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Diné-centered Research Reframes the Gold King Mine Spill: Understanding Social and Spiritual Impacts Across Space and Time

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Abstract

This paper explores how Indigenous-led research reframes the impacts and response to environmental disasters in the context of acid mine spills in rural communities of the Southwest United States. The collaborative research project addressing the Gold King Mine Spill (GKMS) designed qualitative methodologies that center Indigenous worldviews and contribute to broader understandings of environmental justice. The research team, led by Diné scholars and community leaders, gathered qualitative responses from 123 adult participants in twelve focus groups from three rural communities on the Navajo Nation. The project incorporated fluent Diné speakers and

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cultural consultants to lead focus groups in a manner consistent with cultural worldviews. The analysis of the focus group data resulted in original findings that reframe previous understandings of environmental harm by broadening the boundaries to include: 1) social relations across time; 2) social relations across space; 3) spiritual relations; and 4) restoring balance. The findings allow for greater insight into the colonial context of disaster on rural and Indigenous lands and confronts colonial-rooted disasters through Indigenous-informed political action.

Keywords

Diné; Gold King Mine Spill; Indigenous Environmental Justice; Navajo Nation; Relational Identities; Settler Colonialism

Introduction

The Gold King Mine was breached on August 5, 2015 sending a bright yellow plume of three million gallons of acid mine drainage downstream into the Animas River (Colorado, United States). The visual impact of the Gold King Mine Spill (GKMS) shocked watershed residents as the pollution drifted through the communities of Durango, Colorado; Farmington, New Mexico; and through Navajo communities along the San Juan River. Shortly after the GKMS, Diné[i] (Navajo) farmers were notified that the irrigation water for their crops and animals would be shut off due to uncertain water quality. Diné farms located along the San Juan River in Northern Navajo Agency rely on the San Juan River for irrigation water. This region is considered the ”bread basket” of the Navajo Nation and farming and ranching are the main livelihoods for Diné farmers. The crops produced are sold, used for family consumption and for cultural and ceremonial events. In addition to tangible losses of food and livelihoods, GKMS resulted in deep social, cultural, and spiritual relations that exist within the San Juan River system.

The Navajo Nation is the largest tribe in the United States (US), with approximately 330,000 Diné citizens (Navajo Nation Profile). The Navajo Nation also has the largest land base with 25,000 square miles of remote terrain in Arizona, New Mexico, and Utah that is approximately the size of the state of West Virginia, United States. The San Juan is sacred to the Diné people and represents the male river. Ornelas et al (2021) found that Diné people have over 40 different activities associated with the use of the San Juan River in the following categories: recreational, livelihood, cultural and spiritual, dietary, and arts/crafts. The Animas-San Juan River system is central to Diné identity and worldviews.

Clausen et al. (2021) demonstrated that social impacts of the GKMS to Diné communities were different than upstream non-Diné communities based on the political economy and worldviews of the respective regions. The varying social impacts of the GKMS river pollution event is a poignant example of environmental inequality within rural communities. Environmental inequality is the uneven exposure to environmental risks and hazards, and

[1)]The name “Navajo” has its origins in the period of Spanish colonization; however, the preferred term of self-identification, Diné, will be used in this paper to describe individuals accordingly. It should be noted that the Navajo Nation is the official name of the sovereign entity of which Diné are members, therefore Navajo Nation will be called as such.

is intertwined with other inequalities that permeate rural Indigenous peoples' lives. These differential disaster impacts "are largely a function of the power relations (class, age, gender and ethnicity among others) operative in every society" (Bankoff 2006). In the case of the GKMS, the acid mine drainage contamination had different social and cultural impacts to Indigenous and non-Indigenous communities in the region based on the socio-economic and political structures of the communities, and importantly, the varying ways of relating to the natural world. The economic impacts to tourism and commercial agriculture were short-term, and largely forgotten by the next season. In contrast, the impacts to Diné have persisted for years after the GKMS.

Responses gathered from public testimony in part prompted the need for in-depth, qualitative research to further study social, emotional, and spiritual impacts of the GKMS to Diné community members. An interdisciplinary team of Indigenous scholars responded to this need by forming the collaborative Gold King Mine Spill - Diné Exposure Project (GKMS-DEP). The GKMS-DEP used a traditional Diné worldview to design a culturally anchored qualitative study to understand the impacts of GKMS on Diné communities (Teufel-Shone et al. 2021). The implications of the original findings extend beyond this particular event and help reframe understandings of the colonial context of disaster.

Theoretical Frameworks: Settler Colonial Context and Relational Identities

As environmental inequality on Indigenous lands persists, so too do the movements and uprisings by Indigenous protectors and activists to resist and challenge these violations. Recent academic scholarship has responded by engaging with the interwoven theoretical frameworks of settler colonialism and relational identities to better capture the interlocking forms of oppression that connect the social and ecological harms on Indigenous lands (Curley 2019; Yazzie 2018; Whyte 2017).

Settler Colonial Context

A range of scholars have recently advanced theoretical understandings of how the US settler colonial context both created and continues to reinforce environmental injustices (i.e., Geisler 2014; Whyte 2016; Holleman 2018; Norgaard 2019; Bacon 2019). These scholars have built on the foundational work of Deloria's (1969) original analysis of colonization and Indigenous sovereignty and Wildcat's (2010) exploration of the relationship between colonization and environmental destruction. Whyte (2018) connects the historic and contemporary impacts of settler colonialism specifically to issues of Indigenous identity and ecological justice, stating, "Settler colonialism is ecological domination, committing environmental injustice against Indigenous peoples and other groups." This theoretical move provides the much-needed framework to incorporate analysis of colonialism and historical trauma into environmental disaster on Indigenous lands.

Luft (2016) applies the "beyond disaster exceptionalism" framework to help explain the impacts of a recent wildfire on the Northern Cheyenne Indian Reservation in Montana. She demonstrates how the impacts from the fire cannot be understood without acknowledging the permanent disaster of colonization for Native Americans. The crisis of colonization plays out daily for the Northern Cheyenne in the context of lack of infrastructure and

communication systems, what she terms “chronic structural devastation.” These ongoing problems exacerbated the impacts of the fire that ultimately led to the “chaotic scene” during and immediately after the event. Recent work to reclaim and relearn the use of fire as a cultural tool also acknowledges that fire suppression has been part of the ongoing process colonizing land use practices (Adlam et al. 2020).

Bacon (2019) introduces the concept of colonial ecological violence, analyzing how settler colonialism structures eco-social relations. This restructuring leads to disproportionate traumatic impacts to Indigenous peoples and communities, including violence against traditional lands and belief systems. The research stresses that colonial ecological violence is not solely a product of historic forms of genocide; it is also carried out through modern institutions of environmentalism and public education (Bacon 2019).

Relational Identities

Interwoven with the concept of settler colonial context is a nuanced understanding of Indigenous relationships within human and other-than-human communities, which we refer to as ‘relational identities.’ Scholars within Indigenous studies and other social sciences offer new, yet not so new, insight into how Indigenous identity is formed and maintained through relations with kin and the environment, and the emotional and spiritual impact that occurs when these relations are harmed. Wildcat (2009, 9) states that the human knowledge of reality “requires respect for the relationships and relatives that constitute the complexity of life.” He explains how disrupting these relations, such as from the impacts of climate change, affects human cultural development. Cajete (2016) extends this analysis to describe how this way of knowing the natural world is an integral part of Indigenous science. The human-environment relations are interconnected and interdependent, in which humans are not in hierarchical control of the land but are a part of it.

Simpson (2014) demonstrates how Indigenous relations are created and recreated through stories and learning with the land. By sharing a traditional Michi Saagiig Nishnaabeg story about how the Nishnaabeg learned to create maple sugar, Simpson (2014, 7) writes, “To me, this is what coming into wisdom within a Michi Saagiig Nishnaabe epistemology looks like – it takes place in the context of family, community and relations.” She concludes that when one learns with the land, relationships with nature are formed. This worldview is also reflected in the concept of the Three Sisters, linking biodiversity and cultural teachings with the plantings of corn, beans, and squash in Indigenous communities across North and South America (Weinberg 1994).

Norgaard and Reed (2017) further the concept of relational identities by describing the emotional impacts experienced by Karuk people in the face of declining salmon runs of the Klamath River. The Klamath River, located in southern Oregon, once supported abundant salmon populations for the Karuk, Klamath, Hoopa, and Yurok tribes. The authors document how emotions stem from the interconnected relations that exist between people and salmon both as a food source and a spiritual entity. By documenting the lived experiences and worldviews of the Karuk people the authors provide a unique approach to understanding how environmental inequality is produced through disruptions to relationships among nature; in this case, the massive decline of the salmon species from dams and

habitat loss. The authors call for including the relational and emotional identities related to environmental decline to not only better understand the impacts, but also to strengthen and decolonize the movement for environmental justice.

The concept of relational identities is now being incorporated into the broader international movement for Indigenous Environmental Justice (Indigenous Environmental Justice). Ulloa (2017) documents how Indigenous peoples' demands for environmental self-determination in Latin America have coalesced into a framework referred to as "relational Indigenous environmental justice." The concept of *buen vivir,* drawing from Indigenous knowledge systems of Latin America, embraces an alternative vision to recognize relational identities and the intrinsic value of the other-than-human world (McGregor et al. 2020). Similarly, *mino-mnaamodzawin* describes a philosophy from the Anishinaabe people of Canada that informs a new understanding of IEJ by considering the "critical importance of mutually respectful and beneficial relationships among not only peoples but all our relations" (McGregor 2020, p. 7). The relational concepts of *mino-mnaamodzawin* and *buen vivir* vastly expand the understanding of what entities and other-than-human beings are recipients of justice, leading to transformations in both the field of environmental justice and in global political arenas. For example, the Whanganui River in New Zealand is now officially recognized as having intrinsic rights, and the rights of nature have been formalized in the Ecuadorian and Bolivian constitution.

Literature Review

We reviewed findings from three previous environmental disasters that have advanced understandings of environmental injustices from Indigenous perspectives: 1) Uranium Contamination on Navajo Nation 1948–1966; 2) Exxon Valdez Oil Spill of 1989, and 3) Deepwater Horizon Oil Spill of 2010. A review of this literature shows a pattern of how rural Indigenous communities experience an unequal burden of the impacts from environmental disasters.

Uranium Mining on Navajo Nation, 1948–1966

Research on psycho-social impacts of Diné workers' intentional exposure to radiation by the US government has provided a critically important contribution to the literature on environmental inequality (Dawson et al. 1997; Markstrom & Charley 2003; Dawson & Madson 2011). The Navajo Nation endured decades of uranium mining and milling initiated by the US government, with long-term consequences to many aspects of Diné life and land. It is estimated that up to 4,000 Diné worked in the mining and milling sector between 1948–1966 under extremely dangerous conditions. These Diné uranium workers were exposed to high external radiation and radon gas, in the absence of protective measures and equipment, leading to increased rates of lung cancer and other health problems. The US government knowingly withheld information from Diné workers regarding known risks associated with uranium exposure, placing an unjust burden on not only their lives but endangering the wellbeing of their families (Dawson et al. 1997). Similarly, national media barely recognized the catastrophic dam failure that released radioactive tailings waste into the Río Puerco River and through Diné communities; an alarming silence to the largest radioactive accident in US history. Voyles (2015) uses the term "wastelanding" to describe these processes of

deeming Indigenous land as pollutable and worthless, and provides numerous examples of how uranium mining took priority over all life and wellbeing on the Navajo Nation.

Early research by Dawson et al. (1997) demonstrates how non-Indigenous health facilities were not adequately equipped to provide linguistic or cultural understanding to impacted Diné miners. They also conclude that even though compensation and remediation may address short-term issues, many uncertainties remained for the uranium victims that could only be addressed through counselling and traditional health and healing ceremonies. Markstrom and Charley (2003) continued this line of research and documented psychological impacts including bereavement, environmental loss, betrayal, depression, and fear for the future. Their research shows the prolonged duration of psychological effects due to environmental injustice. Brugge, Benally and Yazzie-Lewis (2006) provided the platform for these voices to be heard by compiling an edited volume based on the community-based interviews from the Navajo Uranium Miner Oral History and Photography Project. This collection provides an authentic expression of the lived experiences of uranium miners, their widows, and their families. Recent research demonstrates the persistence of uranium and arsenic contamination in unregulated water wells, continuing to affect the daily lives and diets of Diné people (Ingram et al. 2020; Rock et al. 2019; Hoover et al. 2017; Harmon et al. 2017). These findings reveal important understandings of how psychological impacts persist over time from one generation to the next.

Equally important in Markstrom and Charley's (2003) research is a call for culturally-specific forms of healing, outlining Diné principles, knowledge, beliefs, and communication patterns that should be considered in any psychological intervention. They recommend involvement of traditional healers who are trained to diagnose and treat metaphysical sources of imbalance as a way of restoring balance to the people and the land. Markstrom and Charley (2003) set new precedents with five decades of research, and laid a foundation for future studies to reframe ways in which research and healing is addressed in Indigenous communities.

Exxon Valdez Oil Spill, 1989

For the past 30 years, researchers have studied the sociological impacts of the Exxon Valdez Oil Spill (1989). The initial research demonstrated that environmental disasters can result in social and emotional impacts to community members, and that impacts vary by social location (Gill and Picou 1997, Picou et al., 2004). Palinkas et al. (1992) found that six months after the Exxon Valdez Oil Spill, Alaska Natives who lived near the oil spill were characterized by relatively higher levels of depression compared with Alaska Natives residing outside the spill region. Similarly, Gill and Picou (1997) found higher levels of subsistence disruption, family disruption, and personal distress in the Native Village of Eyak, the Indigenous community in the affected area.

The sociological research on the Exxon Valdez Oil Spill also explored traditional healing mechanisms for addressing harm (Picou 2000). The central concept of using Peer Listening as a community intervention strategy, rather than relying on trained professionals, emerged through a participatory research model with Alaska Native members, social scientists, and local residents. In June 1995, members of the Native Village of Eyak proposed that a

culturally acceptable intervention strategy to address social impacts of the oil spill would be to hold a "Talking Circle" devoted to the Exxon Valdez Oil Spill.[ii] The 2-day Talking Circle event (Jan 27–28, 1996) allowed for community members to share their personal stories and experiences about the impacts of the Exxon Valdez Oil Spill. After the event, the research team learned that the Talking Circle model could help people transform from disaster victims to active participants in their community's survival.

Sociologists studying the Exxon Valdez Oil Spill impacts, in partnership with Alaska Native community members, learned that a greater bond of trust could be established with peers than with professionals and/or strangers. Based on this experience, Picou (2000) extended the model of the Talking Circle to "Peer Listening Circles" as a method for communities to heal from the social impact of the disaster. In a series of workshops, community volunteers were provided basic crisis response skills: listen without judgment, validate your peer's experience, and identify as a fellow survivor. The Peer Listening Circles model proved to be effective in Cordova, Alaska, and became a model for other impacted communities to use when faced with environmental disasters.

BP Deepwater Horizon Oil Spill, 2010

The BP Deepwater Horizon Oil Spill (2010) released the largest amount of oil to date into a marine environment. Much of the sociological research that was learned from the Exxon Valdez Oil Spill of 1989 was applied to this disaster. New investigations were conducted to understand social disruptions such as post-traumatic stress disorder (Mong et al. 2012), the "layering" of acute and chronic disasters (Laska et al. 2015) and the social implications of energy sacrifice zones (Maldonado 2019). These emerging patterns in the literature allowed for more nuanced interpretations of psychological impact, and the disproportionate effects based on gender, race, ethnicity, socio-economic status, and age.

Courselle (2010) summarized findings about how the BP Deepwater Horizon disaster produced heightened threats to the Indigenous communities of the Louisiana Gulf Coast. She outlines impacts to Indigenous communities[1] stating "oil has affected revered fishing areas, and poses a risk to plants used in traditional medicines and basket weaving (Courselle 2010: 27)." Chief Thomas Dardar of the Houma Nation explained how fear of environmental contamination caused their lifestyles to change, and that this fear lingers well beyond when the scientific reports are distributed (Sullivan 2019). Chief Dardar explains, "even if the government says it's all right, history has proven to the Houma people that you still need to be leery and be careful (Sullivan 2019: 502)." The Pointe Au Chien tribe sued BP and received settlement claims over the loss of ancestral lands and fishing grounds due to the oil spill (Ferguson-Bohnee 2011). The historical context, alongside future threats of climate change, combine to create long-standing anxieties and changes within the Indigenous cultures of Gulf Coast region.

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2)The traditional model of "Talking Circles" are not unique to Alaska Native culture, and are used by Native peoples for a variety of social activities.

[1]Pointe-au-Chien Indian Tribe, Grand Bayou Indian Village (Atakapa-Ishak/Chawasha), Isle de Jean Charles Biloxi-Chitimacha-Choctaw Indians of Louisiana, Grand Caillou/Dulac Band of Biloxi-Chitimacha-Choctaw, Bayou Lafourche Band of Biloxi-Chitimacha-Choctaw, United Houma Nation

Picou (2011) describes how the Peer Listening strategies learned from the Exxon Valdez Oil Spill were scaled up and applied to multiple Gulf Coast communities in an attempt to reduce community and mental health problems. In 2010, practitioners trained 600 Peer Listeners across the Gulf Coast region. Additionally, networks of support were built between representatives of Alaska affected by the Exxon Valdez Oil Spill and their counterparts in Gulf Coast residents. This approach represents a significant expansion of previous methods of addressing harm used during the Exxon Valdez Oil Spill, advancing healing strategies for Indigenous and subsistence-based communities.

This literature review provides a foundational understanding of the unique ways in which environmental disaster impacts Indigenous communities differently than non-Indigenous communities, often creating unique and unequal burdens to rural livelihoods and traditions. Manson (2005) explains the particular ways that mental health issues are manifested in Native American communities, demonstrating that the backdrop of intergenerational trauma heightens Native people's susceptibility and potential vulnerability to the consequences of other forms of stressors, such as environmental disaster. Maria Yellow Horse Braveheart et al. (2011) outline the ways in which any clinical considerations must include the emotional responses to the collective trauma and losses experiences by Indigenous peoples, often passed through generations. Finally, Begay (2012) builds upon this research to demonstrate how historical trauma is linked to contemporary health conditions of Indigenous people. This foundational literature contributes to the development of theoretical frameworks to explain larger patterns of environmental injustice within rural Indigenous communities. To further understand these varied and complex dimensions, culturally anchored research methods are required.

Methodology: By Diné, For Diné

In her influential work, Linda Tuhiwai Smith explains that the process of reframing is a crucial component of decolonizing research methodologies. Smith (2012, 154) states, "The framing of an issue is about making decisions about its parameters, about what is in the foreground, what is in the background, and what shadings or complexities exist within the frame." The community participants active in the GKMS-DEP initiated a new process of reframing environmental harm by first deciding that the parameters of the research should include not only biophysical and psychological indicators but also social, cultural, and spiritual impacts of the GKMS event on Indigenous community wellbeing. In this way, the GKMS-DEP team made deliberate decisions to define research parameters that were meaningful to Diné communities. These social parameters are not easy to measure, and are often excluded from research with communities impacted by natural disasters. Deloria (1999, 44) explains, "Thus most emotional experiences of human beings are discarded as unsuitable for the scientific enterprise, or are pushed to the periphery of respectability and grudgingly given a bit of status." Yet these individual and community relationships are the crucial component of what Smith (2012) refers to as the "shadings and complexities [that] exist within the frame."

Research methods were aligned with Diné worldview and blended with western science protocols using the Two-Eyed Seeing approach. Two-Eyed Seeing embraces the

contributions of Indigenous and non-Indigenous systems of inquiry (Martin 2012). Below we summarize examples of how the Two-Eyed Seeing approach and the culturally anchored research methods (for more specific details, see Teufel-Shone et al. 2021).

The research team organized twelve focus groups in three rural Diné communities impacted by the GKMS from 2015–2016 (see Figure 1). All focus groups were conducted in culturally-familiar, local chapter houses. The use of focus groups provides a platform for community members to come together and share their perspectives and experiences, much in the same way that the Talking Circles provided an outlet for community members in Alaska after the Exxon Valdez Oil Spill. A total of 123 Diné adults participated in the focus groups, which were organized around a series of open-ended questions. The questions were framed based on concerns raised during Navajo farming meetings, conversations with Navajo leaders and community partners. Diné researchers documented community members' physical and cultural relationships with the San Juan River before and after the GKMS, and their thoughts about the future of the river. Sample questions included: 1) How were you using the water before the Gold King Mine Spill? 2) Do you have any cultural concerns regarding coming into contact with the San Juan River after the GKMS? and 3) What would you like to see for the San Juan River into the future? Focus groups varied from 90–200 minutes. Each focus group was audio recorded, with non-verbal observations recorded by note-takers.

Fluent Diné speakers facilitated the focus groups and began each session with a cultural practice of identifying matrilineal and patrilineal clans, establishing kinship between participants. The facilitator then offered an opening prayer and invited introductions from the participants. English and Diné languages were used interchangeable by participants throughout the focus groups and translation was provided throughout the conversation. Diné cultural consultants were hired to do all translation and transcription of Diné responses so that cultural context was included.

Non-Diné researchers collaborated with the Indigenous-led research team by coding and analyzing the transcripts. The qualitative analysis team was made of 6 Diné and 3 non-Diné coders from a range of disciplines. Qualitative data analysis using NVivo software and consensus-based coding resulted in a codebook for identifying principal themes that emerged from participant data. Pairs of coders were assigned to each transcript to independently code, then the pair would meet to discuss and reach consensus on the themes that aligned with the codebook. Each coding pair had one Diné coder to ensure that all cultural context was taken into consideration. Additionally, team members employed content analysis of 20 regional media sources within one month after the GKMS to gain context for the qualitative responses gathered during focus groups.

Preliminary results were presented to the Diné Hataalii Association (DHA), an organization made of over 200 Diné spiritual leaders and traditional practitioners. The DHA provided feedback on how to center the research findings within the Diné traditional worldview. The research results were reported back to the local chapter houses of each community during in-person presentations. Results were also made available online as well as through radio

programming for households without internet. In these ways, the sharing of the data was also performed in a manner consistent with Diné worldviews and lived realities.

Results and Discussion: Broadening Understandings of Harm and Healing

Content analysis of media sources demonstrated that Indigenous perspectives of and experiences with the GKMS were not adequately represented in mainstream news outlets. Within one month of the GKMS, we found significant differences in how the mainstream media and Indigenous-owned media reported on the GKMS. Only three out of the ten national sources referenced Indigenous people. In comparison, nine out of the ten Indigenous sources mentioned impacts to Diné people and often cited emotional impacts The finding that only three of the ten mainstream sources referenced the Indigenous community is an indicator of the continued inequities and erasures of environmental disasters on Indigenous rural lands. This finding highlighted the need for in-depth, Indigenous-led research to further understand the impacts of the GKMS. The analysis of focus group data resulted in four key themes: 1) harm to social relations across time; 2) harm to social relations across space; 3) harm to spiritual relations; and 4) restoring balance.

Result #1: Harm to Social Relations across Time

Qualitative findings from the GKMS-DEP focus groups demonstrated that, for the Diné participants, the harm to social relationships is experienced as a continuum of historic events and future risks. The Diné experiences of harm to current social relations and community wellbeing could often only be understood in relation to previous historical traumas. The most poignant examples came from the many participants who referenced the 1948–1966 uranium contamination as a context for how they experience and understand the GKMS contamination. One participant shared:

> We’re still dealing with the uranium. I can identify so many in my own family that got cancer. Some were lucky to survive but others didn’t. So now that causes my anxiety [about GKMS], I’m not going to farm anymore.

The loss and grief over losing family members to a historical injustice that occurred decades before on the Navajo Nation influences how participants relate to and make decisions about the GKMS. The decision to not farm has significant consequences to livelihood, culture, mental health, and current social relations within families. The quote above shows that this difficult decision was based on the disruption to social relations from previous incidents of environmental injustice. In addition to uranium, other participants referenced uncertainties about river health before the GKMS (including industrial dumping and human waste) as part of their concerns, again linking past events to impacts from the current contamination. The GKMS was seen as a continuation of a long pattern of environmental abuse to the land and waters of the Navajo Nation overlaid on a history of historical trauma.

The ability to feel social harm based on concern for future relationships was also clearly evident in the responses from many Diné participants. This sentiment often came in the form of intergenerational impacts from the loss of farming. In the following quote, the participant shares his experience by referencing four different generational time periods:

> Growing up I worked on my grandpa's farm. Now I'm 60 years old and I've always worked on it. I enjoyed farming before all this happened [GKMS] and now afterwards it's really affected me. The main thing that affected me was especially for my grandkids. When the water is contaminated what's going to happen to grandkids?

The concern for grandkids comes, in part, from the way in which farming serves a path to teaching cultural values and life lessons. To stop farming means to stop the flow of knowledge that comes through generations of agricultural practices. One participant explained, "We have little ones and there is a lot of teaching in farming. To wake up early and work. We don't have that and can't pass it on right now. That's what they need. It's a setback." The "setback" is felt not only in the present moment, but also in the ongoing process of life teachings that helps instill future values. Past historical traumas influence the psycho-social impacts of the present, which in turn are influenced by the how Diné perceive future, intergenerational relations.

Result #2: Harm to Social Relations across Space

The Diné participant responses introduce an Indigenous perspective of how the impacts to social relations can extend beyond the geographic borders of the disaster. Participants explained how the GKMS contamination caused harm to relations with other Diné communities from distant parts of the Navajo Nation. This damage was due to the responsibility that the farmers feel to providing sustenance and traditional foods for the good of the whole Diné population. One farmer explained how his concern extended to relations with other people outside his community:

> Not only concerned for the kids, I'm concerned about every person and every Navajo out there on the reservation. I sell my crops. I sell squash. I sell fresh corn, fresh steam corn, and dry corn. I'm concerned, I'm worried about poisoning my people out there on the reservation. That's what my concern is.

The impacts are felt far beyond the scope of the people living near the GKMS, and rupture relationships built on trust and reciprocity. Again, in the following quote, we see how the harm to social relations is felt by other Diné members who rely on the farming regions for self-dependency:

> A lot of those people in the middle of the reservation, they don't have what we have here in Shiprock, running water, water flowing through. They don't have that out there. So they look to us when they buy hay and food. When we sell, they look to us. Now they can't. They depend more and more on grocery store, more and more to put us on food stamps, more and more depending on something else instead of becoming self-dependent.

The experiences of Diné community members demonstrate that harm arises not only from impacts to social relations within the affected community, but also to extended networks of people that relate to one another through reciprocity and shared responsibility throughout the extensive region of the Navajo Nation. There is no clear way to draw a geographic line around the area of "impact" when considering the multiple ways that social relationships extend through Indigenous families, communities, and clans.

Cohen et al. (2019) recently hypothesized that hydro-social relations can change over spatial and temporal dimensions, specifically on Indigenous lands. These changing relations can be seen in the case of industrial pollutants poisoning the water and fish used by the St. Regis Mohawk Tribe, located on what is now the border of New York and Canada along the St. Lawrence River. The authors describe how Mohawk tribal members "emphasize not just water quality as determined by measurement and assessment of water in a particular place at a particular time, but by the level of disruption in the moral relationships that create the fabric of Mohawk societies" (Cohen at al 2019, 3). The responses from the Diné focus groups align with this hypothesis of hydro-spatial temporality by showing how the "fabric" of Diné socio-cultural relationships were affected across time and space. The settler colonial context of the US shapes the ways in which these socio-cultural relationships were harmed over time, given the historical trauma and injustices of genocide, displacement, abuses, and erasure that have intergenerational consequences. Specifically, the Diné participants noted how their perceptions of the current GKMS were directly related to previous environmental abuses by the US federal government in the case of uranium contamination.

Result #3: Harm to Spiritual Relations

Like many Indigenous people, the Diné have a deep and spiritual connection to all elements of the natural world through their culture, traditions, livelihood, and beliefs. To the Diné, all beings are relatives and based on *K'é* – kinship unity through positive values to include respect for all in the promotion of goodwill, peace, positive relationship, and solidarity (Austin 2009). Each being is infused with its own spirit, or 'inner form', which gives it life, a set of relational responsibilities, and purpose within an orderly and interconnected universe. This way of thinking about the orderly and connected world creates enduring bonds and connections. These principles allow for harmonious coexistence, which maintains balance in nature and social groups. *K'é* – a key philosophical concept that underlies traditional Diné culture – is an attribute of *Hózhó* – the state of harmony, peace, beauty, wellness, and balance with all (Kahn-John 2010). *Hózhó* reflects the process, the path, or journey by which an individual strives toward and attains this state of wellness (Kahn-John and Koithan 2015). The purpose of Diné life is to maintain balance and respect between the individual and the universe and to live in harmony and beauty with nature, the social milieu of family and community, and the Holy Ones (Schenk 1988). When the negative overtakes the positive, imbalance arises and can manifest into physical, spiritual, and emotional illness. For example, one participant described river health and illness in the following way:

> Water is life as well as Mother Earth, atmosphere, stars, moon, mountains. The river, the water, it is a concern and it is contaminated. When you look at the river you think "Why? Why are you contaminated", you ask the river. It says there's nothing wrong with me, I've been here, many years ago before life I was here. It's the human technology that is digging for that other stuff that's sacred too. Who put that stuff there? We, Holy People, put it on the Earth. But technology pulled it out, unraveled when it came up. When you look at the river, it says it's not me, I'm just like you my child. You're having a hard time, maybe it's your hearing, it's your sight, your health. My body is that way now…Listen to the water, it talks. It whistles. That's the water way.

The participant described the river as having a life “just like you” demonstrating the ways in which spiritual relations connect human and non-human beings. There is nothing intrinsically “wrong” with the river; rather, it is the external forces such as technological disasters that cause the sickness. To the Diné, there are masculine and feminine essences in all things above, below and around them. They exist in the essential elements of life; water, land, earth (pollen) and air. If one of these elements is disrupted and out of balance, the remaining are also affected – hence, the interconnectedness of life physically and spiritually (Hataalii Lorenzo Max, personal communication, June 17, 2020). Just as a person can become sick from being out of balance, so too does the river have illness from an imbalance between social and natural systems. The “water way” is to show the imbalances in the relationships between humans and society through impacts like water contamination.

This finding can be extended to the experiences of Indigenous communities around the world that have been impacted by mining disasters. For example, the 2019 dam rupture in Brumadinho, Brazil released 13 million metric tons of iron ore tailings, polluting the Paraopeba River and killing 259 people. This catastrophe not only led to ecological and personal loss, but according to a Chief of an Indigenous nearby community, it was like “a piece of our body was cut off.” For the Pataxó-Hã-hã-hãe Indigenous people, “the river is not only what Western thinking understands as nature, but also a part of themselves – the watercourse is a life course” (Brandão et al. 2021). The loss of a spiritual connection to a river, or any other non-human element, must be recognized as a significant harm alongside physical and economic losses.

In addition to harming the spiritual balance – *hózhó* - of the river, participants also described disruption to spiritual practices that involve the plants and water of the river system. Two Diné participants offered examples of specific ceremonies that could no longer be practiced due to the fear of water contamination:

> Before the Spill, we did grow corn for ceremonies. White corn, yellow corn, *tádídíín*. [pollen]. People would come out here and buy corn pollen for their ceremonies. Corn pollen was the main thing they came out for. Before it was like that but now it’s different.
>
> Years back, I would see medicine men have sweat house right next to the river, they would have ceremony, *tácheeh*, and wash themselves in the river. Now I don’t see nobody doing that because of the river [spill].

Tádídíín (corn pollen) and *tácheeh* (sweat lodge) are integral to the practices of Diné spiritual beliefs in the restoration of harmony and balance, the Beauty Way (Hataalii Lorenzo Max, personal communication, June 17, 2020). Having to halt the use of *tádídíín* produced from corn grown in the affected area and *tácheeh* in cultural practices due to environmental contamination was a violation of sovereignty and an unjust burden to Indigenous communities. The harm to spiritual relations cannot be quantified in Western analysis, yet it represents a critical from of environmental injustice that must be acknowledged.

Result #4: Restoring Balance

A final finding that emerged from the Diné participant responses was the emphasis placed on healing. For the Diné, there can be no greater assault than the violative disruption of a community's harmonious state of being. A community is hindered in moving forward effectively and efficiently when the communal sense of *hózhó* is put into disarray. Grandparents and parents are egregiously challenged in educating and guiding their children. Families struggle to stay united and strong to withstand challenges that arise. Without corrective actions, disharmony can bring about undue mental anguish, stress, illness, domestic violence, stigmatization, substance abuse, and death. When any form of harm has been experienced, a Diné person may seek traditional healing to restore harmony and balance. The participants' experiences resonated with this central belief, as many comments about the impacts of the GKMS simultaneously discussed how to address the harm in a culturally-relevant manner. Participants suggested ways of restoring harmony and balance in the following:

> Recently I visited an 80 plus year-old paternal aunt. We kind of [had] a discussion on this water situation. After updating her on the situation, she responded by saying: "the people and the leaders are not concern about our spirituality. Water is sacred and they should do some spiritual offering so we can start using the water again".

> [Diné language] Looking to the government to offer an official apology. Words of healing is what we want to hear first and foremost. We the Navajo people honor our words. They shouldn't let to be. Even though financial compensation is in order, but money is only temporary. Yes, funding will be welcome to fix up as much damage as possible but spirituality needs to be included, depending on the healing process they want. [English language] According to their belief. [Diné language] Because we all have different faith. Some of us have livestock and we would like to have ceremonies performed for them to give the healing herbs and healing tobacco. [English language] I know they won't understand that. [Diné language]: That's my thoughts [English language] A spiritual intervention.

Use of language, spiritual offerings, and healing ceremonies were highlighted as ways of restoring *hózhó*, in addition to the financial importance of monetary compensation or legal awards. These suggestions were reported back to Diné community leaders to emphasize the need for future healing practices.

The four key themes that emerged from the community focus groups represent new ways of framing the impacts of the GKMS spill based on Diné perspectives and worldviews. It is important to recognize that the emotional toll of environmental disaster is not unique to Indigenous communities. Our findings align with the broader field of emotional geographies, highlighting how emotions are produced in relation between and among people and environments (Bondi et al. 2005; Sultana 2010). For example, Little (2012) documents how non-Indigenous community members living with toxic mitigation in their homes express feelings of angst, frustration, and lingering uncertainty, resulting in an embodied pollution experience. Similarly, Du Bray et al. (2017) explain how three distinct settler communities each express feelings of sadness and worry at the possible outcomes

of climate change, even among climate skeptics, indicating high emotional awareness connected to environmental disruption. Finally, these emotional impacts extend to the ways in which communities enact the ethical practice of care after an environmental disaster, such as toxic contamination, as "a generative way of making knowable and actionable their expectations and sufferings" (Tironi and Rodréguez-Giral 2017, p. 91). Each of these cases present ways in which non-quantifiable emotions are experienced and enacted in settler communities impacted by pollution and toxic contamination. Our findings contribute to the literature of emotional geographies by highlighting the specific ways in which impacted Diné communities experience harm to social and spiritual aspects of life that are unique to their interconnected conceptions of time and space.

Conclusion

Given the increased likelihood of continued environmental disruption on rural Indigenous lands, it is crucial that voices and experiences of impacted Diné communities contribute to the expanding field of Indigenous Environmental Justice. The GKMS-DEP presents a clear example of how an Indigenous-led research team can offer new ways of designing, practicing, implementing, and analyzing the problems of environmental injustice as well giving voice to the desire for alternative forms of healing beyond monetary compensation. Diné participants shared many examples of how the contamination of the San Juan River due to GKMS affected their spiritual relations with the water. These experiences and perspectives contribute to the growing Indigenous Environmental Justice literature that explores how relational identities of Indigenous people shape their connections to rivers, animals, and plants, and is critically harmed by the colonial context of environmental disruptions such as climate change, depleting salmon populations, or river contamination.

The GKMS-DEP was committed to the practice of Indigenous Environmental Justice by dedicating time and resources to sharing the authentic findings in relevant policy discussions on the Navajo Nation. In September 2018 and July 2019, GKMS-DEP hosted two Navajo Emergency Response Executive Sessions to present the research findings to elected leaders and traditional spiritual leaders of the Navajo Nation. The presentations helped inform future policy for Indigenous Community Response Plans that could extend beyond traditional Federal Emergency Management Agency (FEMA) planning models. In this way, the GKMS-DEP took an active role in working towards achieving environmental self-determination by giving voice to previously overlooked social harms, documenting the unequal impacts of a singular contamination event, and empowering both traditional systems of healing and political representation. Informed by feedback from the second Executive Session, the GKMS-DEP research team in October 2019 provided support for Diné Hataalii Association and grassroots leaders to conduct a multi-day ceremony for the river. The ceremony began with a talking circle and concluded with an offering to the water, with discussions in between about lessons learned from the spill as well as collective visions and hopes for the future.[iii]

13)Multiple aspects of the ceremony are culturally protected. Therefore, the overview description provided here is not inclusive of all components of the ceremony.

Deloria (1999, 40) adds larger context to this theme, moving beyond decolonizing research methodologies and to the ultimate goals of science itself. He states:

> The movement toward a "science of wholeness" depends in large measure on the ability of philosophers and scientific thinkers to move beyond their comfortable and presently accepted categories of arranging and interpreting data – to glimpse and grasp new unities of experience and knowledge. In order to do this, we must first ask fundamental questions about the goals of science.

The GKMS-DEP adopted a "science of wholeness" approach by including both standard indicators of water health as well as new categories of Indigenous community wellbeing. The project fundamentally shifted the methods of science by incorporating the Two-Eyed Seeing approach into culturally anchored research methods. In a review of over 60 published articles, Vickery and Hunt (2016) state that "Native American EJ [environmental justice] issues continue to challenge 'traditional' Western conceptions of science and health – a challenge that must be integrated into research approaches and understandings as well as responsive policies and programs." The GKMS-DEP provides a direct response to that challenge and offers concrete examples of new possibilities for Indigenous Environmental Justice.

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Highlights

- An Indigenous led research team initiated a new process of framing environmental harm
- Research methods were aligned with the Diné worldview and guided data collection
- Indigenous EJ highlights relationality and the settler colonial context
- Participants desire new forms of healing beyond monetary compensation

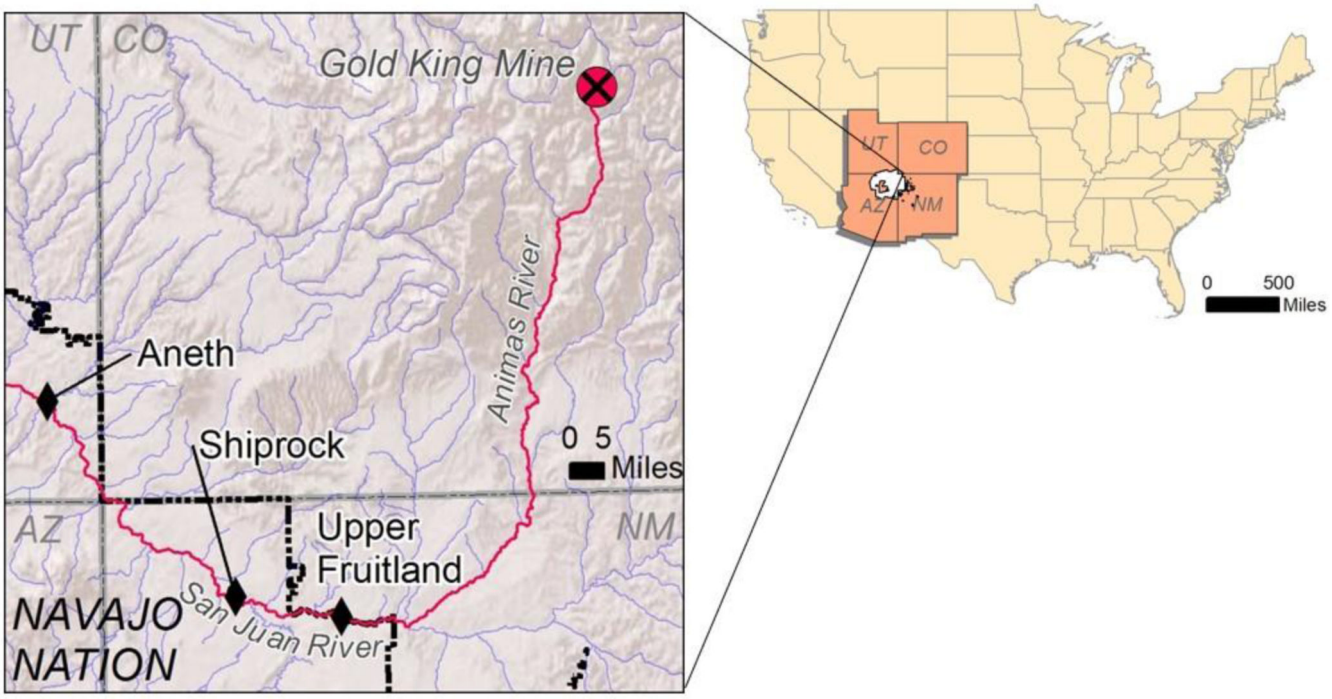

Figure 1.

Study Location is on the Navajo Nation in the Southwest Region of the United States and includes the Navajo Nation Chapters along the San Juan River in Upper Fruitland, New Mexico; Shiprock, New Mexico; and Aneth, Utah.