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Military, Race, and Urbanization: Lessons of Environmental Injustice from Las Vegas, Nevada

Camila H. Alvarez[1]

Abstract

Environmental justice scholarship argues state power perpetrates environmental inequalities, but less is known about the U.S. Military's impact on local urban environmental inequalities. To evaluate the role of the military in contributing to environmental health disparities, I draw on the case study of Las Vegas, Nevada, a southwestern city with active military sites. The analysis uses environmental health, demographic, and Geographic Information System (GIS) data from federal and county agencies. Findings from spatial error models support environmental inequality and treadmill of destruction hypotheses by demonstrating that census tracts in closer proximity to military areas have greater estimated cancer risk from air toxics. Census tracts with a higher percent of poor and Latinx residents, independent of their proximity to military areas, have an additional increase in exposure to air pollution. The case study of Las Vegas offers important lessons of environmental injustice on Latinx environmental health vulnerability and military sites in urban areas.

Keywords

environment and technology, racial and ethnic minorities, race, gender, and class

Introduction

Environmental justice (EJ) research focuses on issues of equal access to clean resources and a healthy environment (Taylor 2014). Previous research demonstrates environmental hazards or privileges are disproportionally distributed. Areas with more residents historically marginalized by race, class, and gender hierarchies are exposed to more hazards and less privileges, relative to dominant groups (Brulle and Pellow 2006; Mohai, Pellow, and Roberts 2009; Pulido 1996; Sze and London 2008). Micro-level health risk disparities are tied to structural levels. The institutional actors contributing to the action and oversight of the environmental injustices are capitalist industries and local and federal officials. Foundational EJ research stresses the role of the state in perpetuating these environmental injustices, especially for their decisions on enforcement and policymaking (Bullard 1990 [2000]). For example, in the Flint, Michigan water crisis, state authorities worked with neoliberal forces "in shrinking services, infrastructure investment, and

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democratic practices," and this ultimately led to the abandonment and poisoning of poor, nonwhite communities (Pulido 2016:2). One of the four pillars in the critical EJ framework focuses on state power because the state is involved in environmental regulation and protection (Kurtz 2009; Pulido 2016), as well as "state repression" processes that criminalize those who organize against state-sanctioned violence toward communities of color and the environment (Pellow 2018:104). This line of critical work has yet to explicitly discuss the U.S. Military. Expanding critical EJ to include the U.S. Military highlights an additional major state institution and categorizes the military's role in contributing to racial environmental health disparities as part of the empire state.

Previous research demonstrates cases where the federal government and the military affected the environmental health well-being of Indigenous communities with nuclear technologies (Hooks and Smith 2004; Kuletz 1998; LaDuke 1999). A recent study found a quarter of Navajo women have traces of uranium in their body systems (Hudetz 2019), thus demonstrating the long-term health consequences of nuclear colonialism (Endres 2009a, 2009b). Moreover, environmental sociology has a long line of research using the treadmill of destruction theory to argue militarism as a major driver of anthropogenic pollution and natural resource consumption (Alvarez 2016; Clark and Jorgenson 2012; Jorgenson, Clark, and Givens 2012). The military and semi-military organizational structure (e.g., para-militia) forcibly displace Indigenous and marginalized communities to make room for natural resource extraction or dam construction (Delina 2020; Downey, Bonds, and Clark 2010). The displacement of people and the production of environmental racial inequalities stresses that the U.S. Military is not just a racial state, but an empire state (Jung and Kwon 2013). To the author's knowledge, little to no research has focused on the U.S. Military producing local urban environmental inequalities even though many urban spaces have military facilities. To situate the U.S. Military as a major contributor to local urban environmental health disparities, I integrate the EJ framework with the treadmill of destruction (Hooks and Smith 2004, 2005) and I draw on the case study of Las Vegas, Nevada.

From the United States acquisition of southwestern land from Mexico in 1848 to the expansion of military facilities in Nevada starting in World War II, the history of urbanization in Las Vegas is tied to the U.S. Military and the empire state. Las Vegas is a relevant environmental injustice case study because it is a metropolitan area near active military sites, including Nellis Air Force Base, the Nevada Test Site, the Tonopah Test Range, and Creech Air Force Base. Currently, Las Vegas has about two million residents and it has several sociological challenges that potentially interact with the military, including housing issues, environmental problems, and racial/ethnic inequalities (Futrell et al. 2010). A recent report from the American Lung Association (2018) reported Las Vegas as the 12th most polluted city in the nation for ozone—a carcinogen harmful to people and animals. Previous research from other southwestern cities demonstrate the people most likely to be affected from air pollution exposure are racial/ethnic minority and poor residents (Collins et al. 2011; Grineski, Bolin, and Boone 2007; Morello-Frosch et al. 2002; Pastor, Morello-Frosch, and Sadd 2005; Taylor 2014). Using GIS data published by the Clark County local government with the National Air Toxics Assessment (NATA), the American Community Survey (ACS), and the National Land Cover Database, findings from spatial error regression models support an environmental inequality hypothesis as well as a hypothesis that census tracts in closer proximity to military areas have worse environmental health risk. The case study of Las Vegas presents an important environmental injustice lesson about the role of the U.S. Military in contributing to local urban environmental health vulnerabilities and suggests future research to follow the lead of the treadmill of destruction and critical EJ scholars.

EJ and the State

The field of EJ research came from the efforts of communities organizing against environmental inequalities defined as the disproportional amount of hazards to historically marginalized communities across racialized, classed, gendered, and nationalized hierarchies (Brulle and Pellow 2006; Ducre 2012; Liévanos 2017; Mohai et al. 2009; Sze 2020; Sze and London 2008). Environmental inequality is an injustice because people exposed to environmental hazards are at higher risk of developing adverse health problems, including birth defects, respiratory illnesses, and even death (Brink et al. 2014). A central focus of the EJ movement is to explain the mechanisms, such as capitalist industries or state agencies, that cause environmental health problems (Ash et al. 2012; Kravitz-Wirtz et al. 2016). Foundational EJ research from Robert Bullard (1990 [2000]) understood the role of the state in perpetuating environmental injustices, and he argued, "[c]urrent government practices reinforce a system in which environmental protection is a privilege and not a right" (p. 115). Moreover, the oft-cited EJ case study of Warren County, North Carolina, activists were organizing *against the state's* placement of a polychlorinated biphenyl-toxic soil landfill. The state is a significant institutional actor of environmental injustices because the state administers various organizations that carry out impactful decisions and oversee enforcement.

Previous research on Indigenous communities documents the role of the state and the military in creating environmental inequalities (Bacon 2019; Clark 2002; LaDuke 1999; Norgaard 2019). Acts of nuclear colonialism—a form of environmental racism—include the abandon uranium mines near Navajo lands, the radiation contamination on Western Shoshone land in Nevada, the Prairie Island nuclear facility affecting the Mdewakanton Dakota Prairie people, and the ongoing proposed nuclear waste facility at Yucca Mountain (Endres 2009a, 2009b; LaDuke 1999). While nuclear colonialism focuses on the specific federal actions of nuclear technologies against Indigenous communities, settler colonialism is a more historical overview of the settler state causing injustices toward Indigenous communities through erasure and dispossession (Whyte 2017). Situations involving extractive industries, such as the Keystone XL and the Dakota Access Pipeline, demonstrate the ways the settler state puts its own interests at the forefront and treats Indigenous communities as expendable in the pursuit of capital (Bacon 2019; Norgaard 2019; Pellow 2018; Whyte 2017). Nuclear and settler colonialism elucidates how the state and the military produce environmental injustices for Indigenous communities. However, the environmental injustices produced by the state and the military are not limited to Indigenous communities and have detrimental environmental effects on broader society.

Nuclear technologies have additional negative consequences on rural communities, and the federal government challenges claims of the adverse health consequences of these technologies. In Tennessee, workers from the federal Oak Ridge Nuclear Reservation facility, where the Hiroshima bomb was produced, faced numerous barriers when proclaiming nuclear exposure–induced illnesses (Cable, Shiver, and Mix 2008). In a related case, residents of Monticello, Utah, formed *The Victims of Mill Tailing Exposure* community group to address the rise of exposure-induced illness and spent years organizing health surveys and public meetings but faced inaction and denial by federal officials and scientists (Malin 2015). Similarly, in Fallon, Nevada, a rural town east of Reno, where a high number of families reported child leukemia cases, and subsequently an investigation by the Center for Disease Control and Prevention found children in the area tested 18 times higher than the national average of tungsten (Lerner 2010). The residents faced resistance when claiming their illnesses were caused by the large Naval Air Base, the Nevada Test Site, and a nearby tungsten plant. These case studies demonstrate the legitimate health concerns of workers and residents from nuclear technologies. Although many of these Indigenous and rural communities have not gained legal recognition and have ongoing legal battles, their significant mobilization efforts are more than enough evidence of the state producing environmental injustices in their communities. Extending the critical perspective of the state and the military to the understanding of urban environmental inequalities can shed light into the mechanisms of environmental injustices and how to conceptualize state power.

Critical EJ expands previous work by applying a critical approach toward governmental agencies and views them as producers of environmental injustices (Pellow and Brulle 2005;

Pulido 2017). The framework of critical EJ focuses on (1) the overlapping of "social categories of differences"; (2) a multiscalar perspective; (3) state power; and (4) racial and environmental indispensability (Pellow 2016:223, 2018). Critical EJ scholarship acknowledges "[t]he degree to which various forms of social inequality and power—especially state power—are viewed as entrenched and embedded in society, elements that must be confronted rather than embraced," including enforcement of EJ policies, state-sanctioned violence, and other forms of institutional power (Pellow 2018:14). One example of the state's criminalization practices is the "[g]reen scare, which includes surveillance, infiltration, intimidation, and imprisonment of activists in the radical earth and animal liberation movement" (Pellow 2016: 100). As mentioned earlier, the state and the military have caused detrimental health effects to Indigenous and rural communities, thus stressing the significance of including the U.S. Military as a major actor of state power contributing to environmental injustices. Only when EJ research recognizes the various state roles, including the military, involved in environmental inequalities then can scholarship work toward alleviating the problem (Pellow 2018; Pulido 2017). Moreover, understanding the military's role in environmental injustices can further advance conceptualizations of state power. The treadmill of destruction is an environmental sociology framework that focuses on militarism and environmental degradation, and in this regard, has a lot to offer.

The Treadmill of Destruction

The treadmill of destruction is a theoretical frame developed by Gregory Hooks and Chad L. Smith (2004, 2005) to emphasize the role the military plays in environmental destruction in a capitalist society. The treadmill of destruction builds on the treadmill of production—a theory focusing on the growth coalition between capital, state, and labor working to accumulate profits and surplus at the expense of social equity, labor protections, and the environment (Gould, Pellow, and Schnaiberg 2004; Pellow, Schnaiberg, and Weinberg 2000; Schnaiberg 1980). Central to the treadmill of production is the expansionary logic of the economic capitalist system. The treadmill of destruction, on the other hand, focuses on the expansionary logic of the military working with capital and contributing to environmental destruction through extracting natural resources and creating pollution. In other words, "the military is not simply a derivative of the economic system but has its own expansionary dynamics with unique environmental impacts" (Jorgenson, Clark, and Kentor 2010:9). Furthermore, the military operates under a different logic as compared with capital, where the military's expansionary actions work through coercive state power and geopolitical control leading to an ever-increasing consumption of resources and production of environmental harms (Hooks and Smith 2005).

The expansionary environmental effects of the military occur in times of war and peace (Jorgenson et al. 2010). The military's usage of natural resources and their production of environmental hazards happen in combat operations, including actions of national security, war, and weapons/technologies (Alvarez 2016). For example, during U.S. Military deployments in Iraq and Afghanistan, military bases used open-air burn pits to dispose their solid waste and thereby exposed chemical toxins, such as PM2.5, PM10, and furan, into the air (Liu et al. 2016). Researchers (Liu et al. 2016) found soldiers in closer proximity to open-air burn pits reported higher rates of respiratory and cardiovascular health issues, including chronic bronchitis and hypertension. Moreover, researchers argue expansionary environmental harms also occur during peacetime or civilian operations because the military relies on large-scale infrastructures that consume many resources (Alvarez 2016). There are environmental consequences to using large-scale technologies outside of explicit wars, including war simulation practices or municipal infrastructures, and those actions consume resources (e.g., fueling of jet planes or using water) and produce chemical toxics (e.g., the air toxics associated with flying aircrafts). Both combat and civilian dimensions of the military release toxics into the air, land, and water.

The treadmill of destruction is used to explain the sacrifice zones created by the military on Indigenous lands throughout the United States and the world (Clark and Jorgenson 2012; Hooks and Smith 2004; Jorgenson et al. 2012). While previously mentioned Indigenous-focused research did not use the treadmill of destruction, it nonetheless demonstrates the negative consequences associated with the military's expansionary logic in developing nuclear and energy technologies. A large extent of the treadmill of destruction research focuses on cross-national analyses demonstrating how militarism drives carbon dioxide emissions, energy consumption, and freshwater withdrawals (Alvarez 2016; Clark and Jorgenson 2012; Jorgenson et al. 2012). Less attention focuses on the military as part of the empire state contributing to local urban environmental inequalities. Using the treadmill of destruction to understand militarism at the local level demonstrates the expansionary dynamics of the military occurring in cities and its corresponding environmental effects from combat and civilian operations.

In the case of understanding environmental inequalities, it is key to connect the treadmill of destruction to the racial state because they both stress the role of the state in enforcing racial violence. Michael Omi and Howard Winant (1994) describe the racial state as "composed of *institutions*, the *policies* they carry out, the *conditions and rules* which support and justify them, and the *social relations* in which they are embedded" (83, italics in original), including governmental policies and agencies that form racial/ethnic inequalities among populations (Goldberg 2001). The U.S. Military is an arm of the racial state that participates in state-sanctioned violence by creating environmental injustices nationwide and abroad, including the poisoning of Indigenous sacred land (Kuletz 1998) or the usage of Agent Orange in Vietnam (Frey 2013). Even further, Moon-Kie Jung and Yaejoon Kwon's (2013) summary of the United States as a racial state concludes that sociologists should aim to examine the United States as an empire state because it colonializes and imperializes lands and peoples. The U.S. Military enforces and reproduces the empire state, and through that same lens, the military takes part in polluting urban spaces and communities of color. Ultimately, by focusing on the U.S. Military, this research aims to evaluate the military's role in contributing to environmental inequalities in an urban area. To contextualize the frameworks of environmental inequality and the treadmill of destruction, the case study of Las Vegas is used.

Las Vegas

The U.S. Military is tied to the history of urbanization in Las Vegas. Las Vegas is originally Paiute land, and the Paiute peoples cultivated the area and grew community in a space whites deemed barren, harsh, and dry (Goldberg and Valley 2015). Throughout its western colonial history from the Spanish colonialists in 1826 to the United States acquisition of the land in 1848, Las Vegas has served as a trade and travel stop between California and the rest of the United States (Gottdiener, Collins, and Dickens 1999). In 1905, Las Vegas was officially declared a city with a local economy of railroad, mining, and warehousing. Through concerted efforts of the tourism industry and governmental officials, Las Vegas today is most well known for its gaming and hospitality industries (Gottdiener et al. 1999), and less for its military presence.

Las Vegas historian Eugene P. Moehring (2000) argues the "federal trigger," defined as the assistance from the federal government, is central to the modern development of Las Vegas. The "federal trigger" includes the lobbying support from state senators Key Pittman and Pat McCarran for New Deal funding to build Hoover Dam and city infrastructure (Gottdiener et al. 1999). The construction of Hoover Dam in 1931 encouraged further development in southern Nevada because it provided water and energy to sustain future urbanization and military facilities (Parker and Feagin 1992). Senators Pittman and McCarran secured additional funds from the Works Progress Administration to build a post office, a war memorial building, and street and sewer infrastructure (Gottdiener et al. 1999). Moreover, national federal funding policies, including the

Interstate Highway Act, also supported early urbanization in southern Nevada by building a transportation infrastructure to encourage people to travel westward (Gottdiener and Hutchison 2010). The civilian projects of Hoover Dam and the national interstate roads further established the arguments for the federal government to build military facilities in Nevada.

One of the first moves to establish military areas was carried out by Senator McCarran. Through his efforts, military facilities and resources were brought to the southern Nevada region, including a magnesium plant and an early gunnery school in the 1940s (Moehring and Green 2005). The motive behind the magnesium plant in the city of Henderson (a city southeast to the city of Las Vegas) was to supply natural resources to produce bombs and aircrafts in the United States (BMI n.d.; Moehring and Green 2005). The federal government transformed the early gunnery school into the permanent Nellis Air Force Base in 1950, and the base has increasingly become important in the military's involvement abroad, including the Vietnam War to current activity in the middle east (Moehring and Green 2005).

As of today, Las Vegas has several military sites within and near the city, including Nellis Air Force Base, the Nevada Test Site, the Tonopah Test Range, and Creech Air Force Base. In addition, the National Guard has two sites in the Las Vegas metro area: the Las Vegas Readiness Center and the North Las Vegas Readiness Center. Soldiers in Nevada air force bases engage in military missions abroad. For example, pilots operate unmanned aerial vehicles (i.e., drones) and are in communication with military personnel in other locations in the United States and abroad (Kaplan 2006; Whitaker 2016). In addition, Nellis Air Force hosts Red Flag combat classrooms where officials from other countries practice in aerial war simulations in the Nevada desert. Air toxics emissions, such as oxides of nitrogen, associated with aircrafts operated by the air force, imply straightforward mechanisms of environmental health impacts (Naugle, Grems, and Daley 1978). The Air Force is pursuing efforts to further expand the Nevada Test and Training Range into the nation's largest wildlife refuge, the Desert National Wildlife Refuge (Willson 2019). The ongoing efforts have been met with opposing veteran-led demonstrations (Willson 2019). Another example of the growing military presence in Las Vegas is the opening of the $23 million North Las Vegas Readiness Center in 2013 (Rogers 2013). The center is part of state and federal government efforts to increase military readiness in resources and soldiers across the nation post-9/11. The treadmill of destruction framework suggests military areas produce more environmental harm due to their intensive resource consumption and pollution production. Las Vegas is a prime site to evaluate this hypothesis because it has military facilities in and near the metro area.

Hypotheses

In light of the theoretical conceptualizations of environmental (in)justice and the history of Las Vegas, I evaluate two hypotheses related to environmental inequality and the treadmill of destruction. The *environmental inequality hypothesis* is census tracts with more racial/ethnic minority and/or poor residents will have higher environmental health risk. This hypothesis follows previous research demonstrating areas with higher percentages of residents of color and lower median household income are exposed to higher environmental health risk (Alvarez and Norton-Smith 2018; Collins et al. 2011; Grineski et al. 2007; Liévanos 2017). To the author's knowledge, a local environmental inequality study of Las Vegas has not been evaluated.

Furthermore, the *treadmill of destruction hypothesis* is census tracts in closer proximity to military areas have higher environmental health risk. This hypothesis evaluates the degree to which the military contributes to environmental inequality while controlling for racial/ethnic and socioeconomic demographics.

Environmental Inequality Hypothesis

Hypothesis 1: Census tracts with higher percentages of residents of color and/or poor residents will have higher environmental health risk.

Treadmill of Destruction Hypothesis

Hypothesis 2: Census tracts in closer proximity to military areas will have higher environmental health risk.

Data and Sample

The dependent variable for environmental health risk is estimated cancer risk from air toxics published by the U.S. Environmental Protection Agency's (EPA) NATA. The EPA publishes NATA reports to evaluate air toxics in the United States, and the report includes data on emissions, ambient concentrations, and human health risks. Over the last three decades, six reports have been published for the years: 1996, 1999, 2002, 2005, 2011, and 2014. NATA reports a "snapshot" of national air quality and health risks because a nationwide monitoring system does not exist, and NATA data consist of 180 hazardous air pollutants known to cause health risks (Office of Air Quality Planning and Standards 2018:4). To produce NATA reports, the EPA does a series of complex, rigorous steps, and their set-up is consistent with the general risk assessment framework from the EPA's guidelines and the National Research Council.

The first step for estimation is to compile the national emissions inventory (NEI). The NEI is collected through a variety of state, local, and tribal agencies. The estimates are collected at various levels depending on the source of emissions, for example, air toxic emissions from point sources are collected at the facility level while on-road air toxic emissions are collected at the county level. After the NEI is collected, the EPA conducts a series of air quality simulations using ambient concentrations multiscale air quality (CMAQ) and atmospheric dispersion (AERMOD) models. In most cases, the air toxics are estimated through one model; however, a few air toxics use a hybrid model combining CMAQ and AERMOD. Air quality modeling consists of using mathematical equations with emissions data, meteorological data, and other information to simulate air toxics in the atmosphere. Finally, based on ambient concentration data, the EPA uses models of inhalation exposure to estimate outdoor human health risks. Information on cohorts and daily activities is used to formulate risk characterization for outdoor exposure to air toxic emissions. The EPA provides risk assessment for cancer and chronic health risks based on outdoor exposure in a lifetime estimated as 70 years. The dependent variable used here is estimated cancer risk from air toxics in a lifetime of 70 years per million persons at the census tract level for 2014. As the measurement is per million persons, it is a standardized measure that can be compared across population sizes and census tract areas.

The demographic variables are from the ACS (U.S. Census 2014) five-year wave of 2010–2014 and were downloaded from the National Historical Geographic Information System (GIS) Web site (Manson et al. 2018). The ACS collects more in-depth demographic estimates (e.g., income and housing characteristics) at various geographic levels and more frequently than the decennial census. The main variables of interest included are percent of racial/ethnic minority residents, median household income, and percent of occupational workers (percent of the labor force in manufacturing and retail). The percent of people of color was calculated by taking the difference of the total population[1] minus white, not Latinx[2] persons and dividing it by the total population.

Table 1. Descriptive Statistics of Census Tracts ($N = 463$).

Variable	*M*	*SD*	Median	Minimum	Maximum
Estimated cancer risk from air toxics per million persons	37.19	5.37	38.08	26.93	50.73
Race/ethnicity by tract					
People of color (%)	53.58	20.06	53.51	9.32	96.35
White, not Latinx (%)	46.42	20.06	46.49	3.65	90.68
Latinx (%)	30.30	19.78	24.54	1.14	91.54
Black, not Latinx (%)	10.28	8.54	8.12	0.00	63.15
Median household income	55,220.30	21,620.05	53,885.00	15,739.00	153,133.00
Distance to nearest military area (km)	10.95	5.44	10.83	0.00	23.56
Distance to nearest highway (km)	2.03	1.60	1.71	0.01	10.07
High-intensity development (%)	16.06	14.49	12.33	0.03	76.30
Population density (pop/km^2)	3.28	8.92	1.53	0.35	120.66
Manufacturing workers (%)	3.20	2.17	2.88	0.00	11.14
Retail workers (%)	11.88	4.67	11.56	1.13	25.28

The analyses include various spatial variables from the Clark County Comprehensive Planning GIS files and the National Land Cover Database (Clark County GIS Management Office 2019; Homer et al. 2015). Highway and military area distance measures were created in ArcMaps by calculating the distance in kilometers between the census tract centroid to the nearest highway and military area. The highways included were the I-15, the Clark County 215, the Nevada Highway, and their corresponding ramps. The military areas included were Nellis Air Force Base, the Northern Readiness Center, and the Las Vegas Readiness Center. The high-intensity development variable was created from the National Land Cover Database's raster land cover shapefile and was calculated by taking the percent of the highest impervious surface area of the census tract (Liévanos 2017). Finally, I used ArcMaps to create a population density variable by taking the population of the census tract and dividing it by the area of the census tract (measured as km^2). Table 1 reports the descriptive statistics.

Figure 1 is a map of the Las Vegas metropolitan area and demonstrates the census tracts included in the study area as well as the military areas and highways. The Las Vegas Boulevard ("The Strip") is included in the map as a popular point of reference. The sample has 463 census tracts within Clark county in the state of Nevada. Nellis Air Force Base and the Northern Readiness Center are located at the top northeast corner of the map. The Las Vegas Readiness Center is smaller and located in southwest corner of the map.

Method

I use spatial regression analysis because ordinary least squares regression does not control for spatial correlation. All spatial analyses were conducted in GeoDa. Spatial regression models incorporate spatial autoregressive structures into linear regression to control for spatial correlation (Rogerson 2010). It is important to control for dependence, whether spatial, temporal, or groups, to reduce the likelihood of spurious claims. The first step in spatial regression is to decide on a spatial weight matrix. Five different distance-based spatial weights from 0.5 to 3 km were evaluated based on the spatial dependence of their residuals and their goodness of fit statistics. Based on the evaluations, the best spatial weight was 1.5 km. The second step of spatial regression is to choose the most appropriate model for the analysis (Anselin 2005). Spatial econometrics researchers use Lagrange Multiplier tests statistics to evaluate which model type is the most

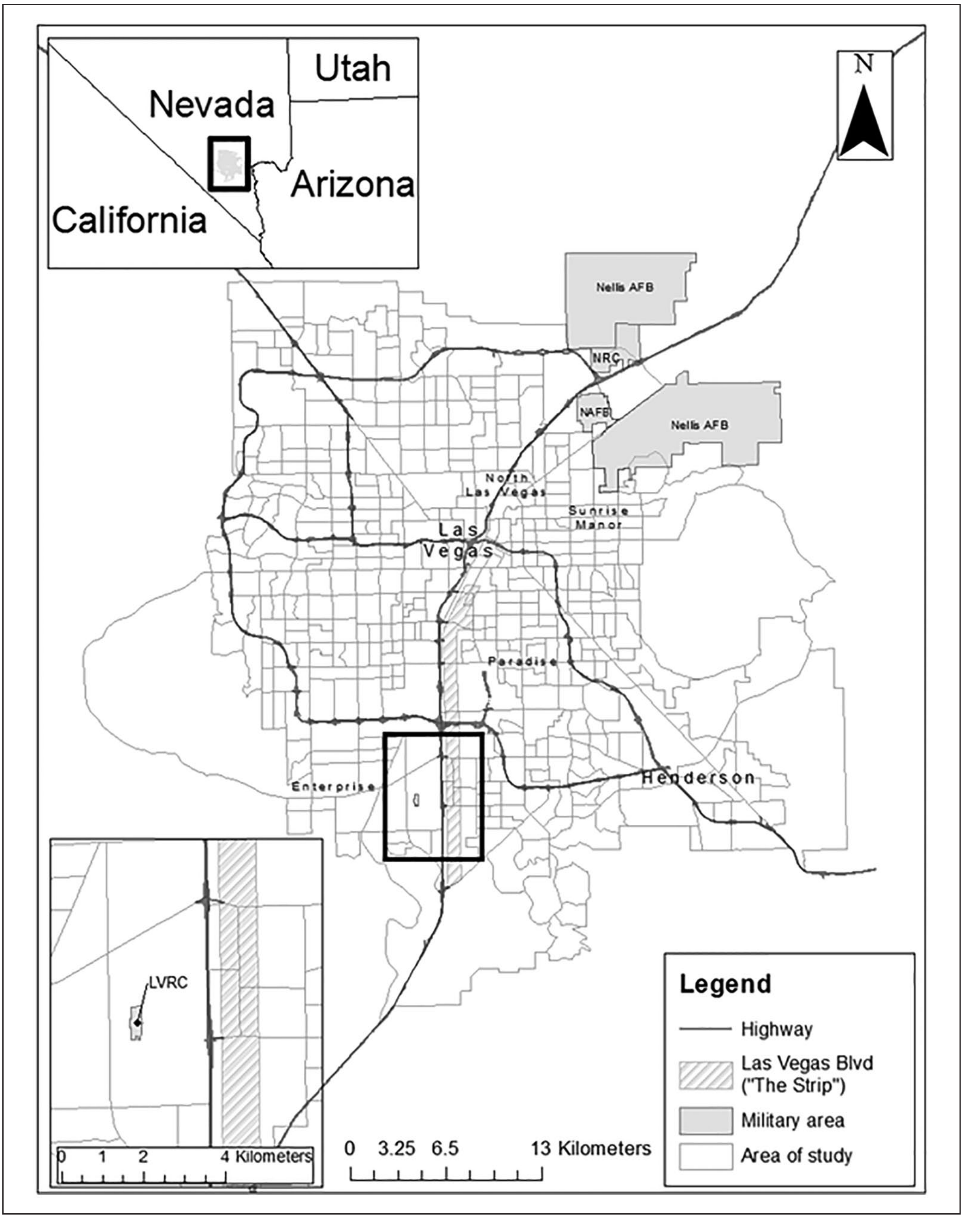

Figure 1. Map of the Las Vegas metropolitan area.
Note. Map plots the 463 census tracts included in the study. The zoom-in box at the bottom left corner is a close-up of the Las Vegas Readiness Center. AFB = Air Force Base; NAFB = Nellis Air Force Base; NRC = Northern Readiness Center; LVRC = Las Vegas Readiness Center.

appropriate: spatial error or spatial lag (Anselin 2005). A spatial lag model incorporates a spatial autoregressive term of the dependent variable (e.g., lagged dependent variable) into the model to account for the assumption of areas near each other are more likely to be similar (Rogerson

2010). On the other hand, a spatial error model incorporates the spatial autoregressive term into the error term to account for the influences of unmeasured independent variables by accounting for the spatial clustering of error terms (Rogerson 2010). The test diagnostics for the data demonstrated favorable results to the spatial error model. After running the spatial error models, I checked the Moran's I of the residuals for any remaining significant spatial correlation. After all the controls were included, there was no remaining significant spatial correlation.

Results

The average estimated lifetime cancer risk from air toxics in Las Vegas is about 37 people per million while the national average is 31. Las Vegas has roughly 54 percent of people of color, including 30 percent of Latinx residents and 10 percent of Black[3] residents. The average median household income is $55,220.30. The average distance between a census tract to the closest military area is about 11 kilometers.

Table 2 reports the results from the spatial error regression models for estimated cancer risks from air toxics across various independent variables. Model 1 indicates marginal support for the environmental inequality hypothesis by reporting census tracts with a higher percent of people of color ($p = .07$) and a lower median household income ($p = .00$), independent of each other, have higher environmental health risk. Model 1 supports the treadmill of destruction hypothesis that census tracts in closer proximity to a military area are predicted to have higher estimated cancer risk from air toxics. Potential spurious relationships of environmental inequalities can occur from failure to include built environment characteristics or demographic factors. Thus, in Model 1, we controlled for various built environment indicators. Model 1 reports as proximity to highways increases, there is a corresponding, albeit not significant, decrease in environmental health risk. On the contrary, census tracts with a higher percent of high-intensity development report significantly higher exposure to airborne health risks. Finally, Model 1 demonstrates increases in population density had a nonsignificant corresponding increase in environmental health risk.

To further examine the marginal significance of the people of color variable, Model 2 disaggregates people of color into the percent of Latinx residents and the percent of Black[4] residents. Model 2 reports the percent of Latinx residents as positive and significant, meaning census tracts with a higher percent of Latinx residents are predicted to have higher environmental health risk. Holding everything constant, for every 25 percent of Latinx residents in a census tract, there is a predicted increase of one additional estimated cancer risk from air toxics per million persons.[5] To put this in context, 25 percent of Latinx residents is the median of the sample. Census tracts with a higher percent of Black residents have a corresponding nonsignificant increase in exposure to carcinogenic air toxics. Thus, suggesting the marginal significance of the people of color variable from Model 1 is from the percent of Latinx residents. The remaining variables in Model 2 maintain their direction and significance from Model 1. As mentioned earlier, to rule out a spurious relationship of environmental inequality, Model 3 includes demographic control variables. In Model 3, the results remain consistent and report increases in the percent of workers in retail and manufacturing, independent of each other, have a corresponding nonsignificant increase in environmental health risk. The results support the environmental inequality and the treadmill of destruction hypotheses for Latinx communities.

The results indicate, independent of each other, Latinx environmental health vulnerability and census tracts in closer proximity to military sites have higher environmental health risk. A follow-up question is whether the distance to the nearest military area modifies the relationship between environmental health risk and Latinx communities. To evaluate this, Model 4 includes an interaction of the percent of Latinx residents and military proximity. Model 4 reports the interaction as marginally significant ($p = .14$) and negative, suggesting there is a marginal additional decrease in estimated cancer risk from air toxics for census tracts with a greater distance to the

Table 2. Results from the Spatial Error Regression Models ($N = 463$).

	Model 1			Model 2			Model 3			Model 4		
Variable	Coeff.	*SE*	*p*	Coeff.	*SE*	*p*	Coeff.	*SE*	*p*	Coeff.	*SE*	*p*
Constant	36.635	0.924	.000	36.321	0.821	.000	36.257	0.849	.000	35.743	0.905	.000
People of color (%)	0.016	0.009	.074									
Latinx (%)				0.040	0.009	.000	0.039	0.009	.000	0.065	0.020	.001
Black, not Latinx (%)				0.007	0.014	.626	0.006	0.014	.656	0.009	0.014	.540
Median household income (10,000s)	−0.187	0.062	.003	−0.162	0.064	.011	−0.163	0.064	.011	−0.165	0.063	.009
Distance to nearest military base (km)	−0.176	0.036	.000	−0.173	0.034	.000	−0.174	0.034	.000	−0.120	0.049	.016
Distance to nearest highway (km)	−0.025	0.080	.758	−0.026	0.079	.743	−0.030	0.079	.710	−0.033	0.079	.677
High-intensity development (%)	0.065	0.010	.000	0.067	0.010	.000	0.067	0.010	.000	0.066	0.010	.000
Retail (%)							0.004	0.017	.823			
Manufacturing (%)							0.019	0.040	.634			
Population density (pop/km^2)	0.000	0.000	.329	0.000	0.000	.096	0.000	0.000	.102	0.000	0.000	.120
Interaction: Military × Latinx										−0.003	0.002	.142
Lambda	0.844	0.017	.000	0.832	0.018	.000	0.833	0.018	.000	0.835	0.018	.000
Log likelihood	−1,043.589			−1,035.821			−1,035.685			−1,034.752		
AIC	2,101.180			2,087.640			2,091.370			2,087.500		
Schwarz	2,130.140			2,120.740			2,132.750			2,124.740		
Moran's I (9,999 permutations)	0.022		.264	0.013		.354	0.012		.361	0.017		.333

Note. AIC = Akaike information criterion.

Table 3. Interaction Calculations.

Military area distance (km)	Cumulative Latinx coefficient
0	0.065
3	0.056
6	0.047
9	0.038
12	0.029
15	0.020
18	0.011
21	0.002
24	−0.007

Note. The p value of the interaction is marginal (p = .14). The cumulative Latinx coefficient is calculated by multiplying the interaction coefficient with the military area distance and then adding the product with the Latinx coefficient. For example, a military area distance of six kilometers calculates to .047 cumulative Latinx coefficient—(–.003) × 6 + .065 = .047.

nearest military area and with a lower percent of Latinx residents. Table 3 reports the cumulative environmental health effect of the Latinx coefficient for a range of distances to the nearest military area from zero to 24 kilometers. The cumulative Latinx coefficient is calculated by multiplying the interaction coefficient by the military area proximity (e.g., 0, 12, or 24) and then adding the Latinx coefficient—for example, .065 + 0 × (–.003) = .065 or .065 + 12 × (–.003) = .029. All things held equal, examining the cumulative environmental health risk effect of the Latinx percent coefficient shows that moving a census tract from zero to 12 kilometers away from a military area almost decreases the association between Latinx percent and estimated cancer risk from air toxics by 50 percent. The coefficients of the other variables remain consistent in direction and significance.

Discussion

The data analyzed here highlight two important findings, including (1) Latinx environmental health vulnerability and (2) the military's role in contributing to greater environmental health risk. In regard to the first, the findings demonstrate a Latinx environmental health vulnerability in Las Vegas, and this is similar to previous research in the southwest finding Latinx environmental health vulnerability in Phoenix, southern California, and El Paso (Collins et al. 2011; Grineski et al. 2007; Morello-Frosch et al. 2002; Pastor et al. 2005). Surprisingly, we did not find a Black environmental health vulnerability in Las Vegas. Most, if not all, national-level research finds Black communities are exposed to more environmental health risk (Ard 2015; Downey et al. 2008; Downey and Hawkins 2008). On the other hand, there are mixed findings at the national level on environmental disparities for Latinx communities with some research reporting higher exposure (Liévanos 2015) and others estimating less exposure as compared with white communities in some regions (Ard 2015; Zwickl, Ash, and Boyce 2014). Researchers have speculated the differences are attributed to whether air pollution measures include transportation sources because pollution from mobile sources are higher in the southwest region and that region has more Latinx communities (Downey and Hawkins 2008). Moreover, future research should examine the vulnerability of intersectional racial/ethnic groups such as Afro-Latinx communities. It is key to situate Latinx environmental health vulnerability in the geography of Latinx migration waves.

Latinx migration within the United States shows poor, Latinx residents are moving from traditional Latinx destinations (e.g., states adjacent to the Mexico-U.S. border) to new Latinx destinations (e.g., states not adjacent to the Mexico-U.S. border) to escape stricter immigration enforcement and high costs of living. The push and pull factors of Latinx growth and environmental inequality are tied to weaker social, health, and environmental protections found in industries of agricultural manufacturing and service (Alvarez and Norton-Smith 2018). Las Vegas is an "emerging" immigrant destination as most of its immigrant growth is from 1980s and 1990s (Singer 2004). Situating its emerging destination status with more recent local statistics shows most residents are moving to Las Vegas from California (City of Las Vegas 2013), and this suggests Latinx residents are moving to Las Vegas in search of lower costs of living or employment opportunities. However, there is an environmental health cost, especially for poor, Latinx residents residing in Las Vegas.

Second, our results demonstrate the military as a contributor to greater local urban environmental health risk for everyone, but with communities of color and low-income facing additional risk. While previous research has showed the military to be a major driver of CO_2 emissions and resource extraction, this unique finding at the local level adds further evidence to the detrimental role the military plays in forming urban environmental inequalities. The treadmill of destruction suggests the heightened exposure to air toxics can be attributed to the use of aircrafts at the air force base as well as the intensive use of natural resources, such as on-road transportation, generated at and around the military facilities. The environmental health consequences of the military must be situated in already existing hierarchies of racism and classism as well as migration patterns. Future research should examine additional domestic military sites and whether they contribute to environmental health disparities. The results support the frames of critical EJ and the treadmill of destruction and suggest the U.S. Military is an arm of the empire state creating racial environmental inequalities through the intensive use of resources and neglect of marginalized communities.

Finally, both findings should be contextualized within the urban history of Las Vegas. The Las Vegas metropolitan area consists of several municipal and unincorporated areas, including the cities of Las Vegas, North Las Vegas, Henderson, and unincorporated areas of Clark County. The city of North Las Vegas has been historically marginalized as compared with other parts of the metro area through Black discrimination in housing segregation and economic opportunities (Gottdiener et al. 1999). Furthermore, economic and social investment to suburban and gated communities outside the urban core to the city of Henderson and unincorporated areas has further pushed the cities of Las Vegas and North Las Vegas into economic stress. Laura Pulido (2000) has demonstrated similar racialized historical actions of suburbanization and decentralization in Los Angeles as acts of environmental privilege. The areas once held to overt racism against Black communities have had a recent growth in Latinx residents. Most of the suburban and gated communities reside in the south side of the metro area as compared with the northeast where the largest military sites reside. Determining the interconnections between suburbanization and decentralization of the city with the development of the military is beyond the scope of this paper. However, future research on this important topic will further advance EJ frameworks.

Conclusion

Foundational EJ research argues the state contributes to environmental injustices with weak enforcement and policymaking. Similarly, the treadmill of destruction focuses on the role of the military in environmental degradation. Results from spatial regression analysis in Las Vegas, Nevada, show military area proximity contributes to greater local air pollution exposure for everyone, but with additional risk for communities of color and low income. To understand local urban environmental inequalities in Las Vegas, the military must be included in the conceptualization of systematic power. Aspects of the military, such as expanding geopolitical control and participating in the global arms race, have local environmental health consequences. Moreover, these features demonstrate the military's role as part of the empire state. The negative environmental health impacts of the military happen in the context of already existing racial and economic hierarchies and push and pull migration patterns, thereby putting communities of color and poor residents more at risk. Expanding critical EJ to include the military as a state institution contributing to environmental inequalities is especially important in our current society because national administrations are working to increase the military state. Indeed, the military's role in environmental injustices should not be overlooked, and the case study of Las Vegas provides important lessons to environmental injustice research, including Latinx environmental health vulnerability and military sites in cities.

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Notes

1. The total population is the total number of those who self-reported a racial and ethnic identity.
2. I use the gender nonconforming term *Latinx* instead of gendered *Latino* (see Vidal-Ortiz and Martínez 2018).
3. In this article, I capitalize "Black." I agree with the scholars W. E. B. DuBois, Kimberlé Crenshaw (1988), and Cherly Harris (1993) who argue: "When using 'Black,' I shall use an upper-case 'B" to reflect my view that Blacks, like Asians, Latin[x]s, and other 'minorities,' constitute a specific cultural group and, as such, require denotation as a proper noun. … (noting that 'Black' should not be regarded 'as merely a color of skin pigmentation, but as a heritage, an experience, a cultural and personal identity, the meaning of which becomes specifically stigmatic and/or glorious and/or ordinary under specific social condition')" (Crenshaw 1988: 1332).
4. The percent of Black resident is residents who self-reported as Black, not Latinx.
5. Twenty-five percent of Latinx residents is calculated by dividing one by the Latinx coefficient in Model 2 (1 / .04 = .25).

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