

Recent Efforts to Research, Preserve, and Protect the Greater Chaco Landscape



Archaeology Southwest

Exploring and protecting the places of our past





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Executive Summary

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This short publication reports on recent efforts by a number of archaeologists and researchers working across the Greater Chaco Landscape. The group is united by its fundamental interest in understanding the ancient Chacoan world by studying its landscapes and by a very high level of concern over the threat of recent oil-gas development to this fragile landscape. This threat is heightened by several recent executive and secretarial orders from the current administration that aim to prioritize energy development on public lands, which could further fragment and degrade the Greater Chaco Landscape.

Chaco Canyon is a UNESCO World Heritage Site that preserves the history and culture of the Pueblo people. Chaco Canyon is the ancestral home of Pueblo people and it is where many of the cultural traditions that are practiced to this day at Acoma, Zuni, Tesuque, Zia, Hopi, Taos, and other pueblos in New Mexico emerged. Chaco's magnificent great houses – Pueblo Bonito, Chetro Ketl, and others – still tower over the canyon floor, while in the surrounding landscape, ancient roads and pathways to outlying villages and shrines offer silent testimony to the wonders of Chacoan society.

Over more recent centuries, the landscape around Chaco was settled by the Navajo people and other groups who have added their own unique traditions to the rich cultural legacy. Federal agencies are also a major, modern-day presence and oversee the canyon itself (a national park since 1980), along with important cultural sites in the surrounding landscape.

Increased oil-gas development associated with the Mancos-Gallup Shale play in northwest New Mexico has been threatening fragile Chaco-affiliated cultural resources across a large portion of the San Juan Basin since late 2011. In response, and in conjunction with the Navajo Area Office of the Bureau of Indian Affairs (BIA), the Farmington Field Office

of the Bureau of Land Management (BLM) is currently in the process of amending the 2003 Resource Management Plan (RMP) and draft Environmental Impact Statement (EIS).

Archaeology Southwest and our partners National Trust for Historic Preservation (NTHP), National Parks Conservation Association (NPCA), and The Wilderness Society (TWS) have provided comprehensive comments and input over a period of three years that BLM and, more recently, BIA, have been working on the planning process. These comments, which includes new information about the significance, location, and interconnectedness of cultural resources within the Greater Chaco Landscape, must be taken into account by BLM and BIA as they develop their new management plan.

The Greater Chaco Landscape includes Chaco Culture National Historical Park and many cultural resources in the surrounding landscape that are affiliated with ancient Chaco, such as the Great North Road and Pierre's Site. Over the years, the BLM has leased more than 90 percent of its managed landscape for oil and gas development (Figure 1).

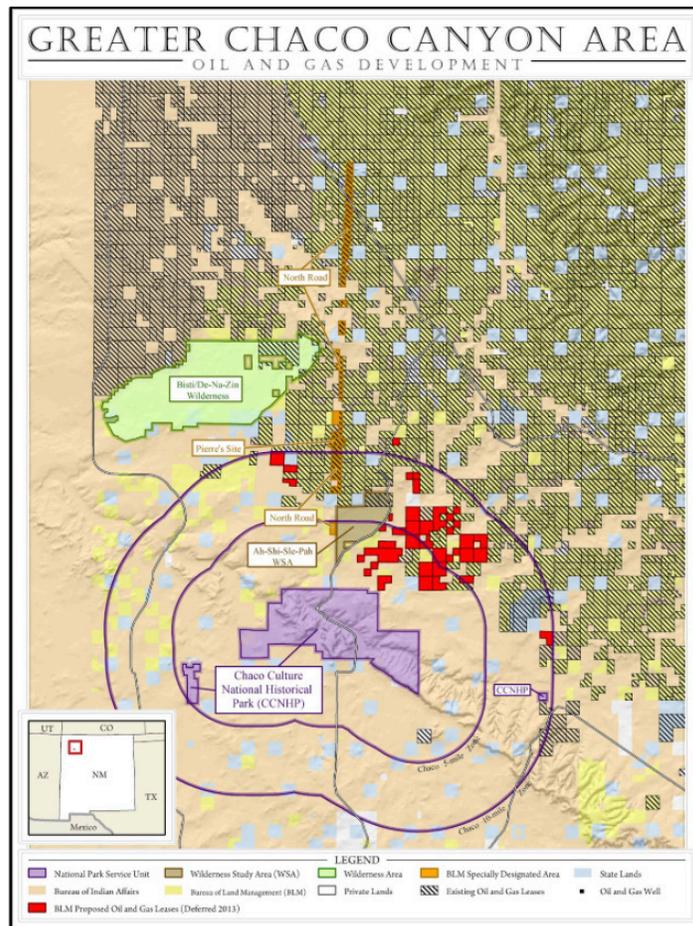


Figure 1. Map showing existing leases, deferred leases (that may be up for sale in 2018), and 5-mile and 10-mile zones of protection around Chaco Culture National Historical Park.

Together with our partners, we have asked the BLM and BIA to put a moratorium on future oil-gas leasing in a 10-mile protection zone around Chaco Culture National Historical Park, and to also ensure the protection of significant sites in the broader landscape, including Pierre's.

The All Pueblo Council of Governors (APCG) has spoken out on several occasions, issuing several resolutions calling on the BLM and BIA to work closely with Pueblo people while preparing this new plan. The Pueblo governors also endorsed a series of measures that would go a long way toward protecting the magnificent cultural resources and modern-day residents of the Chaco area from oil and gas development, including supporting the 10-mile protection zone around the park that would be off limits to oil and gas development and using a master leasing plan (MLP) to guide development in this sensitive area. This is critically important because so much of the landscape around Chaco has already been leased for drilling, and the MLP would provide a protective, guiding framework for managing future development, as well as leasing. Most recently, the APCG has partnered with the Navajo Nation to press the agencies for additional protections across the Greater Chaco Landscape.

Many groups and individuals in New Mexico have worked tirelessly to support this process. U.S. Senators Udall and Heinrich and Congressman Ben Ray Lujan have played an instrumental role in working to find a solution to protect the Chaco Canyon area—recognizing that they must balance all of their constituents' diverse interests. Moving forward, we will continue to need strong leadership from our elected representatives to see this process through.

Archaeology Southwest has continued intensive dialogue with BLM and BIA as they finalize the draft RMP amendment and EIS for the Greater Chaco Landscape. We feel strongly that the standard approach to cultural resource protection, as prescribed by Section 106 of the National Historic Preservation Act (NHPA), and other laws, is not working in this highly sensitive area. The Section 106 approach calls for cultural resources (historic and archaeological sites, traditional cultural places, and sacred sites) to be identified and then either avoided by construction activities or to have adverse impacts to resources mitigated through various measures. This approach has resulted in a highly dissected landscape that is crisscrossed by oil-gas roads and pipelines and various wells pads and other facilities (Figure 2). These activities have severely impacted the ancient Chacoan landscape.

We believe that the agencies should protect larger pieces of the remaining landscape, particularly areas surrounding Chacoan great house communities. With the advances in various technologies, as described herein by Ruth Van Dyke, Anna Sofaer and her colleagues, and Carrie Heitman and Sean Field, it is abundantly clear that archaeologists completing survey work prior to oil-gas development are not identifying all of the archaeological resources and phenomena on the landscape and that continuing with the current approaches to resource protection will result in losses of additional, undocumented cultural resources and further impacts to the Greater Chaco Landscape. Further, consistent with obligations under NHPA, the National Environmental Policy Act and related laws, the agencies must incorporate and utilize the significant new information about the Greater Chaco Landscape that has been generated internally and provided to them by the tribal and archaeological communities. Finally, we ask the agencies to work with us and other stakeholders to find a way to protect what remains of the ancient Chacoan landscape.



Figure 2. Aerial photograph of the central San Juan Basin showing the crisscrossing impacts of roads and pipelines on the Greater Chaco Landscape.

Recent Solstice Project Activities to Protect the Greater Chaco Landscape

Anna Sofaer, Robert Weiner, and Richard Friedman
The Solstice Project

In 2010, the Solstice Project implemented a project using Light Detection and Ranging, better known as LiDAR, to document the Chaco Culture's Great North Road. This was the first use of this cutting-edge technology to document Chaco roads, which have traditionally been identified and studied using aerial photographs, accompanied by ground truthing. The significance of the Great North Road became evident to the Solstice Project through its ground investigations with archaeologist Michael Marshall, and the earlier findings by John Stein, Fred Nials and John Roney reported in the 1980s BLM roads studies. These archaeological investigations indicated a minimal utilitarian use of the road, and rather that ritual architecture was situated on its route and a staircase with apparent ceremonial offerings of pottery sherds at the steep drop into Kutz Canyon, the termination of the road. The results of this study, when shared with the Puebloan historians and educators, revealed the Great North Road's profound importance to Puebloan cosmology as connecting with the spiritually significant direction of the North.

Surface expressions of Chacoan road features have been rapidly disappearing due to natural erosion and increased land use activities in the Four Corners region. Many roads that were clearly visible in aerial photography and on the ground in the 1980s are now virtually invisible from the air or ground. Recognizing that in the case of the Great North Road, intensive oil and gas development and its associated infrastructure, such as modern roads to facilitate access to well pads, were severely impacting its fragile state, the Solstice Project won a grant from the National Trust for Historic Preservation in 2010 to document it with LiDAR.

A LiDAR scanner was strapped onto an airplane that flew over the Great North Road, sending out thousands of laser pulses per second with precise geographic reference that mapped the terrain. Once the raw data was acquired, Solstice Project affiliated Chaco researcher and remote sensing expert Richard Friedman used GIS technology to remove vegetation from the image to reveal the ground surface. Some of the pulses emitted by the scanner pass through the trees and therefore the trees can be filtered out to create a "bare earth model." Friedman then used GIS technology to highlight linear surface anomalies in the LiDAR image by enhancing shadows. He was able to digitally manipulate a light source to emanate from any azimuth and at a low angle to create sharply defined shadows in the linear paths of the roads.

The results of the LiDAR scan, to be published in November 2017 in the journal *Advances in Archaeological Practice*, were extremely rewarding. The computer manipulation of the light source revealed incredibly subtle linear features – including one road with a depth of no more than three and a half inches and that is totally

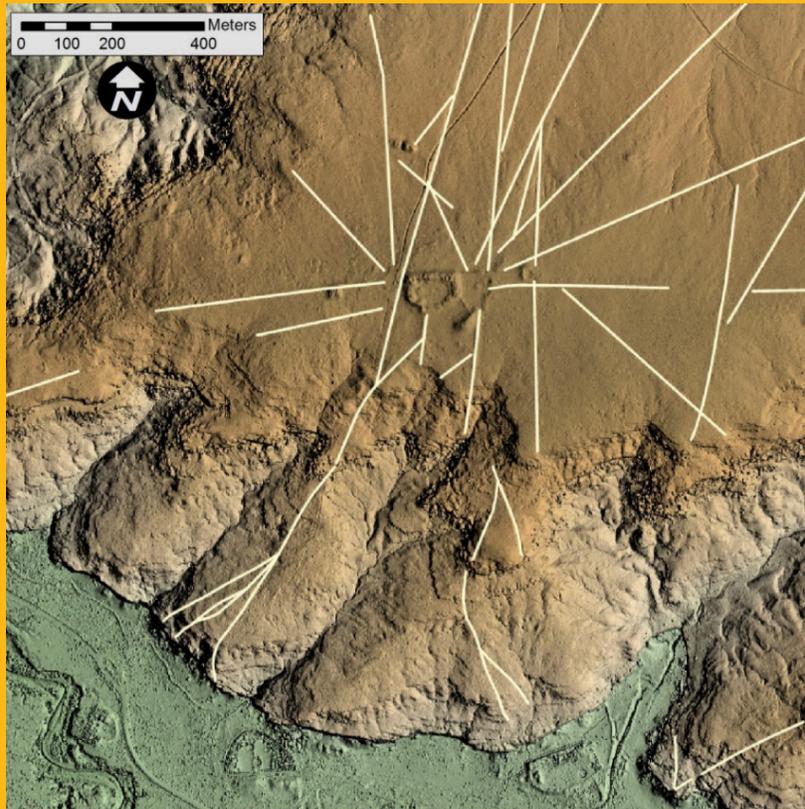
invisible on the ground. Not only were all previously known segments of the North Road detected using LiDAR, but also nearly 2 miles of previously unknown segments. This project showed that LiDAR could be employed to measure the length, width, depth, and cross-sectional profiles of Chaco roads at an unprecedented level of precision and with remarkably cost effective results. In addition, LiDAR data creates an invaluable digital record of roads that are rapidly vanishing on the ground and an archival documentation for researchers interested in Chaco roads now and into the future.

Solstice Project Founder and President Anna Sofaer, along with affiliated archaeologists Richard Friedman and John Roney, traveled to Washington D.C. in 2014 to present the highly effective results of this first use of LiDAR to document Chaco roads. They proposed a larger scale LiDAR project for Chaco roads in meetings with the Deputy Director of the Bureau of Land Management, as well as the staffs of Senators Martin Heinrich and Tom Udall, and Representative Ben Lujan, based on the effectiveness of the LiDAR study of the Great North Road. They stressed the urgency and importance of conducting LiDAR studies to document Chaco roads and other archaeological features within the San Juan Basin in advance of increased energy extraction activities. This lobbying resulted in the BLM recognizing the usefulness of LiDAR and acquiring 4,247 sq. km of LiDAR data in areas surrounding Chaco Canyon in 2017.

Following the LiDAR recording of the Great North Road, the National Trust for Historic Preservation in 2011 gave further support to Chaco's protection, and especially to the Great North Road, in designating the Greater Chaco Landscape as one of the nation's "Eleven Most Endangered Places."

In 2014, the Solstice Project released a four-minute video titled “Fracking Threatens Chaco Canyon’s Sacred American Heritage” hosted on Vimeo to convey the threats to Chacoan cultural resources with increased energy development in the Four Corners region. As of August 2017, the video has had more than 15,000 views and has inspired significant public advocacy for the protection of Chacoan

More recently, Anna Sofaer and Solstice Project Research Associate Rob Weiner have given numerous public talks emphasizing advocacy to protect the Greater Chaco Landscape at various venues including Santa Fe Indian School, Museum of Indian Arts and Culture, School for Advanced Research, New Mexico Natural History Museum, and the RENESAN Institute for Lifelong Learning. For further background on the Solstice Project see solsticeproject.org.



Roads around Pueblo Alto detected by LiDAR. Image by Richard Friedman.

Chaco's Dark Skies

G.B. Cornucopia

Interpretive Ranger

Chaco Culture National Historic Park

Since 1988 Chaco has been active in presenting the wonders of the night sky to visitors. As Chaco's interpretive programs go, the Night Sky Program has become the most popular of Chaco's presentations.

In 1998 Chaco opened the first National Park observatory through a donation from a visiting amateur astronomer who wished to have his own facility under the dark skies of the southwest but didn't want to be burdened with the security issues of an unprotected site (Figure 3). Since its inception the observatory has hosted thousands of visitors, as well as offering a resource for astronomical research. Chaco has initiated partnerships with amateur astronomy clubs in the Albuquerque area who come to Chaco to offer "star parties" for the visiting public.

The National Park Night Sky Team, a grant funded entity of the National Park system, has periodically measured the dark sky qualities of Chaco using state-of-the-art digital recorders and has identified Chaco's darkness as one of the best in the park system. These assessments keep track of any degradation of the sky from sources of light that continue to grow around the canyon. The measurements are taken from the top of the mesas forming the canyon and are in full view of the surrounding lights and flares of nearby oil and gas drilling rigs that are spread across the Greater Chaco Landscape. As the number of rigs and facilities increase, especially to the north and east of the canyon, it is critical to continue this monitoring.

As more and more pictures from space of the earth at night have become available, it is clear that humans have changed the natural balance of light and dark in favor of more and more light. Studies have shown that the effects of increased light on animals, vegetation, and humans pose a serious threat to the natural balance. The good news is that darkness is not a depleting resource and can often be mitigated, if not reversed, by implementing dark friendly lighting techniques. However, this requires education and commitment, so that oil-gas developers can understand the issues before using lighting techniques that compromise Chaco's dark skies.

The International Dark Sky Association, located in Arizona, assesses and monitors dark skies across the world. The group has highlighted locations where skies are dark and still offer a view of the cosmos that communities of ancient people have taken for granted. In Chaco, we have a direct link to the ancient Puebloan builders of the Great Houses a thousand years ago! When we look into the night sky we see the same sky, nearly as dark as those ancient ones saw. Because of this, and because of Chaco's interpretive programs that introduce thousands of visitors each year to the natural wonder of a clear dark sky, Chaco was nominated and designated an International Dark Sky Park in 2013.

If we wish to stay in touch with the natural world, it is essential that we have places where the development that insulates us from the natural balance is held at bay, and we, as individuals, and communities can experience our true relationship with the world at large. Presently, Chaco Culture National Historic Park is one of those rare places. We now have the opportunity to make sure Chaco can continue to do so for future generations.



Figure 3. Astronomical observatory at Chaco Culture National Historic Park.

Geospatial Data, Remote Sensing, and Understanding Chacoan Roads Data

Carrie C. Heitman, Ph.D., Assistant Professor of Anthropology, University of Nebraska-Lincoln
Sean Field, M.A., University of Nebraska-Lincoln

When land management agencies, like the Bureau of Land Management (BLM), make oil and gas leasing decisions, they depend upon digital data ecosystems (like Geographic Information Systems or GIS). This GIS data in turn relies on other digital data ecosystems (like the New Mexico Cultural Resource Information System or NMCIS) to gather and pull in archaeological site location data. In short, data driven decision making requires digital intermediation platforms. And while this is a perfectly reasonable workflow to help inform land management decisions, there are inherent weaknesses in these systems that have real world consequences. We refer to this as the technocratic tyranny of digital data ecosystems.

In using digital intermediation platforms, non-digital data, such as paper maps or printed data tables, effectively do not exist and even bad digital data supersede good, analog data. What's more, data segregation (Balkanized between state and federal agencies, tribes, and separate scholarly networks), has hampered our collective ability to manage and preserve the Greater Chaco Landscape due to inaccurate locations or incomplete site information within some of these systems. From a research perspective, such practices have resulted in inefficient, duplicated efforts to refine those data. No singular entity or agency has the authority or sufficient funding to continually gather and reconcile both older, legacy (historic) and new archaeological data (like raw or processed LiDAR data) about the Greater Chaco Landscape. Hence, relying on one set of site location data (like NMCIS) will lead to land management decisions based on incorrect or incomplete data.

We have been involved in three recent projects that demonstrate the real-world consequences of these challenges. In 2015-2016, Heitman led a team of researchers (funded by the National Park Service) to aggregate and reconcile disparate GIS databases on Chacoan great house locations. This was the second such effort in the last 20 years and will not be the last. The new GIS database was then shared with various state and federal agencies to help improve their site location data. More recently we, along with a team of others, were involved in a NASA DEVELOP collaboration project (in Summer 2016). The main objective was: "To identify Chacoan community signature profiles, such as roads, villages, middens, and structures, throughout the San Juan Basin to help with preservation and protection strategies by using NASA Earth observations." (More information is available at <https://develop.larc.nasa.gov/2016/summer/ChacoCanyonCross.html>)

Among other products, the NASA DEVELOP team created a Chacoan Sites Risk Map to identify areas where Chacoan sites would be at risk from developing infrastructure. [Figure 4] Risk, in the NASA model, was defined as any area in close proximity to one of the following: 1) areas with an expected population increase from 2015 to 2020; 2) existing roads; 3) existing or planned oil and gas drills; and 4) perennial hydrological features. The resulting NASA risk map suggests that a large area of the San Juan Basin is being impacted by developing infrastructure. Forty-five of the 123 (37%) known Chacoan great houses in the NASA study area are at a high risk for disturbance from developing infrastructure. Fortunately, thirteen of these sites are already protected by National Park Boundaries and at least 3 others are protected by the BLM as "Areas of Critical Environmental Concern."

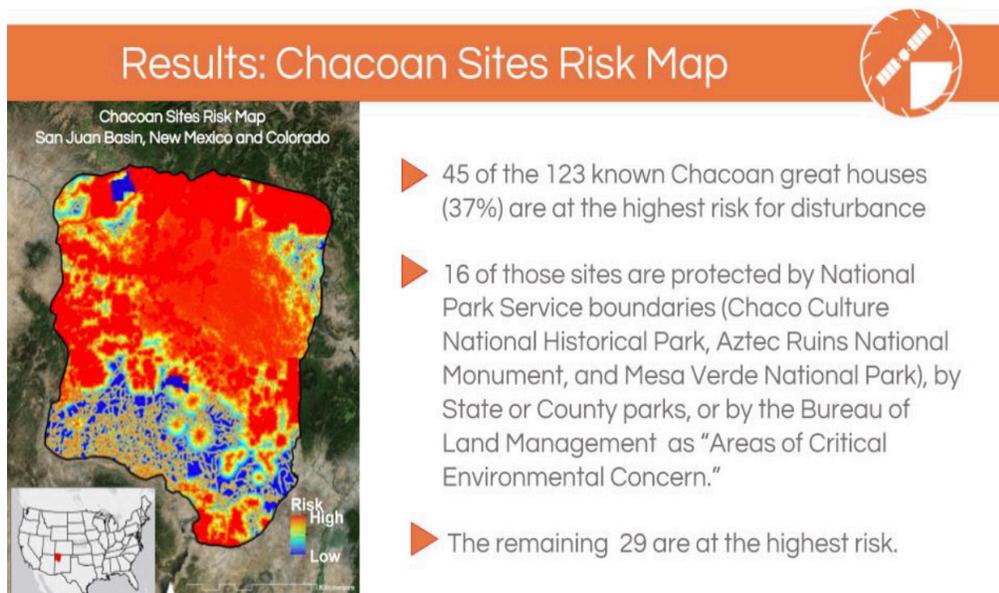


Figure 4. NASA map showing Chacoan outliers at high risk.

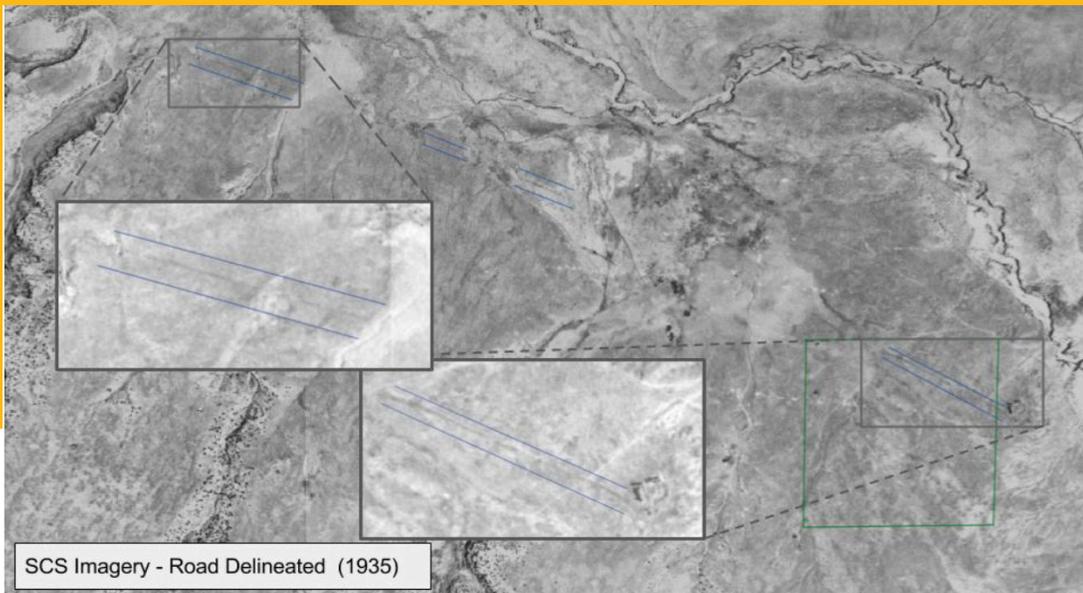


Figure 5. Legacy aerial imagery showing Pueblo Pintado Chaocan road.

Based on Sean Field's Master's thesis research, there is also a need for aggregating, digitizing, and assessing the confidence thresholds for linear, Chacoan road features. Using the Pueblo Pintado to Chaco Canyon road as an example, we have demonstrated the utility of using legacy data in the form of historic aerial imagery to assess the degradation of these features over time. [Figure 5] This archaeological feature was highly visible in 1935, and still visible in 1973 and 1985. Due to human impacts and erosion, it then became invisible (via aerial imagery) on the landscape between the years 1983 and 1991. According to more recent aerial imagery (1991 - 2017) the only remaining viable segments are within the protected NPS boundary around Pueblo Pintado itself. Although LiDAR data provide evidence for the continuity of this landscape feature and surpass aerial imagery as a tool for detection, we think it is important to use multiple sensing technologies to reveal different aspects of the pace and causes of feature degradation. Our ability to identify cultural resources using advanced sensing technologies will not protect these places from possible obliteration. The speed of this feature degradation over the course of 34 years (between 1983 and 2017) is cause for concern and should urge further action to protect these fragile cultural landscape features.

In conclusion, we would like to make a number of recommendations. Collectively, we need to: 1) acknowledge the cumulative and lasting negative impacts data segregation has had on our ability to document, preserve, and manage the Greater Chaco Landscape; 2) foster awareness of the weaknesses and potential improvements for of the digital data ecosystems in which we currently operate; 3) incorporate existing, legacy data sources into land management decisions; 4) recognize that some of our digital data ecosystems have the capacity to infringe on the sovereignty of Native lands and take appropriate actions to prevent this; and 5) promote and support responsible data sharing and the timely dissemination of research findings. While there is no perfect digital data ecosystem, we have an opportunity and an obligation to do the most with the information in hand.

Impacts of Oil and Gas Drilling on the Soundscape and Viewscape at Pierre's Chacoan Outlier, San Juan County, New Mexico

Ruth M. Van Dyke, Ph.D.

Professor of Anthropology, Binghamton University

Chaco Scholar, 1991 – present

Archaeological investigations indicate that viewscales and soundscapes were integral to Chacoan life a millennium ago, yet we are only beginning to study these dimensions of ancient societies. Existing cultural resource management practices do little to help manage or protect less quantifiable dimensions of the landscape, such as viewscales and soundscapes. I demonstrate the problem with a description of the visual and aural impacts of oil and gas drilling in the Pierre's Chacoan community, 15 miles north of Chaco Canyon.

The Chaco phenomenon of northwestern New Mexico in the American Southwest is centered on, but not limited to, Chaco Culture National Historical Park. Chaco Canyon was materially, socially, and most likely politically connected with outlying regions. Archaeologists have long understood this through the evidence of architecture, artifacts, and roads. More recently, we have begun to appreciate the Chacoan world was also connected to outlying communities through visibility.

High mountain peaks and distinctive landforms such as Mt. Taylor, Huerfano Mesa, and Hosta Butte are visible over vast distances against our clear desert skies. For Navajo and Pueblo peoples past and present, prominent visual landmarks such as these are important in oral traditions, contribute to a sense of identity, and help with wayfaring. A millennium ago, Chacoans, too, were concerned with lines-of-sight to prominent peaks and long-distance landscape visibility. In a recent GIS study, colleagues and I demonstrated that a network of intervisible high places across northwest New Mexico likely was one means for connecting the far-flung communities of the Chacoan world. Within Chacoan outlier communities, great houses are often situated on high places, where they can see not only surrounding smaller settlements, but where they can connect back to Chaco Canyon via one of more lines-of-sight.

As our Native colleagues tell us, it is perhaps more important to try to understand an ancient sense of place than to estimate how many potsherds lie buried in a midden or calculate the person-hours required to construct a wall. Thus, phenomenologically oriented archaeologists such as myself are ultimately interested in understanding the human experience of ancient places – particularly sensory dimensions of place, such as viewscales and soundscapes. We have only recently developed the theoretical frameworks and the technological tools to try to understand viewscales in the Chacoan world. We have devoted even less attention to soundscapes – the acoustic properties of archaeological sites, past and present. And, because these kinds of studies are relatively new in archaeology, we lack robust legislation to help landowners and agencies figure out how to evaluate, study, and mitigate potentially damaging effects from oil and gas drilling or other types of destructive development. I turn now to a case study – the Pierre's Chacoan community – to illustrate the kinds of impacts and damage that can result.

The Chacoan outlier of Pierre's, located about 15 miles north of Chaco Culture National Historical Park, is clearly an important spot along the Chacoan Great North Road. At Pierre's, there are two Chacoan great houses on a high mesa overlooking a surrounding community of at least 20 small habitation sites. The Great North Road cuts through this community past a badlands pinnacle dubbed "El Faro," or "The Lighthouse," because it is topped by a small structure including a hearth or firepit (which means it may well have been an ancient place for signaling). Looking south from Pierre's, a viewer can see the great house of Pueblo Alto and other familiar landmarks of Chaco Canyon. There is little doubt among Chaco scholars that the Pierre's complex is a ritual landscape, situated in this place because of

its visibility and position vis à vis the Great North Road. Where great house communities are situated along engineered Chacoan road segments, it is likely that localized ritual processions may have taken place. The importance of the Pierre's landscape has been recognized for 35 years. When Chaco Culture National Historical Park was created in 1980, the legislation included Pierre's in a group of 33 outlying 'Chaco Culture Archeological Protection Sites'. Pierre's was one of the Chaco outliers included when Chaco Culture NHP received UNESCO World Heritage status in 1987.

The ground footprints of the archaeological sites at Pierre's are well-protected, but the surrounding viewscales and soundscapes on BLM and Navajo lands are not; our archaeological preservation laws are not generally invoked to protect these less tangible aspects of the past human experience (Figure 6). In November 2016, I visited Pierre's to study and assess these impacts. I used relatively new viewscale and soundscape recording techniques, including 360 photography and a Roland Edirol digital recorder. I found that, despite the due diligence agencies have exercised to protect the ground footprint of Pierre's, there have been significant impacts to the viewscale and the soundscape. From the great houses and EL Faro, at least 12 pumpjacks are visible from the high places in the community – 6 of these lie in the view towards Chaco Canyon (Figure 7). Until the BLM asked the company to provide a muffler, noise from the nearest pumpjack was audible from throughout the community. Rather than a sacred landscape and part of a UNESCO World Heritage Site, the Pierre's community had the feeling of an industrial park.

PIERRE'S VIEWSCAPE

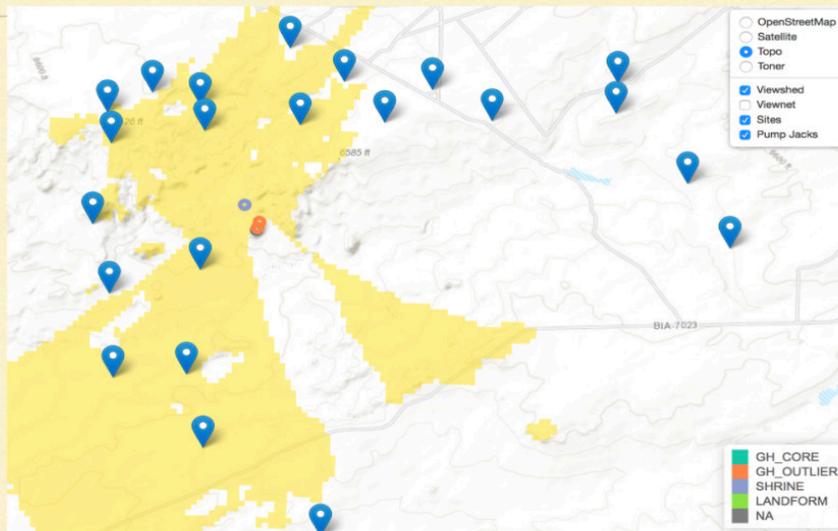


Figure 6

Locations of pumpjacks visible from Pierre's El Faro. Yellow = the area visible from El Faro, and the blue pins are the pumpjacks, derived from public information on the locations of oil and gas wells in New Mexico. Viewshed analysis & graphic by R. Kyle Bocinsky.

Archaeologists, legislators, and government employees must work together to ensure that these kinds of impacts to viewsapes and soundscapes do not continue unabated across the Chacoan world. We urge the BLM to withdraw unleased areas from consideration for oil and gas development. Where areas have already been leased, we urge the BLM to protect Chacoan communities from indirect and cumulative adverse impacts to their surrounding viewsapes and soundscapes. We can work with existing NHPA and NEPA language to help them do this. Where impacts have already happened, we can urge the BLM to require mineral developers to make amends. The most important thing that the public can do is invest in sustainable energy development, call our Congresspeople to impress upon them our values and opinions, and vote.

Figure 7

View from the nearest pumpjack, "Hoss Com #95," to the Pierre's community. The site labeled "LA 16509/ House A" is one of the two great houses atop the mesa. Photo by author.





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