2023

Who's To Gain? Fluid Mineral Extraction on Oklahoma's Non-Reservation Native Lands

Tait J. Ferguson
Denison University

Who's To Gain?
Fluid Mineral Extraction on Oklahoma's Non-Reservation Native Lands

Tait Ferguson

Environmental Studies
Denison University

Spring 2023

Abstract

This study explores the effects of natural gas and oil extraction on federally-managed Native land in a comparative analysis of Blaine County, Oklahoma and Caddo County, Oklahoma. Both Blaine and Caddo have high levels of extraction over time, and sit adjacent to each other on the Anadarko Basin in western Oklahoma. Yet, Caddo County has six times the Native American population and two times the amount of Bureau of Indian Affairs-managed land, increasing the potential of federally-mediated fluid mineral leasing on Native lands. By analyzing county-wide trends of economic, health, and population variables related to natural gas and oil extraction, this study found that Caddo County experiences worse outcomes than Blaine County over time in per-capita personal income, per-capita GDP, home values, chronic respiratory mortality, and self-harm/interpersonal mortality. Settler-colonial narratives and an environmental justice framework help reveal the potential of indirect federal exploitation of Native resources at the expense of Native populations, where specific attention is given to the role of Indian Communitization Agreements. Although this study does not develop any causal outcomes, it builds on a large foundation of past scholarship to raise questions on the reality of Native American sovereignty. Particularly, why the federal government continues to play a paternalistic role in Native land and extraction management while counties with high rates of Bureau of Indian Affairs land and Native populations, such as Caddo, suffer worse impacts than an adjacent county with similar extraction rates.

Introduction

The extraction of onshore natural gas and oil on federal lands, or fluid mineral extraction, has a long history in the United States. Even today, as climate change threatens the future of fossil fuel industries, natural gas and oil production has been booming across the country (Energy Information Administration 2022). Without a doubt, extraction has a vast array of consequences on all natural environments and communities adjacent. But, no population has been in conflict with the federal government over land and resource use longer than Native American communities (Batra Kashyap 2020). Therefore, it is difficult to discuss the expansion of onshore natural gas and oil drilling without discussing it in conjunction with the consequences on Native American communities. Without question, the federal government has often constricted Native American land, sovereignty, and right to autonomy (Marsh 1996; Parfomak et al. 2013; Rosier 2013; Swinford 2015). In a national climate where the federal government has directly and indirectly acted contrary to Native American interests, the federal role in Native land management and extraction becomes ripe for analysis.

The history of U.S. federal policy towards Native land use and extraction rights is varied, complex, and dynamic. In this vein, this research will utilize an environmental justice (EJ) framework. Environmental justice is the equitable treatment of all people regardless of race, income, or ethnicity in regards to environmental laws, regulations, and policies (EPA 2023). Analysis utilizing this framework seeks to uncover or address environmental injustices, which are the inequitable effects of environmental hazards coupled with a lack of involvement in environmental decision-making processes–based on demographic or socioeconomic differences. Finding its roots in the civil rights and social justice movements of the mid-20th century, environmental justice emerged as a critical topic of analysis in the late 1970s and early 1980s

(Bullard n.d.; Melosi 2006). The catalyst of the modern EJ movement is a 1979 lawsuit that demonstrated how 80% of waste facilities in Houston were located in Black neighborhoods, even though only 25% of the city's population was Black (Bullard n.d.). This lawsuit led to an avalanche of studies and legal challenges across the country, with many finding that environmental injustices were occuring systematically. Towns in North Carolina, California, Alabama, New Jersey, Louisiana, Michigan, and more were demonstrating these injustices in their own communities. Clearly, the harmful effects of resource extraction and development were disproportionately affecting marginalized populations across the United States. Waste, chemical, and resource extraction facilities were repeatedly being placed in marginalized communities, leading to more severe effects from environmental hazards among marginalized populations.

The grassroots and community-centered campaigns of the EJ movement led the federal government to create the Office of Environmental Equity in 1992 (later changed to the Office of Environmental Justice), but environmental injustices have yet to be wholly resolved (Bullard n.d.). Research in the 21st-century has continued to find instances of direct and indirect environmental injustices, where marginalized communities suffer increased exposure to environmental hazards (Mohai et al. 2009; Hirsch et al. 2018). The EJ movement has its foundation in environmental health hazards; early EJ cases include lead poisoning, dangerous manufacturing chemicals like polyvinyl chloride (PVC) and Polychlorinated biphenyls (PCBs), and natural gas and oil refineries (Bullard n.d.; Baurick et al. 2019). These hazards have not disappeared, and often compound other inequities such as poverty and political powerlessness, connecting the EJ movement to its roots in the broader civil rights campaign and expanding environmental injustices to include negative economic and social consequences (Perry 2013; Melosi 2006). As a vulnerable population, with a long history of systemic exploitation at the

hands of governing institutions and private interests, Native American communities suffer the effects of environmental injustice across economic, health, and social variables. The Keystone and Dakota Access natural gas pipelines, which threatened the health of people and ecosystems on Native American land, are examples of how Native populations are included in an EJ frame.

This study will focus on Oklahoma, the fifth largest natural gas producer and sixth largest crude oil producer in the United States in 2021 (Energy Information Administration 2022). The two counties studied here, Blaine and Caddo, sit atop the Anadarko Basin in western Oklahoma, this Basin is one of the country's largest natural gas and oil reserves and is a state-wide hub for extraction (Wells and Wells 2022). This same region has a high number of Native American communities whose land and lives are affected by the high rates of extraction. The federal government has a complex history of constricting Native land and sovereignty to manage the effects of land use, making the EJ frame relevant. (Marsh 1996; Parfomak et al. 2013; Rosier 2013; Swinford 2015).

Federal management of Native land in Oklahoma shifts region to region. But even between Native American reservation land and tribal statistical areas (the classification of regions with federally-recognized tribes not on reservation land for the purposes of the U.S. Census), land is still held in trust with the federal government. Land held in trust gives the federal government the responsibility to manage the land in partnership with tribal governments, instead of the land being in private ownership. Trust agreements often entail land use and economic development differences from private (fee) land, and the federal government claims it is essential to Native sovereignty (Bureau of Indian Affairs n.d.). One example is mediating natural gas and oil extraction agreements. When Native land is held in trust with the federal government, federal agencies manage the extraction leasing process and procure leases that

should work in the best economic interests of the Native American benefactors (Royster 1993; *25 CFR 212.28* 1996). In western Oklahoma, this landscape is unique. In the Blaine-Caddo region, which sits on top of one of the largest fluid mineral reserves in the country, Native land is held in trust with the Bureau of Indian Affairs (BIA). This land is not formal reservation land, and the federal government plays a central role in determining how fluid minerals on this land are extracted, and who benefits. Without question, the federal government plays a hand in mediating effects of extraction by and near Native communities in the Blaine-Caddo region. Exploring the distribution of extraction consequences across demographic groups is essential to test if Native communities are benefiting (or not) from federally-mediated extraction lease agreements.

Scholarship documents the relationship between the federal government and Native beneficiaries for decades. Even further, several recent studies have used environmental justice (EJ) frameworks to assess the effects extraction has on marginalized populations (Weber 2012; Hirsch et al. 2018; Mohai et al. 2009). Plenty of room remains, though, to study the effects of onshore oil and natural gas extraction on Native American populations specifically. A large portion of non-reservation Native land is federally leased for extraction using Indian Communitization Agreement (ICA), a federal leasing regulation that consolidates lease tracts so the expenses and profits of a well are evenly distributed among all adjacent land owners (DOI 2012). Land held in a trust or restricted land use agreement means the land is held by the United States federal government for the benefit of Native American individuals or tribes (Bureau of Indian Affairs n.d.). When Native land is held in trust with the federal government, rights to extraction returns remain with the Native population but cannot be realized without approval by the federal government (who can communitize wells without Native lessor approval). With

recent natural gas and oil booms in western Oklahoma, ensuring Native American communities do not experience disproportionate negative impacts from extraction is of urgent importance. The comparison of Blaine and Caddo counties is salient given that Caddo has six times the Native American population as Blaine, and over twice the amount of BIA-managed land. The two counties also have similarly high rates of oil and natural gas extraction, making Blaine them a natural pair for this study.

This work asks: are Native American communities extracting oil and natural gas on land managed by the federal government, often in Indian Communitization Agreements (ICAs), experiencing more negative consequences from extraction than neighboring non-Native communities? Using an EJ framework and by calling on the history of Native American exploitation, this study argues that an increase in negative consequences from extraction in Caddo County as compared to Blaine County could be explained by the increased presence of Native Americans and implicit federal exploitation of said communities in Caddo County.

First, this study will present a broad review of past scholarly work covering the landscape of onshore extraction in the United States, the history of federal leasing and contemporary processes, and the negative consequences associated with extraction. This review will have an eye towards these topics within the context of Native American communities. Next, the conceptual framework and the purpose of the study design will be presented. Third, the background section will overview recent trends and patterns relating to Native American populations, extraction, and land management in both Blaine and Caddo counties. This section forms the conceptual foundation for this comparative analysis. The fourth section introduces the methodology, hypotheses, and variables to be analyzed over time in both counties. Fifth, the results section will present trends in Blaine and Caddo over time for population, economic, and

health variables related to extraction. Finally, the discussion and future research sections will explain the extent to which the guiding questions and hypotheses were confirmed, and what this means for Native American communities living and extracting on federally-managed lands.

Literature Review

I. State of Onshore Extraction in the United States

Resource extraction in the twenty-first century United States has been defined by the rapid rise in natural gas drilling, often in the form of unconventional drilling, called hydraulic fracking. Moreover, U.S. energy consumption of natural gas continues to increase in the twenty-first century (Energy Information Administration 2022). During this time, the U.S. has moved from being one of the largest importers of natural gas to being self-sufficient, as a result, increased exploration and extraction. (Wang et al. 2014). Scholars and activists continue to raise concerns about natural gas extraction and its effects on the environment, but U.S. natural gas production has increased nationwide every year since 2009 (Buse et al. 2019; Energy Information Administration 2022). With global natural gas extraction expected to continue to rise for the next decade, scholars predict supplies will peak in 2035 (Maggio and Cacciola 2012; MIT Energy Initiative 2011). Clearly, natural gas is one of the most lucrative extractive industries in the U.S., extraction rates will guide national and global energy markets for years to come. Although several scholars have implied that natural gas may serve a less environmentally harmful alternative to coal burning (Buse et al. 2019; Wang et al. 2014; IEA 2012; MIT Energy Initiative 2011), recent scholarship increasingly demonstrates that fluid mineral extraction has negative health, economic, and population effects on communities (Buse et al. 2019). The effects

of natural gas and oil extraction are varied, but it is clear that fluid mineral extraction causes particular harm to marginalized communities (Hirsch et al. 2018; Mohai et al. 2009; Weber 2012; Weber et al. 2014). As global production and consumption of natural gas and oil continues to rise, it is imperative for Native American environmental justice and health that scholars and governing institutions research the effects of this extraction on marginalized populations.

Ia. Federal Leasing for Natural Gas Extraction

The federal government owns roughly one of every three acres in the U.S., with higher proportions in western states (Leshy 2010). This is the impetus for extraction leases sold by the federal government, where private interests lease federal land to drill. This system has roots nearly as old as the United States itself, stretching back to the 1785 Land Ordinance which first established private ownership and use of public lands (Lewis 2019). For much of the 20th century, federal land has been managed by the Bureau of Land Management (BLM). Current policies towards federal leasing can be traced to the 1976 Federal Land Policy and Management Act, which established how the BLM could manage land for multiple uses and retain public lands in federal ownership (Bureau of Land Management 2022). In 1987, Congress passed the Federal Onshore Oil and Gas Leasing and Reform Act, which established a competitive system for land leasing–the origins of our current natural gas leasing system (Rising 1988).

Today, the United States does not have a centralized system for resource management, with rights being owned by the federal government, state governments, or public interests (Lewis 2019). Generally, natural gas extraction on federal land is met with more bureaucratic barriers than private ownership (Smith 2022). Lewis describes how this patchwork system leads to varying regulations and expectations for drilling. Federal land typically has a higher

environmental standard governed by the Environmental Protection Agency, which varies from project to project and is at the discretion of the Agency. Environmental restrictions are largely based on the National Environmental Policy Act of 1970 and might include endangered and vulnerable species protection, drilling a certain distance from fragile ecosystems, and other stipulations (Lewis 2019). Lewis also discusses positives of federal drilling, these leases tend to allow longer periods for a firm to start drilling than private contracts. Federal land leasing for natural gas extraction has decreased steadily throughout the 21st century; now only 11% of total U.S. natural gas production comes from federal land (Bureau of Land Management 2022; Smith 2022).

In this context, natural gas drilling on federal (public) lands in the U.S. continues to be relevant in the broader conversation on natural gas extraction. Although offshore federal drilling has decreased dramatically in the twenty-first century, onshore drilling has decreased at a much slower rate and the federal government continues to pursue new drilling leases (Humphries 2016; Federal Energy Regulatory Commission 2022, Energy Information Administration 2022). Recently, the Biden administration has reduced the land open to lease by 80%, citing environmental and community concerns (Brownstein 2022; Department of Interior 2022). Even with this marked decrease in federal lands available for drilling, extraction from previously approved contracts continues to occur (Bureau of Land Management 2022). Some reports have even indicated little concern over a moratorium or decrease in federal natural gas leasing, with companies citing years of drilling inventory (Handler 2021). The landscape for federal onshore oil leasing is changing dramatically, but a national reliance on natural gas extraction for the foreseeable future remains likely. Largely, this is due to federal fossil fuel subsidies, which make federal land leases among the cheapest forms of extraction (Ratledge et al. 2022). As Ratledge et

al. point out, natural gas remains highly relevant to federal fossil fuel extraction going into the third decade of the 21st-century.

Less than 2% of land in Oklahoma is managed by the Bureau of Land Management, among the lowest in the U.S.. Yet, the state still maintains some of the highest numbers for federal natural gas leases through agreements with the Bureau of Indian Affairs (Vincent et al. 2020). A robust history of natural gas extraction exists in Oklahoma, the geologic setting providing a vast amount of recoverable gas reserves (Boyd 2002). The rapid increase of Oklahoma natural gas production at the onset of the twenty-first century was aided by technological developments in horizontal drilling and hydraulic fracturing (Boyd 2002; Murray 2018). The state's particular geologic setting, and the investment in natural gas on both public and private lands has catapulted it to fifth in natural gas leases, even with such a small percentage of public land (Energy Information Administration 2022). In 2022, the U.S. Energy Information Administration reported that although wind-supplied energy superseded natural gas in state electricity generation in Oklahoma for the first time in 2021, the state still produces and consumes copious amounts of natural gas.

II. Federal Management of Native Land and Resources

There is a long and varied history of the federal government playing a role in the oversight and regulation of native land, ranging from resource management to the mediation of socioeconomic benefits (Zimmerman 1957). Founded in 1824, the Bureau of Indian Affairs is considered one of the oldest bureaucratic branches in the United States federal government (Indian Affairs 2022). Initially, the BIA was tasked with negotiating treaties and trade between federally-recognized tribes and the federal government. Since then, the Bureau has played a

major role in the implementation of U.S. federal policy regarding Native Americans. In the first half of the 20th century, the federal government largely pursued legislation that directed the explicit assimilation of native populations, with a particular emphasis on how to manifest the economic benefits of the managed native land (Zimmerman 1957). During the 19th-century, the federal government often claimed rights to resources extracted on Native lands. In 1873, the Supreme Court ruled timber cut on Native lands was discharged of any rights of the Native populations (Royster 1993). Eventually, the rights of native populations to the extractive potential of their land was recognized in the Supreme Court ruling *United States v. Shoshone Tribe of Indians* in 1938 (Royster 1993). Since then, the relationship between the federal government and native lands has moved from legislation aimed at explicit assimilation to a recognition of tribal self-determination (Indian Affairs 2022; Zimmerman 1957; Butler 1978).

More recently, the Bureau of Indian Affairs has shifted to the role of a technical advisor and the agency is almost entirely staffed by individuals with native ancestry (Indian Affairs 2022; Fixico 2012). The Nixon and Ford administrations began the federal shift towards self-determination in the 1970s (Butler 1978). New legislation granted native tribes more agency in the federal management of designated tribal lands, which established precedent for a more voluntary and advisory relationship between the Bureau of Indian Affairs and the tribes (Butler 1978). In more recent years, the relationship between the federal government and tribal land has been centered around self-governance (Fixico 2012; Royster 1993). The ability for true self-governance has been complex, as can be seen in the 2020 Supreme Court case that acknowledged much of eastern Oklahoma as tribal land, and the subsequent challenges to the rulings that continue today (Totenberg 2022). The Caddo Nation, located in and around the Blaine-Caddo region, serves as an example of the federal flip-flopping on Native land

management and sovereignty. In 1887, the federal government split Caddo's tribal land into individual allotments of private land. Then, in 1902, the U.S. granted some of the allotments directly to Caddo tribe members and placed in them trust with the federal government (Meredith n.d.). Since then, Native Americans in the Caddo-region have been unable to regain control of their land. Federal courts in the 1980s were still affirming that the U.S. government must manage Native lands in order to make them profitable for Native communities (Marsh 1996). In short, federal attempts to move towards self-determination have looked more like the federal government assuming a paternalistic role over Native American communities.

Although the role of the BIA and the federal government in relation to tribal sovereignty has shifted over the course of U.S. history, the BIA continues to act as a mediator between the federal government, native populations and land, and business interests (Fixico 2012). Now, as the federal government has moved away from violent removal or explicit assimilation of Native communities, the BIA primarily works to implement federal native policy and supervise native land. Federal policy guides the work of the BIA, and the Bureau's services range from facilitating Native self-determination in governance to road maintenance on tribal lands. Since the BIA plays a role in the management of Native American land, and is itself directed by federal policy on Native resource management, the Bureau remains a central player in the livelihoods of Native communities and extractive potential of their land.

Although a large proportion of public land held by the United States government is managed by the Bureau of Land Management (BLM), some is reserved for Native American tribes in trust land and managed by the Bureau of Indian Affairs (Bureau of Land Management 2015). When held in trust by the BIA, the land is only reserved for use by Native American tribes, who work closely with federal agencies to manage the resources and conduct governance.

In terms of resource management and extraction, the BIA and BLM often work in tandem as mediators on BIA land (Department of Interior 2012). In these arrangements, the BIA will approve the location and method for extraction as the surface management agency. The BLM will then approve the permit to drill and assess the environmental stipulations in consultation with the BIA (Department of Interior 2012). On BIA managed trust lands, there is a shared responsibility between federal agencies for extraction management and approval. The shared responsibility between the BLM and the BIA means extraction on Native land is still directly governed by federal decision-makers. This leads to a confusing and often complex bureaucratic environment, where a variety of federal agencies split decision-making and responsibilities for management may be unclear for the Native land owners.

Especially common for extraction on BIA trust lands are Indian Communitization Agreements (ICA). ICAs emerge from well spacing regulations, and are utilized when multiple small tracts of Native American leases are combined to comply with spacing regulations (Reuters 2022). Well spacing units are used to evenly allocate production and reduce waste in the extraction lease process, the Oklahoma units are usually rectangular and in a regular pattern (Marsh 1996). While spacing units allocate production, communitization agreements allocate cost and risk associated with the extraction wells to the lessors (Marsh 1996). This communal ownership allows for the benefits (and potential risks) of production from a single well to be distributed to multiple owners (Department of Interior 2012). The history of ICAs runs parallel to the history of self-determination for tribal lands and mineral ownership. ICAs emerged from the landmark Indian Mineral Leasing Act of 1938, which authorized the communitization of tribal and allotted lands at the discretion of the Secretary of the Interior (Hook 1997). The Indian Mineral Leasing Act has been subsequently updated by Congress, in a 1996 modification the Act

removed the requirement of tribal consent when approving communitization on allotted lands (Hook 1997). This sets the stage of the current process of ICA management, where the BLM and BIA are required to consult tribal stakeholders, but tribal consent is not necessary for final approval of the communitization agreement.

ICAs are regulated by a complex relationship between the BLM and BIA. The layered relationship between the federal government, business interests, and the native populations is a critical area of study, since many native populations rely on the economic opportunities offered from extraction (Royster 1993). In this relationship, it is understood that the federal government (BLM and BIA) has the responsibility to secure maximum economic benefits for the tribe (Royster 1993). The modern shape of federal management of tribal mineral resources is understood through this 'best interests' framework, where the federal government is expected to make decisions with the best economic and cultural interests of the tribe involved (*25 CFR 212.28* 1996). Naturally, this leaves a significant amount of discretion to federal agencies to define the best interests of the Native American populations and tribes impacted by fluid mineral extraction. In Oklahoma specifically, several federal court cases throughout the mid- to late-20th century demonstrate how the Department of Interior (which oversees the BIA and BLM) has not followed a policy of maximizing tribal revenues through ICAs (Marsh 1996). 20th-century Oklahoma 10th Circuit cases *Kenai Oil and Gas Inc. v. Department of Interior*, *Cotton Petroleum Corp. v. Department of Interior*, *Cheyenne-Arapaho Tribes of Oklahoma v. United States*, and *Woods Petroleum v. Department of Interior* all demonstrate this reality (Marsh 1996). In the *Woods* ruling, the Native land owner is essentially mandated to participate in extraction through an ICA, as the federal court views standard spacing units as synonymous with ICAs. This led to rushed decisions by federal agencies in *Kenai* and *Cheyenne-Arapaho* that failed to

maximize economic benefits in lease agreements for Native owners (Marsh 1996). Within this context, the BIA and Department of Interior in *Cotton* and *Woods* are seen siding with the corporations by approving drilling timelines expeditiously and without proper consideration of Native owners (Marsh 1996). Through land trust agreements and ICA drilling regulations, the federal government has more often protected public and commercial interests than its obligation to Native American tribes. This relationship furthers the exploitation of Native American communities, land, and resources in the United States. Although federal policy no longer claims that resources extracted on Native land belong to the federal government, federal lease management strips Native Americans of their autonomy to extract resources and secure their own economic and cultural benefits.

III. Negative Social, Economic, and Health Effects Associated with Extraction

With the expansion of natural gas extraction across the U.S., many researchers have studied the potentially negative environmental and community effects associated with drilling. These include air and water pollution, negative long-term effects on home values, and community conflict, among many others (Saunders et al. 2018; Jones and Bradshaw 2015; Ladd 2014; Apergis et al. 2021; Apergis et al. 2019; Buse et al. 2019; Emanuel et al. 2021; Jacquet 2014). It is clear that there are a wide array of negative effects associated with natural gas and oil extraction, particularly for already marginalized members of communities adjacent to wells (Jones and Bradshaw 2015; Butler 2015; Emanuel et al. 2021; Perry 2013). However, there has been little research specifically focused on indigenous communities and environmental harm associated with natural gas extraction. This is especially critical as the Biden administration

alters the federal leasing process as natural gas continues on its path to peak consumption (Department of Interior 2022; Maggio and Cacciola 2012). The consequences of natural gas and oil drilling on surrounding communities found throughout previous scholarship are reviewed below.

IIIa. Public Health Concerns

The health consequences associated with natural gas drilling and extraction are well-established (Buse et al. 2019). Buse et al. found that a majority of studies focused on natural gas extraction studied health-related effects. Extraction plays a critical part in individual and community-wide health, and current research must focus more attention to the health of marginalized communities (Brisbois et al. 2019). Recent literature has focused broadly on air and water contamination (Saunders et al. 2018; Witter et al. 2013). In their review of literature on health effects from extraction, Saunders et al. found that although methodological approaches varied, scholars often found that air and water contamination were the most critical environmental consequences of oil and natural gas extraction. Although many scholars and some advocates contend that natural gas provides a lower risk to water and air quality than other fossil fuels, it is clear that extraction still presents an immediate risk to water and air quality (Jackson et al. 2014; Shonkoff et al. 2014). Jackson et al. and Shonkoff et al. describe water and air pollution, respectively, as key risks of natural gas extraction. Both pollutants lead to negative community-wide health effects, particularly water pollutant mortality rates.

Recent literature has also focused on health issues among new-born children. Infant health has been shown to be connected to water contamination levels, exposure to harmful water contaminants negatively affects infant health (Currie et al. 2013). Further research demonstrates

how extraction-related chemicals infiltrate public water sources, which one study links to an increase in preterm births and low birth weights among infants (Hill and Ma 2022). More research connecting extraction to water contamination and infant mortality is needed, but current scholarship emphasizes the importance of assessing infant health in communities with onshore extraction. This foundation makes clear that studying a vast array of health factors will be important for accurately assessing extraction consequences in Blaine and Caddo Counties.

Another emerging health concern in recent scholarship is how interpersonal and community-wide relationships can be affected by fluid mineral extraction. A review of recent scholarship by Hirsch et al. contends that mental health needs more attention in relation to extraction. Alongside exposures to environmental health hazards, the process of extraction in a community can heighten worry, anxiety, fear, and depression, especially among already marginalized populations (Hirsch et al. 2018). Buse et al. discusses how these community health shifts have been seen to contribute to increases in violence and risk-taking behaviors in communities being extracted (2019). Therefore, research that explores the health effects from extraction should account for environmental health hazards as well as interpersonal health concerns. These health concerns may also have relationships to shifts in economic well-being and population trends (Hirsch et al. 2018).

IIIb. Socioeconomic Implications

Oil and natural gas extraction influences socioeconomic factors in adjacent communities. Buse et al. described socioeconomic effects related to adjacency to extraction wells as fluctuating population trends, declining home values, and shifts in personal income. Previous scholarship has demonstrated how population levels may show large increases due to extraction, often

alongside rising employment opportunities (Brown 2014). Sometimes, fluctuating populations and economic shifts alter social cohesion in these communities as they undergo acute or chronic changes. This is especially salient between indigenous and non-indigenous communities when certain cultural norms vary widely (Buse et al. 2019). Therefore, communities often endure long-term increases in poverty rates and declines in home values in exchange for short term economic growth (Perry 2013; Jacquets 2014). Qualitative research has shown that housing prices can be an indicator of socioeconomic stress (Ryser et al. 2014). As communities undergo natural gas extraction periods, housing prices may shoot up to unaffordable levels due to rapid economic development or decrease due to adjacency to extraction wells and extraction-related infrastructure (Gopalakrishnan and Klaiber 2013; Jellicoe and Delgado 2015). Low-income residents will be especially affected by the shifting housing market and squeezed out. Often, the opportunity of the housing market supersedes the needs of local communities (Weber et al. 2014). Weber et al. found that extraction-related economic booms may lead to price gouging in the housing market, alongside an already tight rural housing market. Already vulnerable populations within these communities will see unaffordable price jumps and increased homelessness, leading many long-time residents to leave (Weber et al. 2014).

Conversely, some research has indicated that counties experiencing natural gas booms see higher personal incomes than counties without (Bilgili et al. 2020). Yet, other scholars have contended that although mean incomes rise, the poverty rates of these counties also increase at a higher rate than non-boom counties (Weber 2012). Weber suggests that although natural gas extraction can lead to a rise in mean incomes across a county, the associated economic boom is often too overwhelming for local stakeholders in the long-term. Natural gas extraction and individual economic benefits do not always go hand-in-hand. Income increases within a

non-diverse economic environment could contribute to increased social tension and inequitable service provisions, increasing disparities. (Buse et al. 2019; Weber 2012; Haggerty et al. 2014). Evidently, the socioeconomic consequences of extraction are not clear-cut, community- or county-wide increases in economic metrics like income and GDP may not translate to prosperity among all community members. Immediate positive increases in the housing and job markets may not last, and scholars have found that already marginalized populations, Native American communities included, have a greater chance of being left by the wayside during economic booms.

Conceptual Framework

There are a wide variety of variables (only some of which are presented above) that contribute to the environmental, health, and socioeconomic effects of onshore fluid mineral extraction in the United States. Onshore natural gas and oil extraction has potentially disproportionate effects on marginalized communities, which is why this work is driven by environmental justice (EJ) theory. By using an EJ frame, this work will explore if environmental injustices are taking place among Native American populations through a paired comparison of Blaine and Caddo Counties. The history of marginalization of Native American populations in the United States has led to higher rates of environmental hazards in among Native communities broadly (Mohai et al. 2009; Keating 2020). To fully understand the nature of EJ narratives when applied to Native American communities, it is essential to understand the history and ramifications of settler-colonialism in the United States.

As long as settler populations have used and exploited natural resources on land populated by indigenous communities, there has been direct and indirect violent conflict. The

United States was built on settler-colonialism, with early Europeans instigating a genocide of Native Americans that continued into the 19th century (Batra Kashyap 2020). From the early European settlements in North America to late-19th century U.S. Supreme Court cases, white Europeans believed they had a right to Native land and labor (Batra Kashyap 2020; Royster 1993). This belief manifested in direct violence, leading to the near-elimination of Native populations from the American landscape by the start of the 20th century (Keating 2020).

Although direct physical violence sprouting from settler-colonialism is now much more rare, the indirect negative consequences of the settler mindset persist among Native American populations. Contemporary colonial narratives manifest in the conflicts over the Dakota Access Pipeline, Keystone Pipeline, and uranium mining (Drake 2015; Whyte 2020; Parfomak et al. 2013). Scholars have utilized critical inquiry and post-colonial frameworks to understand these environmental conflicts and the indirect violence suffered by Native communities (Butler 2015). As Butler explains, the EJ and post-colonial frameworks are important for understanding how institutions still function as colonial actors. Lacking sufficient political power and privilege, Native American communities are a '[path] of least resistance' that governments and corporations take advantage of when siting hazardous land use projects like oil and natural gas refineries (Vickery and Hunter 2016). Native American populations suffered centuries of population decline from the diseases and warfare introduced by settlers. Today, a federal chokehold on Native land and resource rights has made it difficult for Native communities to make trade-offs or procure benefits after land use and resource extraction. Today, corporate and government exploitation of Native American populations manifests in disparate health impacts and higher mortality rates in Native communities (Batra Kashyap 2020; Rosier 2013). Further, Native American poverty rates remain highest in the U.S. when compared to all other racial

demographic groups, alluding to the federal government's failure to secure Native economic prosperity and well-being (Creamer et al. 2022). Government, economic, and health systems remain imbued with implicit settler colonialism hundreds of years after European settlers landed in the Americas (Batra Kashyap 2020; Drake 2015; Whyte 2020; Parfomak et al. 2013). The federal government has a long and documented history of inequitable treatment of indigenous populations concerning resource extraction (Marsh 1996; Swinford 2015). Coupled with the varied and complicated history of federal management of Native American lands, it becomes clear that an environmental justice framework is necessary to fully contextualize the exploitation of Native communities.

Research Design

In this study, Blaine County, Oklahoma and Caddo County, Oklahoma will be compared through a 'most-similar' lens, with the assumption of a variety of similar variables alongside a few differences, in a paired comparison analysis (Tarrow 2010). Both counties are located adjacent to each other and in the same geographic region of western Oklahoma. Blaine County sits at the northern border of Caddo County, and both counties sit on top of the Anadarko Basin. The Anadarko Basin is one of the largest natural gas and oil reserves in the United States (Wells and Wells 2022), theoretically allowing communities in both Blaine and Caddo access to rich reserves. Additionally, Blaine and Caddo County, on average, have both suffered greater population declines than the state of Oklahoma between 2020 and 2022 (U.S. Census Bureau, 2022). Alongside this, both counties have higher poverty rates and lower median household incomes than state-wide averages in recent years. Central to this research is one critical difference: According to the U.S. Census Bureau, Caddo County has more than double (25.4%)

the Native American population of Blaine County (9.7%) (2022). Therefore, this research investigates the extent to which the Native American population can serve as one potential explanatory variable for understanding the effects of onshore oil and natural gas extraction.

Importantly, this research does not attempt to make causal inferences between the dependent variables (effects associated with extraction) and the independent variable (Native American populations). As a paired comparison analysis, there is an insufficient number of cases to make these causal jumps. Yet, plenty of room remains to build an intimate and holistic narrative covering extraction trends as they relate to county-wide trends. A narrative will be constructed using process tracing; to assess the events in Blaine County and Caddo County regarding extraction, and determine if those patterns mimic previously documented trends of extraction within marginalized communities (Bennett 2008). This process of narrative building is deliberately exploratory, with the intent to view structural factors, such as population demographics and land management systems, within the context of extraction outcomes. This research explores instances of non-reservation and BIA-managed land in both counties. Direct attention will be given to the regulatory environment that occurs with native extraction in this distinct land management arrangement. The unique Native land management structure in both counties emphasizes the importance of this specific paired comparison.

Background

Population, Land Management, and Extraction

This section introduces population demographics, the state of Native land management, and fluid mineral extraction trends in Blaine and Caddo counties. This research sits on the foundation of county-level Native American population levels and federal land-management

trends in both Blaine County and Caddo County. Since only county-level data was available within the scope of this research, an understanding of population demographics and the BIA presence in both counties is essential to describe how variables related to extraction may affect Native American communities.

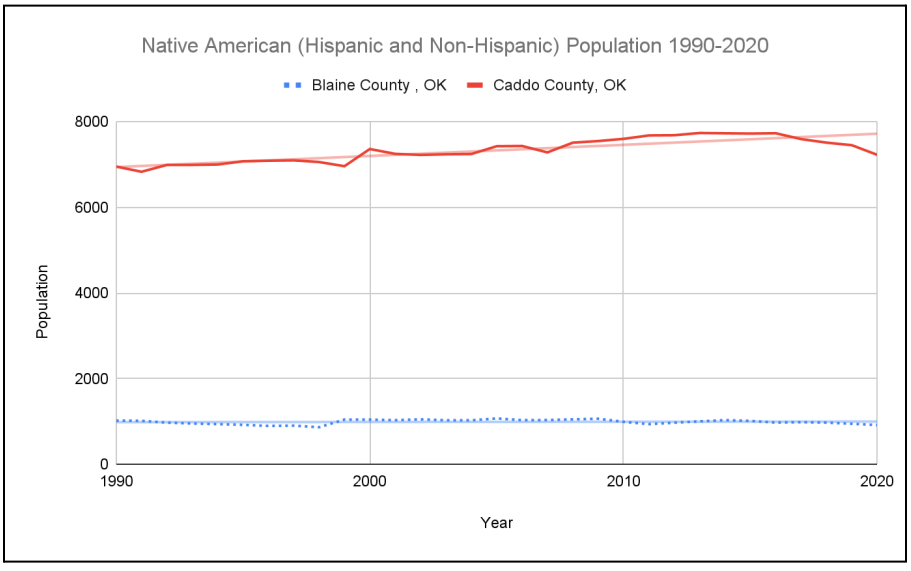
Native American Population Statistics in Blaine and Caddo

The ancestors of the Caddo people have an archaeological history in Louisiana, Texas, Arkansas, and Oklahoma that stretches back to 900 A.D. (Caddo Nation 2023). During the late 18th- and 19th-century, the U.S. federal government continued to push a large number of Native tribes and populations west, leading to a conglomeration of Native ancestries being forced into the Oklahoma region (Fixico n.d.). The western Oklahoma Blaine-Caddo region in this research includes land designated for the Caddo, Wichita and affiliated, Delaware, Cheyanne-Arapaho, and other smaller tribes (Oklahoma Department of Transportation 2022). The Caddo, Wichita and affiliated, and Delaware tribes have their tribal headquarters in Caddo County. Throughout the 19th and 20th centuries, tribal status and federal management of the Native populations changed continuously through federal legislation. As an example, the Caddo Nation was originally granted a tribal reservation, which was eventually transitioned into land allotments in 1887; land losses ensued as reservation land was sold to non-Native individuals (Meredith n.d.; Caddo Nation 2023). Throughout Blaine and Caddo counties, Native populations have continued to exist on private land and in allotments held in trust with the federal government. Even further, tribal governments for each of the aforementioned tribes continue to hold varying degrees of cultural and administrative organization in the study area. This study does not look at any

particular Native nation, but recognizes the conglomeration of Native tribes within the settler borders of Blaine County and Caddo County.

Today, Caddo County has a significantly greater population of Native American individuals than Blaine County, as seen in Figure 1. below. In 2020, Caddo County had 7,230 individuals who identified as Native American while Blaine County had 921 (U.S. Census Bureau QuickFacts 2022). Caddo County has a Native American population (hispanic and non-hispanic self-identifying) six to seven times the size of the Native American population in Blaine County. These Native American population differences between both counties, as seen in Figure 1., persist over time. Caddo County shows a steady increase in Native American population totals, while Blaine County remains stagnant from 1990 to 2020.

Figure 1.



U.S. Census Bureau., 2017

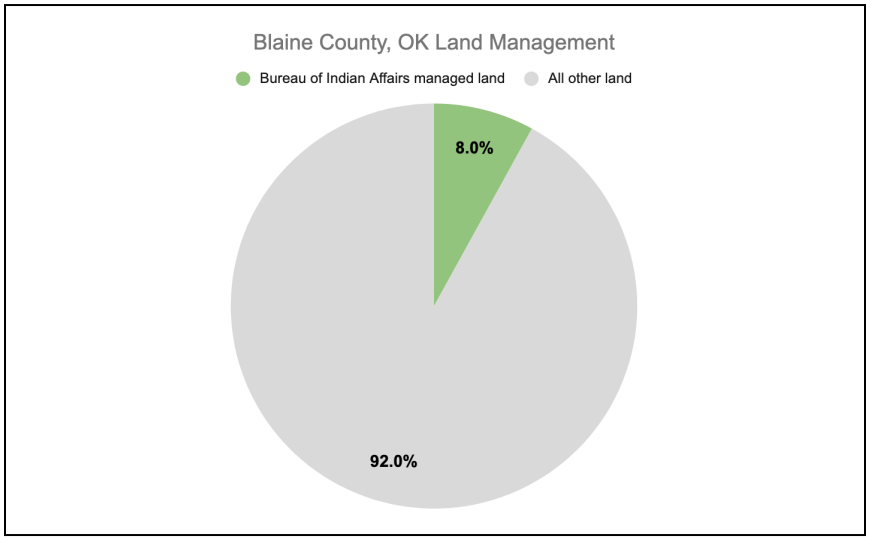
Native American populations have already experienced centuries of population decline from the diseases and warfare introduced by settlers. Today, corporate and government exploitation of Native American land and communities remains potent (Rosier 2013). Since Native communities lack systemic political power, they become a path of least resistance when siting hazardous environmental projects. Settler-colonial attitudes allow the presence of Native populations alone to be justification for land use and resource exploitation. Even though not on designated reservation land, Native communities in the Blaine-Caddo region have not been immune to this exploitation. Previous scholarship, and the lived experiences of Native communities, clearly demonstrate how even the presence of Native Americans alone may lead to EJ inequities. Thus, the difference in Native American populations between Blaine and Caddo counties is in itself central to the conceptual framework of this study.

Land Management in Blaine and Caddo

The federal government often plays the role of middle-man in the relationship between Native communities and land management. Allotted and trust land agreements give the federal government vast purview in the allowance or restriction of extraction, making an overview of land management realities critical. Data was sourced from the Native Land Information System (NLIS), and reflects a Freedom of Information Act (FOIA) request by the NLIS in 2019. Thus, these land management statistics reflect only a snapshot in time. Even still, a quick glance at BIA Maps published by the Department of Interior in 2023 make clear that the BIA remains a significant presence in both Blaine and Caddo counties. The deliberate allotment of land to the Caddo Nation occurred as early as 1902, and the use of ICAs to manage extraction on such land throughout Oklahoma is evident beginning in the 1970s (Meredith n.d.; Marsh 1997).

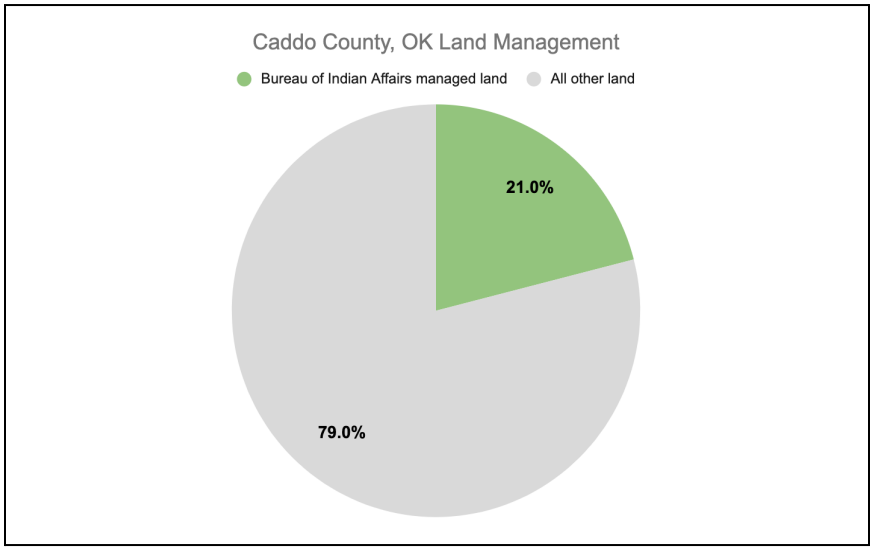
The Bureau of Indian Affairs has a footprint in both counties, but takes up significantly more land in Caddo County than Blaine County, as seen in Figure 2a. and Figure 2b. below. This aligns with Native American population demographics in both counties.

Figure 2a.



Native Land Information System, 2019

Figure 2b.

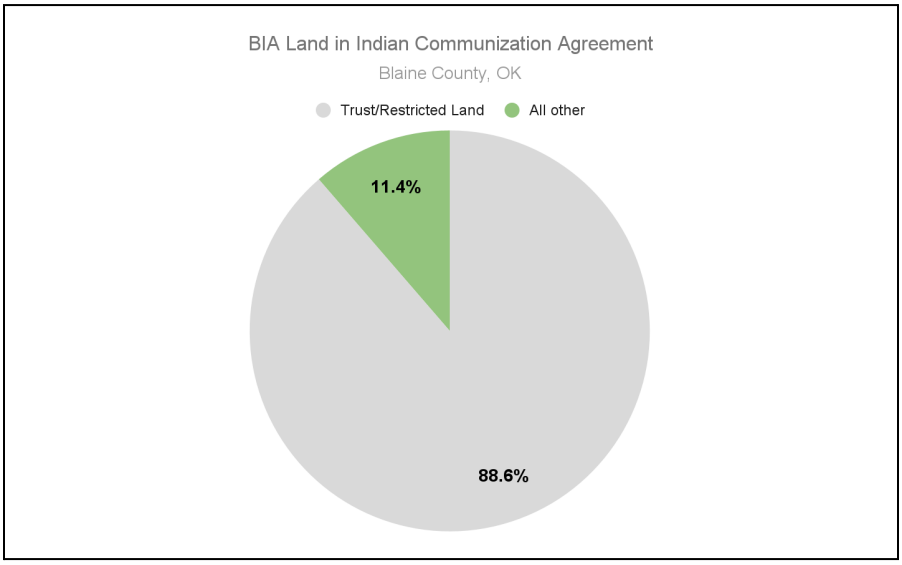


Native Land Information System, 2019

As of 2020, only 3% of Oklahoma land was reservation land, but the presence of allotted land and tribal statistical areas throughout the state leads to higher rates of federally-managed Native land than this number suggests (Energy Information Administration 2022). In Caddo County, 21% of all land is managed by the BIA, compared to 8% in Blaine County. With over one fifth of all land in Caddo County managed by the BIA, federal management of land and the type of agreements that lead to extraction will play a critical role in understanding the state of extraction effects in Caddo County. With such a sizable footprint, BIA-managed extraction has the potential to influence the impact variables, and therefore Native American populations.

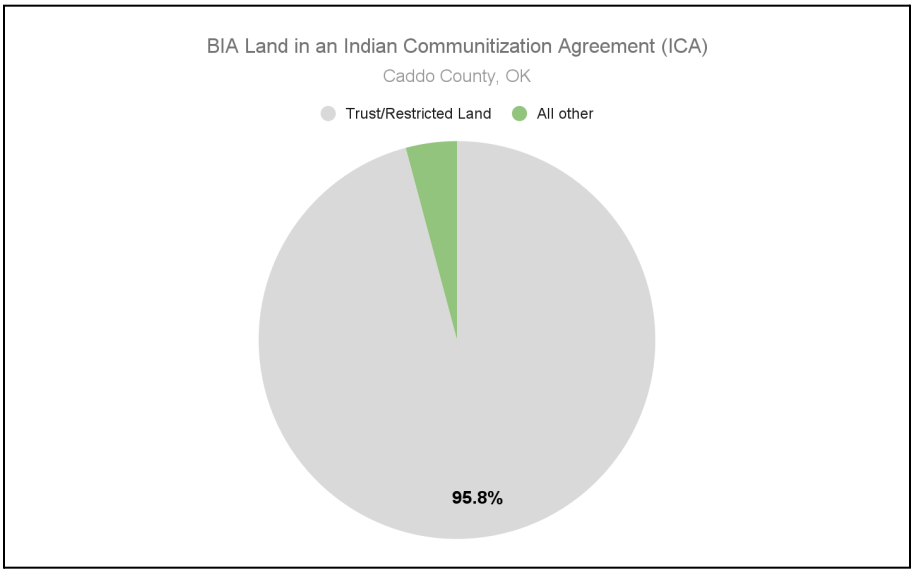
However, the presence of BIA land in both counties alone does not show the full picture. In Blaine County, 88.6% of the BIA-managed land is in trust or restricted land-use agreements, meaning extraction on those lands is also open to extraction through an ICA. This is seen in Figure 3a. In Caddo County, nearly 95.8% of the BIA-managed land is in trust or restricted land-use agreements, meaning extraction on those lands is open to extraction through an ICA. This is seen in Figure 3b. Although specific data on what land is held in an ICA agreement was unavailable without an updated FOIA request, data on land held in trust or restricted agreements with the BIA was available.

Figure 3a.



Native Land Information System, 2019

Figure 3b.



Native Land Information System, 2019

As discussed above, the BIA-managed land is primarily held by individuals in trust with the federal government, highlighting the importance of Indian Communitization Agreements

(ICAs). Although extraction leases on trust land are managed by the United States federal government for the benefit of Native American individuals or tribes, federal decisions often require no approval from the Native individuals. Even further, by equating drilling and spacing units with the ICAs, and then not allowing the units to change, the Oklahoma 10th Circuit case *Woods Petroleum v. Department of Interior* in 1994 "practically mandates" that Native individuals who want to participate in extraction do so through communitization agreements (Marsh 1996). Thus, extraction occuring on BIA trust land is highly likely to be managed through an ICA, even though the federal government has repeatedly prioritized commercial and public interests over Native American land owners in these agreements (Marsh 1996). Federal regulations of extraction on trust lands state that ICAs are for the benefit of Native land owners, with the federal government responsible for maximizing economic and cultural returns (*25 CFR 212.28* 1996). Previous case studies demonstrate how the federal government has repeatedly failed to live up to this expectation on BIA land in Oklahoma. Therefore, the high percentage of trust land in Caddo County sets the stage for assessing how the effects from fluid mineral extraction might differ from Blaine County. Using an EJ framework, the significant differences in land management in Caddo County from Blaine County could lead to an abuse of trust and communitization agreements. Case law demonstrates this reality has already been documented in similar cases elsewhere in Oklahoma (Marsh 1996). With nearly a fifth of Caddo County land in BIA trust agreements, Native communities will have no choice but to undergo extraction mediated by the federal government.

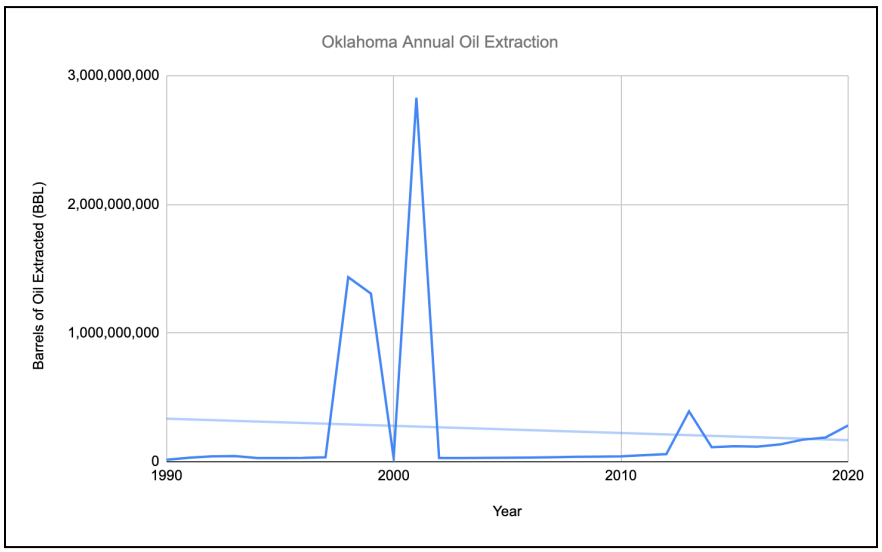
Extraction Trends

Extraction of oil and natural gas in both Blaine and Caddo counties is based on data for oil and natural gas extraction from 1990-2020 and was sourced from MineralAnswers.com.

MineralAnswers is a database intended for use by mineral and royalty owners to gain knowledge on local mineral extraction. According to the website, MineralAnswers aggregates data from 20 states and over 100 other sources. Publicly-available extraction data from the U.S. Department of Agriculture and the Oklahoma Corporation Commission report covered extraction from 1990-2010, and data in this slightly shorter time frame replicated trends in the MineralAnswers aggregate data

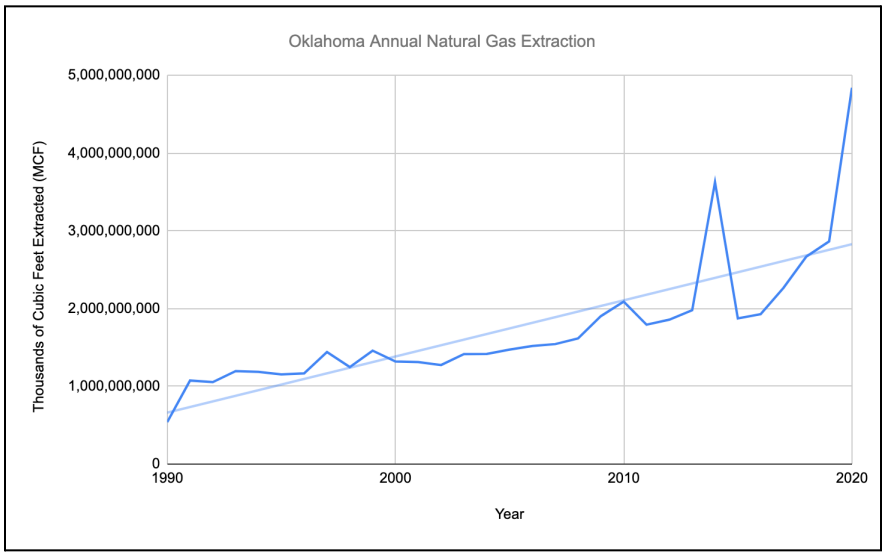
State-wide extraction of oil between 1990 and 2020 was in mild decline. Four peaks are noticeable in the years 1998, 1999, 2001, and (to a lesser extent) 2013. These peaks likely represent the discovery of a new oil reserve that was subsequently tapped and extracted. In all three cases, oil extraction totals in Oklahoma returned to status quo within one to two years. Interestingly, oil extraction on a year-to-year basis does begin to increase around 2010, continuing to do so until 2020. Yet, oil extraction remains stagnant or in mild decline over time, as seen in Figure 4a. below. State-wide natural gas extraction between 1990 and 2020 shows quite a different trend. Natural gas production trends nearly tripled state-wide during this time frame. As described in chapter one, the emergence of hydraulic fracturing (hereinafter 'fracking') in the 1990s and early 2000s likely contributed to the rapid increase in production. Single-year peaks in extraction are still evident in state-wide natural gas trends, but peaks are less pronounced than in state-wide oil extraction. The 30-year trend line follows year-to-year natural gas production closely. In sum, state-wide natural gas production steadily increased between 1990 and 2020, as seen in Figure 4b. below.

Figure 4a.



Data Commons. (n.d.). Retrieved January 17, 2023

Figure 4b.

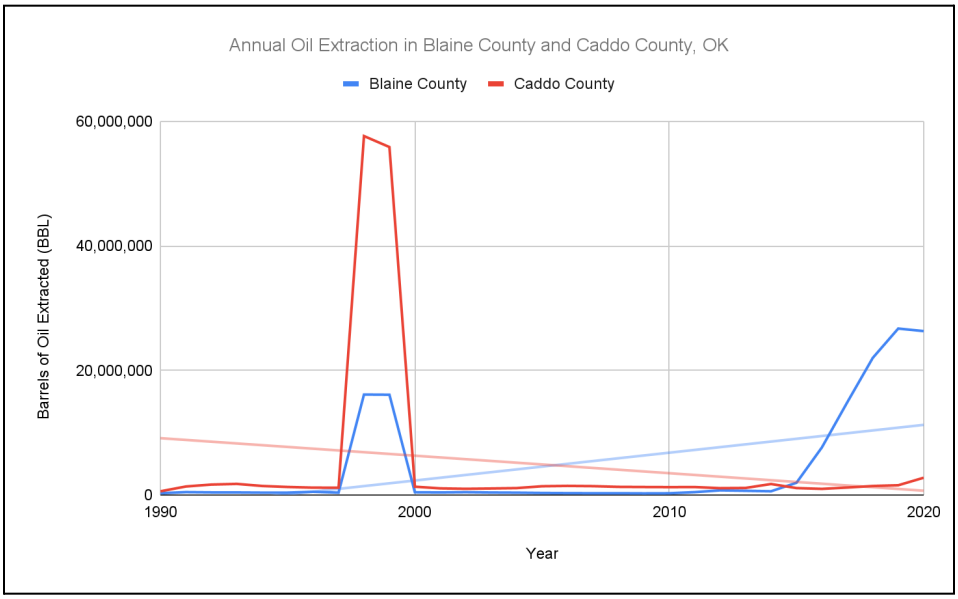


Data Commons. (n.d.). Retrieved January 17, 2023

Extraction of oil followed different trends in Blaine and Caddo counties between 1990 and 2020. Oil production in Caddo County followed a trend similar to state-wide production; a steady decline over time with major peaks disrupting the status quo. Caddo County mimicked the 1998 and 1999 state-wide booms in oil extraction to a greater extent than Blaine County. Caddo County trends can be seen in red in Figure 5. Blaine County oil production moved opposite of state-wide and Caddo production. Between 1990 and 2020 year-to-year oil extraction remained stagnant in Blaine County, with a rapid increase in production beginning in 2015 and continuing until 2020. Blaine County oil production can be seen in blue in Figure 5. below.

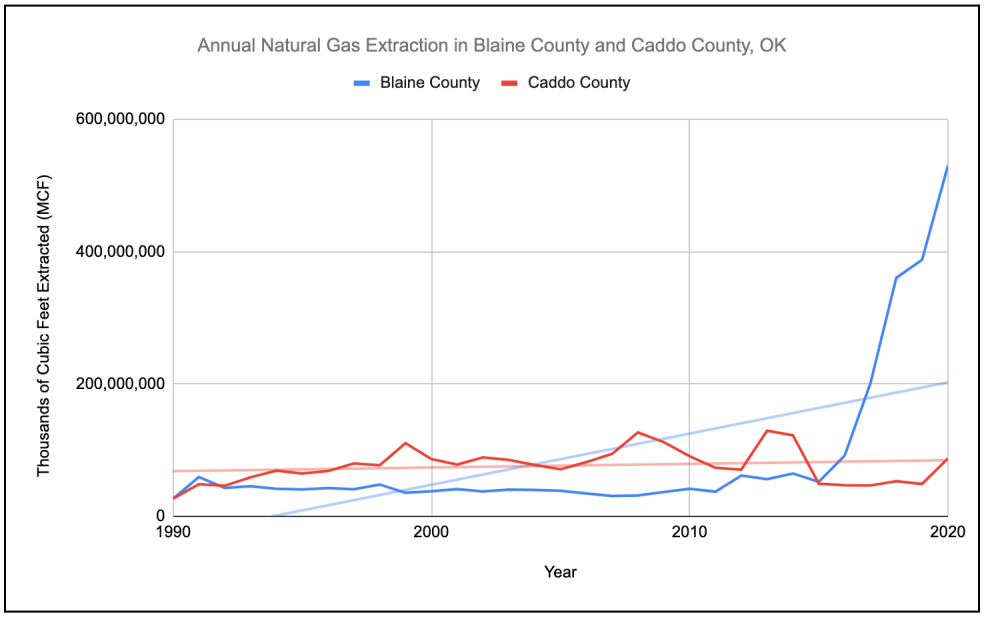
Natural gas production, similar to state-wide production, followed different trends from oil production in both counties. In Caddo County, natural gas production varied year-to-year, but over time remained stagnant. Caddo County natural gas trends are seen in red in Figure 6. below. Natural gas production in Blaine County began at similar levels to Caddo County in 1990 and remained at lower, and often stagnant, extraction levels until 2015. For most of the 30 years studied, natural gas production in both counties was similar, and butted against state-wide increases over time. Yet, Blaine experienced a massive natural gas boom following 2015, with extraction growing tenfold between 2015 and 2020. This five-year boom led to an increase in extraction over time. Blaine County natural gas trends are seen in blue in Figure 6. below.

Figure 5.



Data Commons. (n.d.). Retrieved January 17, 2023

Figure 6.



Data Commons. (n.d.). Retrieved January 17, 2023

As explained below, oil and natural gas production trends in both counties will be compared to the studied impact variables. Given that both counties saw relatively similar production patterns from 1990 to 2015, gaps between the impact variables associated with extraction will be central to analyzing the root of said variables in both counties. The following chapters will discuss how extraction-related variables manifest in both counties, and if discrepancies are explained (or not) by extraction production trends.

Methodology

This research will employ qualitative methodology, using observational numerical data to ground the research findings. To determine which variables measuring the effect of extraction were worthy of consideration in this research, previous literature covering the consequences of onshore oil and natural gas extraction was consulted. Additionally, previous research assessing what effects were particularly salient among marginalized communities was included. This process yielded a wide range of variables, which were reduced to those variables where county-level data was available. Table 1. lists the *impact variables* included below. In addition to variables measuring the effect of natural gas and oil extraction, *context variables* were used as background to explain the relevance of impact variables in the extractive and land management landscape. Oklahoma natural gas and oil extraction data and county-level natural gas and oil extraction data was included. Data was also collected measuring total BIA-managed acreage in both counties and total acreage of trust and restricted land managed by the BIA in both counties.

Table 1.

Impact Variable	***Impact Variable***	***Impact Variable***
Population	Economy	Health
Overall population *(% change over time)*	Per-capita personal income *(% change, real U.S. dollars)*	Mortality rate: chronic respiratory causes
Native American population *(% change over time)*	Per-capita GDP *(% change, real U.S. dollars)*	Mortality rate: neonatal disorder causes
–	FHFA House Price Index *(% change in home value)*	Mortality rate: self-harm and interpersonal causes

Each of the variables have a strong foundation of research connecting them to onshore oil and natural gas extraction. Additionally, many of the variables have been associated with negative effects on Native American communities throughout the United States. Although this research will not be concerned (due to the scope and available data) with determining causal relationships between BIA land extraction agreements and the impacts on Native American populations, it hopes to add to the conversation on environmental justice narratives. Further, this research will contextualize findings within specific federal land use agreements between Native American communities and the BIA that have not been extensively studied in prior research. Focusing on variables already associated with extraction and environmental justice narratives among Native American communities will make the assessment of the specific land-use agreement more salient. The research questions and associated hypotheses that guide this research are as follows:

Research Question One: Are the effects related to natural gas and oil extraction on federally managed land differently distributed between Blaine County and Caddo County in Oklahoma?

H1: There will be more negative effects derived from natural gas and oil extraction in Caddo County than in Blaine County

H1.1: The increase in negative effects from natural gas extraction will be higher in Caddo County than Blaine County.

H1.2: Caddo County will experience more steep declines in population following extraction booms than Blaine County

A. Declines in Native American populations post-extraction booms will occur at a greater rate in Caddo County than Blaine County

H1.3: Caddo County will see increased rates of…

A. Mortality due to chronic respiratory causes between 1990 and 2010
B. Mortality due to self-harm/interpersonal causes between 1990 and 2010
C. Mortality due to neonatal disorder causes between 1990 and 2010

H1.4: Caddo County will see decreased rates of…

A. The home value index between 2000 and 2020
B. Per-capita personal income between 1970 and 2020
C. Per-capita GDP between 2000 and 2020
D. Overall population between 1970 and 2020
E. Native American population between 1990 and 2020

Research Question Two: Did the 1996 change in the federal management and approval of leasing through Indian Communitization Agreements affect economic and health effects in both counties equally?

H2: Negative economic effects from natural gas extraction in Caddo County and Blaine County will be lower in the years measured before 1996.

H2.1: The increase in negative economic effects from extraction after 1996 will be higher in Caddo County than in Blaine County.

H3: Population shifts from natural gas extraction in Caddo County and Blaine County will be lower in the years measured before 1996.

H3.1: The increase in negative population shifts from extraction after 1996 will be higher in Caddo County than in Blaine County.

H4: The difference in negative health effects derived from natural gas extraction in Caddo County and Blaine County will be higher after 1996 than before.

H4.1: Caddo County will show increased rates of chronic respiratory mortality when compared to Blaine County after 1996

H4.2: Caddo County will show increased rates of self-harm/interpersonal mortality when compared to Blaine County after 1996.

H4.3: Caddo County will show increased rates of neonatal disorder mortality when compared to Blaine County after 1996

Data was sourced from a variety of online sources, each of which are outlined below. Population data was sourced from Data Commons, a database supported by Google which aggregates demographic data from a wide range of federal government offices and departments into one dataset. Federal departments referenced in this dataset include the U.S. Census Bureau American Community Survey and the Population Estimates Program. This research uses annual population totals from 1970 to 2020 for both counties. These totals were converted into percent change in population from the previous year. Since population totals in Caddo County overall are greater than Blaine County, this will allow side-by-side comparisons. Native American population trends in both counties are tracked from 1990 to 2020, and reflect data from the U.S. Census Bureau. Data on Native American population totals in both counties from before 1990 was unavailable.

Economic data used in this study were aggregated from a variety of federal sources. Per-capita personal income ranging from 1970 to 2020 was collected from the Bureau of Economic Analysis' (BEA) Local Area Personal Income datasets. Once collected, each year was

converted to real dollars using the U.S. Bureau of Labor Statistics' CPI Inflation Calculator. Graphs below reflect BEA per-capita personal income data after it was converted using the inflation calculator. Gross Domestic Product values for each county was collected from the Bureau of Economic Analysis and spans 2000 to 2020. Once GDP totals for each county were reported, each year was divided by the total population in each county to create a per-capita GDP metric. This allowed for a side-by-side comparison of both counties' GDP trends. Finally, housing values in both counties were assessed using the House Price Index (HPI) created by the Federal Housing Finance Agency (FHFA). This HPI measures the change in home values from the previous year, at the county level. The FHFA HPI uses repeated valuations on the same property over time to calculate the broad movement of property prices over time (Federal Housing Finance Agency 2023). The FHFA HPI data available for this study measures home values from 2000 to 2020.

Health data was sourced from the University of Washington Institute for Health Metrics and Evaluation Global Health Data Exchange (GHDx). Mortality rates for each of the selected variables was available from the GHDx at the county-level from 1990 to 2010. Rates represent the number of deaths per 100,000 individuals within the county population. Graphs demonstrate all three health variables alongside state-wide rates, also sourced from the GHDx.

Once the variables were selected from previously collected data, each impact variable and all extraction data were graphed using simple scatter plots to view trends over time. County-level overall population and per-capita personal income were measured from 1970-2020. Extraction totals at a state- and county-wide level and Native American population totals were measured from 1990-2020. All health variables were measured from 1990-2010. Finally, per-capita GDP and FHFA House Price Index variables were measured from 2000-2020. The

ideal time frame was 1970-2020 and above data represents time frames where county-level data is readily available online. Some data sets were split into pre- and post-1996 time scales to assess trends before and after regulatory shifts in ICAs. This process will determine which impact variables have similar trends as extraction data and BIA land use in Blaine County and Caddo County. For all variables, Blaine County and Caddo County will be assessed alongside each other, to determine if county-level differences emerge in trends-over-time for each variable.

Impact variable trends will be used as a foundation for informing a larger narrative on the effects of extraction on federally-managed Native American land. Data will be viewed alongside theories of environmental justice and the history of federally-managed extraction on Native lands. With this method of analysis, larger patterns over years of extraction in both counties will come to bear. Due to this big-picture approach, each impact variable will offer room for further research and in-depth analysis in the specific context of BIA-managed extraction.

Results

Population Trends in Blaine and Caddo Counties

Population patterns play an important role in teasing apart environmental justice issues for this research, as introduced in Section Two, but they also serve as an impact variable generally. Previous research on the effects of fluid mineral extraction demonstrates that shifts in population are a common effect. Population shifts are often connected to a variety of variables, and may be a secondary effect following positive or negative trends in economic and health variables where extraction is taking place (Buse et al. 2019; Hirsch et al. 2018). To address this impact variable, this study will look at population trends county-wide, in addition to Native American-specific trends. Couching broader trends in population within the context of Native

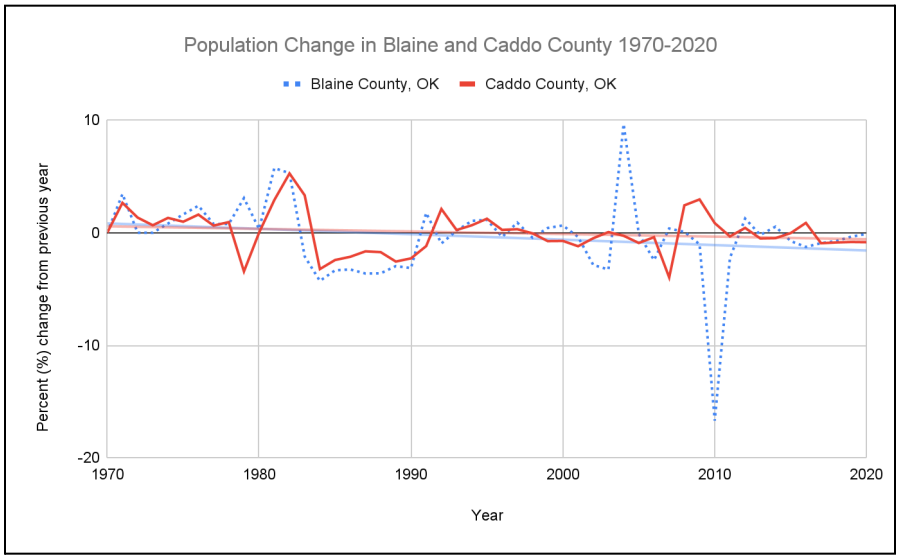
population patterns will add an additional layer to discerning the effects of extraction and presence of environmental justice questions.

This results section will address each of the hypotheses presented above. These hypotheses explore population trends as an impact variable associated with extraction trends, similar to health and economic metrics. Generally, these hypothese assume that Caddo County will experience a faster decrease in population totals overall and among Native American populations as compared to Blaine County over time. This hypothesis assumes that Native American communities will be more susceptible to the negative consequences of a rapid boom-bust cycle from oil and natural gas extraction.

Native American population trends in Blaine and Caddo counties

Between 1970 and 2020, in both Blaine County and Caddo County, overall population numbers followed a downward trend, visible in Figure 7a. below. Blaine County decreased at a marginally quicker rate than Caddo County. Throughout the timeframe, a few outlying years with large increases or decreases in population are evident. The early 1980s, early 1990s, 2004, and 2010 all demonstrate this rapid increase or decrease in county-wide population. Previous literature has attributed rapid jumps like these to the boom-bust cycle of extraction (Buse et al. 2019). Yet, extraction rates in both counties during these years do not show rapid increases or declines.

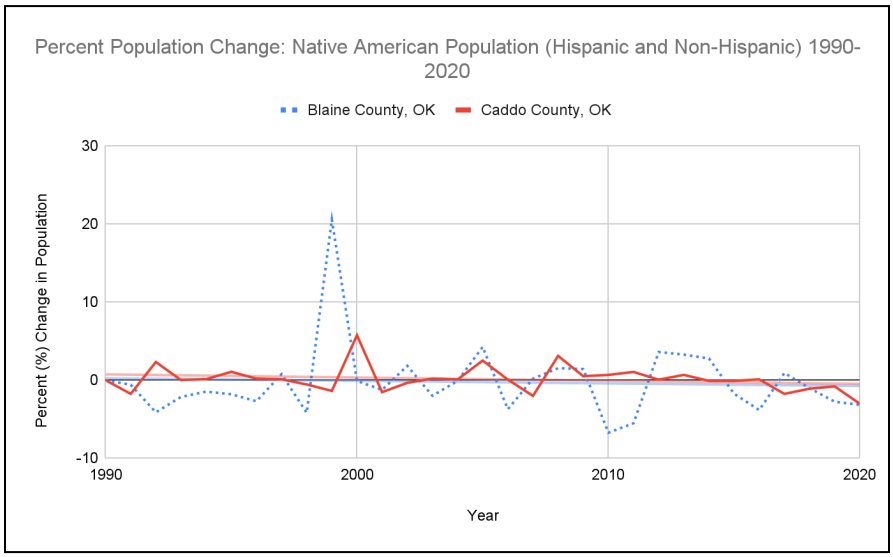
Figure 7a.



Data Commons. (n.d.). Retrieved January 17, 2023

Native American population totals were converted to percent change from previous year so that both counties could be assessed side-by-side. As seen in Figure 7b. below, Native American population rates see a marginal decline from 1990 to 2020. This decline is similar to overall population declines seen in Figure 7a. There are a few outlier years, just as with overall population trends, but they do not align with outliers in Figure 7a., and are predominately visible in Blaine County. A rapid decrease in Native American population in 2010 in Blaine County does align with the rapid decrease seen in county-wide populations. Overall, there does not seem to be a noticeable difference between county-wide population trends and Native American population trends in both Blaine County and Caddo County in the time period studied.

Figure 7b.



U.S. Census Bureau, 2017

Economic Trends in Blaine and Caddo Counties

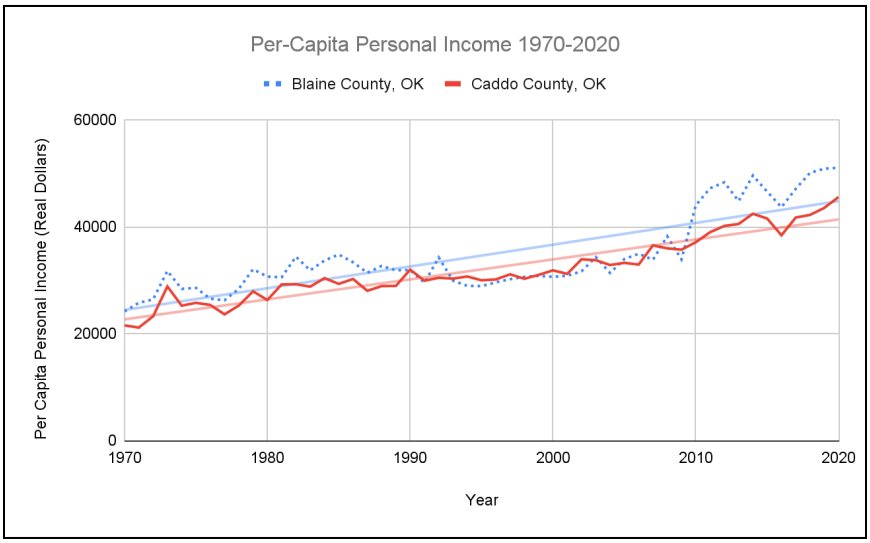
This chapter reviews the economic health of both Blaine and Caddo County over time; these variables are critical for understanding the impact of federally-managed extraction, as the federal government promises economic benefits to the Native populations on trust land (*25 CFR 212.28* 1996). As opposed to population shifts and health variables, economic effects tend to have short-term reactions to shifts in extraction, meaning there is little lag time between drilling and visible economic effects (Hoy et al. 2017). Although data on home value shifts and per-capita GDP was only available from 2000 to 2020, per-capita personal income data at the county level spans 1970 to 2020. Trends in personal income for both counties will be assessed across this 50-year time period, while also being split up to address trends before and after the ICA regulatory shift in 1996 (Hook 1997).

The guiding research question asked if Caddo County is experiencing disproportionate negative economic consequences from fluid mineral extraction as compared to Blaine County over time. This section will address the hypotheses H1.4 and H2.

Per-Capita Personal Income

Between 1970 and 2020, both Blaine County and Caddo County saw significant increases in per-capita real income. Rates in both counties followed a steady positive trend, with a mild slump seen between 1990 and 2010. For the most part, the income trends in both counties mimic each other. Blaine County sees a more exaggerated jump in per-capita income between 2010 and 2020, leading to a marginally wider gap between the two counties in 2020 than was present in 1970. These trends can be seen below in Figure 8a.

Figure 8a.

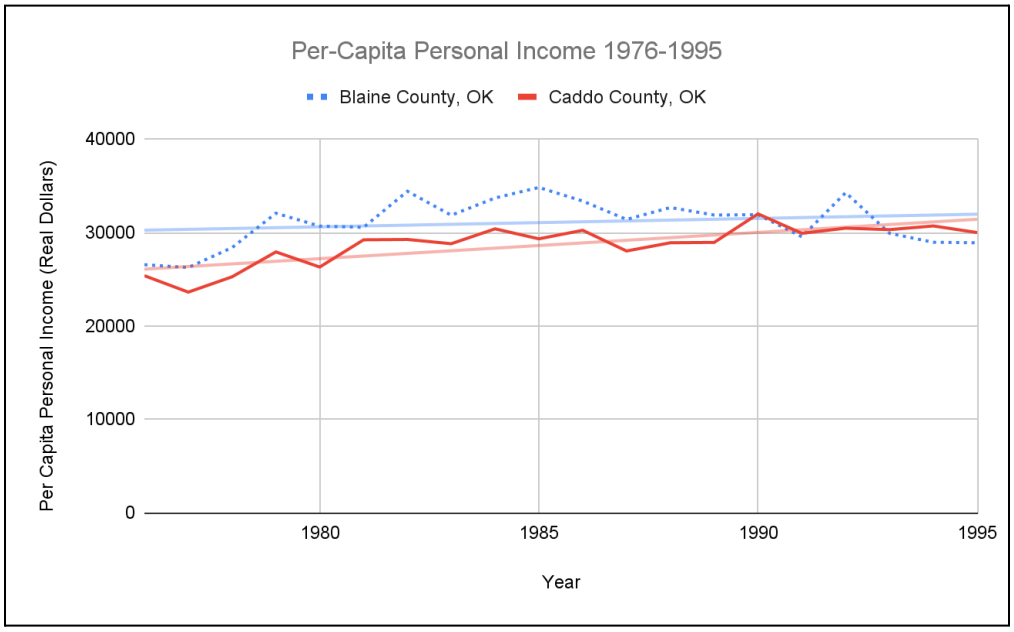


Bureau of Economic Analysis, 2022

To assess the potential consequences of the 1996 regulatory shift that removed Native American voice from ICAs, per-capita personal income was charted for the 20 years before 1996

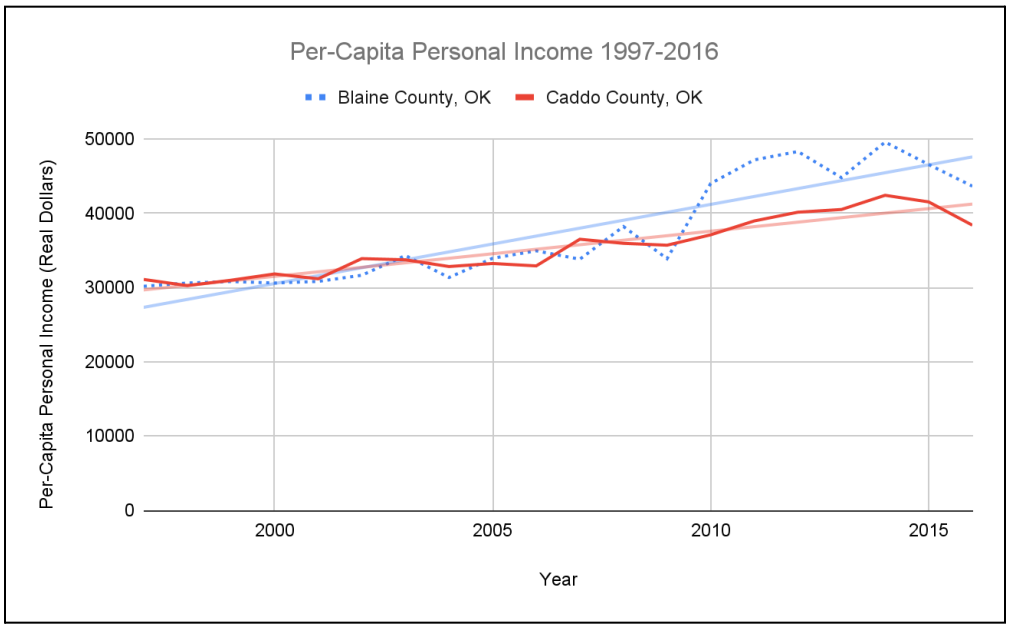
and the 20 years following. This allowed for a closer analysis of the trends present. As seen in Figure 8b., the trends visible on a smaller 20-year scale are different from the overall trends seen in Figure 8a. Blaine County per-capita personal income was relatively stagnant over time between 1976 and 1995. Conversely, Caddo County sees significant gains during this period after beginning 1976 well below Blaine County personal income. Caddo gradually increases and eventually reaches the same level of per-capita personal income in 1995 as Blaine County. Again, this is seen below in Figure 8b. In the 20-year period following 1996, seen in Figure 8c., the opposite trend is apparent. Although Caddo County briefly overtook Blaine County in per-capita personal income between 1997 and 2003. Between 2003 and 2016, Caddo County income cannot keep up with Blaine, even as both counties see real-dollar increases. This is seen below in Figure 8c.

Figure 8b.



Bureau of Economic Analysis, 2022

Figure 8c.

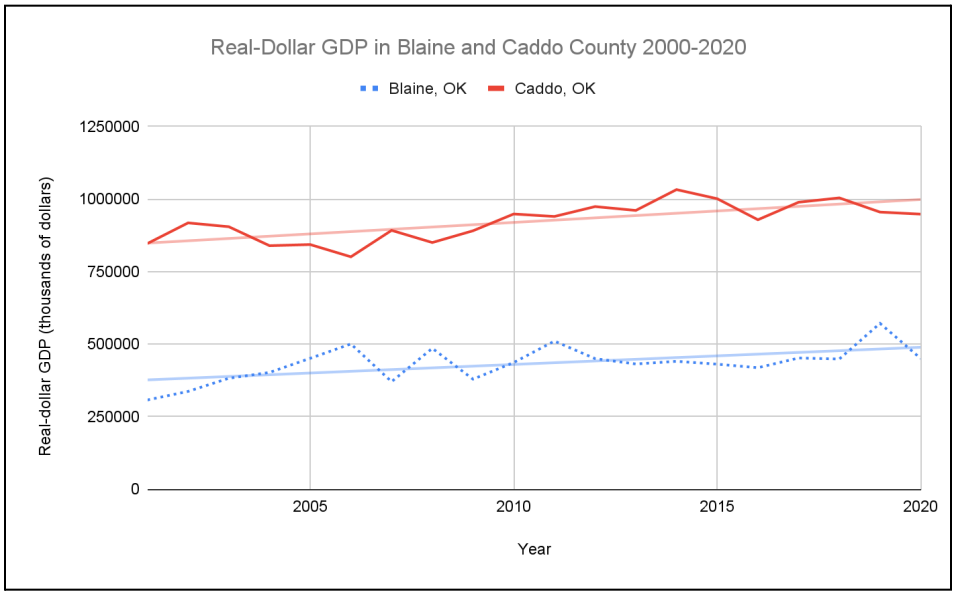


Bureau of Economic Analysis, 2022

Per-Capita Gross Domestic Product (GDP)

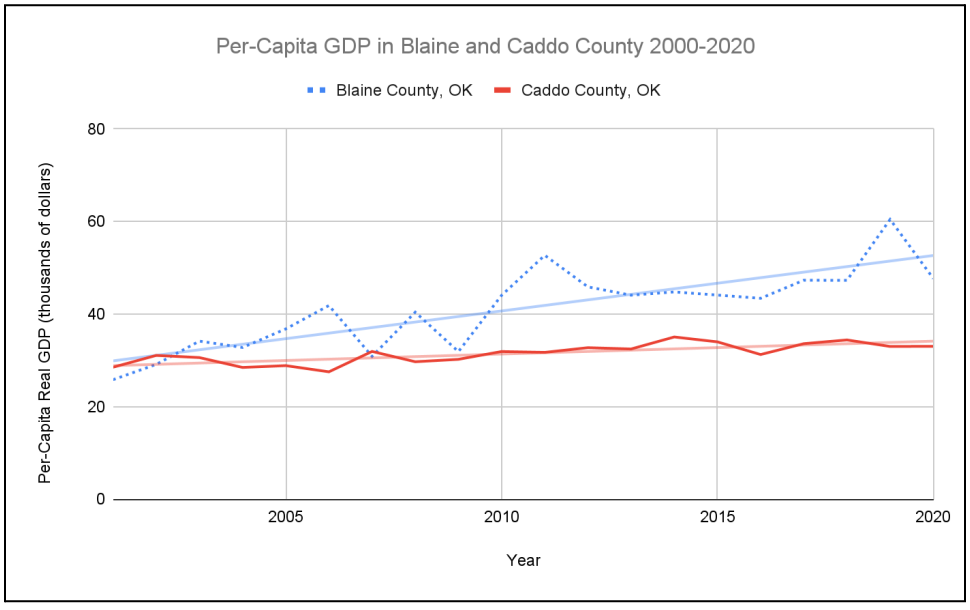
Caddo County has a significantly higher GDP than Blaine County between 2000 and 2020, as seen in Figure 9a. This is to be expected, as Caddo County has a much higher population than Blaine County. Once converted to per-capita GDP, an entirely different pattern emerges. In 2000, both Blaine County and Caddo County had roughly similar per-capita GDP's. Yet, between 2000 and 2020, Blaine County sees a 46% increase in county-wide GDP per-capita. Alternatively, per-capita GDP in Caddo County sees a much smaller increase, growing by 12% in the twenty year time frame. This difference is seen in Figure 9b. below. Noticeably, Blaine County sees much more fluctuation in year-to-year per-capita GDP than Caddo County, which remains mostly stagnant and tightly fitted to the trend line.

Figure 9a.



Data Commons. (n.d.). Retrieved January 17, 2023

Figure 9b.

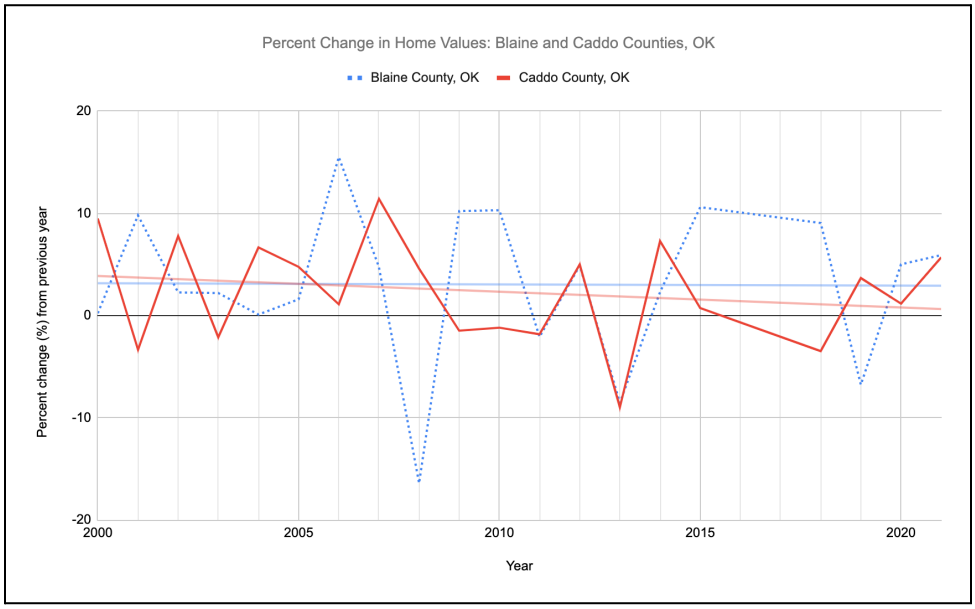


Data Commons. (n.d.). Retrieved January 17, 2023

Home Value Index

Between 2000 and 2020, the change in home values year-to-year varied greatly in both counties. Overall trends show Blaine County home values remaining stagnant, large slumps and large increases in the HPI kept the overall pattern constant over time. Thus, as personal income and real-dollar GDP increased over the same time period, home values did not mimic this effect. In Caddo County major year-to-year fluctuations are also apparent, yet the data demonstrates a decrease in home values over time. These trends are visible in Figure 10. below. Also noticeable is that Blaine and Caddo county often flip year-to-year HPI results; both counties are not tied at the hip on home values, indicating that other factors may cause different trends between counties.

Figure 10.

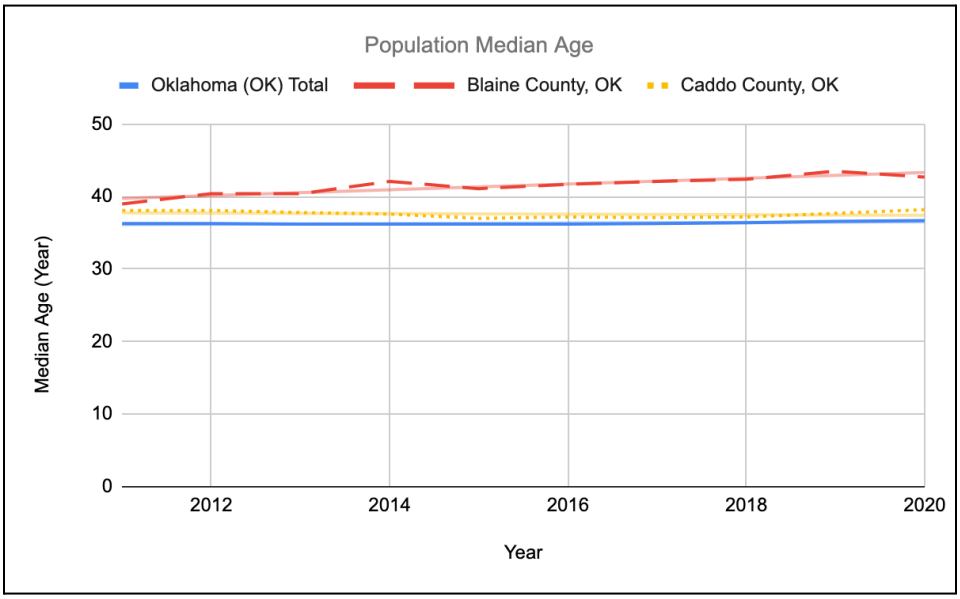


Federal Housing Finance Agency. (n.d.). Retrieved December 8, 2022

Health Trends in Blaine and Caddo Counties

Understanding trends in health in both Blaine and Caddo County will play a critical role in analyzing the effect of extraction and determining the points of difference between the two counties. The guiding research question asked if Caddo County is experiencing disproportionate negative health consequences from fluid mineral extraction as compared to Blaine County over time. This section will address the hypotheses H1.3 and H4. To address a potentially conflicting variable for health outcomes, Figure 11. below shows the average age in both counties between 2011 and 2020, aligned with the second half of the health data. Blaine County shows a higher average age year-to-year as compared to Caddo County, and increases slightly over the 10 years included. Caddo County's average age stays four to five years lower, on average, than Blaine, and overall trends remain stagnant after a slight drop.

Figure 11.

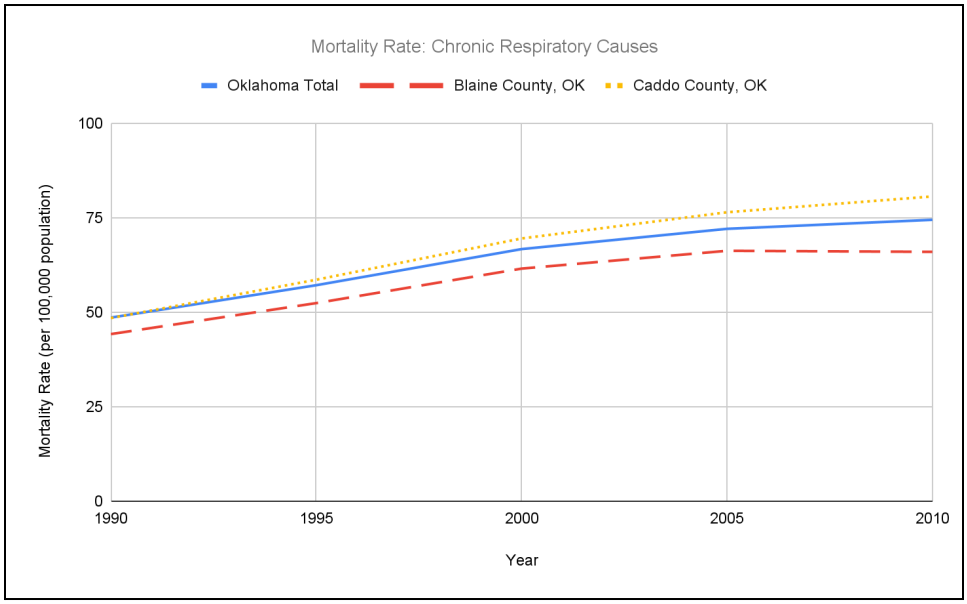


Data Commons. (n.d.). Retrieved January 17, 2023

Chronic Respiratory Causes

Between 1990 and 2010, mortality rates from chronic respiratory causes rose steadily across the state of Oklahoma. Overall, these trends were mimicked in Blaine County and Caddo County. Both Blaine and Caddo County began 1990 at or below state-wide mortality rates for chronic respiratory causes. Yet, by 2010 Caddo County was seeing higher mortality due to chronic respiratory causes than state-wide and Blaine County rates. Rates in Caddo County continue to increase, but Blaine County has remained relatively stagnant since 2000. All of these trends are visible in Figure 12. below.

Figure 12.



IHME: GHDx County Health Data, 2022

Self-Harm/Interpersonal Causes

Between 1990 and 2010, Oklahoma state-wide and Blaine County self-harm and interpersonal mortality rates remained closely aligned, with Blaine County rates following below

state-wide reporting shortly after 2005. Caddo County shows a different story, mortality rates for self-harm and interpersonal causes remain marginally higher than Blaine County and Oklahoma as a whole, but follow similar trends. Beginning in 2000, however, mortality rates in this category began a steady upward trend in Caddo County while Blaine County moved in the opposite direction. These trends are visible in Figure 13. Below.

Figure 13.

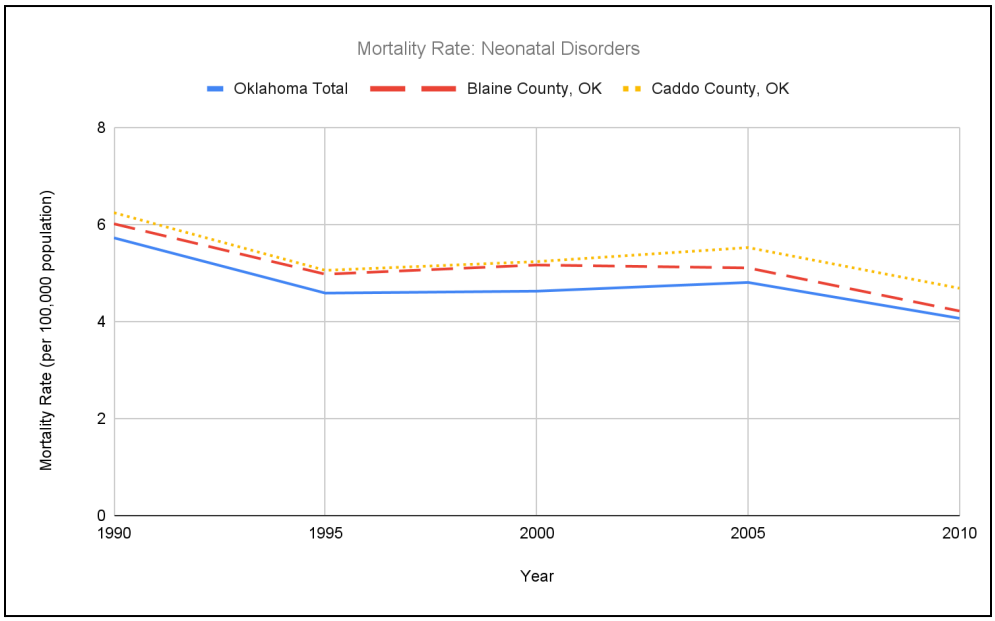
IHME: GHDx County Health Data, 2022

Neonatal Disorder Causes

Mortality rates from neonatal disorders show quite a different trend from both chronic respiratory and self-harm/interpersonal causes state-wide and in both counties. Between 1990 and 2010, neonatal disorders are in broad decline across all three geographies. Both Blaine County and Caddo County record higher mortality rates than Oklahoma, but all three follow the same downward trend. Although Blaine County and Caddo County have nearly identical rates

for neonatal disorder mortality between 1990 and 2000, Caddo County declined slowly between 2000 and 2010, largely due to an increase in mortality visible in Caddo between 2000 and 2005. These trends are visible in Figure 14. below.

Figure 14.



IHME: GHDx County Health Data, 2022

Discussion

As a reminder, this research explores whether Caddo County is experiencing more negative consequences from fluid mineral extraction on federally-managed Native American land than adjacent Blaine County. Overall, this research contends the general hypothesis that Caddo County is experiencing more negative effects from fluid mineral extraction than Blaine County due to the significantly higher Native American population present in Caddo. The history of federal exploitation of Native extraction and land-use rights in Oklahoma demonstrate that

Native American populations could be experiencing environmental injustices at the hand of federally-managed extraction. (Marsh 1996; Royster 1993; Mohai et al. 2009; Hirsch et al. 2018; Swinford 2015). The results reveal that the paired comparison of Blaine County and Caddo County is meaningful, and the impact variables related to fluid mineral extraction could build on the wider narrative of Native American exploitation. County-wide health and economic trends reveal discrepancies between the two counties that become suspicious in the broader context of federal land management and the history of Native American persecution at the hands of the federal government.

Extraction Trends

Although Blaine County has seen recent booms in both oil and natural gas production beginning in 2015, extraction in both counties followed similar trends for a majority of the time period studied. Fluid mineral production remained virtually level in both counties from 1990 to 2015. Additionally, Caddo County maintained higher rates of extraction than Blaine County for a large portion of the time period. These production patterns indicate that Caddo County should see more exaggerated negative *and* positive consequences of extraction. When looking at oil and natural gas production trends in both counties, it is important to remember the federal promise (*25 CFR 212.28*) to maximize benefits for Native communities in trust agreements. Caddo County has a significantly greater proportion of land managed in BIA trust agreements compared to Blaine County, land on which the federal government assures positive economic and health outcomes for tribes. So, Caddo County's larger extraction totals should lead to more positive economic and health outcomes as compared to Blaine County.

Many effects related to fluid mineral extraction manifest with a lag, so Blaine County booms in production late in the time period studied will not radically change the impact variables

(Hoy et al. 2017). Economic variables such as per-capita GDP and per-capita personal income are an exception, since these variables vary based on extraction trends in the short-term. Thus, peaks in production and the five-year boom should be visible in county-level economic variables.

The Impact Variables

Across five health and economic variables, it becomes clear that Caddo County is experiencing worse conditions over time. Both chronic respiratory and self-harm/interpersonal mortality rates increase in Caddo County as they are decreasing in Blaine County. GDP and per-capita personal income rise at much slower rates over time in Caddo County as compared to Blaine. Caddo housing values decrease while rates in Blaine remain stagnant. Positive health and economic returns for Native Americans from the federal lease management system do not seem to materialize, butting up against the federal promise of beneficial economic and cultural extraction returns (Marsh 1996; *25 CFR 212.28* 1996). A pattern of negative effects rooted in extraction-related variables emerges in Caddo County, even after decades-long extraction booms in the late 20th century. This is cause for concern, since it is consistent with settler-colonial realities from the 19th and 20th centuries, when the federal government explicitly exploited natural resources at the expense of Native communities (Royster 1993). Although direct causation cannot be made, positive economic and health outcomes for Native communities from federal land management in Caddo County are highly unlikely.

Population

Previous scholarship demonstrates that rapid increases in population may occur due to extraction, which could lead to adverse economic and health outcomes in extracted communities

(Buse et al. 2019; Brown 2014). First, population trends, as a consequence of extraction, did not shift in noticeably distinct ways between counties. Population totals marginally declined at a similar rate in both counties, with specific Native American declines following a near identical trend. Even when both counties' populations are measured against extraction trends, there are no noticeable patterns resulting from a boom-bust cycle of rapid influx and/or decline in population. Large scale boom-bust communities tied directly to extraction do not seem to be present in either county. Current infrastructure and drill locations might not necessitate mass in-migration in both Blaine and Caddo. Thus, population change, measured for county-wide and specifically Native American totals, do not demonstrate disproportionate effects as related to extraction between Blaine and Caddo counties.

Economy

Per-capita income responds quickly to extraction activity, showing little lag time before effects are played out (Hoy et al. 2017). Therefore, income trends over time can be closely compared to extraction trends over the same period. Previous literature contends that there should be positive county-wide economic effects from extraction (Bilgili et al. 2020; Paylor 2016). On one hand, this is noticeable in both counties, per-capita income rates rise steadily over the 50-year time period measured. Yet, even as real-dollar income increased in both counties, it rose at a slower rate in Caddo. The gap between Blaine County and Caddo County per-capita income rates continues to widen, even as Caddo County experienced natural gas and oil booms at higher rates than Blaine County until as recently as 2015. This trend aligns with previous literature which illustrates how marginalized communities (such as Caddo's high Native

American population) are often excluded from the immediate positive economic consequences (Weber 2012).

These outcomes become even more pronounced when the per-capita income graphs are adjusted to represent trends in the 20 years before the ICA shift in 1996 and the 20 years following. In the 20 year period before 1996, Caddo County is steadily gaining on Blaine County personal income rates. Seemingly, the positive economic effects of extraction activity are paying off. Then, Blaine County per-capita income rates suddenly began to rise at a much quicker rate than Caddo in the 20 year period following 1996. During this time, extraction rates in Caddo County are much higher than Blaine County, meaning extraction alone fails to explain the sudden shift in per-capita income rates. Just as previous scholarship has noticed in recent decades, economic benefits related to extraction do not provide the same expected returns in a vulnerable community (Buse et al. 2019; Weber 2012; Gopalakrishnan and Klaiber 2013; Jellicoe and Delgado 2015). Thus, a pattern of unequal experiences over time emerges.

HPI values and per-capita GDP (both measured from 2000 to 2020), show a similar pattern as per-capita income. Again, extraction rates in Caddo County remain above Blaine from 1990 until 2014, and past literature affirms that overall economic growth should mimic this (Bilgili et al. 2020). Instead Caddo County per-capita GDP rates rise only marginally compared to Blaine County and home values in Caddo County steadily decline. The immediate economic booms promised by extraction, especially due the high rate of federally-managed ICA agreements in Caddo, do not materialize. These results illuminate possible environmental injustices, that Caddo County, with its higher Native American population and federally-managed extraction sites, does not experience equal economic benefits from extraction. Blaine County, which has less than half the percentage of BIA-managed land and a Native

American population one-sixth of Caddo County, sees increased economic benefits even alongside lower extraction rates over time.

There exists almost no previous scholarship on ICAs and extraction on non-reservation BIA Native land, and no county-specific ICA data without a FOIA request. This makes it impossible for this study to tease out the direct, quantifiable relationships between ICAs, BIA-land, and economic outcomes. But, available data does reveal that ICAs and trust land are plentiful in Caddo County and that negative economic trends related to extraction are taking place in the county. Once compared to the better economic conditions and the lower number of ICAs, trust land, and Native Americans in Blaine County, negative economic trends could be attributed to environmental injustices and Native exploitation in Caddo.

ICAs allow federal agencies, like the BIA and the BLM, to determine how the economic expenses and profits from drilling will be distributed. ICAs are not inherently negative, but the current regulatory process for ICA approval lacks any Native American input. Thus, Native populations that wish to extract cannot play a role in determining the economic trade-offs associated with extraction. Stripped of their agency by federal extraction regulations, the possible economic harm of extraction seen in Caddo County can not be balanced with certain overall economic benefits, such as rises in personal income and home values. A lack of existing research investigating ICAs and non-reservation BIA land means the economic exploitation of Native communities, possibly at the hands of the BIA and federal extraction regulations, is going unaddressed.

Health

Health variables are measured on a different scale than economic variables; the emergence of health trends can be both acute and chronic, so some trends may be manifestations of decades of drilling (Johnston et al. 2019). A significant portion of research studying the effects of extraction focuses on health, and although further research is needed, extraction development leads to negative health outcomes for communities surrounding extraction sites (Buse et al. 2019). Aligning with this scholarship, we found that Caddo County experiences more detrimental health trends in relevant mortality rates than Blaine County among two of the studied variables. Further, Caddo County showed a lower average age over time than Blaine County. This weakens the chance that increased negative health trends in Caddo can be explained by an older population. Addressing discrepancies between Caddo County and Blaine County, the hypotheses predicting Caddo County would see increased mortality rates in two of the health categories is confirmed by the results. Further, as the research hypotheses predicted, Caddo County saw an increased departure from Blaine County in chronic respiratory, self-harm/interpersonal, and neonatal disorder mortality rates between 2000 and 2010 (following 1996), addressing potentially chronic health consequences from extraction and differing impacts from the ICA regulatory shift that removed Native American communities from decision making in BIA extraction agreements.

As described in the section introduction, chronic respiratory and self-harm/interpersonal causes for mortality have been seen in recent scholarship to increase in relation to extraction (Hirsch et al. 2018; Shonkoff et al. 2014; Stretesky et al. 2018). These results demonstrate that Caddo County is experiencing more negative effects than Blaine County among variables related to extraction. Importantly, these effects come after the oil and gas booms in Caddo County. Due

to the chronic nature of some health effects, immediate patterns that connect extraction rates to mortality rates should not always be expected (Johnston et al. 2019). In two counties where fluid mineral extraction has been widespread for decades, the increase in mortality among Caddo residents is a noticeable difference. These results affirm the assumptions of the EJ framework; Caddo (with a larger population of Native Americans), suffers more negative health consequences from hazardous environmental development, like extraction, than Blaine due to the increased presence of Native Americans.

As opposed to the other chronic respiratory and self-harm/interpersonal variables, mortality from neonatal disorders did not show trends that affirmed the hypotheses that mortality rates in each county would increase due to extraction. Further, although Caddo County maintained a slightly higher rate, there was not a wide difference between both counties in neonatal-caused mortality over time. This is not totally unexpected, as scholarship connecting neonatal mortality to extraction is still an emerging topic of research (Currie et al. 2013; Hill and Ma 2022). As noted above, there is a discrepancy between the two counties on neonatal mortality, but trends did not align with the broader narrative of unequal negative consequences from BIA-managed extraction in Caddo County.

Summary

In the case of both health and economic variables that are attributed to extraction, Caddo County is experiencing worse outcomes than Blaine County. A simple EJ narrative would attribute this to the presence of Native American communities alone, but that does not paint the whole picture. The federal regulatory landscape and the unique nature of resource use on Native land raises new questions. Blaine County sees positive economic trends closely tied to extraction

booms, even as Caddo County does not. Additionally, the high rate of BIA-managed and ICA-likely land in Caddo, alongside a history of the federal government prioritizing non-Native interests instead of Native communities, make it challenging to dismiss the results as unrelated to indirect Native American exploitation. The scope of this research and the data available for study restrict the possibility to causal claims, but the presence of more negative effects closely related to extraction, alongside an increase in BIA-managed drilling, emerges in Caddo County and should inspire future research to explore these questions further.

Given the history of settler-colonial attitudes in federal policies and actions in regard to Native American populations, it is alarming that the federal government plays such a patriarchal role in 21st-century Native mineral development. As recently as the early 20th-century, the federal government was explicitly claiming ownership of resources on Native lands (Royster 1993). It is cause for concern, then, when the federal government constructs a regulatory environment where federal management of extraction is required for Native economic and community benefit. Causal connections could not be made in this work, but the extraction landscape and the trends seen above make it highly unlikely that positive outcomes for Native communities will occur. Previous scholars have long theorized how governing institutions still act as colonial powers, this reality coming to bear in Blaine and Caddo Counties is possible after assessing economic and health trends over time (Batra Kashyap 2020; Butler 2015; Drake 2015; Whyte 2020; Parfomak et al. 2013; Vickery and Hunter 2016). The BIA is positioned to interpret the needs of Native communities with their input, and make extraction decisions that could have detrimental acute and chronic effects on these same Native communities. The siloed decision-making process was heighted in 1996, when a regulatory change meant federal agencies no longer needed Native approval for ICAs.

Inequities in extraction outcomes between Blaine County and Caddo County are suspiciously aligned with a regulatory landscape that limits Native American agency. Previous literature broadly claimed that economic and health variables related to extraction trends are disproportionately negative among marginalized communities (Buse et al. 2019; Hirsch et al. 2018; Mohai et al. 2019; Weber 2012; Weber et al. 2014). But, the distinct landscape of BIA-mediated extraction and land management reveals the potential roots of the difference in health and economic well-being between Blaine and Caddo. Clearly, ICAs and BIA trust management need a closer look. Variables such as per-capita income, which is measurable over a 50-year time period, showed different trends before and after the 1996 federal regulation changes to ICAs that removed Native American input from the ICA approval process. The federal government promises Native lessors in trust agreements that it will maximize economic and cultural benefits in extraction negotiations (*25 CFR 212.28*). Yet, between economic and health trends, that reality is not coming to bear in Caddo. In a county with more BIA-managed land and a higher Native American population, extraction does not seem to be paying off in Caddo to the same extent as it is in Blaine. Against the backdrop of settler-colonialism in the United States, it seems very possible that Native Americans in Caddo County are yet again victimized by a federal grasp on their resources, land rights, and agency.

Future Research

The perilously paternalistic nature of federal management of extraction in Native communities and the emergence of negative health and economic trends over time in Caddo County make future research critical. Even further, there are an alarmingly small number of studies investigating ICAs and non-reservation BIA-managed extraction. Most of what currently

exists is rooted in case law from the 1990s, resulting in little research to critically assess the impacts of ICAs and BIA management on Native populations. Without a doubt, this research demonstrates the need for more work looking at the impacts of ICAs and non-reservation federal management of Native lands. These negative trends in Caddo County over time demonstrate the possibility that federally-managed extraction agreements between the BIA and Native American communities are negatively affecting Native Americans. Given previously documented environmental injustices and the array of settler-colonial institutions that have long oppressed Native communities, it seems possible that an indirect system of injustice has emerged among ICAs, BIA land-management, and Native extraction on federal lands.

Given the scope and scale of this research, the above findings are primarily exploratory and presented with the intent to stimulate further questions and research. Without a doubt, there is ample room to explore causal explanations and provide further context in regards to federally-managed oil and natural gas extraction on BIA land in Oklahoma. Future research needs to investigate the causal foundations of these trends, which could have broad implications for federal policy towards fluid mineral extraction and Native American land management procedures. Given that neither of the counties in this study have reservation land, these findings also raise questions about Native American sovereignty and why the federal government continues to play a paternalistic role in land and fluid mineral management. More specific opportunities for future scholarship are described below.

The research questions explored if Native American communities were experiencing more negative consequences from extraction than non-Native communities, specifically in the case of federally-mediated fluid extraction in ICA agreements. Again, causal explanations cannot be made within the scope of this study, which was intended to build a narrative by assessing

histories of Native extraction and viewing extraction effects over time. The results clearly demonstrated in the cases of per-capita personal income, per-capita GDP, home values, chronic respiratory mortality, and self-harm/interpersonal mortality that Blaine County fared better than Caddo County over time. Past scholarship has demonstrated how each of these variables is tied to extraction of fluid minerals, but further research can expand on how these variables respond to extraction specifically in Oklahoma. Future research will need to demonstrate which specific variables are causally related to extraction in Oklahoma, and Blaine and Caddo Counties, to be able to better understand the effects of fluid mineral extraction. This research incorporated variables with particular consequences for vulnerable populations, but more research on impact variables salient among Native American communities in the region will be essential to build casual connections between extraction and community well-being.

This study was also based on the specific land-management system in Blaine County and Caddo County. Observational analysis conducted in this research demonstrates how a significant amount of extraction in Caddo County occurs on BIA-managed land, likely in ICA agreements, which disadvantage Native communities (Marsh 1996). This study was unable to directly correlate extraction points and impact variables, relying exclusively on county-wide data. Further research should use a FOIA request to directly determine how many ICAs exist in both counties. Alongside data on specific points of extraction in both counties, as opposed to county-wide totals, more direct claims can be made about extraction consequences in relation to ICAs. This research was able to demonstrate the possibility of a connection between these two variables, showing Caddo County (with higher rates of ICA agreements and Native populations) experiencing more negative consequences from extraction.

A multitude of research questions emerge, including, among others: what specific community-wide consequences are derived from fluid mineral extraction in Oklahoma? Which of these consequences are critical for Native communities? Are negative consequences from extraction disproportionately concentrated on BIA-managed ICA agreements? Why does the federal government continue to manage fluid mineral extraction for Native communities in trust agreements? Why are Native American community members not included in the decision-making process for determining the use of an ICA? Clearly, there is much that must be explored by future studies, with broad implications for United States and Native American relations.

Conclusion

This research began with one question: Is Caddo County, Oklahoma experiencing more negative trends over time among variables associated with fluid mineral extraction than Blaine County, Oklahoma? Through this paired comparison analysis and relying on an environmental justice (EJ) framework, a variety of observations emerged. First, it became clear that the land management system for Native Americans in western Oklahoma provides important context. Most Native American land in this study is held in a trust agreement with the BIA, as opposed to reservation land or fee simple land (private ownership). This environment allows for the likely emergence of Indian Communitization Agreements (ICAs) in most places where extraction occurs on Native land. Alarmingly, Native American stakeholders were written out of the ICA and BIA/BLM extraction decision-making process in 1996 (Hook 1997). Essentially, this means Native communities are unable to play a role in determining the economic, health, and environmental trade-offs of extraction. Without this individual and community-wide agency,

Native communities are wholly subject to decisions made by federal agencies when they want to drill, or reap the benefits of natural gas and oil wells on their land. Research specifically assessing the effect of ICAs on Native communities, as opposed to more traditional drilling agreements on non-Native land, remains almost non-existent.

Second, it became clear that Caddo County, which has a Native American population six times that of Blaine County and hosts over two times as much BIA land, is worse off in many extraction-related variables as compared to Blaine County. Even over periods of time when fluid mineral extraction in Caddo County was higher than Blaine County, Blaine experienced more beneficial trends among extraction-related impact variables. These patterns emerged in per-capita GDP, per-capita personal income, home values, chronic respiratory mortality, and self-harm/interpersonal mortality that Caddo County is worse off even during extraction booms. Importantly, per-capita income rates in Caddo County stagnated following the 1996 decision to remove Native American input from extraction approval on their land.

These are critical observations, but none of the analysis conducted in this research was designed to make causal conclusions. By incorporating an EJ framework grounded in previous literature and a history of U.S. settler-colonialism, the demographic and land management differences between Blaine and Caddo Counties bolsters the importance of negative impact variable trends. The trends observed in this study necessitate a call-to-action to motivate future researchers and decision-makers to investigate possible inequities in the federal management of Native resource use. More quantitative research will be necessary to assess potential causal links between extraction on federal Native land in ICAs and the impact variables among Native communities. More qualitative research will be needed to ensure the elaborate and complex nature of Native land management and extraction practices in Oklahoma is fully understood.

Caddo County is experiencing negative trends among the impact variables when compared to its neighbor Blaine County. These trends persist over time when Caddo County is producing more, and less, natural gas and oil than Blaine County. This is alarming given the large Native American population that lives in Caddo County, a community which could be subject to indirect federal exploitation of Native extraction rights. The lack of Native American individual and community-wide agency incorporated with BIA-oversight adds further suspicion to the federal management of Native resources. In the short-term, onshore fluid mineral extraction will continue to boom across Oklahoma and the United States. Thus, it is imperative that future research directly illuminates extraction-related consequences on Native populations in relation to the federal system of Native American resource control.

Works Cited

References

25 CFR 212.28. Unitization and communitization agreements, and well spacing. (1996). Retrieved February 16, 2023, from https://www.ecfr.gov/current/title-25/chapter-I/subchapter-I/part-212/subpart-B/section-212.28

Apergis, N., Dastidar, S. G., & Mustafa, G. (2021). Fracking and Asset Prices: The Role of Health Indicators for House Prices Across Oklahoma's Counties. *Social Indicators Research*, *154*(2), 583–602. https://doi.org/10.1007/s11205-020-02544-z

Apergis, N., Hayat, T., & Saeed, T. (2019). Fracking and infant mortality: Fresh evidence from Oklahoma. *Environmental Science and Pollution Research*, *26*(31), 32360–32367. https://doi.org/10.1007/s11356-019-06478-z

Batra Kashyap, M. (Nov. 2020). U.S. Settler Colonialism, White Supremacy, and the Racially Disparate Impacts of COVID-19. *California Law Review*, *11*(517). 517-528. : https://doi.org/10.15779/Z388S4JQ10.

Bennett, A. (2008). Process Tracing: A Bayesian Perspective. In J. M. Box-Steffensmeier, H. E. Brady, & D. Collier (Eds.), *The Oxford Handbook of Political Methodology,* 702-721. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199286546.003.0030

Biden Administration Reopens Federal Lands for Oil and Gas Leasing Under Reformed Program. (2022, April 20). Brownstein Hyatt Farber Schreck. Retrieved September 27, 2022, from https://www.bhfs.com/insights/alerts-articles/2022/biden-administration-reopens-federal-lands-for-oil-and-gas-leasing-under-reformed-program

Bilgili, F., Koçak, E., & Bulut, Ü. (2020). The shale gas production and economic growth in local economies across the US. *Environmental Science and Pollution Research*, *27*(11), 12001–12016. https://doi.org/10.1007/s11356-020-07776-7

Boyd, D. T. (2002). Oklahoma Natural Gas: Past, Present, and Future. *Oklahoma Geology Notes, 62*(4), 143-155.

Brisbois, B. W., Reschny, J., Fyfe, T. M., Harder, H. G., Parkes, M. W., Allison, S., Buse, C. G., Fumerton, R., & Oke, B. (2019). Mapping research on resource extraction and health: A scoping review. *The Extractive Industries and Society*, *6*(1), 250–259. https://doi.org/10.1016/j.exis.2018.10.017

Brown, J. P. (2014). Production of Natural Gas From Shale in Local Economies: A Resource Blessing or Curse?. *Economic Review, Federal Reserve Bank of Kansas City*, *QI*, 1-29.

Buse, C. G., Sax, M., Nowak, N., Jackson, J., Fresco, T., Fyfe, T., & Halseth, G. (2019). Locating community impacts of unconventional natural gas across the supply chain: A scoping review. *The Extractive Industries and Society*, *6*(2), 620–629. https://doi.org/10.1016/j.exis.2019.03.002

Butler, R. V. (1978). The Bureau of Indian Affairs: Activities Since 1945. *The ANNALS of the American Academy of Political and Social Science*, *436*(1), 50–60. https://doi.org/10.1177/000271627843600106

Creamer, J., Shrider, E. A., Burns, K., & Chen, F. (2022). *Poverty in the United States: 2021*. U.S. Census Bureau: Current Population Reports. P60-277.

Currie, J., Graff Zivin, J., Meckel, K., Neidell, M., & Schlenker, W. (2013). Something in the water: Contaminated drinking water and infant health. *Canadian Journal of Economics/Revue Canadienne d'économique*, *46*(3), 791–810. https://doi.org/10.1111/caje.12039

Drake, K. (2015). The Trials and Tribulations of Ontario's Mining Act: The Duty to Consult and Anishinaabek Law. *McGill International Journal of Sustainable Development Law and Policy*, *11*(2), 183–218.

Emanuel, R. E., Caretta, M. A., Rivers, L., & Vasudevan, P. (2021). Natural Gas Gathering and Transmission Pipelines and Social Vulnerability in the United States. *GeoHealth*, *5*(6). https://doi.org/10.1029/2021GH000442

Environmental Justice. (n.d.). EPA: United States Environmental Protection Agency. Retrieved April 17, 2023. https://www.epa.gov/environmentaljustice.

Fee to Trust Land Acquisitions. (n.d.). Bureau of Indian Affairs. Retrieved February 14, 2023, from https://www.bia.gov/bia/ots/fee-to-trust

FERC approves new natural gas pipeline projects to increase U.S. exports. (2022, May 24). U.S. Energy Information Administration—EIA. Retrieved September 27, 2022, from https://www.eia.gov/todayinenergy/detail.php?id=52478

Fixico, D. L. (2012). *Bureau of Indian Affairs*. ABC-CLIO.

Fixico, D. L. (n.d.). *American Indians | The Encyclopedia of Oklahoma History and Culture*. Oklahoma Historical Society. Retrieved February 21, 2023, from https://www.okhistory.org/publications/enc/entry?entryname=AMERICAN%20INDIANS

Fluid Mineral Estate Procedural Handbook. (2012, July). Department of Interior: Bureau of Indian Affairs. Retrieved October 11, 2022.

Gopalakrishnan, S., & Klaiber, H. A. (2014). Is the Shale Energy Boom a Bust for Nearby Residents? Evidence from Housing Values in Pennsylvania. *American Journal of Agricultural Economics*, *96*(1), 43–66. https://doi.org/10.1093/ajae/aat065

Haggerty, J., Gude, P. H., Delorey, M., & Rasker, R. (2014). Long-term effects of income specialization in oil and gas extraction: The U.S. West, 1980–2011. *Energy Economics*, *45*, 186–195. https://doi.org/10.1016/j.eneco.2014.06.020

Hill, E. L., & Ma, L. (2022). Drinking water, fracking, and infant health. *Journal of Health Economics*, *82*, 102595. https://doi.org/10.1016/j.jhealeco.2022.102595

Hill, E. L., & Ma, L. (2017). Shale Gas Development and Drinking Water Quality. *American Economic Review*, *107*(5), 522–525. https://doi.org/10.1257/aer.p20171133

Hirsch, J. K., Bryant Smalley, K., Selby-Nelson, E. M., Hamel-Lambert, J. M., Rosmann, M. R., Barnes, T. A., Abrahamson, D., Meit, S. S., GreyWolf, I., Beckmann, S., & LaFromboise, T. (2018). Psychosocial Impact of Fracking: A Review of the Literature on the Mental Health Consequences of Hydraulic Fracturing. *International Journal of Mental Health and Addiction*, *16*(1), 1–15. https://doi.org/10.1007/s11469-017-9792-5

Bureau of Indian Affairs (BIA). (n.d.). U.S. Department of Interior: Indian Affairs. Retrieved April 3, 2023. https://www.bia.gov/bia.

Hook, M. J. (1997). Approving Communitization Agreements Covering Native American Lands. *Natural Resources & Environment*, *11*(3), 14–19.

Housing Price Index Frequently Asked Questions. (n.d.). Federal Housing Finance Agency. Retrieved February 27, 2023, from https://www.fhfa.gov/Media/PublicAffairs/Pages/House-Price-Index-Frequently-Asked-Questions.aspx

Hoy, K. A., Kelsey, T. W., & Shields, M. (2017) An Economic Impact Report of Shale Gas Extraction in Pennsylvania with Stricter Assumptions. *Ecological Economics*, *138*, 178–185. https://doi.org/10.1016/j.ecolecon.2017.03.037.

Humphries, M. (2016, June 22). *U.S. Crude Oil and Natural Gas Production in Federal and Nonfederal Areas*. Congressional Research Service, R42432.

Interior Department Announces Significantly Reformed Onshore Oil and Gas Lease Sales. (2022, April 15). U.S. Department of Interior. https://www.doi.gov/pressreleases/interior-department-announces-significantly-reformed-onshore-oil-and-gas-lease-sales

Jackson, R. B., Vengosh, A., Carey, J. W., Davies, R. J., Darrah, T. H., O'Sullivan, F., & Pétron, G. (2014). The Environmental Costs and Benefits of Fracking. *Annual Review*

of Environment and Resources, *39*(1), 327–362. https://doi.org/10.1146/annurev-environ-031113-144051

Jacquet, J. B. (2014). Review of Risks to Communities from Shale Energy Development. *Environmental Science & Technology*, *48*(15), 8321–8333. https://doi.org/10.1021/es404647x

Jellicoe, M., & Delgado, M. S. (2015). Quantifying the Risks of Underground Natural Gas Storage. *Agricultural and Resource Economics Review, Northeastern Agricultural and Resource Economics Association*, *44*(2), 1-24. http://doi.org/10.22004/ag.econ.207740

Johnston, J. E., Lim, E., & Roh, H. (2017). Impact of Upstream Oil Extraction and Environmental Public Health: A Review of the Evidence. *Science of the Total Environment, 657*, 187-199. https://doi.org/10.1016/j.scitotenv.2018.11.483

Jones, J., & Bradshaw, B. (2015). Addressing Historical Impacts Through Impact and Benefit Agreements and Health Impact Assessment: Why it Matters for Indigenous Well-Being. *The Northern Review*, *41*. 81-109.

Keating, J. (2020). Teaching Human Dignity: The Assimilation, Removal, and Elimination of Native Americans. *McGrath Institute for Church Life, University of Notre Dame*.

Ladd, A. E. (2014). Environmental Disputes and Opportunity-Threat Impacts Surrounding Natural Gas Fracking in Louisiana. *Social Currents*, *1*(3), 293–311. https://doi.org/10.1177/2329496514540132

Leshy, J. D. (2010). Federal Lands in the Twenty-First Century. *Natural Resources Journal*, *50*(1), 111–137.

Lewis, E. (2019). Patchwork Policies, Spillovers, and the Search for Oil and Gas. *American Economic Journal: Economic Policy*, *11*(1), 380–405.

Major Pipeline Projects Pending. Federal Energy Regulatory Commission—FERC. (2022). Retrieved September 27, 2022, from https://www.ferc.gov/industries-data/natural-gas/major-pipeline-projects-pending

Marsh, R. L. (1996). Secretarial Discretion in Communization of Indian Oil and Gas Leases: The Tenth Circuit Speaks with a Forked Tongue. *Tulsa Law Journal*, *32*(23).

Meredith, H. (n.d.) *Caddo (Kadohadacho) | The Encyclopedia of Oklahoma History and Culture*. Oklahoma Historical Society. Retrieved February 19, 2023, from https://www.okhistory.org/publications/enc/entry.php?entry=CA003

Michaud, M. (2017, April 22). *Study Links Fracking, Drinking Water Pollution, and Infant Health*. URMC Newsroom. Retrieved December 7, 2022, from

https://www.urmc.rochester.edu/news/story/study-links-fracking-drinking-water-pollution-and-infant-heath

Mohai, P., Pellow, D., & Roberts, J. T. (2009). Environmental Justice. *Annual Review of Environment and Resources*, *34*(1), 405–430. https://doi.org/10.1146/annurev-environ-082508-094348

Murray, K. E. (2013). State-Scale Perspective on Water Use and Production Associated with Oil and Gas Operations, Oklahoma, U.S. *Environmental Science & Technology*, *47*(9), 4918–4925. https://doi.org/10.1021/es4000593

National Timeline. (n.d.). Bureau of Land Management. Retrieved October 4, 2022, from https://www.blm.gov/about/history/timeline

Oklahoma State Profile and Energy Estimates. (2022, May 19). U.S. Energy Information Administration—EIA. Retrieved September 27, 2022, from https://www.eia.gov/state/?sid=OK#tabs-3

Parfomak, P. W., Pirog, R., Luther, L., & Vann, A. (2013, December 2). *Keystone XL Pipeline Project: Key Issues*. Congressional Research Service, R41668.

Paylor, A. (2017). The social–economic impact of shale gas extraction: A global perspective. *Third World Quarterly*, *38*(2), 340–355. https://doi.org/10.1080/01436597.2016.1153420

Perry, S. L. (2013). Using Ethnography to Monitor the Community Health Implications of Onshore Unconventional Oil and Gas Developments: Examples from Pennsylvania's Marcellus Shale. *New Solutions: A Journal of Environmental and Occupational Health Policy*, *23*(1), 33–53. https://doi.org/10.2190/NS.23.1.d

Ratledge, N., Zachary, L., & Huntley, C. (2022). Emissions from fossil fuels produced on US federal lands and waters present opportunities for climate mitigation. *Climatic Change*, *171*(1), 11. https://doi.org/10.1007/s10584-021-03302-x

Re-engineered Communitization Agreement Approval Process. Bureau of Land Management. (2015). Retrieved October 14, 2022, from https://www.blm.gov/policy/im-2015-124

Rising, L. K. (1988). The Federal Onshore Oil and Gas Leasing and Reform Act of 1987. *Natural Resources Law Center, University of Colorado School of Law.*

Royster, J. V. (1993). Mineral Development in Indian Country: The Evolution of Tribal Control over Mineral Resources. *Tulsa Law Journal*, *29*.

Ryser, L., Markey, S., Manson, D., & Halseth, G. (2014). From Boom and Bust to Regional Waves: Development Patterns in the Peace River Region, British Columbia. *Journal of*

Rural and Community Development, *9*(1), Article 1. https://journals.brandonu.ca/jrcd/article/view/837

Saunders, P. J., McCoy, D., Goldstein, R., Saunders, A. T., & Munroe, A. (2018). A review of the public health impacts of unconventional natural gas development. *Environmental Geochemistry and Health*, *40*(1), 1–57. https://doi.org/10.1007/s10653-016-9898-x

Shonkoff, S. B. C., Hays, J., & Finkel, M. L. (2014). Environmental Public Health Dimensions of Shale and Tight Gas Development. *Environmental Health Perspectives*, *122*(8), 787–795. https://doi.org/10.1289/ehp.1307866

Stretesky, P. B., Long, M. A., McKie, R. E., & Aryee, F. A. (2018). Does oil and gas development increase crime within UK local authorities? *The Extractive Industries and Society*, *5*(3), 356–365. https://doi.org/10.1016/j.exis.2018.03.006

Tarrow, S. (2010). The Strategy of Paired Comparison: Toward a Theory of Practice. *Comparative Political Studies*, *43*(2), 230–259. https://doi.org/10.1177/0010414009350044

Totenberg, N. (2022, June 29). Supreme Court hands defeat to Native American Tribes in Oklahoma. *NPR*. https://www.npr.org/2022/06/29/1108717407/supreme-court-narrows-native-americans-oklahoma

Tribal Consultations for Oil and Gas Leasing Handbook. (2020, September). Bureau of Land Management: Colorado State Office.

Vickery, J., & Hunter, L. M. (2016). Native Americans: Where in Environmental Justice Research? *Society & Natural Resources*, *29*(1), 36–52. https://doi.org/10.1080/08941920.2015.1045644

Vincent, C. H., Bermejo, L. F., & Hanson, L. A. (2020, February 21). *Federal Land Ownership: Overview and Data*. Congressional Research Service, R42346

Weber, B. A., Geigle, J., & Barkdull, C. (2014). Rural North Dakota's Oil Boom and Its Impact on Social Services. *Social Work*, *59*(1), 62–72. https://doi.org/10.1093/sw/swt068

Weber, J. G. (2012). The effects of a natural gas boom on employment and income in Colorado, Texas, and Wyoming. *Energy Economics*, *34*(5), 1580–1588. https://doi.org/10.1016/j.eneco.2011.11.013

Whyte, K. (2019). The Dakota Access Pipeline, Environmental Injustice, and US Settler Colonialism. In C. Miller and J. Crane (Eds.), *The Nature of Hope: Grassroots Organizing, Environmental Justice, and Political Change* (pp. 320–337). University Press of Colorado. https://doi.org/10.5876/9781607328483.c015

Witter, R. Z., McKenzie, L., Stinson, K. E., Scott, K., Newman, L. S., & Adgate, J. (2013). The Use of Health Impact Assessment for a Community Undergoing Natural Gas Development. *American Journal of Public Health*, *103*(6), 1002–1010. https://doi.org/10.2105/AJPH.2012.301017

Zimmerman, W. (1957). The Role of the Bureau of Indian Affairs Since 1933. *The Annals of the American Academy of Political and Social Science*, *311*(1), 31–40. https://doi.org/10.1177/000271625731100105

Data Sources

Bureau of Economic Analysis: Local Area Personal Income. (2022, November 16). Retrieved December 8, 2022, from https://www.bea.gov/data/income-saving/personal-income-county-metro-and-other-areas.

Bureau of Indian Affairs Land Area Totals for US Native Lands for 2019 (2019). Native Land Information System. Retrieved December 7, 2022, from https://nativeland.info/blog/dashboard/land-area-totals-for-us-native-lands/

CPI Inflation Calculator. (n.d.). U.S. Bureau of Labor Statistics. Retrieved December 11, 2022, from https://www.bls.gov/data/inflation_calculator.htm

House Price Index Datasets (n.d.). Federal Housing Finance Agency. Retrieved December 8, 2022, from https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx

Index of /programs-surveys/popest/datasets. (2017). U.S. Census Bureau. Retrieved January 17, 2023, from https://www2.census.gov/programs-surveys/popest/datasets/

Oklahoma State Energy Profile. (2022, May 19). U.S. Energy Information Administration—EIA. Retrieved February 13, 2023, from https://www.eia.gov/state/print.php?sid=OK

Data Commons. (n.d.). Timelines Explorer. Retrieved January 17, 2023, from https://datacommons.org/tools/timeline.

United States Mortality Rates by County 1980-2014. (2022, March 12). IHME: GHDx. Retrieved November 30, 2022, from https://ghdx.healthdata.org/record/ihme-data/united-states-mortality-rates-county-1980-2014

U.S. Census Bureau QuickFacts: Blaine County, Oklahoma. (n.d.). Retrieved December 1, 2022, from https://www.census.gov/quickfacts/blainecountyoklahoma

County-level Oil and Gas Production in the U.S. (2014, April 8). U.S. Department of Agriculture: Economic Research Service. Retrieved December 13, 2022, from https://www.ers.usda.gov/data-products/county-level-oil-and-gas-production-in-the-us/

Spears, N. M. (2022, March 7). *Oklahoma, tribes tension compared to western states*. ICT News. https://ictnews.org/news/oklahoma-tribes-tension-compared-to-western-states

Villamil, J. A. (1992, April 22). *1990 Census of Population: American Indian and Alaska Native Areas*. U.S. Census Bureau. Retrieved January 17, 2023.