Reflections from the Fracking Reality Tour and Contextualization of My Search for Fracking Pollution Data

By Antonia Ruiz, Dec 2, 2025

"Tell me who you are before you tell me what you know": Self Introduction and Contextualization of this Written Work

My name is Antonia Ruiz, daughter of Juan Pablo Ruiz Soto and Angela Mariko Sylvestre, granddaughter of Lucia Soto, Pablo Ruiz and Hiroe Fukui, great granddaughter of Margarita de Soto. I was born in Bogotá, Cundinamarca, Colombia and was raised from the age of four in Albuquerque, New Mexico. My mother and I moved to New Mexico to start a new life together and the communities here in Albuquerque took us in, guided us and supported us; however, at that time I was not taught that I was living in and being sustained by 13 Pueblo's Homelands, I learned that much later from my Indigenous mentors and peers at UNM. I grew up being taught to respect the knowledge and lifeways that come from working in relationship to the land. My Abuela Lucia was an independent woman who raised four children by driving her tractor and selling eggs and milk she produced on a farm in the mountains bordering Bogotá. She chose to run a small farm even though she had come from an urban background and had worked as a secretary in the city when she was earning money to help her mother support her siblings. There was a love for the land stewardship and caring for animals in natural systems that drove her to move to the mountain and raise my father there. My dad inherited my Abuela's independence and curiosity to do things she hadn't done before. This led him to mountaineering when he turned 18, and the years he spent walking down and up the mountain every day to go to school became the physical foundation for this passion. Through climbing many glaciers and volcanic peaks in Colombia, he started to observe the rapid melting of tropical glaciers and the ecosystems that were shifting and disappearing due to climate change.

My Abuela's love for living in relationship to the land sprouted in each of her children in different ways: my aunt wanted to become a veterinarian, my uncle became a practicing agronomist, and my father became an environmental economist. That influence can also be seen in my generation. My older sister Manu became highly involved with natural reserves and rural communities in Colombia as the center of her professional and academic life; she showed me how to take these passions into graduate school work and build on a foundation of critical thinking. My mother also did a variety of environmental and community work: working with the NRDC, in an NGO called 'We Can' that focused on supporting homeless people in New York, and in a recycling and household waste composting program that produced fertilizer for native tree nurseries fueling reforestation efforts in Colombia. My parents, my sister and my Abuela instilled in me a love for the land and the people who live and hold deep relationship with the land. They taught me that land and water is central to all life, and that the responsibility we hold

in our relationships to both are inescapable and will impact us whether we are aware or ignorant of it.

I'm introducing myself because I want to honor the teaching: "Tell me who you are before you tell me what you know". In my case, I think it's important to tell a bit about my context and background because it shapes how I came to be on this journey of learning about the Greater Chaco Region and the impacts of oil and gas on the Indigenous communities that live on and in relationship to their Homelands in what is now known by many as the four corners region. As I became an adult and started learning about land relations in Colombia through an internship I was participating in with CIPAV (Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria), I became aware of the importance of multi-generational land relations and the understanding of change, cycles and shifts in the landscape that comes from lifetimes of observation and interaction with that landscape. While not completely understood by me at the time, I also started to learn the lesson that a lot of "natural disasters" are caused by human actions. At the time, I was learning through people's stories about the devastating erosion and imbalance in the watershed caused by Imperialist green revolution policies and imposed monocultural practices marketed as "the latest and greatest technology from the gringo north". It was through listening to the stories of dozens of rural land stewards and families from the high-altitude mountainsides of the Cordillera Central to the valleys and slopes of El Valle del Cauca, that I started to learn 3 essential things: to learn to see phenomena unfolding before my eyes I need to listen to people who understand and have experienced the history and cycles of that place; there are things that can only be learned while in respectful relationship with people in their Homelands, some things cannot begin to be understood until they are directly experienced; and that as a guest, a visitor, an outsider and a learner it is important to listen more than I speak. At that time I learned that I wanted to work in efforts that helped keep people in their Homelands and protected communities from displacement.

When I came back to New Mexico to center myself in place and do my Masters program in water resources, I knew that I wanted to expand my relationship and understanding with the communities whose Homelands I had been living in for the past 20 years. Now aware that land relations are central to ethical, sustainable, and healthy life, I was uncomfortable knowing that I did not yet have a relationship with the Peoples and Homelands that had received my mother and I and given us life for such a significant period of our lives. At this point I want to include a teaching from Dr. Jessica Hernandez that has given me a lot of guidance with regard to my positionality as a welcome or unwelcome guest in Indigenous Homelands:

> "My cultural and family roots will also continue to play a major role in the legacy I will get to leave as a future ancestor. They also remind me that anywhere I go I am either an unwelcome or welcomed guest. This was a teaching my grandmother instilled in me at a young age whenever I would visit her in my maternal homelands. She would tell me, 'Never forget that anywhere you go that is not your home, it is someone's home, and you must pay them respect and build relationships with the land and the people to be welcomed into their home. Otherwise, you are walking in their home as an unwelcome

> guest.' . . .I do not forget that I have the responsibility of an unwelcome guest to carry on my teachings and work to build relationships with the stewards of my new home and lands. This is a constant reminder that I am always residing on Indigenous lands, no matter if I move into a city or rural location. . . . The same way I expect guests to behave in my homelands and build relationships with our land and our people is the same way I carry myself as a displaced Indigenous woman. For non-Indigenous peoples, becoming a welcomed guest is a lifelong journey because they inherit the role of settlers. . . Understanding one's positionality allows one to foster the type of relationships they have to work toward and the actions they have to take as either settlers or unwelcome or welcomed guests " (Hernandez, 2022, pp.2-3).

What I didn't know at the time I returned to NM was that the lack of grounding and discomfort I felt always lurking underneath the surface as I lived here, came from being a settler and an unwelcome guest in Indigenous Homelands. That discomfort drove me to seek mentorship. When I started my masters at UNM I was searching for mentorship that demonstrated a deep care and knowledge of responsibility to community and land, and I found that in Dr. Lani Tsinnajinnie and the way she taught us in her watershed management class. I was incredibly lucky when an opportunity arose to work with her as a research assistant, and that has led me to the work I'm doing now, building relationships with a team consisting of Community Members, Indigenous Professors, and Peer Mentors: Dr. Lani Tsinnajinnie, Dr. Leola Tsinnajinnie-Paquin, Mr. Daniel Tso, Mr. Mario Atencio, Dr. Silas Grant, Ms. Allison Shaddox, Mr. Curtis Littletree, Mr. Nicholas Redhouse, Ms. Anna Perez, Mr. Jonathan Bolman, Ms, Janice Lee, Ms. Jisella Napoleon, Ms. Keren Assaf, Dr. Elspeth Iralu, and Dr. Sharon Hausam. I am in the beginning stages of the lifelong work of building relationship with these mentors and the communities they work with. I am grateful to the blood and non-blood relatives that have guided me and will continue to guide me on to this path. Every guidance I've received is a gift I try to hold and carry with me. These gifts come with responsibility. I hope that with this work I am able to begin to work towards reciprocity for the gifts I've been given.

This work is written from my perspective as a sardina/ young, inexperienced newcomer and therefore only contains a limited synthesis of some of the knowledge and teachings shared with me by the community members and activists who have done this work for generations. I include some of my reflections along the way and my preliminary exploration of publicly available pollution data sources I found in an effort to understand the state of pollution regulation better. It is important to me that this be me "standing with" and not "speaking for" the people I'm building relationship with in the Greater Chaco Region. The teachings and reflections come from the experience of going on the Fracking Reality Tour and learning within a Sacred Landscape, breathing the fumes of fracking, and listening to Mr. Daniel Tso, Mr. Mario Atencio, Dr. Silas Grant and Dr. Leola Tsinnajinnie-Paquin tell us the stories that taught us to see what was going on right before our eyes. The time, work and care that they all take when they take people to teach them what is happening in their Homelands, or in the Homelands of their allies when it

comes to non-Indigenous allies and activists in this work, is immense. It is deeply important and deeply demanding work. When I started this written piece, I wanted to better understand how the pollution from the oil and gas industry impacts the Air, Water and Health of the Local Communities. I wanted to understand how the Governor and the State could push for the use of filtered produced water and, thereby, keep enabling the oil and gas industry to pollute and drain the community's groundwater, instead of effectively protecting communities and putting the break on industry pollution. I also wanted to understand why they could speak with so much confidence about successfully regulating air pollution, when the smog and toxicity that the communities are exposed to continue to be dire and life-threatening. I hope to explore these questions in this piece by looking at what pollution data sources are available to the public, what the data shows, and what the data gaps are. I worked in collaboration with resident excel and data analysis expert, Angela M. Sylvestre (my mom), who taught me how to handle and analyze the data I was finding. I hope our work will be helpful. Thank you for reading.

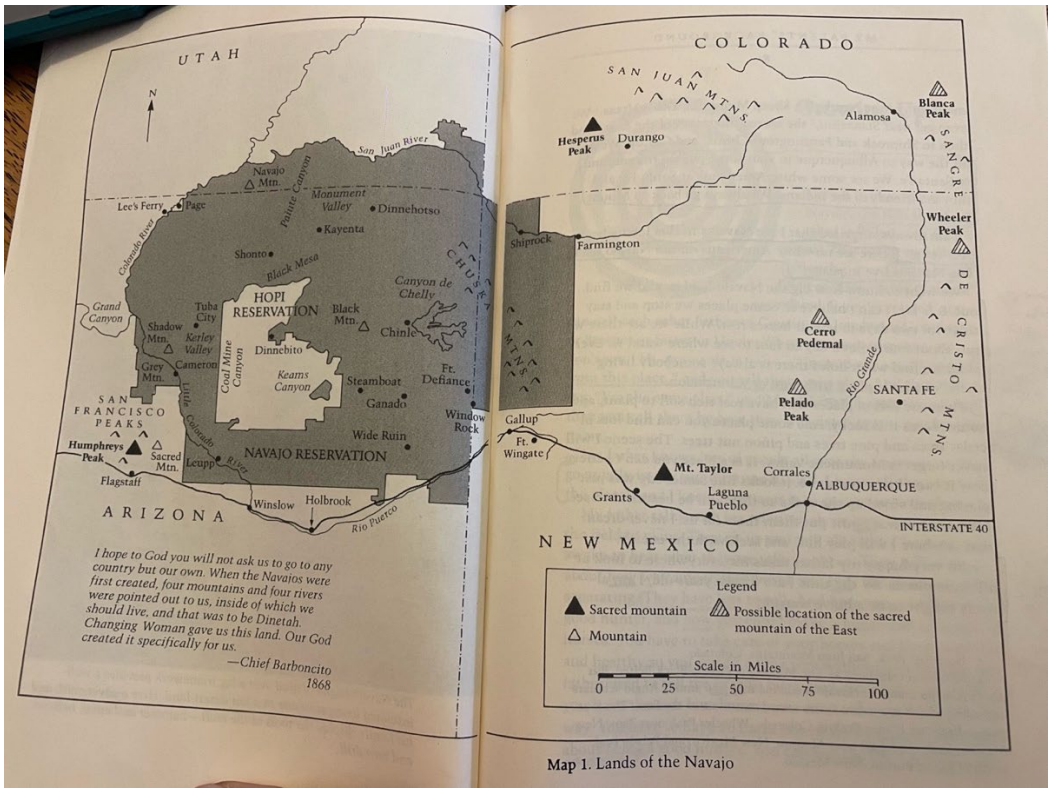
Getting Centered in Place: The Greater Chaco is Diné and Pueblo Homeland- Lessons from Community Stories

To understand even a fraction of the significance of the Greater Chaco Region as Diné and Pueblo Homelands, you have to start by learning about the history of the Land and the Communities who have stewarded and formed relationship with the land since time immemorial. Chaco Canyon was built over a thousand years ago over multiple generations. The constructions are a manifestation of knowledge of the landscape, astrology, seasonality, and spirituality: understandings that are maintained and continue through the generations, manifesting in worldviews, ways of life, deep connection to place, awareness of change and cycle and shift (Tso and Ramsey, 2022; Van Dyke & Heitman, 2021). What settler communities in the United States forget is that the history of the U.S. Colonial state is miniscule, short, infantile in scale within the Indigenous context of these lands. Naturally, the settler understanding of the landscape, of shift and change and cycle is also infantile. The most major harms that have led to the industrial assault Diné and Pueblo People and their Homelands are experiencing today started manifesting in earnest as late as 175 years ago (Bighorse,1990). That's the blink of an eye, a mere second in the context of history, and that makes the responsibility of the assaulters that much greater, as they were able to do a lot of harm in very little time. Settler industry and constructed entitlement is by no means the law of the land or part of a natural progression. It's been sudden, violent, and intense, and the impact has been catastrophic- a continuation of the human-made natural disasters Indigenous communities have faced since colonization (Gilio-Whitaker, 2019).

In the 1840s, when Tiana Bighorse's father Gus Bighorse was born on Diné lands near Mt. Taylor, Diné families were living like they had for countless generations on the land. In Gus Bighorse's words as retold by his daughter Tiana:

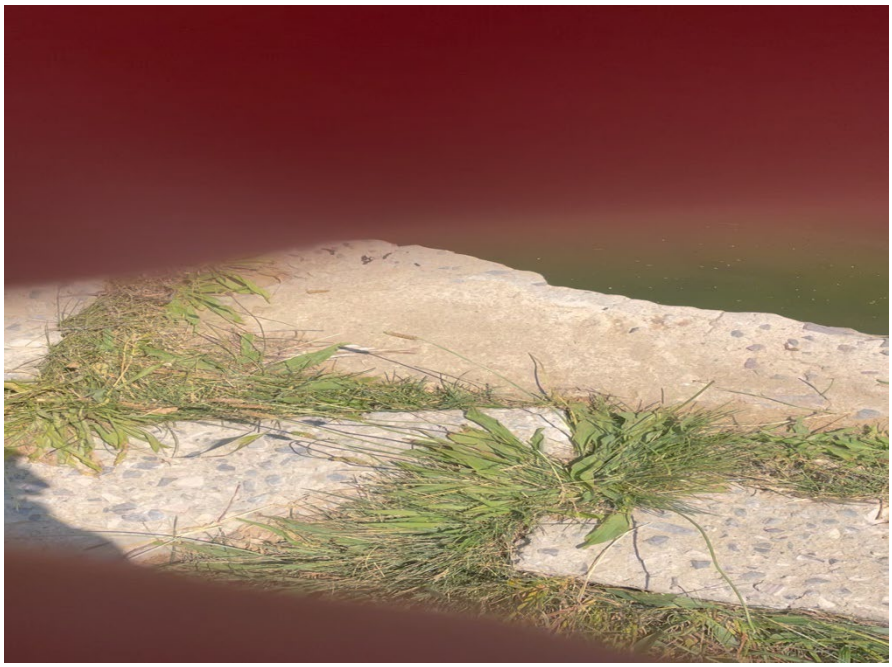
> “[My father] says, ‘The sky is our father and he earth is our mother. If you get in trouble with the enemy, always look up to your Father Sky. You are already in your Mother Earth’s hand.’ My father takes me all over the Navajo land to see the place when I am nine years old. We ride mostly every day—four years, summer and winter. We always start from Tsoodzil, Mount Taylor, where we live and keep coming back. Mount Taylor is the sacred mountain of the South. We go to Leupp and to Flagstaff. We go around Dook’o’oosłííd, San Francisco Peaks, a sacred mountain of the West. And from there to Grand Canyon, and around Lee’s Ferry and around Navajo Mountain and through Four Corners. And around the sacred mountain of the North, Big Sheep Mountain, Dib’e Ntsaa. We even get near Sisnaajiní, the sacred mountain of the East. And then to Shiprock and Farmington, Chinle, and Gallup. We go all the way to Albuquerque to visit some pueblo friends, and to Santa Fe. We see some white Americans at Santa Fe, and they are friends to the Indians. We always go back to Mount Taylor. I am always surprised what I see Navajos in this land wherever we go. There are no white Americans on the Navajo land. The Navajos live in peace. . .While we are there we run about four miles a day on foot to see where water is. Every place we find water holes there is always somebody living there, or a little place with corn or watermelon. There are lots of places with rich soil to plant, and some places it is rocky. And some places you can find lots of cedar trees and pine trees and piñon nut trees. The scene I will never forget is Monument Valley . . I never dream that is where I will play hide and seek with the enemy. I am very happy my father takes me everywhere to look at all these places. By the time I am fifteen years old, I am already taught to be a brave warrior.” (p. 3-8).

As recently as the 1840’s, the Diné People were living in peace in their Homelands. Gus Bighorse was taught by his father and taken to every corner of Diné Homelands (see image below) to learn and experience the different cycles and systems in the landscape every day for four years; that’s an education in Place-connection and understanding that most of us will never acquire in a lifetime.



Map of Navajo Lands, from Bighorse the Warrior by Tiana Bighorse, p.6-7.

On my visit to Torreon and on the fracking reality tour, my mentors shared with us some of their knowledge and understandings of their Homelands as Sacred and living landscapes that are life-sustaining for their communities. On my first visit earlier this year, I accompanied Dr. Tsinnajinnie, Dr. Tsinnajinnie-Paquin, Mario, Allison, and Davian and Timberlee out to the Torreon Chapter to collect water samples from some springs and wells that the communities use for getting drinking water. Dr. Tsinnajinnie told us about how, like many communities in New Mexico, the communities in the Eastern Navajo Agency rely a lot on their aquifer and groundwater springs that are held in and upwell from the sandstone. The groundwater first falls as snow in the mountains, where it infiltrates slowly into the earth and flows laterally into the aquifer (Tsinnajinnie et al., 2018; Huntington & Niswonger, 2012); therefore, the groundwater and spring water is old and a sample of water can be tested for certain ions to see how much of it came from older groundwater vs freshly fallen surface water (Linhoff et al., 2023). Fresh surface water runs off over the earth's surface in the form of ephemeral streams and then infiltrates. For that reason, if it flows through contaminated soils it can contaminate the aquifer and community wells. So Dr. Tsinnajinnie collected samples to see how groundwater dependent different drinking water sources are so that she can then assess how vulnerable to contamination brought in by surface runoff each source is.



Video 1 (double click on it to play) shows a newt swimming around in a natural spring in the Torreon Chapter/ Diné lands in the Greater Chaco Region. These are one of several sacred springs the Diné communities use and know about due to their deep connection with and knowledge of the landscape. They provide important freshwater for all living beings on the landscape. They are also surrounded by fracking sites, abandoned oil wells, past oil spill sites and places that are at high risk of future oil spills or explosions. Therefore, many of these sacred springs are at high risk of contamination by fracking toxic waste and non-point source pollution coming from the thousands of fracking sites and wells across the landscape.

On the drive up for the second visit, Mario told us stories of the landscape and the people. He pointed out the Rio Puerco of the East and the little canyon it has carved out for itself over time: this little canyon is so deep that the tops of yellow cottonwood trees peek out the top, which was at ground level for us. He pointed out the sacred mountains and formations that we were passing and told us who they are sacred to. He pointed out patches of green hidden in the slopes and foothills and taught us how to see signals for where there is water. He told us the story of how the landscape we were driving through is where the Diné Warriors defended their People and their Homelands from the invading U.S. colonial armies. Around 1862, the U.S. colonial army was sent from Washington to force all Diné families off their lands. The plan was to march all the Diné People more than 300 miles from their Homelands to Fort Sumner in Bosque Redondo, an area along the Pecos River (see map below) (Bighorse, 1990, p.33;). 9000 Diné people, including Elders, pregnant women, and children, were forced to undertake the journey on foot in the winter (Bighorse, 1990, pp.33-39). At the time, some families and warriors were able to escape and hide in the landscape. Gus Bighorse describes his experience as one of these

warriors, and how his knowledge of the landscape helped him and the resistance survive: " I am very happy my father already took me everywhere when I was young to look at all those places on the Navajo land. Now I have to fight for our land, and I already know where to hide, where to get food, where there is water" (Bighorse, 1990, p. 18). The Diné resistance, led by Chief Manuelito, were eventually able to sign a treaty that allowed the Diné people held in the prison camp at Fort Sumner to go back to their homelands.

Around 50 years after the people were able to return home, the U.S. government started another big interference on Diné ways of life:

> "Before they went to Hwéeldi [the Diné name for Fort Sumner and its surroundings] the people had lots of sheep, thousands and thousands—maybe eight thousand. But after Hwéeldi there was just a few left. And ever since they came back, the people had been praying to the Holy People to bless them with all kinds of livestock—for sheep and goats and horses and water and for grazing land, and for all these things to increase. The hope and prayers of our people were answered, and now there are animals all over the reservation and lots of grass. The government don't like it. They say the feed is not enough, and they say too many animals will ruin the land. They want the Navajo to get rid of their livestock. The Navajo don't have a place to sell their goats or sheep or horses, so the government just sends some workers to the reservation. They shoot lots of horses and take lots of goats, all kinds of goats—the blue, the black, the brown, the white. We Navajo think the government broke the treaty again. They told us to put our weapons down, and here they are shooting all our livestock—the only food we live on" (Bighorse, 1990, pp. 95-6)

All of this was done under the colonial government's Stock Reduction Program that was active between 1933-1945, specifically to impeded with how Diné people led their lives and stewarded their Homelands. The U.S. colonial state and federal government then proceeded to checkerboard the region, gradually turning Diné homelands into "private" (and thereby sellable), state or federal lands, thereby, making it difficult for Diné people to protect and steward their lands. All of these impacts are still felt today and come together to continue compounded and multi-layered harm on communities. It seems to me that because they couldn't defeat the Diné People by using the military, the colonial State and Federal government turned to using colonial law, capitalist concepts of private property and the oil and gas industry as tools to continue their assault on the Diné people.

Despite these assaults, the communities remain living in deep connection with their Homeland; however, the impacts of the oil and gas industry are threatening all forms of life in the region. On our visits Mario pointed out the Sage grass Steppe ecosystem that spreads across the landscape. He told us how it's not every place in this high-dessert that has a water table high enough to support vegetation like what they have in Torreon. This high water table is a blessing and makes the area possibly some of the most ideal rangeland and home for both Diné Communities and non-human relatives. The sage grass steppe is a significant ecosystem in NM

and home to the Sage Grass Hen, an endangered/threatened species that used to be protected under Section 10(a)(1)(B) of the Endangered Species act of 1973 (LPC Conservation LLC, 2021). Mario told us he's always on the lookout for the hen, hoping that her presence can help make the case for the protection of the landscape, since so far, the courts have deemed all evidence of harm presented to them as "not enough". Land and water protectors in Texas had previously tried to take this approach, making the sage grass hen a thorn in the Industry's side, although the protection sought has not been successful to the extent needed down there either (McNutt, 2024). Unfortunately, the hen has been stripped of that protection due to the State of Texas sewing in 2023 because they claimed it's protection "curtailed oil and gas production" (Dex, 2025). Today, one of the main concerns of Diné communities is the impacts of oil and gas industry contamination on their drinking water sources (Tso and Ramsey, 2022).

Detailing the impacts of fracking: Lessons from the Fracking Reality Tour

Today, the dominant land use in these landscapes is no longer providing a safe homeland for Diné communities, pasturing sheep (cattle, horses), growing peaches and crops, providing habitat for golden eagles or guiding clean precipitation and snowmelt into the sandstone aquifer. In other rural areas, driving the roads is fluid because the houses are spread across ranch acreage and there aren't enough community members to create a traffic jam; however in the Greater Chaco traffic jams do happen. The roads are filled with oil and gas trucks, some carrying produced water, some carrying fracked oil, that sometimes line up for hundreds of meters along the road, blocking any way through. This happens so often that parents have to be strategic in making sure they can get to the school bus stop to pick up their kids. During the fracking reality tour we stopped at a gas station across the street from an old missionary school. As we spoke there, oil and gas trucks were passing us almost every 3 minutes, straight past a community-made sign that reads "Entering Energy Sacrifice Zone" (see image x below).

Image x of community-made sign near the old mission school. Taken during fracking reality tour in October 2025 from the gas station across the road.

On the hood of the truck, Mr. Tso showed us a map of all the school bus routes for each Navajo Chapter. He told us of how the bus routes are normal dirt roads that can be washed out by the rain, while the roads the fracking trucks use are all gold standard: covered in gravel, elevated and drained. Mario calls our attention to the North and tells us about the importance of the viewscape, the sacredness of what we were seeing, how if we look in another direction we can see a portion of 20 mile mesa. He then points to the mountains in the distance and the smog you can see on the horizon (see image x below).

Image x:. Looking at the horizon, you can see that there is something in the air causing discoloration/ haziness in the atmosphere. New Mexicans are familiar with how the horizon gets hazy when there are dust storms and wind bringing in smoke from fires. Well, in this case its volatile organic compounds (VOCs), methane, and Hazardous Air Pollutants (HAP) emitted from fracking flares, and its persistent presence. On any other day I would have assumed it was dust swept up by the wind or some other light phenomena, but he let us know that that is toxic smog that spreads across and settles in the topographic bowl created by the Chuska Mountains and the Nacimiento mountains (see image y). When taking this picture we were all breathing that smog because it's settled in the bowl we're standing in, but you can't see it when you're standing in it, unless you look at the horizon. This was one of many instances where I learned how to see through being there on the land with people who know what to point out.

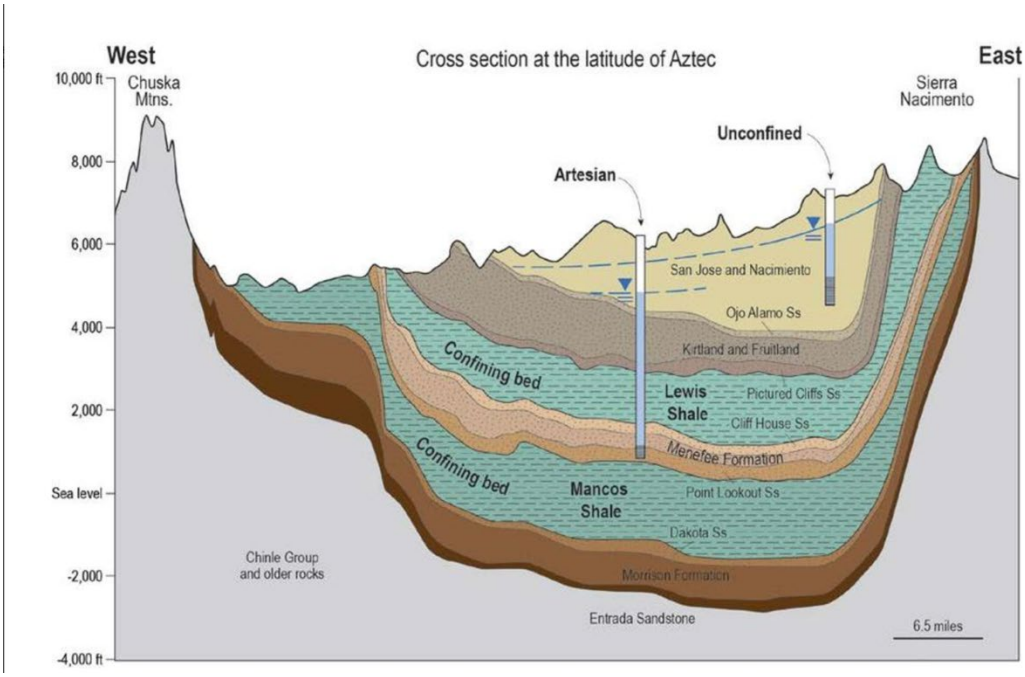


Image y shows the topographic bowl formation that a good portion of the Greater Chaco Region and the Easter Navajo Agency sits in between the Chuska Mountains and the Sierra Nacimiento. Image Retrieved from https://geoinfo.nmt.edu/resources/water/projects/home.cfml?id=44&project=Hydrologic+Assessment+of+the+San+Juan+Basin

On our second stop we breath the fumes of one of seventeen fracking sites that are within a 2 mile radius of the local elementary school (see image y below).

Image y: One of the 17 fracking sites within a 2 mile radius of the Lybrook elementary school.

We only had to stand there for 5-10 minutes for some of us to start feeling lightheaded or queasy from breathing the fumes. Mario told us how these fumes, which contain Benzene, Tolulene, and other carcinogens, accumulate within the school and expose children to daily toxin concentrations likely well beyond what a grown person should be exposed to in a lifetime.

At the next stop, next to a compressor station, we stand in a lower area where runoff collects (see image below).

Image z: Cracked earth, the evidence of the impacts of drought. It's also evidence that there was once water there because clay mud that was once wet or the bottom of a puddle cracks like that when it dries. You can see that it was once mud because of the deer tracks in it.

When I looked at the deer tracks I wondered, "did they come here to drink the water that was puddled there? What did that water have in it after falling through this contaminated air and flowing over contaminated soils? Are those chemicals now inside the bodies of the deer?" As we stand there together Mr. Tso tells us about how eagles used to mate on the mesas in this area, but their number has been dwindling. He suspects that, just like the sheep who started giving birth to lambs with physical anomalies, the golden eagles' fertility might be being impacted by the toxins in the pollution. There was a lamb in a local herd that was born without an anus recently. Scientists said that lack of an anus was probably the result of a "natural genetic anomaly" but how can they be sure it's not because of toxic chemicals harming living organisms both currently living and yet unborn? To protect our families it was suggested we clean our shoes and clothes immediately upon returning home because we walked and talked in this landscape. What about the people who live here? What impacts are all the toxins having on their bodies, minds, homes and current and future children? There's research that suggests that the cancers caused by these types of toxic pollutants can manifest many years after exposure starts (). Once it starts manifesting we can't be sure we can cure the cancer in that person's body, and we are all responsible because we are complacent in what the State and Federal government has done in

leasing Diné Homelands to oil and gas companies. Some of the money from the oil and gas industry pays for improvements to New Mexico public libraries, our healthcare and our college education scholarships. It's all blood money coming directly from the suffering of the communities living in the Greater Chaco Landscape, coming directly from the desecration of this Sacred Homeland and likely toxic effects that may impact generations yet unborn. I need everyone who reads this to sit with that. For me it is the most terrible situation I have ever witnessed in my life. The weight of this knowledge is something I'm not yet sure how I'm going to process. I feel that it's important to be very careful with what I say in this regard because real people, real families are impacted by this. Every word that is spoken, written, read or heard about this situation has weight. Everyone has to be aware of this and take special care. This is something that too many politicians, researchers, industry bosses, and policy makers do not do enough. If you understand the importance of family and community, the immense love and impact beloved people and more than human beings have on each other, then you need to take special care with your words and actions related to the situation communities are facing in the Greater Chaco Region.

Pollution Stories: From Previous Studies, NMED Publications, Statements from the Office of the Governor & Conscientious Community-Partnered Research

This section details some of the scientific, journalistic and political stories that I read when I was trying to understand the extent of oil and gas industry pollution in the Greater Chaco Landscape. All of these stories generated questions for me and spurred me to go on the search for publicly available pollution data that I hoped would help me answer these questions. Some of these stories are told by caring people that have done the best they can with the information and skills that they had at the time, and these stories I see as guides that push me to build on the careful, respectful and intentional foundation that they've been building. On the other hand, some of these stories are less mindful, often don't address important gaps in the data and thereby make claims that are in direct contradiction with the community's lived experience without providing solid and long-term evidence that constitutes due diligence. They are examples of how not to talk about this situation. Both are useful for identifying questions that need answering, but they are fundamentally different types of work. It's important to be aware of this and think about which one you are contributing to when you speak or write on this subject, because publications and conceptual framings can do real harm or help do good.

For me this means that I have to be really mindful of how I do my work, check my work, double and triple check it, getting it peer reviewed, and present it. I need to take the upmost care to only present information when I'm sure I'm not contributing to misinformation. At this stage of the work, I've only been searching for data for around a month, and the most important dataset I found and will be exploring a bit with you is one I found in the past week at the moment of writing this paper. Given that, it's important that you check everything I present for yourself, and understand that what I'm presenting here is preliminary. I'm putting together detailed step-by-step infographics and possibly videos of how my mom and I interacted with the data we

found so that our work can be checked. I am aware that there are likely many people who are searching for answers in the same data with the same intention as us, and who have been doing it for a lot longer than we have. I hope that in the near future, on this data journey, I can learn from these people and help in these efforts within my capacity. I'm making infographics so that both data-minded and data inexperienced people can recreate what I did and in doing so check it as well. Reports of mistakes I've made or misinterpretations are always welcome. That said, I reiterate: what I'll be sharing here is preliminary exploration of data sources, not final, publishable analyses. I hope to work towards the publishable analyses with more time as I get to know the data inside and out and check and double check things. Now back to the existing pollution stories that started me on this data-journey.

Data Story 1: The Four Corners Methane Anomaly

All the gasses and volatile organic compounds released by oil and gas flaring settle and concentrate in this topographic bowl where they react with nitrogen oxide in the heat of the sun to create compounds that can be seen as haze and smog (Grant, 2021). The atmospheric contamination in the San Juan Basin is so bad that it can also be detected from satellites that use infrared spectroscopy to detect trace gasses (including methane) in the atmosphere (see image w). Consistent with the findings of on the ground studies that found that these gasses were coming primarily from oil and gas industry and coal plant emissions (Frankenberg et al., 2016; Smith et al., 2017), methane trackers today, like Carbon Mapper, have found that the vast majority of these methane plumes come from oil and gas industry activities with a much smaller percentage coming from coal plants and the amount coming from livestock being so little relative to the other two that it doesn't even show up in the figure (see image c) (Carbon Mapper, 2025). *Carbon Mapper estimated that the 299 methane plumes they detected between 2019-2025 contributed to an estimated 27,800 kg of CH4/ yr (Carbon Mapper, 2025).*

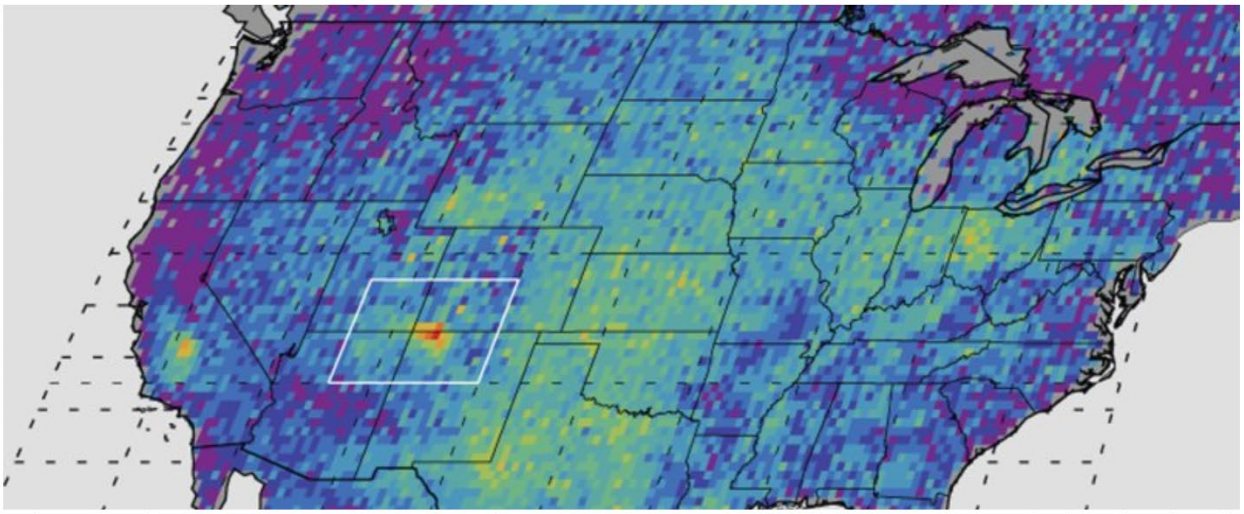


Figure 1 – The Four Corners methane anomaly. Kort et al. (2014). Image credit: NASA/JPL-Caltech/University of Michigan.

Image W is the visualization of satellite atmospheric methane measurements reported in a 2014 study by Kort et al. The image was retrieved from Dr. Silas Grant's Doctoral thesis (2021).

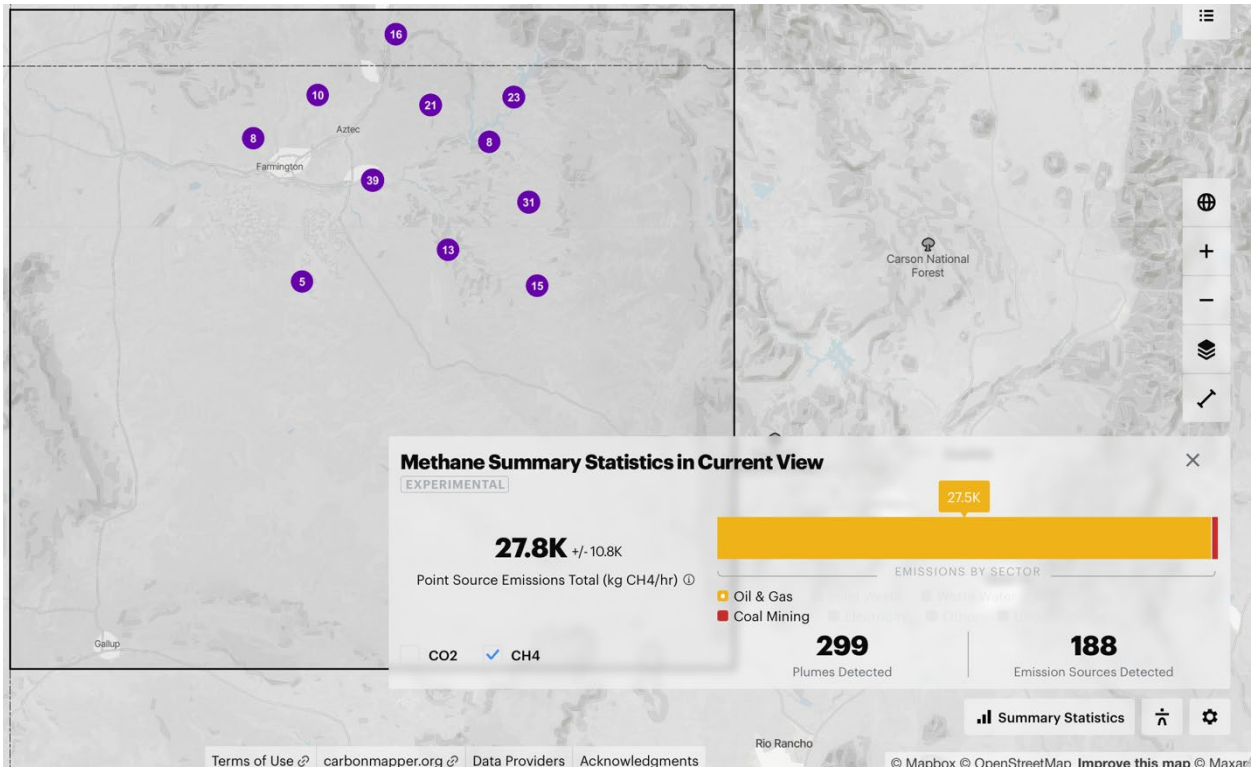


Image C shows the number of plumes detected in the San Juan Basin between 2019- 2025 (if you zoom in, instead of being compiled together in one purple circle, you can see all the individual plumes separately) and how the vast majority of methane emissions in the Basin come from the Oil & Gas industry, with estimated point source emissions totaling around 27,800 kg of CH4/hr. If you click on an individual plume you can see the date it was detected, an image of it, the number of days it was observed, and it's source emission rate in kg CH4/hr. Image retrieved on November 25, 2025 from Carbon Mapper (2025).

Data Story 2: Some of what the Office of the Governor, NGO Journalists, and Researchers have said about the Methane anomaly and Air pollution since it's discovery till now.

NMED air quality compliance and enforcement page links to the draft Ozone Precursor Rule that ended up becoming law on August 5, 2022. The regulation is supposed to help control VOC and NOx pollution in Chavez, Doña Ana, Eddy, Lead, Rio Arriba, Sandoval, San Juan and Valencia counties, but does not include McKinley County, which is also relevant to the Greater Chaco Region (Oil and Gas Sector-Ozone Precursor Pollutants, 2022). The website states the regulation "aims to greatly reduce harmful emissions annually from oil and gas operations in New Mexico . . . outlines compliance obligations for new and existing oil and gas operations in New Mexico counties with high ozone levels . . . It is estimated that the rule will result in a

reduction of 260 million pounds of oxides of nitrogen and volatile organic compounds along with a co-benefit of reducing methane emissions by over 851 million pounds annually" (NMED, 2025a). Since the draft was made into law in 2022, we should be able to see these reductions in VOC, NOx and methane emissions in the data for 2023, 2024 and 2025; however, I was not able to find reports showing the data that proves this reduction is actually taking place. Therefore, I started looking for publicly available Industry methane, VOC, NOX, and HAP emission tracking data to see if a decreasing trend could be seen in the data. I describe the data sources I found, what they do and do not show and the gaps they have in the next section.

The Reciprocity Piece- Searching for Publicly Available Data that can help fill the data gaps and answer my questions.

REFER TO THE "Greater Chaco Water Story Highlights Presentation" (a seprate document) for the details and results of this part of the work. The sections of the work is included here so that you can decide whether it sounds interesting enough to go take a look.

Step 1 on the Data Search: NMED's Air Quality Monitoring OpenEnviroMap (Kort et al., 2025)

Step 2 On the Data Search: Finding & Looking more Closely at Some Flyby Data

Step 3 on the Data Search: Carbon Mapper and MethaneSat

Step 4 on the Data Search: NMED Excess Emissions Reports

Step 5 on the Data Search: NMED's Emissions Analysis Tool

Step 6 on the Data Search: The Oil Conservation Division's Geospatial Hub, & Liquid Spill Data

Step 7 on the Data Search: New Mexico Tech's GO-TECH Oil, Gas and Produced Water Production Database (Petroleum Recovery Research Center, 2025)

Implications of Oil and Gas Production and Pollution Data for Community Based Monitoring

Conclusions:

Next Steps In The Data Journey

Our analysis of the liquid spills dataset and the G0-Tech oil and gas production dataset helped us understand a lot more about how and to what extent is oil and gas industry pollution threatening community water sources. Just from the preliminary look at the data both of us had many ideas about how it could help us pinpoint wells to track and maps that could help determine which water sources are most at risk of contamination. After identifying these wells the next step is to continue digging deep to uncover all that is known about them and how they measure or do not measure pollution, and then develop systems for ensuring that pollution is accurately measured in the long-term. Community monitoring of contaminants in soils and waters will be a big piece of this and key for closing the specific contaminant data gaps left open by the fracking industry. The goal is to make this monitoring something co-created and controlled by local communities so that it can become a long-lasting data monitoring infrastructure that doesn't disappear when the NGO runs out of money or down staffs. It should be designed centering Indigenous Data Sovereignty and ensuring that the power is in the community's hands and meets community needs in both the short and long-term. I look forward to continuing to work with the data, finish building the infographics showing our data process, and presenting some peer-reviewed and solid final analyses to you all soon. I hope this was helpful as a story of how newcomer human beings who care about what's happening to communities in the Greater Chaco Region and care about Indigenous Environmental Justice can commence on a journey towards reciprocity.

Caring Vision for the Land: Centering Community Visions for a Healthy Future & Calls to Action

What fuels all of these efforts is an understanding and respect of the unbreakable connection that Diné, Hopi and Pueblo People have to the Land. It is the strength and clarity of caring memories, experiences and visions of the Land that center human and non-human community wellbeing and our abilities as caretakers of the Land and of current, past and future generations instead of violators, poisoners, and extractors. When we sat down to eat with Daniel, Mario and Silas after going on the fracking reality tour, I remember Daniel speaking about how healthier economies, like agrotourism, raising sheep, and nature tourism, would be much more life sustaining for the communities and the region than the poisoning industry of oil and gas extraction. As Mario said, the high water table in this area is a gift that should be protected, respected and recognized as a life-giving characteristic of the Land where plants, animals, communities and ecosystems can thrive. I remember community members talking about the herds of sheep their parents and grandparents took care of and how now a days these herds have

shrunk; however these ways of life and special genius in how to move and survive in this sacred landscape are not far in the past, they are close to us here and vivid in the memories of many of the current generation (Tso and Ramsey, 2022). As long as they are remembered, they can be nurtured, centered, healed and protected, like many practitioners, teachers and knowledge holders are doing across Dinetah and Pueblos Lands.

For those of us who are non-Indigenous allies, we each have strengths, gifts and talents that we can use to contribute to the fight to protect the Communities, Lands, Waters, Air, and Future Generations of the Greater Chaco Region, and therefore New Mexico as a whole. We know the impacts of what happens in this region are vast and spread throughout and even far beyond the State. Pollution does not recognize boarders and does not discriminate between bodies once it's present. Centering Indigenous Environmental Justice, Indigenous Water Sovereignty, Indigenous Cultural and Economic Sovereignty, and Indigenous Data Sovereignty is what will lead to a healthier and sustainable future for all of us in New Mexico, across the United States, and throughout the world. Thank you for reading.

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