

Section A: Project Summary

Title: Urban Environmental Geography, Public Health, and Pest Animals in US Cities, 1850-Present

Although they did not know of the germs the animals might carry, residents of US cities in the 1860s and 70s cited the flies, roaches, and rats who swarmed the tenements in arguing for community sanitary programs. In the 1950s vermin provided justification for housing and health agencies to pursue urban renewal, and also gave tenant activists a striking symbol of officials' neglect of their neighborhoods. Today, though we know that vermin produce indoor allergens, and we have pesticides designed to keep vermin at bay, the fact that both may be hazardous confuses parents, health officials, and other advocates who seek to protect health. As long as people have lived in cities, pest animals have joined us in our homes and buildings, affected our health, and propelled our policies on the urban environment. The social geography of pests, however, reflects the social position and physical surroundings of our neighborhoods.

The researchers' objective is to use the ecological history and social geography of pest animals, which have been blamed for several kinds of disease exposures throughout the past two centuries, to investigate how health and environmental conditions are connected with poverty in cities. Specifically, why is poverty linked to infestation, and what political-economic, scientific, and cultural factors have influenced interventions in pest problems? Since the development of US cities, animals living with humans have posed both public health threats as well as practical quandaries for a range of groups: residents, especially those with low incomes; housing and public health officials; and animal rights activists to name just a few. Though by the twentieth century many vector-borne illnesses such as plague and typhus posed less of a threat, pest animals continued to create stressful and injurious conditions for the low-income people who disproportionately live with them. In addition, scientists and activists increasingly regard as dangerous ñ especially in intimate settings such as homes and schools ñ the very chemicals designed to protect people from pests. Furthermore, emerging zoonoses and other illnesses problematize human contact with wild and domestic animals. A closer look at the historical case of urban pests will help inform a social approach to urban ecology, and highlight key tasks that lie ahead for ecologists and housing and public health officials.

The *broader impacts* of this research lie in its potential to explain historical relationships among low-income communities, the urban physical environment, and populations of pest animals such as rodents, roaches, mites, bedbugs, and stray domestic animals, and to use this history to inform present-day actions on pest issues. The project will benefit society by pointing out gaps in urban, health, and environmental policy and science. These arenas have insufficiently addressed the intersections between poverty and environmental conditions in US cities. A social-geographic analysis broadens the questions we may ask of urban nature, and this project will use interviews to expand participation of low-income communities and communities of color in setting the agenda of urban ecology. Environmental history and history of science have revealed parallels between past and present policy discourses, thus lending a unique perspective on current problems. Like any examination of the past, this one will reveal a deeper history to current debates and conditions than what policy-makers today recognize, a history which they may use as a fund of knowledge. Specifically, what have been the mistakes, successes, and injustices in past pest control interventions in poor neighborhoods? By tracing the evolution of political and institutional responses to vermin by a range of sectors, the researchers will be able to inform present-day efforts to protect urban communities from vermin-related disease and damage. It also bears implications for the ways cities accommodate nature, including pests and emerging disease vectors along with other sorts of animals.

The *intellectual merit* of the proposed activity lies in its exploration of interdisciplinary work at the confluence of urban geography, environmental history, and history of science and medicine. Our primary methods will include archival work, interviews, and spatial and quantitative analysis. Our sources will include literature from industrial, public, scientific, community, environmental, and military institutions concerned with pest management and pest ecology; demographic and housing data from US and state censuses; records of infestations and reports of related disease from health agencies at local and national scales; and interviews with surviving community residents who have experienced infestations. Urban geography will provide the basis for understanding the spatial patterns of human-pest interactions, the politics of the urban environment, and popular and scientific representations thereof. The city is a relatively recent focus for researchers in environmental history and history of science, so this project will help expand the geographic purview of those fields while employing their strengths at interpreting past relationships between humans and nature. Finally, this project will bring together health geographies and animal geographies for a fuller understanding of the non-human life of cities.

Section C: Project Description

C.1. Research objectives and hypotheses. Urban geographers and environmental historians have only recently begun to account for the nexus of social, political, physical, and non-human factors that constitute urban environmental problems. While poverty and disease have been major concerns for researchers, few advance a broad notion of the urban environment that accounts for human dimensions such as neighborhood social differences and the aging of infrastructure alongside non-human features such as animals, water, and pathogens. This project proposes to use the suite of environmental, social, and health issues associated with urban animal pests to show how poverty, the politics of a changing urban environment, including housing and development, and pest control strategies have influenced the historical geography of human-pest interactions in US cities since 1850.

The researchers will employ the tools of urban geography, environmental history, and history of science and medicine – including archival work, interviews and spatial analysis – to develop a view of human-pest interactions that integrates material changes to the city and its human, animal, and disease ecology, with the history of representations and discourse about pests, people, and place.

C.1.1. Hypotheses. The following hypotheses will guide our research: First, pest animals and associated health problems have affected poor neighborhoods disproportionately because of the lack of investment in maintaining the physical environment and the kinds of pest management strategies deployed there. This uneven geography of pests has had political effects as well as physical ones: while outside officials represented lower-income neighborhoods as infested, unhealthy, backwards, and possibly in need of invasive renewal measures, communities have used their own pest problems as a rhetorical tool to gain recognition for urban environmental problems. Second, conceptions of disease and environment, along with politics, have affected interventions in pest problems. While public agencies have assumed increasing responsibility for managing pests in all parts of cities, a private pest control industry has also grown to promote products and services that are used to different levels of effectiveness by various sectors of the urban population. Though animal rights and animal welfare ideas have recently influenced pest control strategies, as exemplified by preventive methods and humane trapping, these have been deployed mostly among more affluent clients, resulting in an unequal urban ecology of health risks and human-animal interactions across communities.

C.1.2. Project significance. An historical examination of the interrelationships among human social conditions, pest animal populations, and the urban environment will reveal a poorly understood but potentially controversial aspect of the ecology of cities, and shed light on present efforts to control urban pest animals and also on similar environmental projects. Environmental history and history of medicine can inform current discussions by illuminating parallels between past and present situations, and also reveal contradictions, misrepresentations, or silences in present policy discourses about environmental and health problems (Cronon, 1993; Leavitt, 1997; Craddock, 2000b). The proposed project will also inform research frameworks in use among urban environmental historians, animal geographers, urban political ecologists, and historians and geographers of health. These fields are just beginning to grapple with dialectical relationships among social difference, politics, physical conditions, and non-human nature, particularly in an urban setting.

This project will advance understanding of the ways social inequalities structure urban residents' exposure to health threats and decaying physical surroundings. Poor communities and communities of color have often borne the greatest environmental and health impacts of industrial development, and also of disinvestment in infrastructure as urban populations and economies have declined (Hurley, 1995; Hurley, 1997; Pulido, 2000; Gandy, 2002; Curtis, 2004). Furthermore, projects to improve urban environments have often been less accessible for these communities, or failed to address their specific needs (DiChiro, 1996; Brownlow, 2003; Heynan, 2003). Discourse on urban environmental problems has often blamed communities rather than analyzing the ecological, political-economic, and social forces that produce poor conditions and environmental injustice (Anderson, 1991; Craddock, 2000b; Klinenberg, 2002). At the same time, communities attempt to resist both negative images imposed from outside and the lack of recognition of their environmental and social situations (Gottlieb, 1993; Pulido, 1996; Craddock, 2000a; Gandy, 2002).

Urban policies and discourses also disregard urban animals, and researchers have yet to develop ways to ensure their well-being alongside that of marginalized human communities (Philo, 1995; Wolch et al, 1995). The populations of many urban species are stable or growing, and strategies used to keep them out of buildings in older neighborhoods rely on frequent application of killing traps or poisons rather than more preventive measures. Encounters between animals and humans in cities and other settings will only become

a more urgent concern with the spread of actual and possible zoonoses, diseases which may jump from non-human animals to humans (Deem et al, 2000; Cook et al, 2004). These include hantavirus (Mills et al, 1999), Lyme disease (Klein et al, 1996; Peavy, 1997; Patz et al, 2004), monkey pox (DeGulio and Eckburg, 2004), West Nile virus (Daszak, 2001), SARS, avian flu, and prion diseases. The wide range of factors affecting the pest environment of cities exist in tension with one another: dire limitations on urban health and infrastructure budgets; the political and economic exclusion of low-income communities; conflicting notions of responsibility for environment; conflicting notions of health and ecology; and differing cultural values of animals. These are tensions to which this project will speak.

C.2. Historical case studies, geographical scope, and relevance to project. The following situates our hypotheses in the history of science and urban politics, society, reform movements, public health, and the environment from 1850 through today. To best show how we will frame these research questions, we have outlined our questions and narrative as dissertation chapters. We will identify case studies for these chapters as part of Phase I research. Case studies will draw primarily from large US cities of the Northeast and Midwest because of their similar histories and ecological conditions, but we will also address broader trends in professions such as public health and pest control. We briefly name the kinds of sources on which these chapters will be based; for further discussion of sources, see section C.4.

C.2.1. Animals, knowledge, and ideas of infestation. How has the context of social, urban, and health history influenced beliefs about pests among professionals, scientists, and layfolk? The purpose of this chapter is to explore evolving knowledge of the species that will play a starring role in the narrative, from the mid-nineteenth century to today. Only by learning how science and other discourses represented these animals can we proceed with subsequent chapters. Species include the Norway rat, the black rat, the house mouse, the house fly, two species of cockroach, bed bugs, mites, fleas, lice, mosquitoes, termites, raccoons, and stray dogs. We will also discuss disease agents associated with these animals, for example the pathogens that cause typhus or allergens in the feces of domestic arthropods. We will examine recent zoonoses, which lend a sense of urgency to discussions of urban pests that live intimately with humans. We expect that discourses about pests cast value judgments on places, peoples, and environmental practices associated with them. For this reason we will also discuss the evolving use of terms such as *infestation*, *pest*, *vermin*, and *zoonoses*, along with animal rights and welfare. Sources will include literature from natural history, medicine, public health, ecology, pest management, and the popular press.

C.2.2. Pests, immigrants, and urban sanitary reform. This chapter asks three major questions, and it addresses our first hypothesis which concerns the distribution of pests and their political implications. What was the state of pest control knowledge and practice in the US at the dawn of urban sanitary reform in the 1880s? How did popular and professional discourse map pest problems onto immigrants and immigrant spaces? What variables were associated with pest problems? Using a local case study we will examine spatial patterns of three factors: first, the urban physical environment, including housing, open space, and solid waste; second, perceived and documented health threats from pest animals; and third, the social composition of neighborhoods based on ethnic identity and income level. Sanitary reform emerged just as waves of human (and animal) immigration from Europe crested and population growth strained basic infrastructure and housing. The filth theory of disease was prominent, and both the general public and health professionals believed that miasma attracted vermin. Policy-makers and affluent residents used economic and ethnic segregation to avoid pests, but reformers soon made the case for community sanitation reform (Melosi, 1981; Duffy, 1997). A few disease outbreaks affected ethnic communities most severely, and established residents conflated immigrant neighborhoods, backward hygiene practices, and diseased vermin (Craddock, 2000b). We expect to find that while miasmas led cities to take action on some of the conditions that facilitated pests, health departments applied sanitary strategies unevenly across the city, and immigrants bore the brunt of both rhetoric about infestation and also of the underfunding of sanitation. This chapter will draw evidence from sanitary program records, censuses of population and housing, and literature on pest problems in the popular and professional press.

C.2.3. Pests and infectious disease in the Progressive Era up to World War II. How did the approaches of experts working on pest control from 1880 through 1940 differ from those of activists, and what led to declining incidence of vector-borne disease? This chapter speaks to our second hypothesis, concerning interventions in pest problems. We expect to find that differing theories of disease influenced pest control strategies. During the Progressive Era (1880-1920) scientific and political institutions grappled seriously with urban sanitation problems, and a guild of exterminators developed just as public health agencies came to accept germ theory. Incidence of infectious disease abated after a few major outbreaks, such as plague in

San Francisco (Craddock, 2000b), but pest animals continued to affect poor residents by biting, spoiling food, destroying homes, and depositing wastes. Meanwhile, lay and professional activists saw links between pest problems and other social and urban ills, notably housing (Addams, 1945; McBride, 1991). Though bacteriology had prevailed, activists continued to focus on sanitary concerns. In spite of poor conditions, the late Depression era saw a moment of improvement in preventive efforts through the work of New Deal sanitation programs. This chapter will use literature from exterminator associations, New Deal work relief records, and activist groups (for example, settlement houses and African-American civic organizations) to contrast their scientific and political assumptions and their practices in neighborhoods.

C.2.4. The development of institutions for pest control science and practice. The purpose of this chapter, addressing our second hypothesis, is to trace the expansion of the pest control industry, and the divergence of private and public work in the field in the 1940s and 50s. How did pest control institutions diverge into distinct niches – the chemical industry, private pest-control companies, public health pest control bureaus, and academic research programs – and what were the effects of this divergence? These institutions contradicted one another in their assumptions about neighborhood responsibility for pest problems; in the stage of pest population growth at which they chose to deploy eradication strategies; and the kinds of clients or spaces they served (Snetsinger, 1983; Russell, 2001; Sullivan, 2004). Meanwhile, as the next chapter will show, domestic pest populations were growing as housing conditions degraded in older, lower-income neighborhoods. Did the differences between these sectors leave gaps – literal and figurative – in the walls between pests and people? Like the previous chapter, this one will use records, when available, from the relevant institutions, but in this case we will focus on a few cities to illustrate the specific intra-urban geographic logics of the different sectors. We will frame our discussion around these institutions' approaches to particular species.

C.2.5. Pests, urban renewal, and urban tenants. The purpose of this chapter, addressing the first hypothesis, is to explore the relationships among urban renewal, pest problems, and tenant activism in the 1940s through the 1970s. How and why did public health agencies and urban redevelopment authorities use vermin as an indicator of blight for renewal programs? How did blight elimination affect pest problems? And how did resident organizations make pests a major issue in protests against landlords and urban governments, and whether environment was a major term with which they framed their protests? We expect that urban renewal not only dislocated human communities and deprived families of affordable housing but also facilitated pest populations (Sullivan, 2004). We also expect that pests such as rats, roaches, and bedbugs, menaced residents in two distinct ways: by stigmatizing their communities in blight surveys, and by causing continued illness and injury. We will use events from selected cities, examining the environmental surveys used in the middle 1940s to establish pest problems and set blight elimination priorities; allocation of federal and local pest control funding across neighborhoods; and distribution of pest conflict reports. We will also interview surviving members of community and tenant associations, church groups, real estate interests, housing officials, and public health bureaucracies involved in local actions.

C.2.6. Pests, chemicals, and the indoor environment. Speaking to our second hypothesis, in this chapter we will examine the convergence and contradictions between concerns about pests that produce indoor allergens and about the use of indoor pesticides to control these animals since the 1960s. How did communities, parents, and health, school, and housing officials navigate the conflicting needs to protect people from allergens and from the acute and chronic effects of pesticides? What leads different neighborhoods, schools, and housing projects to different strategies for controlling pests and allergies? We expect to find that older and poorer neighborhoods have relied on fumigation in their public and private facilities because of inability to maintain buildings. In this chapter we will conduct a brief case study on the scientific and pest control literature on one pesticide that has been controversial since the 1970s, chlorpyrifos, to trace disagreement about its value and the dangers it may pose (Davis and Ahmed, 1998); in addition we will examine other pesticides and survey and interview school grounds departments, parent groups, public health bureaucrats, and EPA pesticide researchers and regulators.

C.2.7. Pests and urban ecology. What is the potential for urban ecology, based on its development since the 1970s, to bring about education and urban environmental change and thereby healthy relationships between humans, animals, and the urban landscape? Can urban ecology as a science and as a community movement address the implications of our closeness with animals in domestic and urban spaces? We expect to find that attention to social difference and decaying environments is critical for urban ecology's potential to intervene in pest problems. Like miasma theory in the nineteenth century, urban ecology stresses holism and the creation of healthy overall conditions in the physical environment. Urban ecology speaks to ways cities can have positive interactions with nature, but research and programs to date may neglect the social

and health implications of urban wildlife for low-income neighborhoods. A research program that is more attentive to older neighborhoods could help advance preventive approaches to infestation and possibly show how species typically regarded as pests can share the city with humans, healthily. This chapter will analyze the practices of urban ecological science, along with urban nature center programming, and present interviews with scientists and staff about their priorities and goals. It will contrast this discourse with research on emerging zoonoses which have been of limited concern to urban ecology.

C.3. Analysis of relevant research. This project will trace the history of human-pest interactions in US urban areas and of responses to animal pests by public health, housing and urban development, community, industry, scientific, and environmental interests since the mid-nineteenth century. We will also attempt to explain associations between pest animals and geographies of human poverty. The history of urban pests and human health bears implications for a diverse array of research themes to which we intend to speak: geography; history; history of science and health; ecology; disease ecology; environmental studies; and urban studies. We will use this project to engage four broad areas of current research: first, urban environmental history; second, geographies of urban environmental politics, including environmental justice, political ecology, and cultural geography; third, histories and geographies of health, particularly those that address health inequalities; and fourth, geographies of human-animal interactions.

C.3.1. Urban environmental history and urban nature. Environmental history scholars disagree about whether the field should address issues of human difference or environments constructed by people, such as factories or neighborhoods. Some insist that the discipline's aim should be to privilege the place of nature (that is, those aspects of the world not created by humans) in human history in order to correct the subordination of nature at the hands of people, as well as in historical research in general (Worster, 1990). However, this view would constrict the kinds of city research that would be considered part of the field because the urban environment is so highly humanized. Furthermore, industry, the state, environmentalists, and other agents produce environmental change and deploy ideas about nature along lines of power and human difference (Williams, 1980; Hurley, 1995; Taylor, 1996; Warren, 1997).

Urban environmental historians have explored how reform movements, including lay activists as well as professionals, contributed to the development of urban infrastructures and ecological systems that cope with the physical challenges of running a city. These include systems for water, sewage, sanitation, energy, and transportation that channel flows of material, energy, and people into, through, and out of the city (Blake, 1956; Warner, 1968; Melosi, 1981; Steinberg, 1991; Tarr, 1996; Melosi, 2000b; Tarr, 2004); similar systems played a role in disease prevention (see below in section C.3.3). For reform groups sanitary and environmental infrastructure connoted moral and social uplift for urban residents (Melosi, 2000b; Rawson, 2004). Similarly, historians of fields such as landscape architecture, planning, and restoration ecology, have shown how these professions have worked to change the order of humans and nature in the city, including constructing ideas of sustainability and creating healthier and more ecologically sound spaces in cities (Spirn, 1984; Schuyler, 1986; Spirn, 1996; Hall, 2002).

Urban environmental historians have developed narratives of the "brown" environmental agenda concerned with pollution and human health, a political movement that has existed just as long as its better-known "green" counterparts concerned with wildlands issues (Gottlieb, 1993; Melosi, 2000a). Framed in settings of great human diversity, political struggles over the urban environment are informed by the social and locational position of groups, for example racially-segregated communities; the effects of pollution and environmentally-mediated disease are felt unequally by residents and workers in cities (Hurley, 1995; Flanagan, 2000; Greenberg, 2000; Merchant, 2003). Communities of color and lower-income groups have historically lacked prerogative to choose where they live and to control their economic destinies; environmental historians have demonstrated how real estate dynamics and industrial practices burdened these communities with poor environmental quality (Hurley, 1997).

This project enters the debate about the scope of urban environmental history by questioning whether we can draw a line between the non-human environment and the parts of our surroundings constructed by people. It does this by highlighting two aspects of urban nature that are both deeply influenced by people and yet only partly under human control: the ecology of pest animals and their pathogens, and the human body itself. Furthermore, we will show that the politics of urban housing and processes of neighborhood change, intimately connected with human race and class, help create the niches that make up the habitat of urban wildlife. Environmental historians have written little on the place of housing in the urban environment, and we intend to highlight its importance as a physical and social entity. The ecological factors of interest to historians of the larger urban infrastructure, such as sanitation, play out at the smaller

scale of the neighborhoods, blocks, and buildings that make up the habitat of urban pest animals. Finally, reformers and community activists involved with pests and health issues deserve a place in the narrative of environmental politics because of their unique articulation of problems and solutions at the interface of society, environment, and health.

C.3.2. Geographies of urban environmental politics. Based on the environmental justice movement, geographers and sociologists have developed a theoretical framework for understanding inequities in exposure to toxics and other risks to residents and workers at the scale of the city or region (Bullard, 2000). This approach, in its most geographical form, analyzes systemic processes of racial and economic segregation; racism may act through the real estate market, allowing white residents the choice to live in neighborhoods far from toxic facilities and leaving people of color with limited options in potentially hazardous areas (Pulido, 2000). Some of these researchers have documented how communities of color develop activist movements to demand inclusion in planning processes; members of these movements have framed their work through place-based and ethnic identities at a very local level (Gottlieb, 1993; DiChiro, 1996; Pulido, 1996). Hazards researchers model the factors that mediate environmental risks and disasters at a somewhat larger scale ñ in human processes such as planning, decision-making, and the use of technology, though they tend not to explicitly consider the political-economic systems underlying those processes (Cutter, 1994; White, 1994; Cutter, 2001). The hazards literature attempts to explain why particular demographic groups are more vulnerable than others (Kates, 1994); factors of identity and place, however, have appeared less frequently than in the environmental justice literature (Cutter, 1994).

Recently, other geographers have applied the framework of political ecology, typically used in rural settings in less-developed countries, to urban problems, showing that environmental degradation in cities occurs through the same processes of capitalist development, state control, land management, and place-making operate dialectically (Heynan and Swyngedouw, 2003). Economic restructuring is one expression of capitalism that contributes to the degradation of urban environments in the Northeastern and Midwestern US; the cities of the rustbelt share ecological and political factors such as toxic and abandoned landscapes; rehabilitation and re-use of these landscapes; and the formation of new political alliances to fight toxic exposure and exclusion from the planning process (Gandy, 2002). Political ecologists insist that production-side analyses of urban amenities and urban nature are at least as important as those stressing consumption; private firms dealing in lawn care (Robbins et al, 2001), real estate, ecological restoration (Robertson, 2000), environmental remediation, and waterfront redevelopment (Keil and Desfor, 2003) do not only satisfy individual aesthetic desires but benefit from public policies that may ultimately degrade social justice, non-human nature, or human health. Furthermore, funding schemes and market-driven policies limit access to critical urban resources such as water, trees, or open space, and also deny participation to groups who would contest such policies (Swyngedouw, 1999; Heynan, 2003; Kaika, 2003; Bond, 2004). Cultural geographers working in a less ecological vein have shown that entrepreneurial local agencies, including boards of health and redevelopment authorities, have constructed negative representations of urban groups, such as immigrants (Anderson, 1991; Craddock, 2000b) or African-Americans (Weber, 2002), condemning their environmental practices to justify invasive policies of neighborhood renewal. Few political ecologists have examined health, particularly in the urban context of industrialized nations (Mayer, 2000). Some geographers have criticized political ecologists for ignoring the agency of nonhumans, and propose ways of valuing nature while tracing histories of scientific knowledge and political ecology (Braun and Castree, 1998; Whatmore, 2002); this includes the agency of animals in cities (Wolch, 2002) ñ see section **C.3.3** and **C.3.4** below.

This project will build on both environmental justice and urban political ecology research by addressing how disinvestment in poor urban neighborhoods contributes to the creation of ecological niches for pest animals and thereby variation across the landscape. The animals themselves have agency to change environments, in tension with and through human practices. Furthermore, though urban development, housing, and public health work are important functions of the state that produce urban environmental change, political ecologists have given these processes little attention; environmental justice movements have been more committed to such policy areas. Poor building maintenance and public sanitary conditions, which facilitate the growth of pest populations, are embedded in the processes of housing development, redevelopment, and disinvestment. The ecology of pest populations also plays a role in health and landscape, but urban reformers have largely understood this role through changing scientific and popular conceptions of pests, not the political and economic forces that influence urban ecology. Pest management, like so many other environmental industries at work in cities, has benefited from urban policies but is also applied unevenly across the city. Public health strategies addressing pests have also resembled other

invasive redevelopment policies, in the way they change environments and the way they target and represent low-income communities. Like environmental justice communities, however, those affected by urban renewal and pest populations have resisted such representations and demanded opportunities to participate in urban politics, and to have their environmental problems recognized in their terms.

C.3.3. Histories and geographies of health. Historians of health in the US context have examined the influence of urbanization and resulting changes in environmental dynamics such as overcrowded housing and exposure to human wastes in causing epidemics, and the concurrent rise of public health and sanitary experts to address urban health problems and develop infrastructure as a preventive measure (Blake, 1956; Rosenberg, 1962; Melosi, 1981; Tarr, 1996; Duffy, 1997; McMahan, 1997). In fact, they have shown that practices such as environmental sanitation have contributed more to declining urban mortality rates than medicine itself, although the former's benefits were indirect (McKeown, 1979; Leavitt, 1982; Duffy, 1990). A strong thrust of health historiography, whether addressing cities or rural areas, has used the lens of environment to evaluate past practices and ideas about public health, often arguing that reformers who subscribed to the miasma theory of disease in the 1800s and ecological theories in the 1900s were more likely to pursue preventive measures and environmental improvement than their counterparts who conformed only to germ theory (Jordanova, 1979; Melosi, 1981; Valencius, 2002; Anderson, 2004). The ecological view also called into question the security of borders on a variety of scales: national, local, and bodily (King, 2004). Along with shifting theories of disease, historians of public health have documented changing notions of where responsibility for health and health care lies: with individuals and families, community, or the greater public (Melosi, 1981; Leavitt, 1982; Klinenberg, 2002). Some have highlighted lay health knowledge and lay activists, who argued for more holistic theories of disease, and in the age of ecology called on the notion of uncertainty to question medical knowledge and the safety of toxins (Brown and Mikkelsen, 1990; McBride, 1991; Krauss, 1998; Sellers, 1999; Bullard, 2000; Warren, 2000; Fortun, 2001; Sellers, 2004). The social construction of disease is an important framework for historians of health; researchers working in this vein have shown how popular and scientific discourses represent people and place, often stigmatizing ethno-racial groups and particular locations or neighborhoods (Kraut, 1995; Leavitt, 1997; Valencius, 2002; Mitman, 2003; Mitman et al, 2004).

Geographers and other researchers concerned with health inequalities have also used a social constructivist approach to address the representation of places and communities as healthy or unhealthy, including policy responses by public health departments such as the surveillance of immigrants or people of color communities that marks them as deviating from proper environmental and health practices (Philo, 1989; Peterson and Lupton, 1996; Craddock, 2000a; Craddock, 2000b). To recognize lay understandings of health conditions, and to support a goal of well-being rather than merely freedom from disease, some have called for a move from medical geographies to geographies of health (Gattrell, 2002; Gesler and Kearns, 2002; Curtis, 2004). Based on concerns about social justice, health geographers have documented local health inequalities rooted in environmental and structural factors such as racial segregation, exposures in the home and the workplace (Macintyre et al, 1993; Sooman and Macintyre, 1995; Schell and Czerwinski, 1998; Neumann et al, 1998), and differential access to care and preventive services, all patterned spatially (Gattrell, 2002). Resources such as housing belong to networks of factors that influence health (Smith et al, 2003). Because such structural or environmental theories of health inequalities are not always related to medical issues per se, health geographers frequently look outside the realm of medicine to poverty, racism, industrial practices, and environmental policies as possible means for correcting such problems (Curtis and Taket, 1996; Wilkinson, 1996).

Environmental epidemiology and environmental health examine the role of the quality of the physical environment in health problems, including such threats as toxic pollutants in air, water, soil, and indoor areas (Meade and Earickson, 2000; Gattrell, 2002). Health and medical geographers have adopted the frameworks of disease ecology and landscape change to examine the spatial patterns of pathogens and other disease agents and their response to environmental conditions such as climate, land cover, and animal populations (Learmonth, 1988; Parkes et al, 2003). A number of historians and biologists have brought microbes to the study of the human past, often using exchanges of pathogens at various scales to explain and embed social, political, and demographic processes (Crosby, 1972; McNeill, 1976; Crosby, 1986; Denevan, 1992; Lederberg, 1992; Diamond, 1997; Cliff et al, 1998). Meanwhile, studies of emerging diseases focus on many scales of environmental change that influence disease ecology, as mediated by humans: global-scale climate change; regional desertification and deforestation; and local and regional urbanization (Dubos, 1952; Garrett, 1994; Cook et al, 2004; Patz et al, 2004). A fairly new vein of disease ecology in geography builds on the insights of political ecologists by analyzing not only the environmental

and biological influences on spatial health patterns, but also the political and economic factors that with them make up the complex phenomenon of landscape change (Mayer, 1996; Mayer, 2000).

Our research will contribute to knowledge of the geography and history of health inequities by adding to the literature a little-studied kind of problem, pest-borne and pest-related disease, and connecting these problems not just to gradients in the natural landscape but also to physical features of neighborhoods such as garbage and waste, decayed housing and the aging of the built environment, open space, food sources, and the chemicals and other technologies used for pest control. The health threats of concern to this project encompass several types, from toxic exposure to infectious disease, from allergies to injury and emotional stress. The project will help weave a complex web of associated social, physical, and biological causations of disease, all turning on the central pivot of vermin. This implies that we must reckon with factors of urban political economy. We will build on the use of spatial methods, in particular by applying them in a historical framework with multiple human and non-human variables. The project may also reveal ways in which some strategies for controlling pests, such as the broad application of pesticides that continues today, are unsuitable for the most intimate urban environments such as homes and schools. Finally, our research will situate the human body in relationship to several small scales that are under-studied in geography: the home and other buildings, blocks and neighborhoods, and city ecology.

C.3.4. Animal geographies. Geographers of wildlife have examined how conflicts develop among human groups over their valuations of animals, and over perceived threats of animals to safety or property (Naughton-Treves and Sanderson, 1995; Treves and Naughton-Treves, 1999). Researchers working in agricultural, urban, and wildlands settings have revealed how land managers respond to animals that damage their crops, and construct ideas about which animals are pests, who is responsible for damage by pests, and how to address pest problems (Child, 1995; Davies et al, 1999; Naughton-Treves, 1999). Environmental policy agencies and resource users have clashed over endangered species laws and wildlife preserves; such policies often act through channels of power to further marginalize small holders, subsistence hunters, or poor farmers (Warren, 1997; Neumann, 1998); this research emphasizes both the cultural meanings of wildlife and the property and conservation regimes in which conflict is embedded. Studies of human-wildlife conflicts often stress the potential for community-based conservation to bring about more democratic, socially just, and effective practices with wildlife (Lewis and Alpert, 1997). Perhaps because urban residents engage in only limited degrees of agricultural activity, and only a small number of urban residents are dependent upon urban gardens and farms, there has been little research on such conflicts over animals in urbanized settings. Notable contributions have highlighted the ways pets and stray animals in cities may threaten health, and while these advanced ecological insight they considered only to a limited degree the social, political, and economic dimensions of urban animal problems (Beck, 1973).

Cultural animal geographers show how societal practices and discourses assign value to different sorts of animals in different locations, and their work reveals inconsistencies and contradictions in the ways we privilege nature and culture (Hinchliffe, 1999; Whatmore, 2002). The very notion of human-animal conflict reveals a human-centered bias. Similarly, subjective human values are implicated in debates over whether animals should be allowed to occupy certain places in the city (Philo, 1995; Hinchliffe, 1999). Discourse maps negative views of vilified human groups onto animals and vice-versa, for example Roma and their pet animals (Sibley, 1995); such discourses are bad for both subaltern humans and animals in that both are denied a place in the city as full residents or citizens (Tuan, 1984; Elder et al, 1998; Anderson, 2000; Griffiths et al, 2000). To secure a more positive and visible place in cities for animals, these geographers reject anthropocentrism and argue for urban theory that places animals on a level equal with humans (Wolch et al, 1995). Both within and outside of geography, other researchers have highlighted the ways agriculture, science, technology, and other practices and discourses have created tight biological and cultural bonds among humans and animals (Haraway, 1989; Diamond, 1997; Swabe, 1999; Haraway, 2003). Scientists, businesses, entertainers, activists, and pet owners have used animals as icons for ideas about race, class, and gender (Ritvo, 1987; Haraway, 1996; Davis, 1997; Nelson, 1997; Mitman, 1999; Price, 1999).

Our project will bring questions about conflicts between humans and wildlife, typically employed in the global south and in rural areas, to US cities. This setting, while still replete with human groups who hold varied social positions, livelihoods, and valuations of wildlife, differs because of the ways cities are culturally constructed in opposition to nature. The idea of a *pest* itself is a construction, fraught with conceptions about rights to occupy urban spaces. If cultural animal geographers are correct that urban policies and practices have written animals out of the city, then we should look to the role of health

departments in constructing boundaries between humans and so-called pests. Health policy and pest control rhetoric, as well, helps marginalize urban spaces and the people and animals associated with them. We intend to take a critical position on anthropocentrism, recognizing power differences exist among humans as well as between humans and animals. Whether real, perceived, or exaggerated, health problems and injury caused by pests complicate animal geographers' arguments for multi-species cities. The fact that some urban animals pose health threats, or threats to the quality of life for groups of urban residents whose status in the city is already tenuous, demands that animal geographers re-imagine the animal-human interface. Those humans with less power to determine their environmental conditions, then, may find nature in the city more hazardous than others. The framework we propose uses historical perspectives from a variety of community and professional perspectives to illuminate evolving discourses about pests, and will also examine the role of physical environment in facilitating interactions between humans and pests.

C.4. Methods. The proposed research will employ a range of qualitative methods complemented by retrospective spatial and quantitative analysis. The phases of the project are dynamic, and though they will proceed mostly in sequence they will also feed back into one another. The initial stage (Phase I) of the project entails two concurrent efforts: one involves *analyzing* national-level literature from professional and popular sources dealing with pest management, public health, ecology, and urban development, much of which will be possible to do with the resources available at the home institution. The other involves *identifying* local-level cases to focus on for each of the questions addressed above in **section C.2**. The next stage (Phase II) will involve collecting data from archives that pertain to the case studies in Phase I, and identifying informants and conducting interviews cases with surviving human subjects. The final stage (Phase III) involves qualitative, spatial, and quantitative interpretation and analysis of the epidemiological, demographic, housing, and development and health policy data gathered from archival work and interviews.

C.4.1. Archival research. This research task will account for most of the work in Phases I and II of the project, and it will provide the data for the analysis and interpretation in Phase III. Archival research will be the most important method in our tool kit for reconstructing past scientific and popular ideas about and approaches to urban pests in general, and for developing a narrative of evolving political and public health responses to specific local problems. Archives will also provide us with the qualitative and quantitative data necessary to describe physical, socio-economic, and political conditions in urban areas believed to suffer from pest problems, as compared to those areas believed to be relatively free from vermin.

There are four main objectives for our work with archival research. First, as part of Phase I, we must identify prominent themes ñ political, professional, and popular content; controversies; knowledge claims; language and terminology; contradictions; and silences ñ in literature and discourse pertaining to the professional and political interest groups involved in pest problems that affected urban neighborhoods. Our content analysis of these sources assumes a social constructivist view of health, disease, nature, place, and people. That is, ideas about these items are constructed in specific historical and geographical contexts, and cultural representations from all fields are mutually constitutive with material and political processes carried out by historical actors (Mitman et al, 2004).

Many of the documents necessary for conducting this phase of research are available in facilities on the University of Wisconsin ñ Madison campus: Steenbock Library (life sciences, agriculture, and human ecology), Ebling Library (health sciences), State Historical Society (primarily state records, but also literature from popular activist movements), and the University Archives (personal papers of faculty, for example the rodent ecologist John Emlen). Others will be available through inter-library loan. We will also use the documents in these facilities to identify the local and institutional archives the co-PI will visit in Phase II. Some categories of documents we will use include:

- Results of scientific research on ecology, entomology, and health in peer-reviewed journals
- Surveys of pest problems by health and housing agencies
- Proceedings of conferences on pest control science, urban ecology, and the pest management business
- Published trade journals for the pest control industry
- Advertisements for pest control services and products
- Pest-control guides for householders distributed by pest control businesses and health departments
- Representations in the popular national press of epidemics involving vermin

The remaining three objectives of archival research rely on documents the co-PI will collect as part of visits to archives and informants outside of Madison; funding for travel will make it possible for us to

fulfill these objectives. The sorts of documents we expect to find in local archives in Phase II (which we will analyze in Phase III) include: records of local vermin management programs; local health department surveys; records of housing and redevelopment programs; documents from local activist and advocacy programs aimed at improving environmental conditions and democratic process; popular media representations of pest problems; and local historic business directories listing pest control businesses. We will obtain qualitative, quantitative, and spatial data from these sources. Our second objective is to use evidence from mostly local literature from health, housing, urban development, and advocacy agencies to qualitatively describe the physical environment of neighborhoods that were perceived to have pest problems. Given the representations we find in these items are themselves part of socially-constructed discourses, it is necessary to both triangulate on these descriptions using several sources, and interpret the social position of the sources' authors. Our third objective is to identify and describe interventions ñ policies, practices, and protests ñ staged by public agencies, private businesses and researchers, and activist groups to address pest problems. We intend to learn what strategies pest management professionals, public health officials, and housing agencies employed to address and prevent pest problems in specific locales, and what rules governed their use of these methods. Our fourth objective is to collect and analyze spatial and quantitative data about reported health problems related to pests, the allocation and use of funding for pest management, and demographic and housing census data. See below in section **C.4.3** for further discussion of how we will proceed from collecting documents through archival research, to spatial analysis.

C.4.2. Interviews. While content analysis of written sources found in archival research will produce the most valid results ñ because the authors of the materials cannot tailor their answers to what they perceive the interviewer wants ñ interviews will be important for supplementing the information available in written sources in those cases where there are surviving human subjects. The most important set of potential informants includes individuals who live in communities affected by pest animals and pest control programs, because unlike scientists, pest control professionals, and health and housing officials these residents are less likely to have produced much written, archival material. We will also pursue interviews with surviving scientists, pest control workers, public health and housing officials, and landlords when possible. Like archival research, interviewing involves the three-step process of first identifying informants, then conducting the interviews and producing transcripts, and finally analyzing and interpreting interview transcripts. We intend to seek interviewees from locations identified in Phase I by contacting community organizations such as block clubs, resident associations, churches, and schools whose members have been involved in past and continuing activism around pest animal issues and the local environment. Our goal in interviewing people from community organizations is to learn about their perceptions of pest problems and the methods they and others have used to manage them. The inclusion of these voices is also a key step in making claims about social justice movements and the agency of activist groups, and bolsters the possibilities for this project to achieve the broader impacts we seek.

C.4.3. Quantitative and spatial analysis of social, health, and pest data. In Phase III we will analyze qualitative and quantitative data using spatial methods in a GIS with the goal of fusing ecological history and urban social and health geography. Historical GIS analysis is a relatively new field of endeavor (Knowles, 2002), and we intend to contribute to its growth and development by showing how four kinds of variables ñ demographic, housing, health, and ecological ñ can be analyzed to reconstruct past urban environments. Environmental historians and historians of health have used basic mapping techniques to support interpretations of qualitative analysis and to make distinctly spatial arguments (Cronon, 1991; Hurley, 1995; Craddock, 2000b; Beveridge and Weber, 2002). Medical and health geographers have found GIS to be an important technique for revealing and explaining health inequities (Gattrell, 2002; Curtis, 2004). We will use overlay techniques to enhance analysis of the correlation between variables including reported health problems, pest populations, housing age and condition, crowding, socioeconomic factors, and pest control funding and program activities. We hypothesize that housing age and low incomes will correlate strongly with pest problems. Speaking to our second hypothesis about interventions in pest problems, we also wish to ask, what sorts of pest control programs have been deployed in various sorts of neighborhoods? Some of the necessary analysis is likely to have been begun by municipal health departments, national health surveys, and to some extent national and state agencies that funded local efforts and collected data to monitor infestation, epidemics, sanitation, and other pest-related items. Peer-reviewed ecological studies, which we intend to identify in Phase I of the project, will also present quantitative animal population and spatial data for relevant species of pest animals that we wish to integrate with demographic, housing, and health data. The objective of this set of analyses is to use these in conjunction with demographic and housing data from the US census to discover what characteristics, such

as neighborhood socio-economic trends, health program funding, and age and quality of housing and other community buildings have been associated with pests and related health problems. This objective speaks directly to our first hypothesis and to the questions we pose in the above sections C.2.2., C.2.5, and C.2.7. This technique will also help us disseminate a visual message that may reach a broad range of readers including both policy makers and popular audiences.

C.5. Research schedule. The co-PI began the literature analysis for Phase I as part of an earlier project that resulted in a paper presentation at the 2004 meeting of the Association of American Geographers. We have already identified two research programs that occurred at the Johns Hopkins School of Hygiene and Public Health in the mid-twentieth century as appropriate case studies for chapters in sections C.2.4, C.2.5, and C.2.7 above. Analysis of these projects and their relationship to urban neighborhoods and environmental conditions revealed that they incorporated assumptions about the class, race, and environmental practices of residents in their study areas, and that these assumptions affected the policy and technical recommendations of the researchers. The initial stage of research will proceed through July 2005, and will employ resources at the indicated library facilities on the campus of UW-Madison along with the inter-library loan system. Prior to July 2005 the co-PI will also establish contact by telephone, mail, and email with collection specialists at the relevant archives, and with potential informants among community groups, scientists, and urban ecology center staff. Beginning in July 2005 the co-PI will begin Phase II, visiting archives and sites for interviews. This is the phase of research for which we are requesting funding. The co-PI will visit six cities with at least one archive each; we have tentatively identified three cities for case studies of recent activities where we are likely to conduct interviews: Baltimore, New York City, and Chicago. The co-PI will spend the duration of city visits collecting materials at archives and meeting with informants, and she will conduct analytic and interpretive work (Phase III) while at the home institution between city visits in order to save on accommodations and subsistence needs. Conducting these Phases in tandem will permit the co-PI to identify additional data needs when visiting subsequent archives. The co-PI will conclude archival visits and interviews in July 2006; she will continue with data analysis (qualitative, spatial, and quantitative) through September 2006. The processes of data gathering, data analysis, and writing are dynamic, but the bulk of writing work will begin in September 2006.

C.6. Research experience. Both the PI (William Cronon) and co-PI (Dawn Biehler) have significant experience conducting archival research in environmental history and historical geography in the North American context. William Cronon has examined environmental change and ecological history, western history, and the history of environmentalism. His monographs include *Changes in the Land: Indians, Colonists, and the Ecology of New England* (1984) and *Nature's Metropolis: Chicago and the Great West* (1991). William Cronon's work in history is noted for the degree to which it reaches popular audiences and policy makers; his influence on this project will help make it both accessible and applicable to wider audiences. Dawn Biehler's experience researching urban animals in nineteenth-century New York City has given her a good command of the use of local, state, and institutional records and the interpretation of historical sources. She conducted most of her work at the New York State archives, the New York City municipal archives, and the New-York Historical Society; these institutions are likely to be important sources of information in this project as well. Dawn Biehler has also conducted research which involved identifying and interpreting historic legal documents such as court cases pertaining to attacks and property damage by dogs and wolves as a collaborator with Professor Lisa Naughton. Dawn Biehler's undergraduate degree is in Biology with a focus in Ecology, and she spent two summers as a field crew assistant collecting data for a long-term ecology research project. This background in ecology and biology prepares her to interpret historical and present-day ecological data and ecological theories. Dawn Biehler has co-authored three guide books, one for naturalists and two for community food advocates. This work has prepared her to interview activists, write for a broad audience, and address local political concerns; these research and writing skills will translate into a written dissertation that has an impact on public social and environmental issues.

Section D. References

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