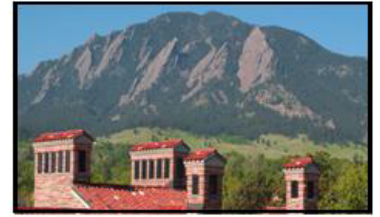


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WORKING PAPER

Native Americans: Where in Environmental Justice Theory and Research?

Jamie Vickery
Lori M. Hunter

March 2014

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Where in Environmental Justice Theory and Research?**

Abstract: Unique political and cultural dynamics surround the study and pursuit of environmental justice (EJ) in Native American communities. While the last two decades have seen important theoretical, empirical, and policy advancements in pursuit of EJ, much remains to be done with regard to Native Americans. This review summarizes Native American environmental justice issues based on a literature search of over 50 cross-disciplinary publications. We discuss the unique nature of tribal EJ in terms of conducting research and working toward restitution of environmental ills. The review suggests that Native American environmental justice issues are distinct for three major reasons: (1) standard EJ indicators may not apply to indigenous experiences; (2) debates continue over who qualifies as a tribal “member”; (3) tribal sovereignty complicates research and policy. We conclude with discussion of important remaining gaps.

Keywords: climate change, environmental health, environmental justice, environmental inequality, indigenous, Native Americans, natural resources

**Native Americans:
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While important theoretical and methodological advances have been made in environmental justice (EJ) research in the past two decades, much remains to be done with regard to Native American communities, because of their unique political and cultural dynamics. This review summarizes the state of the scholarship on Native American environmental justice issues: current knowledge, methods employed, and important questions that remain.

Case studies of these issues have provided wide-ranging coverage across an array of cultural dimensions, although broader empirical investigation has been limited. Scholars have analyzed environmental threats to indigenous culture or ways of life (e.g., Adamson 2011; Hoover et al. 2012), resource exploitation (e.g., Leonard III 1997; Smith and Frehner 2010), environmental health (e.g., Shriver and Webb 2009; Smith and Frehner 2010), and, recently, climate justice (e.g., Doyle, Redsteer, and Eggers 2013; Gautam, Chief, and Smith Jr. 2012; Krakoff 2011; Lynn et al. 2013; Maldonado et al. 2013; Mohai et al. 2009; Smith and Frehner 2010; Whyte 2013). To situate this material, we first present a brief overview of environmental inequality research more generally.

Environmental Inequality Research: Theory and Application

Substantial progress has been made in understanding and theorizing social inequalities in environmental exposures and other forms of environmental vulnerability. “Environmental inequality” refers to social variation in the distribution of environmental ills. Such inequality has been linked to demographics including, but not limited to, race, ethnicity, gender, and age (Sze and London 2008). “Environmental racism” focuses more specifically on environmental

disadvantage primarily associated with racial and ethnic minority status (Sze and London 2008). And finally, “environmental justice” involves efforts by an affected group to obtain restitution from environmental harm (Cutter 1995). From a legal and policy perspective, the Environmental Protection Agency (EPA) defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (EPA 2013).

Race is often a powerful indicator of environmental inequality (Bullard 1993; Bullard 2001; Bullard and Wright 1993; Holifield 2001). However, variation in exposure to environmental risk extends across other social categories such as gender, age, and socioeconomic status more broadly (Bullard 1994; Cutter 1995; Di Chiro 1996; Malcoe et al. 2002; Tierney 2006). In the past decade, substantial methodological progress has been made in studying environmental inequality, including increasing sophistication in the application of spatial methodologies (Downey et al. 2008; Mohai et al. 2009). Longitudinal work has allowed for disentangling the timing of hazardous facility placement, as well as racial and ethnic residential concentrations and neighborhood transitions (Been and Gupta 1997; Oakes, Anderton, and Anderson 1996; Pastor, Sadd, and Hipp 2001).

Generally, research suggests that power and influence grant certain populations the ability to defer locally unwanted land uses (LULUs) (Bullard 1993; Chess, Burger, and McDermott 2005; Mohai et al. 2009). More vulnerable groups and their communities become “paths of least resistance” (Bullard and Wright 1993; Mohai et al. 2009)—as in the case of Native American populations.

Environmental justice activists have applied research findings to make the case for increased subject participation in research and decision-making as well as to change the ways in which environmental science is conducted (Minkler et al. 2008; Shepard et al. 2002; Sze and London 2008). For example, Brown's *Toxic Exposures* (2007) shows how environmental justice activists have sought to connect environmental health and medicine by promoting a more patient-centered practice and linking clinical practice with research and awareness of environmental causes. As this review will later demonstrate, Native American EJ research has moved in a similar fashion, with researchers increasingly employing participatory methods to gain a more accurate understanding of EJ issues in tribal communities.

Selection of Articles

To generate the following narrative summary of research and writing on Native American environmental justice issues, we used a variety of search engines to construct a wide-ranging interdisciplinary database of materials. Search engines included Google Scholar, Web of Knowledge, *JSTOR*, and the University of Colorado library system, Chinook Libraries. Chinook Libraries provides access to a multitude of databases such as Sociological Abstracts, Social Science Research Network, and Proquest.

Keywords searched include "Native American environmental justice," "Native American environmental injustice," "indigenous environmental justice," and "indigenous environmental injustice." Browsing articles and books derived from these keywords led us to add four more keywords: "indigenous climate justice," "indigenous climate injustice," "Native American climate justice," and "Native American climate injustice." We included only articles and books that focused solely or predominantly on Native American environmental justice, excluding pieces with a specific focus on other indigenous groups in other countries. The process of

selection was based on the relevancy of material to Native American EJ. Relevancy was determined by examining the article titles and abstracts. For example, when typing in ‘Native American environmental justice’, the results eventually became less focused on Native American EJ articles and more focused on general EJ articles. When this occurred for each of the keyword searches, the search was terminated.

While our emphasis is on social science, to gather a holistic overview we also included law, environmental, and public health studies pertaining to Native American environmental injustice. A total of 52 documents included 49 peer-reviewed articles, one book as well as relevant material obtained from one government and one non-profit website.¹ The documents included represent a variety of academic disciplines: environmental sociology, geography, anthropology, political ecology, Native American law, and environmental law. The material's crossdisciplinarity yields an appropriate multitude of perspectives. After materials were selected for inclusion, we then summarized each document and identified central overlaps with regard to conclusions, implications, and mention of research and policy gaps.

The Unique Dimensions of Native American Environmental Justice

Native American environmental justice issues are unique for three major reasons: (1) standard EJ indicators may not apply to indigenous experiences of environmental injustice given cultural distinctiveness both across Native American communities themselves and between them and the broader culture; (2) debates continue over who qualifies as a “member” of a tribal population (carded members vs. those who claim Native American ancestry); (3) tribal sovereignty requires different research approaches and policy prescriptions.

¹ An additional 20 articles and books or book chapters were used to provide broader background on environmental inequality research.

Measuring Native American Environmental Justice

EJ researchers frequently face problems of how to conceptualize processes of injustice and how to operationalize indicators for analysis (Cutter 1995; Harris and Harper 2011; Holifield 2001). Such challenges are exacerbated within studies of Native American populations for a number of reasons; but, in general, indicators typically used to reflect environmental inequality are derived largely from Western science and do not coincide with indigenous measures of health and well-being.

Several authors note the problem of applying Western concepts of well being to Native American understandings of health and comfort (Adamson 2011; Burger et al. 2010; Harris and Harper 1997, 2011; Martin 2002; Ranco et al. 2011). Common EJ measures reflecting, for example, distance to hazardous facilities does not capture the complexity of Native American connections to landscape.

Harris and Harper (2011) provide perhaps the most extensive and detailed approach to measurement within Native American environmental justice research. They specify several alternative measures of injustice for tribal groups based upon subsistence lifestyle exposure scenarios—including but not limited to degree of tribal access to sacred resources, net loss or recovery of traditional activities (e.g., number of lost visits to traditional cultural landmarks, ability to conduct sacred ceremonies, etc.)—As well as various other scales including decreased cultural education opportunities and lost tribal skills such as trapping and hunting (p.233-35). As an additional solution to the challenge of appropriate indicators, Harris and Harper encourage the use of tribal narrative: “Because traditional native life is intertwined with the natural resources, we have found it helpful to begin the affected resource section with a tribal narrative that gives a local tribal perspective and describes the oral history and environmental knowledge of the area

and some of the key ecological and cultural keystone resources” (p.232). The authors add that by incorporating “eco-cultural attributes” of indigenous resources as well as tribal narratives, we may be better able to evaluate environmental health impacts (p.233). They claim that culturally appropriate metrics can give researchers and policy makers a more informed understanding of environmental impacts on tribes, so that tribal concerns are not dismissed as opinions or “uncertainties” (p.237). Typical measures of environmental justice or risk analyses do not fully capture the many pathways connecting Native Americans to their environment. Use of tribally identified metrics for environmental impact analyses provides a holistic picture of the relationship between tribal communities and their natural environment as opposed to merely assigning a dollar valuation to environmental harm (Harris and Harper 2011).

With regard to environmental health indicators, Ranco and colleagues (2011) find that some of the tribal definitions of health are difficult to quantify and therefore not appropriately addressed in quantitative risk assessments (p.227). Certain practices such as gathering and growing food have not only physical purposes of nourishment, but also spiritual and communal purposes for the cultures and traditions of tribes. However, considerations of communal health and spiritual well-being are often overlooked in risk and impact assessments because they cannot be easily measured: “many of the dimensions of good health are difficult to quantify, such as participation in spiritual ceremonies, intergenerational education opportunities, and traditional harvesting practices, yet they may be negatively impacted or even destroyed when resources are contaminated” (Ranco et al. 2011, p.227).

Culturally significant plants and animals play an important role in the health status of tribal groups (Adamson 2011; Lynn et al. 2013), again demonstrating cultural definitions at odds with mainstream measures of health. “First foods” in Native America, for example, represent not

only sustenance, but also a source of pure spirituality and mental health. Thus some researchers argue that efforts to keep “first foods” pure are not political statements, but statements of a desire to ensure healthy populations (Adamson 2011).

Defining Tribal Populations

Environmental justice researchers have long struggled with appropriate definitions of populations deemed environmentally vulnerable. For example, early empirical research in the U.S. aimed to disentangle income and race effects in environmental exposure. Results tended to indicate that racial and ethnic minority groups were even more consistently exposed to environmental ills than were low-income groups generally (Bullard 1999; Crowder and Downey 2010; Pulido 1997). Therefore, Downey and colleagues (2008) argue, “if environmental inequality researchers want to fully understand environmental racial inequality and the ways in which local, regional, and national factors shape environmental racial inequality, they will have to include multiple racial/ethnic groups in their research” (p.270). Their results suggest that residential segregation and income disparities are poor predictors of environmental inequality outcomes (p.270), because these two factors vary by racial and ethnic group.

Like other racial/ethnic groups in today’s melting pot, Native Americans are not easily categorized. Specific to Native Americans, however, are questions of federal recognition of specific tribal groups as well as issues of reservation residence vis-à-vis tribal membership. Zimmerman (1993) explains that Native Americans may be under- or overrepresented in studies depending on the criteria used: “The case of Native Americans further illustrates the issue of inconsistent classification. It raises some specific instances where inconsistent classification has influenced the portrayal of social and economic characteristics in a subpopulation. This has had serious implications for public policy” (p.641-42).

Social and economic characteristics such as employment and earnings, infant mortality, and various other health indicators are greatly affected by the types of classification used (Zimmerman 1993). Native American populations are defined in various ways; blood quantum levels, tribal membership, and reservation residency are examples of the measures agencies and groups use to quantify and depict tribal populations (Zimmerman 1993). Inconsistencies in classification of Native Americans influence understandings of the socioeconomic and health status of Native populations, thus affecting the types of solutions employed by policy makers and researchers to address specific population issues. Particularly given the policy relevance of environmental justice scholarship, issues of population definition are critical.

Tribal Sovereignty

Tribal sovereignty, self-determination, and the trust relationship between the federal government and Native tribes are three aspects of Native Americans' political and cultural standing that differentiate them from other groups seeking restitution in response to environmental injustices.

What distinguishes the situation of Tribes from all other environmental justice groups, however, is the fact that environmental justice issues affecting Tribes must always be viewed against the backdrop of tribal sovereignty, the federal trust responsibility owed by the United States to Tribes, the government-to-government relationship, treaty rights, and the special jurisdictional rules applicable to Indian Country. (Walker, Bradley, and Humphrey 2012, p.381)

Unlike other groups seeking environmental justice in the U.S., federally recognized tribes are inherently self-governing and self-regulating (Bureau of Indian Affairs 2014). This right to sovereignty is limited to those tribes who have established legal relationships with the United States through treaties and executive orders, for example (Bureau of Indian Affairs 2014; Native American Rights Fund). Tribal sovereignty essentially allows federally recognized Native American tribes the right to govern themselves. Importantly, tribal sovereignty is not a

“partnership” between tribal groups and the federal government. Rather, it “must be recognized, by the dominant culture, that tribal governments can form the basis of a different civic community, a different sense of the public good” (Ranco and Suagee 2007, p. 692). Tribal governments have the right to exercise their political independence and determine their nation’s economic, political, and cultural trajectory.

Tribal groups are distinct with regard to their ability to manage and regulate their land and resources (Zaferatos 2006, p.904). Sovereignty enables (or is supposed to enable) Native American tribes to establish their own forms of environmental regulation within the boundaries of their jurisdiction (Ranco 2008; Walker, Bradley, and Humphrey 2012). The U.S. Environmental Protection Agency is required to enforce regulations created by tribes—even if these regulations conflict with state regulations. For example, in exercising their sovereignty, the Pueblo of Isleta set their own water quality standards (WQS) that reflected their tribal members’ needs and desires to keep drinking water clean for both everyday and ceremonial use (Ranco 2008). However, the tribe’s WQS were much more stringent than the state of New Mexico, which was a significant issue considering the fact that the Pueblo were downstream from water controlled by the state. Despite the fact that New Mexico had proposed its own WQS pertaining to downstream discharge, its proposal did not adequately reflect the concerns and needs of the tribe. The state’s proposal to implement these standards was therefore not granted by the EPA, who recognized the tribe’s sovereign authority to impose regulations in their jurisdiction (Ranco 2008). Despite the Pueblo’s apparent victory, Ranco (2008) claims that the use of tribal sovereignty is limited and is not readily available to all tribes:

While the U.S. EPA does provide grants for the development of water monitoring programs on Indian reservations, this money is generally not enough to develop and implement WQS. Thus, while legally an option to all federally recognized tribes, establishing WQS has become a program pursued by mostly wealthier, larger tribes with

a government bureaucracy capable of adopting and implementing the full array of the U.S. EPA programs. (p. 360)

Limitations on tribal sovereignty include, but are not limited to, a tribe's lack of economic power to oppose harmful regulations and development as well as whether or not a tribe is federally recognized as a sovereign nation (Arquette et al. 2002; Bureau of Indian Affairs 2014; Maldonado et al. 2013; Ranco and Suagee 2007). This has substantial implications on such tribes' ability to control environmentally harmful activity on or around their lands.

Self-determination, or Native Americans' rights and abilities to manage their own development—politically, economically, socially, and culturally (Ranco et al. 2007)—became a popular concept in the 1960s, when movements and legislation sought to reverse the former paternalistic policies of the U.S. government towards tribes (Jarding 2004; Leonard III 1997). Self-determination represents Native American tribes' ability to exercise sovereignty, specifically, decision-making power on issues that affect their communities (Bureau of Indian Affairs 2014; Ranco and Suagee 2007; Smith and Frehner 2010; Tsosie 2007; 2009). For example, this right is expressed through ability to assess government policies and determine which are beneficial to their community's interests: "With respect to voluntary, incentive-based policies, tribal adherence to federal directives is conditioned upon the tribe's assessment of what policy is best suited to advance the tribe's own interests. In addition, Indian nations must examine their own norms and values to determine what is most consistent with the tribe's own view of its desired future" (Tsosie 2009, p.213).

Importantly, tribal self-determination does not always equate with a romanticized idea of Native American environmentalism. A tribe may choose to accept or reject development that may cause environmental harm (Smith and Frehner 2010; Leonard III 1997; Tsosie 2007): "According to . . . Native leaders, tribal self-determination entailed the need for tribes to decide

their own priorities for economic development and to assume authority as sovereigns over the reservation environment” (Tsosie 2007, p.1631). Tribal decision making on development is determined by a number of factors including economic security, job opportunities, and values placed on tribally important natural resources. Smith and Frehner (2010) and Tsosie (2007) urge that the tribe must decide the future of its own community—whether or not that coincides with environmentalist values or economic progress.

For example, in the case of the Swinomish Indian Reservation in Washington State, the Swinomish sought environmental remediation of tribal land that had been harmed through use as a petroleum dumpsite (Zaferatos 2006). In an effort to heal the land, the tribe utilized its power of self-determination to persuade the EPA to correct the environmental ills imposed on tribal lands: “Environmental justice was accomplished through the concurrent tribal actions of political assertiveness, applying technical knowledge in assessing environmental risk, and framing an effective strategy to achieve remedial action” (Zaferatos 2006, p.906).

Conversely, in implementing their right to self-determination, tribes may also decide to allow development on their lands that may be environmentally harmful (Leonard III 1997; Smith and Frehner 2010; Walker, Bradley, and Humphrey 2012). Again, reasons for these types of decisions may vary, but are predominantly associated with the fact that development brings with it economic growth and employment to tribal communities (Bullard 1993; Leonard III 1997; Smith and Frehner 2010; Walker, Bradley, and Humphrey 2012). The case of the Mescalero Apache’s decision to allow uranium extraction on their lands is described in the upcoming section and demonstrates an excellent example of why tribes may “willingly” opt to allow harmful development on their lands (Leonard III 1997).

The trust doctrine is a third aspect of Native Americans' political and cultural standing that distinguishes them from other environmental justice groups seeking restitution. The trust responsibility is defined as "the responsibility of the U.S. to protect tribal resources" (Bureau of Indian Affairs 2014; Native American Rights Fund; Ranco 2008, p.356). In theory, the trust doctrine is a rule of conduct between tribal governments and the U.S. federal government that serves "as a check on federal administrative power" (Leonard III 1997, p.674). The trust responsibility of the U.S. government is embedded in the sovereignty of tribal nations. In accordance with the trust responsibility, the U.S. government is called to safeguard tribal resources to the fullest capacity so as to ensure the right to tribal sovereignty in maintaining and protecting tribal communities (Bureau of Indian Affairs 2014; Native American Rights Fund; Leonard III 1997). Standards set by the EPA that affect tribal lands, for example, must try to limit the amount of environmental harm imposed on tribal communities by protecting resources on Native lands.

However, tribal sovereignty and self-determination as well as the trust relationship between the U.S. and tribal governments are often ignored or made secondary to federal and corporate endeavors (Arquette et al. 2002; Ranco 2008). Additionally, many tribes lack the resources necessary to exercise sovereignty. The sociopolitical structure of the U.S. remains exploitative and discriminatory, thus limiting tribal self-determination: "Despite treaties, agreements, compacts, covenants, and statutory obligations that affirm sovereignty and self-determination, Native Nations often are not respected or considered sufficiently competent to have meaningful participation in decisions that affect their Nations, lands, and resources" (Arquette et al. 2002, p.260).

Strategies in Native American Environmental Justice Research

Historical Analyses

Historical analyses are often engaged to explain the emergence and significance of environmental burdens on Native populations and lands (Clark 2002; Harris and Harper 2011; Holifield 2001; Hooks and Smith 2004; Leonard III 1997; Lord and Shutkin 1994; Smith and Frehner 2010). Such historical perspectives shed light on present-day environmental justice issues (Hooks and Smith 2004).

Indeed, some argue that without an historical perspective, today's conditions may actually be misinterpreted: "To approach history casually and complacently is to evade history's inevitably multiplicitous facts and to mask the many meanings the facts could support" (Lord and Shutkin 1994, p.5). For instance, in a Vermont Supreme Court case in 1992, the Abenaki, a Native American tribe from New England, were ruled not to have title to land they had held for centuries. Because of the complexity of the historical record containing proof that the Abenaki had indeed maintained legal residence and the rights to land ownership, the court chose not to heed historical accounts. Such disregard for historical analysis has serious implications regarding how we view not only Native American history, but also justice (Lord and Shutkin 1994).

Many case studies involve historical analyses of energy or military initiatives on Native lands as well as the historical processes of external, nontribal land management. For instance, Native Hawaiians sought restitution for damage to the island of Kaho'olawe, degraded by over forty years of abuse from the U.S. military as a target range for warplanes (Blackford 2004). Through an assessment of military actions since the 1930s as well as the political struggles of Native Hawaiians with the federal government, Blackford's study illuminated how present-day

conditions at Kaho'olawe originated and also illuminated the environmental justice issues faced by Hawaiian Natives and their efforts to reassert control of their land.

Other historical case studies show how the economic vulnerability of several Native American tribal groups is linked to natural resource extraction that ultimately yields socioeconomic and environmental harm. The Mescalero Apache tribe of New Mexico has undergone decades of exploitation since uranium deposits were discovered on its land in the 1950s (Leonard III 1997). At first uranium extraction was an involuntary activity imposed on tribes during the development of nuclear power and due to the U.S. military's desire to obtain uranium for weapons creation during the Cold War but it has since developed into an economic necessity for many tribes, including the Mescalero Apache (Leonard III 1997). When the tribe was approached with a proposal to build a monitored retrievable storage facility for nuclear waste on its land in the early 1990s, the chief and tribal council welcomed the opportunity. The tribe's socioeconomic vulnerability was apparent: "Despite the presence of the resort and other industry on the reservation, more than one-third of tribal members are unemployed and over half live under the federal poverty line. The tribe also suffers from a housing shortage as well as a lack of any school system" (Leonard III 1997, p.659). This case demonstrates that in Indian country environmental injustice can involve not only direct exploitation, but also indirect exploitation through consent under severe economic pressure.

Even more troubling, many of the case studies showcase involuntary development such as military use of native lands through resource extraction or placements of hazardous waste (Blackford 2004; Brook 1998; Hooks and Smith 2004; Hoover et al. 2012; Leonard III 1997). Indeed, energy, resource, and military development on Native lands are perhaps three of the most extensively recorded and studied Native American environmental justice challenges (e.g.

Blackford 2004; Burger, Powers, and Gochfeld 2010; Gowda and Easterling 2000; Hooks and Smith 2004; Smith and Frehner 2010).

Participatory Research

A participatory approach characterizes much Native American environmental justice research (for examples see Arquette et al. 2002; Hoover et al. 2012; Minkler et al. 2008; Quigley et al. 2000; Smith and Frehner 2010; Whyte 2011). Research participation ranges from interviews with tribal members about specific environmental issues to inclusion of communities throughout the research process, including design of data collection instruments, risk assessments, presentation of findings, and development of educational materials (Arquette et al. 2002; Minkler et al. 2008; Quigley et al. 2000). The goal of much participatory research is to improve poorly conducted risk assessments and to create more appropriate assessments that reflect the environmental and health understandings of Native Americans.

Studying the Mohawk tribe at Akwesasne, Arquette and colleagues (2002) found that unique perspectives emerged through engaging the community, since Native American tribes have unique histories and environmental exposures that traditional risk assessments fail to recognize. The authors used participatory research to establish a holistic risk assessment approach that captures socioenvironmental interactions and tribal definitions of health and well being. Arquette and colleagues claim that “[i]n order to promote health, justice, and equity, long-term investments must be made in community-based research, including efforts that develop specialized strategies for communication and community participation” (p.263).

Similarly, research on tribal health and hazards management has engaged tribal members through research training, shared decision making, tribal assistance in approval of grant applications, project publications, presentation of progress reports, and developing community

exposure profiles (Arquette et al. 2002; Minkler et al. 2008; Quigley et al. 2000). Quigley and colleagues (2000) argue that

participatory research outcomes are far more preferable to the traditional environmental health approaches whereby a technical team determines a health research methodology, with minimal community accountability, and conducts a health study whose findings have little meaning or benefit, and often are more of a detriment, to the communities' health protection. (Quigley 2000, p.324)

Participatory research not only benefits the subject population, but also increases researchers' understanding of how to more appropriately assess environmental inequalities and best craft response programs and policies.

Native American Climate Justice

Case studies document a variety of environmental inequalities with regard to Native America, including lead poisoning (Bullard 1994; Malcoe et al. 2002; Shriver and Webb 2009), military weaponry testing and waste disposal (Blackford 2004; Hooks and Smith 2004), and—especially over the past ten years—vulnerability to climate change (Cochran et al. 2013; Maldonado et al. 2013; Lynn et al. 2013; Gautam, Chief, and Smith Jr. 2012; Shearer 2012). Climate change has become an environmental justice issue because those experiencing the most harmful effects of a changing climate are those who contribute the least to greenhouse gas emissions (Krakoff 2008; Trainor et al. 2007). Native groups' vulnerability to climate change manifests through issues of food security, impacts to traditional knowledge, climate adaptation, and tribal control of resources.

The food security effects of climate change have already begun to negatively affect Native Americans (Cochran et al. 2013; Dittmer 2013; Gautam, Chief and Smith Jr. 2012; Lynn et al. 2013; Trainor et al. 2007). Tribal concerns about their changing environment are frequently evoked from their in-depth knowledge of the land. Many tribal members are able to recognize

changes (e.g. changing migration patterns, changes in harvesting times for various plants, etc.) in local environments (Cochran et al. 2013; Doyle, Redsteer, and Eggers 2013; McNeeley 2012). Additionally, tribal environmental concern can stem from government restrictions on hunting and harvesting of tribal natural resources (Lynn et al. 2013; McNeeley 2012). Not only are tribal concerns about contaminants and over-harvesting restricting tribes' access to traditional foods (Adamson 2011; Arquette et al. 2002; Smith and Frehner 2010), some tribes increasingly face difficulties storing food (Doyle, Redsteer, and Eggers 2013; Lal, Alavatapati, and Mercer 2011; Lynn et al. 2013; McNeeley 2012). For example, natural ice cellars traditionally used for storing perishables such as fish are less efficient, often causing food-related illnesses and resulting in less traditional food use (Cochran et al. 2013). In addition, climate change is altering water flows and, therefore, salmon runs (Dittmer 2013). And broader ecosystem shifts have complex impacts: “..tribal harvesters have noticed shifts in harvest times for traditional foods; if the timing of flowering plants and the presence of pollinators, such as birds and insects, become less synchronized, impacts can ripple throughout the food webs” (Lynn et al. 2013, p.2).

“First foods” is a concept use synonymously with traditional foods, but specifically represents foods considered unpolluted, fresh, culturally meaningful, and accessible on Native lands (Adamson 2011). Declining use of first foods is impacting Native American health (Adamson 2011; Cochran et al. 2013; Lynn et al. 2013). For example, the quality and quantity of wild berry plants, a Wabanaki first food, are becoming inaccessible due to climate changes such as shifting seasonal patterns and increasing temperatures (Lynn et al. 2013). Wild berries are used to enhance the Wabanaki's spiritual and physical health, often in ways that are not entirely scientifically known (Lynn et al. 2013). Lynn and colleagues (2013) expand on the Wabanaki's use of berries, stating, “[w]ild berry plants serve a number of utilitarian, nutritional medicinal,

and spiritual purpose among the Wabanaki people...[b]erries serve as key cultural indicators of ecosystem services in Wabanaki culture” (p.4). Many tribes now supplement first foods with purchased foods, which have resulted in increases in obesity, diabetes and cancer linked to dietary shifts (Alkon and Norgaard 2009; Lynn et al. 2013).

In addition to physical health impacts, loss of first foods negatively impacts spiritual health through lessened ability to pass down traditional ecological knowledge (TEK) (Doyle, Redsteer, and Eggers 2013; Harris and Harper 2011; Lynn et al. 2013; Voggesser et al. 2013; Whyte 2013). TEK, or the “indigenous way of knowing” (Lynn et al. 2013, p.3), is built upon the tribe’s relationship to and dependence on traditional foods (Hoover et al. 2012; Krakoff 2008; Lynn et al. 2013). This relationship is directly associated with the spiritual, cultural, physical, and emotional health of tribes (Lynn et al. 2013). Because TEK is embedded in a “climatic and ecological context,” climate change increases the vulnerability of TEK—especially when elders possessing TEK pass away (Cochran et al. 2012).

Tribal adaptation to climate change is increasingly being studied (Cochran et al. 2013; Smith and Frehner 2010; Guatam, Chief and Smith Jr. 2012; Krakoff 2008; Krakoff 2011; Lal, Alavatapati, and Mercer 2011; Lynn et al. 2013; Maldonado et al. 2013; McNeeley 2012; Voggesser et al. 2013; Whyte 2013). Frequently, researchers argue that tribes should be able to make their own culturally appropriate decisions about adaptation strategies (Cochran et al. 2013; Krakoff 2011; Maldonado et al. 2013). Considering the oppressive history surrounding Native Americans, such tribal participation is critical in ensuring that decisions made about tribal climate adaptation originate from the impacted groups themselves. For instance, if relocation is the only viable option for climate adaptation, tribal participation in the decision-making process is a necessity (Maldonado et al. 2013).

Some researchers argue that TEK may be a valuable resource for climate adaptation (Cochran et al. 2013; Lal, Alavatapati, and Mercer2011; Lynn et al. 2013; Reo and Parker 2013; Robyn 2002; Voggesser et al. 2013). TEK can better inform policy, resource management and scientific research in order to reduce negative impacts of climate change on natural resources (Lal, Alavatapati, and Mercer2011; Lynn et al. 2013; Voggesser et al. 2013). “TEK and tribal connection to traditional foods offer strategies for adaptation that can help tribal and non-tribal resource managers confront the climate challenge. As TEK informs research, tribes and non-tribal entities can work together to incorporate TEK in a tribally-appropriate manner” (Lynn et al. 2013, p.3).

Unfortunately, tribal adaptation to climate change and access to traditional resources is often impeded through regulations or policies that limit tribes’ climate responses (Krakoff 2008; Lynn et al. 2013; Whyte 2013). Regulations that, for example, limit the times of year tribes can fish or hunt (despite seasonal changes) further exacerbates Native American struggles to fully practice and achieve self-determination and sovereignty (Lynn et al. 2013). In order to overcome these barriers, Whyte (2013) argues that stakeholders are key:

Insofar as these leaders, scientists and professionals work with or for tribes, they are responsible to do what is in their power to address the coupled political obstructions and ecological challenges of adaptation They are responsible because they do have some capacity to make changes in institutions and political orders, even if these changes must start at scales that are initially local or quite broad. (Whyte 2013, p.7).

Conclusion and Future Directions

Despite the increase in Native American environmental justice studies, the "startling" level of environmental risk borne by these groups mandates additional scholarship (Hooks and Smith 2004, p.588). This review offers a foundation from which subsequent research can expand. Through examination of a cross-disciplinary collection of recent studies, we identify

common findings and methodologies within Native American studies of environmental justice. Research related to climate vulnerability is also identified as a critically important gap.

Another critical gap -- and as recognized in broader environmental justice scholarship -- is the critical positioning of contemporary environmental inequalities within historical processes. Recent research focused on urban environmental justice links present inequalities to past patterns of racial and ethnic disparities in power and privilege (Taylor 2009). Such a perspective is essential in examination of the issues facing today's native peoples.

The myriad case studies brought together here further suggest that Native American EJ issues continue to challenge “traditional” Western conceptions of science and health -- a challenge that must be integrated into research approaches and understandings as well as responsive policies and programs. We argue that such cultural reflection is potentially one of the most significant contributions this collection of literature has provided to the broader field of environmental justice scholarship and one that requires further synthesis and consideration.

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