public health" issue. The question remains as to whether these programs will be extended and expanded, as well as whether the lessons of climate catastrophes, like wildfires and floods, will be harnessed to redirect housing policy and limit exurban growth on a national scale — along the lines of a Green New Deal for Housing legislation. If so this would make it possible to build on small scale efforts at "managed retreat", the "urbanizing" of informal settlements, and other means of mitigating disaster-prone development in interface areas, while reinvesting in social housing and protecting tenants in the urban core.

Housing advocates are seizing on these discursive shifts to push for such broader, longer term change. Much as urban housing activists should be recognized as "low carbon protagonists" (Aldana Cohen, 2017), and part of emerging "climate publics" (Elliot, 2021), we might argue that they also be seen as protagonists for public health and ecological conservation, as well as for environmental and health justice. Based on the relational analysis explored here, I would suggest that to elevate these protagonists it will also be crucial to forge new coalitions across geographic and disciplinary lines. Imagine housing and right to the city activists working together with those in conservation and public health, as well as those with traditional knowledge in stewarding the land and protecting habitat, such as farmers and indigenous groups. Might it be in our interest to find common ground, politically speaking, across the interface?

Perhaps this unprecedented moment offers such an opportunity. Disasters, we know, fall unevenly and in complex combinations, exposing and linking deeply rooted inequalities of race and class, citizenship and housing tenure, with the potential to spiral into far-reaching crises. Yet these crises are also full of the possibility of collectively imagining far reaching change. This can begin with one fundamental step: ensuring housing as a universal right. If pandemic isolation, wildfire evacuation, and any number of recent disasters have taught us anything, it is that all of us, in city or hinterland, depend upon each other to stay safe, and that this safety will require inclusive cities and homes for all.

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