

# Remote Sensing and Indigenous Communities

## Challenges and Opportunities

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### ABSTRACT

Although remote sensing techniques are increasingly becoming ubiquitous within archaeological research, their proper and ethical use has rarely been critically examined, particularly among Native American communities. Potential ethical challenges are outlined, along with suggested changes to archaeological frameworks that will better address Native American concerns. These changes center on a revised view of remote sensing instruments as being potentially invasive and extractive, even if nondestructive. Understanding the potentially invasive and extractive nature of these tools and methods, archaeologists are urged to work closely with Native/Indigenous communities to create more holistic practices that include community knowledge holders and to actively discourage stereotypes that pit archaeologists and Native/Indigenous communities against one another. Considering the speed at which remote sensing is being used in archaeology, these changes need to be embraced as soon as possible so that future work can be conducted in an ethical manner.

**Keywords:** remote sensing, ethics, Indigenous archaeology, public archaeology, North America

Si bien las técnicas de percepción remota se están volviendo cada vez más omnipresentes dentro de la investigación arqueológica, su uso correcto y ético rara vez ha sido examinado críticamente, particularmente entre las comunidades Nativas Americanas. En este artículo, describimos los posibles desafíos éticos junto con los cambios sugeridos a la práctica arqueológica abordando las preocupaciones de los Nativos Americanos. Dichos cambios se centran en una visión revisada del uso de instrumentos de percepción remota como potencialmente invasivos y extractivos, incluso si no son destructivos. Al comprender la naturaleza potencialmente invasiva y extractiva de estas herramientas y métodos, se insta a los arqueólogos a trabajar en estrecha colaboración con las comunidades Nativas/Indígenas, para crear prácticas más holísticas que incluyan a los guardianes del conocimiento comunitario desalentando activamente los estereotipos antagonistas. Teniendo en cuenta la velocidad en la que se está utilizando la percepción remota en la arqueología se debe considerar la aplicación de esta propuesta lo antes posible para que los trabajos a futuro se puedan realizar de manera ética.

**Palabras clave:** percepción remota, ética, Indígenas arqueología, pública arqueología, América del norte

Since the 1970s, when geophysical instruments first became available, to the last few decades with the ready accessibility of lidar data and drone-based imaging, advances in remote sensing technologies have revolutionized archaeological research several times over. Many have documented the empirical, methodological, and theoretical impacts of remote sensing in archaeology (e.g., Chase et al. 2011; Thompson et al. 2011), yet it is only recently that archaeologists considered the unique ethical challenges created when using these technologies. Remote sensing technologies create ethical challenges for many reasons, which include the fact that they (1) can be deployed without engaging local communities; (2) require significant financial investment and specialized knowledge to operate; and (3) create datasets that can be easily shared and are often given a great deal of authority, yet are difficult to manage and interpret (e.g., Cohen et al. 2020). As such, inexpertly designed and poorly implemented projects can dispossess people of their cultural heritage, reinstall or amplify

unequal power relations, threaten sovereignty and intellectual property rights, and otherwise alienate communities and peoples at the center of research. These impacts are likely only to be further amplified and expanded as remote sensing technologies become increasingly powerful, extensive, efficient, and accurate. The precise challenges (and opportunities) created by remote sensing technologies are heavily influenced by local political, economic, social, and cultural conditions, which means that archaeologists are best served by adapting to the needs of the communities with which they wish to collaborate rather than adopting a universal set of policies.

NDN<sup>1</sup> communities are rarely considered within the ethical reassessment of remote sensing technologies, which has been focused outside of North America (although see Fernandez-Diaz et al. 2018). Within this article, as well as the other articles in the theme issue (Greibenkemper et al. 2021; Nelson 2021; Wadsworth

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et al. 2021; Warrick et al. 2021), we provide a first step in describing the unique challenges associated with conducting remote sensing studies with NDN communities. Many of these challenges arise because NDN communities in the United States and Canada occupy unique legal and political positions in which self-governance and sovereignty are central rights. Perceived by the archaeologist as noninvasive, remote sensing technologies can often be deployed without consideration or respect of NDN self-governance and sovereignty. Consequently, they can maintain barriers or create new damage to relationships between NDN communities and archaeologists. Likewise, many NDN communities have cultural sensibilities, traditions, and practices that can be violated, undermined, and mistreated when remote sensing projects are undertaken without due consideration and consent. Much as NAGPRA and discussions over repatriation continue to help educate archaeologists about the proper manner of project design when working with human remains and mortuary objects, a similar discussion is required regarding sacred landscapes and entombed ancestors. Finally, as archaeologists, policy makers, and governmental officials in the United States and Canada are increasingly viewing remote sensing as a viable alternative to pedestrian surveys and excavations when reviewing development projects and research programs, NDN communities will increasingly find their cultural landscapes and communities surveilled by these technologies. For these reasons, it is vitally important to consider the challenges created when deploying remote sensing projects within NDN communities and cultural landscapes before their use becomes entrenched and a mainstay of archaeological practice. It is critical to note that NDN communities are remarkably diverse; each has their own cultural sensibilities, history of engagement with archaeologists and the federal government, means of decision making, and other localized situations that can dramatically alter how they might be impacted by remote sensing studies. In the following pages, we rely on our own experience working as, within, and among NDN communities to highlight points of potential friction while recognizing that not all will be relevant in every situation and that we may also have missed some. Specifically, we suggest that archaeologists be particularly mindful about how remote sensing technologies can conflict with local cultural sensitivities, NDN sovereignty, relationship building, data accessibility and ownership, and traditional knowledge. Our hope is that our presentation of potential challenges will provide researchers with some guidance that they can tailor based on local NDN collaboration.

Although our article focuses on the challenges associated with remote sensing, we recognize that many archaeologists have chosen to use these technologies because they view them as a more responsible and ethical means of study. As we highlight points of potential conflict, we do not intend to discourage the use of remote sensing techniques. Instead, we encourage archaeologists to recognize that these methods—like all methods—can create broader social, cultural, political, and economic impacts within the communities in which they are deployed. Therefore, they require close consideration. For this reason, we suggest ways in which archaeologists could recalibrate their approach to develop increasingly responsible, ethical, and sustainable projects. Many of these recalibrations are explored and made evident in the articles contained in this theme issue. Taken together, the goal of this introduction and this theme issue is to provide an opportunity for researchers to consider (1) the potential impacts of deploying remote sensing technologies within NDN nations and

communities and (2) the ways in which they can address these challenges. Although we consider archaeologists employing remote sensing technologies to be our primary audience, we hope that this article is also useful for NDN nations/communities and Indigenous archaeologists to the extent it makes explicit their own unease and provides solace that they are not alone with those concerns.

## POTENTIAL CHALLENGES

We identify four potential areas of conflict that can arise, or be made worse, when deploying remote sensing techniques: cultural sensitivity, sovereignty and relationship building, data accessibility and ownership, and conflict with traditional knowledge/NDN science. These topics are not exhaustive, and each community will have their own proclivities, but these are the most common in our experience.

### Cultural Sensitivity

Although observation is not as invasive as excavation, many NDN's experience the act of observing their ancestors as taboo, problematic, and dangerous—even when done remotely. Consequently, it is crucial that archaeologists interrogate how their use of remote sensing technologies can create moral, ethical, spiritual, cosmological, and social stress, particularly when investigating highly sensitive phenomena such as burials. As an example, Grebenkemper and colleagues (2021) describe how their use of cadaver-seeking canines needed to be conducted in a very specific manner, even when searching for people who died centuries or millennia ago. As the debate over the Ancient One (named Kennewick Man by archaeologists without consultation with NDN descendant communities) brought into focus, the passage of time does not reduce the violence inflicted on ancestors and descendant communities when they are disturbed, nor does it relieve NDN communities from their obligation and responsibility to care for their ancestors. As such, although remote sensing technologies are certainly preferable to excavating human remains, archaeologists must consider how these technologies remain invasive—particularly those that emit electromagnetic signals into the ground with the explicit goal of encountering burials.

Even in nonmortuary contexts, archaeologists must recognize the potential harm that remote sensing technologies can cause when they reveal broader patterns of landscape use that relates to closely held NDN traditions. For example, lidar is often seen by archaeologists as a benign means of data acquisition, yet it can reveal features within the landscape relating to important social, cultural, and spiritual practices of local NDN communities. Often, these important places hold immense cultural value because they are private and not shared outside of specific community members. For this reason, a seemingly innocuous map showing the distribution of stone shrines, earthen mounds, or other phenomena can be viewed as remarkably insensitive within NDN communities, who view these landscapes as infused with a spiritual power that is diminished or threatened when shared too broadly.

It is also critical to consider the appropriateness of using remote sensing technologies, particularly aerial instruments, because they are a means of surveillance. Most, if not all, NDN communities

have a deep history of conflict with federal, state, and local agencies resulting from 500 years (or so) of experiencing Indian policy aimed at control and genocide. Because of these histories, and the general concern over privacy within the United States, it is worth considering how NDN communities might view remote sensing as invasive or exploitive, exacerbating justified and deep-seated distrust. Exploitation is a particular concern for NDN communities that have weathered decades of scientific colonialism during which settler-colonial (Euro-American) individuals and institutions have benefited from studying/surveilling their members. Consequently, remote sensing projects can be viewed as part of a longer tradition in which NDN landscape, heritage, and culture are threatened (Brown 2004).

## Sovereignty and Relationship Building

After centuries of dispossession, genocide, and broken treaties, NDN communities have fought to maintain a level of self-determination or sovereignty that includes some controls over their homelands and activities conducted there, although they are not fully recognized by settler nation states and archaeologists. Consequently, NDN nations are typically included (by law) when development projects pose a threat to their cultural heritage or when archaeologists wish to conduct research within their ancestral territories. The same protocols are not always followed when that work relies on remote sensing technologies. Because remote sensing technologies are perceived by archaeologists as non-destructive, the rules and regulations imposed on them are less restrictive than those imposed on excavations and, at times, even on surface surveys. With relatively lax rules and regulations, archaeologists can deploy remote sensing technologies, particularly aerial instruments, with limited or no NDN consultations. Removing NDN nations from consultations is a direct threat to their sovereignty, ability to self-govern, and NDN futurity. For example, it is unclear whether tribal nations in the United States can regulate the air space above their own lands (Haney 2016). Consequently, it is feasible that archaeologists could conduct aerial surveys of reservation lands not only without consultation but even against the explicit wishes of tribal governments. Such a case would have to be worked out through the judicial system. This highlights the gray area occupied by remote sensing technologies, and the potential damage these instruments could inflict on tribal sovereignty if deployed unilaterally.

Even when remote sensing projects entail consultation with NDN groups, the speed at which they can be deployed—and in the case of aerial imagery, the distance at which they can be conducted—can make more collaborative relations appear unneeded or even unrealistic to the archaeologist. Traditional survey and excavation projects often last weeks, if not months, and they may recur periodically over many years, during which it is possible to build long-lasting relationships between NDN communities and archaeologists. In contrast, remote sensing projects might only take a few days to acquire data, after which no further visits by the researcher would be required. In the case of aerial data collection, the project might only take a few hours, and the operator might be far away. Although archaeologists often celebrate the speed at which they can conduct remote sensing surveys, it is worth noting what can be lost with such efficiency—namely, relationships, reciprocity, and respect with local communities. In this way, remote sensing projects can challenge the current trajectory of archaeology, which is to be more engaged, more local, and more

respectful and responsive to NDN community concerns and desires (e.g., Atalay 2012).

## Data Accessibility and Ownership

The nature of remote sensing data poses unique challenges when working with NDN communities. Whereas surface surveys and excavations acquire physical objects, many of which are amenable to NDN engagement and interpretations, remote sensing technologies produce complex digital datasets that require specialized training to decipher. Object-based collaborations—in which NDN peoples work directly with archaeologists in studying artifacts, architecture, and other material remains—can help build bridges between these two groups. It is more difficult (although not impossible) to create the same collaborative environment when pouring over remote sensing datasets, especially in the early stages of analysis prior to the creation of maps where points of interest have already been defined. Because they require specialized knowledge to decipher, remote sensing technologies can make NDN communities dependent on archaeologists to access their own heritage. Such a reliance perpetuates long-established divisions between NDNs and archaeologists by emphasizing that knowledge production is undertaken by scholars and specialists within elite institutions—such as academic centers, governmental agencies, and private corporations—rather than by community members and community intellectuals. This divide threatens many of the gains that have been made within archaeology to make practices and power structures more democratic by instead reaffirming the unequal relationships that have long defined our discipline (e.g., Gould 2016).

Ownership of remote sensing data also needs to be considered when working with NDN communities. Archaeologists often view remote sensing data as distinctly different from material objects in that they “reflect” the archaeological record rather than being part of it. Viewed as a secondary or derived dataset, it is easier to assign ownership of remote sensing information to those who produced the data (often archaeologists) rather than local community members, descendent groups, or even landowners. Indeed, because remote sensing surveys require some level of investment, the resultant datasets are typically owned by the institutions supporting the research with little legal recourse for local communities who consider these data as their cultural heritage. In an effort to share ownership, archaeologists may offer digital files to NDN nations/communities, yet this often creates new problems when these groups are not accustomed to handling gigabytes of data that are often only accessible by expensive software. Such sharing of raw data also does not address the underlying issue, which is that NDN nations/communities are often more concerned about owning the decision-making process regarding data usage than owning the data.

Archaeologists working outside of North America have encountered this problem, particularly when acquiring aerial data from satellites not owned by the countries being studied. Such datasets are considered the legal property of the institutions that pay for the research, but an increasing number of archaeologists suggest that local communities ought to be afforded some level of “moral ownership” (e.g., Fernandez-Diaz and Cohen 2020). Providing moral ownership to local communities recognizes that remote sensing datasets are often the only way in which important aspects of cultural heritage can be accessed. For this reason, local

stakeholders should have a say in how these datasets are acquired, stored, managed, processed, interpreted, distributed, and curated.

The ability to control distribution of remote sensing data is of particular concern to many NDN groups, in part because the images and maps made using these technologies can be easily shared with a wide and possibly unintended audience through file sharing, websites, and social media. Over the last several decades, archaeologists have begun to respect the differing protocols needed when considering sharing images of skeletal remains, funerary objects, sacred items, and other highly sensitive objects. Few, however, consider the display of remote sensing data drawn from similar contexts as requiring the same level of sensitivity. A Facebook, Instagram, or Twitter post displaying a successful GPR survey that found dozens of burials may be perceived by archaeologists as harmless, but it may be experienced as a violation of the values, protocols, and needs of NDN communities whose heritage is being represented.

The inability to regulate and control remote sensing data can result in conflicts over intellectual property rights. Like many communities dispossessed by settler colonialism, NDN communities have long battled cultural appropriation and the perception that they are ahistorical. From institutions using a Native American as a mascot to Euro-Americans “playing Indian” at summer camps across North America, it is our experience that the commodification of NDN heritage is a top-level concern for communities working to retain their intellectual property rights. Consequently, there is a concern that remote sensing projects could result in a threat to these rights. For example, geophysical studies can result in remarkably accurate images showing intricate architectural details, patterns of movement, and use of space that are considered sensitive, sacred, or otherwise important to local NDN communities (e.g., Friberg et al. 2021). Control over this intellectual property is therefore critically important: if left unguarded, NDN communities might find this information widely broadcast and perhaps even replicated within the commercial market or used without knowledge or consent in a manner that objectifies and dehumanizes them within research contexts.

### Conflict with Traditional Knowledge and NDN Science

The technical/inaccessible nature of remote sensing instruments imbues projects with an air of Western scientific authority. Armed with this authority, archaeologists can influence decisions regarding land use, development projects, and attribution of cultural connection in much of the United States and Canada. Remote sensing data can threaten or undermine NDN perspectives and priorities such as NDN/Indigenous science, traditional knowledge, and oral histories when deployed unilaterally. The danger of pitting NDN perspectives against remote sensing projects is heightened when archaeologists attempt to address large-scale questions about migration, cultural affinity, economic modeling, sacred landscapes, and societal structures engaged by ancestral peoples. Many of these questions are already addressed within NDN knowledge systems, and any attempts to consider them without centering existing knowledge perpetuates scientific colonialism (Nicholas and Hollowell 2010) exacerbating, long-standing tensions between opposing communities, as defined by Vine Deloria Jr. (1997).

Remote sensing projects risk not only causing harm and alienating traditional knowledge holders and community intellectuals but also reaffirming the much abused “science versus religion” trope that has already greatly damaged relationships between NDN communities and archaeology (Thomas 2002). Agency officials, developmental managers, grant-giving institutions, policy makers, and other members of the public are often overly impressed by the inner workings and apparent scientific rigor of remote sensing instruments. Blinded by these inner workings and resultant images and maps, members of public often contrast remote sensing data with traditional knowledge as they would contrast objective knowledge with subjective knowledge, or they frame it as a conflict between science and religion. Instead of recognizing the knowledge contained within NDN (Indigenous) science—specialized knowledge and wisdom passed down through generations, held by community specialists (Bruchac 2014)—this acts to reaffirm stereotypes classifying NDNs as nonscientific, backward, unintelligent, uncivilized, or otherwise substandard peoples clinging to an ancient way of life.

The “discovery” of “lost cities” or “vanished peoples” is another recurrent and damaging trope often attributed to remote sensing projects (e.g., Canuto et al. 2018). This further promotes the colonial construct of the “vanishing Indian,” a construct that fed much of the early anthropological works in North America, which observed and documented attempts at dispossession and genocide while doing nothing to intervene. NDN communities have neither vanished nor are they disappearing. Instead, they hold deeply engrained knowledge of their past, including where their ancestors once lived. When archaeologists describe their projects using this trope, or when their projects are presented in this way in popular media, it reaffirms a view of NDNs as having disappeared or being disconnected from their past, or as being in need of assistance from elite academics, governmental officials, or other agents of the colonial state to “save” their histories. Such narratives clearly undermine NDN assertions of cultural continuity with their ancestors as well as their ability to be good stewards of these histories.

## REFRAMING REMOTE SENSING

While remote sensing technologies and data can produce unique challenges when working with NDN communities and their heritage, they can also create opportunities. In the following section, we suggest several ways in which archaeologists might consider reframing their view of remote sensing to mitigate potential problems and to accentuate positive opportunities. When appropriate, we draw on articles from this theme issue as examples of this reframing. We again stress that NDN communities are remarkably diverse, so the challenges outlined above will not be applicable to every community. Likewise, not every means of reframing outlined below is needed.

### Nondestructive, Noninvasive, and Nonextractive: The Importance of Developing Relations

Because every community has different concerns, priorities, traditions, and notions of propriety, it is of upmost importance that archaeologists build relationships with local NDN communities

with the intent of developing consensual and reciprocal partnerships. The focus on relationship building has come to define a small but growing wave of “Indigenous archaeology” that was introduced more than a decade ago, but it is one that continues to gain (slow) support in our field (e.g., Atalay 2012). Although these collaborative, power-sharing premises have begun to receive more serious consideration across the discipline, these frameworks and applications require further discussion in order to differentiate between Indigenous and Indigenous-centered archaeologies. The authors assert that Indigenous archaeology be defined as a methodology relying on the four Rs: Relationality, Reciprocity, Responsibility, and Rematriation/Repatriation/Reparation, contributing to decolonizing, upholding Indigenous science perspectives, as well as being responsible to the identity of the practitioner as an NDN person. Like Indigenous archaeology, Indigenous-archaeology relies on the same methodologies (the four Rs), is place based and community specific, and upholds the same principles, but it recognizes that the practitioner is not an NDN-identified person. The purpose of this definition is to honor our NDN colleagues and community members, avoiding unintentional appropriation of identity and recognizing the ways in which the ontologies and epistemologies of NDN peoples matter. We ask for the same differentiation that would be allowed to members of the Society of Black Archaeologists—recognition and honor of Blackness and Black experience in settler-colonial nations. NDN archaeologists and those who are relying on Indigenous-centered paradigms worry that remote sensing technologies create opportunities to disregard these methodologies, largely because orthodox archaeologists, policy makers, and governmental agencies view these instruments as nondestructive—a position that can unintentionally undo the strides that have been made in repairing relationships between NDN communities and archaeology.

Without a doubt, every NDN community would prefer that their ancestral homelands and cultural landscape not be disturbed or destroyed. The ability to conduct nondestructive remote sensing studies is therefore often preferable to excavations. The articles in this theme issue relate the tension often found between those who wish to preserve ancestral sites, including NDN communities, and the forces at work that threaten them. For a very long time, archaeologists have been viewed by many NDN communities as part of the threat. An obvious benefit of deploying remote sensing technologies in lieu of subsurface testing is that it typically leaves the underlying deposits intact. Peter A. Nelson (2021) highlights the benefit of this approach, arguing that archaeologists, particularly within the realm of compliance-based work, ought to accept remote sensing data as more than simply complementary to excavations. In his use of ground-penetrating radar, Nelson has found that “ground truthing” is often not needed and that he can instead advocate for projects that reveal the character of underlying deposits but do not require excavations. The importance of preserving ancestral places from destruction is made clear by Gary Warrick and colleagues’ (2021) article, in which they detail the remarkable level of loss endured by the Huron-Wendat Nation, which has seen hundreds of ossuaries, villages, and other important sites destroyed in the last 150 years. This scale of loss is typical, and most NDN communities see themselves as responsible for the preservation of an ever-dwindling number of ancestral sites.

While pursuing nondestructive projects is important, we suggest that this is a relatively low bar and that archaeologists interested in

conducting ethical remote sensing studies with NDN communities must also think in terms of whether their work is invasive. Reiterating some of the points already made earlier in this article, we urge archaeologists to think about remote sensing instruments being invasive based on how they can (1) disregard sovereignty and self-governance as well as personal and communal privacy, (2) intrude into hidden aspects of cultural heritage, (3) impact spiritual forces and nonhuman entities, and (4) act as unauthorized and unwelcome surveillance.

As already noted, NDN sovereignty and self-governance are threatened by unauthorized surveillance in Indian Country and ancestral lands. Likewise, unauthorized surveillance intrudes on privacy when it is conducted on private property or when it targets the lives of individuals. Given the historic relationship of the settler nation state to NDN Nations and peoples—including genocides, dispossession of land and rights, stealing of children and heritage, broken treaty rights, and the continued persistence on behalf of resource exploitations aided in part by CRM/CRH and archaeologists acting as the authoritative voice on issues of heritage, preservation, and stewardship—there is a great risk to NDN futurity when remote sensing is introduced without explicit permission, consultation, and the defining of protocols.

Archaeologists also need to consider how remote sensing technologies—especially electromagnetic signals, lasers, and other bursts of energy—not only threaten national, communal, and individual privacy but are intrusive in that they create data from covered, buried, or otherwise obscured deposits. Some NDN nations view certain things as being hidden for a reason and see remote sensing technologies as revealing potentially dangerous information.

Many also question whether intrusive technologies might impact or affect ancestors, animals, plants, and other nonhuman or spiritual entities/relations. These entities are often seen as more susceptible to the energies used by remote sensing technologies because they dwell in other cosmological realms or have different or more sensitive senses than their human counterparts. Consequently, there are questions and concerns regarding whether these technologies can be deployed with little or no impact if they might disturb local spiritual, animal, or plant communities.

In addition to reframing their view of remote sensing as being potentially invasive, it is also important to consider whether these projects are extractive. Many NDN nations and individuals recognize extraction as a cornerstone of colonization and see the shift from extracting material wealth to extracting data as a continuation of colonial practices (see Deloria 1969, who offered this critique decades ago). When non-NDNs (diversely realized) gain grants; fulfill developmental projects; sell books; acquire academic, private sector, and governmental positions; and otherwise profit using data extracted from NDN cultural heritage, it matters little if the information was gleaned through destructive or nondestructive means. Given that they can be deployed with little governmental oversight and are touted as nondestructive, remote sensing technologies can provide a particularly insidious means of extracting data. This is because NDNs might not always have an opportunity to deny their application or might feel they are unable to make this denial.

Recognizing the potential intrusive and extractive nature of remote sensing instruments should compel archaeologists to redouble their efforts in engaging local NDN nations/

communities. Not all nations will see remote sensing instruments as invasive or extractive. NDNs may also see them as invasive or extractive in different ways. Archaeology can best learn these intricacies and how to mitigate concerns by talking with local nations and communities. It is also worth noting that reaching out to NDN nations/communities about remote sensing projects is an excellent opportunity to begin to build relations and demonstrate respect as part of a voluntary methodological approach. These sorts of contacts are likely to appear—and to be realized as—more genuine than contacts demanded by the law.

Every article in this theme issue demonstrates the benefits of developing close and sustained relationships with NDN communities. John Grebenkemper and colleagues (2021) have built such a solid reputation with many NDN communities that their use of Human Remains Detection (HRD) canines is requested by these communities when ancestral remains are thought to be present. Such relationships require work, however—particularly when researchers are not part of the NDN community. Grebenkemper and colleagues outline how they developed these relationships over the years by visiting NDN communities, allowing these groups to test their canines, and participating in important ceremonies. Likewise, Gary Warrick and colleagues (2021) demonstrate how their close relationships with the Huron-Wendat Nation provided an opportunity to conduct small-scale excavations to acquire soil samples because they found this to be one of the most accurate means of delineating the presence of underlying villages and homes. By combining this technique with geophysical instruments and working closely with NDN representatives, Warrick and colleagues were able to find a balance of techniques that satisfied all invested parties.

### Interweaving Datasets: Working with Knowledge Holders and Rejecting Stereotypes

Indigenous and settler-colonial (Euro-American) ontologies and epistemologies (knowledge systems) are increasingly viewed as complementary rather than exclusionary. This is also the case in archaeology, where researchers from both groups advocate for a “braided knowledge” in which both systems remain intact yet draw from one another to create a more holistic understanding of the past (Atalay 2020:6). We have already noted that the nature of remote sensing technologies might make such braiding difficult, but articles in this theme issue show that it is not impossible. For example, William T. D. Wadsworth and colleagues (2021) demonstrate the mutual benefit drawn from inclusive project design in which NDN goals, concerns, ways of knowing, and traditions are centered within the research program. Rather than being added at the end, Wadsworth and his team engaged with their NDN partners throughout their project—including while conducting fieldwork—which resulted in a more holistic understanding of the past and a more beneficial impact on the contemporary community. Wadsworth and colleagues suggest that archaeologists embrace Indigenous Knowledge (IK) as a parallel and complementary way of knowing that not only added value to their archaeological interpretations but also allowed them to build trust with the community and help affect change in the modern world. They assert that their use of remote sensing technologies, informed by IK, provided an opportunity for and means of decolonization and reconciliation with their community partners.

Earlier, we suggested that remote sensing technologies can amplify traditional schisms found between archaeologists and

NDN peoples when they reaffirm binary oppositions (e.g., science vs. nature). Nelson (2021) shows that remote sensing technologies also offer an opportunity to deconstruct stereotypes about NDN peoples. He describes how he leveraged his position as a Native American archaeologist utilizing geophysical instruments to disrupt public opinions and notions of NDN people and instead open a new space in which he could redefine himself and his community on their own terms. The articles in this theme issue suggest that we will see more NDN communities and individuals embracing and deploying remote sensing technologies for their own goals and within their own dominion. It will be interesting to see how, or if, this will impact the public view of NDN communities as “antiscientific” or if public perception will change.

### Moral Ownership, Data Control, and Intellectual Property

When building relationships with local community members, it is critical that archaeologists engage in discussions about how data derived from remote sensing surveys will be controlled. Thinking about NDN nations/communities as the rightful owners of these datasets is important because it provides a counterweight to the traditional emphasis on legal ownership. Moral ownership provides significant rights to NDN nations in that it provides them with the ability to restrict the distribution of these datasets, which honors NDN sovereignty. There will be situations in which archaeologists do not have the authority to recognize NDN claims to moral authority (e.g., a massive geophysical survey of underwater resources off the coast funded by energy companies), but there is generally some level of flexibility offered to archaeologists about how, when, and whether data is shared widely.

In many regards, archaeologists and NDNs have the same goals in terms of limiting data availability because neither would like to hand over sensitive information to potential looters. Consequently, it is often relatively easy to come to an agreement about not sharing detailed locational information too broadly. For some NDN nations/communities, this is the extent of their concerns. For others, however, there could be additional worries about long-term access to data, the display of sensitive materials (such as burials), and control over intellectual property rights. These concerns are typically going to be very project specific and community specific, so they are difficult to generalize. For this reason, a frank and honest discussion about concerns is required to preserve relations between NDN communities and archaeologists.

## CONCLUSION

The deployment of methods, techniques, and technologies takes place within existing theoretical and ethical frameworks. Archaeologists have largely come to realize the ethical considerations necessary when conducting orthodox techniques—such as excavations—but “nondestructive” practices are often viewed as benign, especially when wrapped in the mantle of scientific objectivity, as is often the case when dealing with remote sensing technologies. Given that remote sensing technologies are becoming increasingly available and affordable, resulting in ubiquity within archaeological research and compliance projects, this is a critical point at which we must examine the ethical, social, and cultural challenges associated with using these tools.

NDN nations/communities and individuals have long fought against colonial forces to control their own narratives. These conflicts have historically pitted NDNs against archaeologists (Deloria 1969), although these groups are increasingly finding themselves on the same side of the table. Additional conflict may arise when identities of NDN and archaeologist intersect, placing NDN archaeologists in a position of community, internal, or disciplinary conflict. The widespread application of remote sensing technologies will likely have dramatic impacts on the relationship between archaeologists and NDNs. If conducted in a culturally relevant and respectful manner, these impacts can be positive because remote sensing technologies provide unique opportunities to engage with cultural heritage in ways that are often viewed as less destructive and potentially more accommodating than orthodox methods. It is also possible that these perceived opportunities will facilitate oversight and concealment of considerable ethical challenges associated with remote sensing techniques. After decades of efforts to establish respectful relations, trust, and equitable community partnerships, this is an important moment to consider how we can properly utilize remote sensing when working with or in NDN nations/communities.

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## Data Availability Statement

There are no original data associated with this article.

## NOTE

1. NDN is a form of shorthand used by Indigenous peoples to refer to ourselves, and it is also an acronym for “Not Dead Native” (Belcourt 2019). The authors, both NDN (Barnett, who is Unangax) and non-NDN (Sanger), rely on this abbreviation as a reminder of the lack of appropriate terminology and colonial misnaming, the attempted genocide, and the continued erasure, dispossession, and lack of inclusion of NDN peoples and communities commonly referenced as First Nations, Native American, Alaska and Hawaiian Native, and Indigenous—all categories that exist only in relation to settler-colonial nations and peoples. We also use “tribal” to designate when we are referring to a specific political unit within the United States rather than a broader identity associated with being NDN.

## REFERENCES CITED

Atalay, Sonya  
2012 *Community-Based Archaeology: Research with, by, and for Indigenous and Local Communities*. University of California Press, Berkeley.

- 2020 Indigenous Science for a World in Crisis. *Public Archaeology*, in press. DOI:10.1080/14655187.2020.1781492.
- Belcourt, Billy-Ray  
2019 *This World Is a Wound*. University of Minnesota Press, Minneapolis.
- Brown, Michael F.  
2004 *Who Owns Native Culture?* Harvard University Press, Cambridge, Massachusetts.
- Bruchac, Margaret  
2014 Indigenous Knowledge and Traditional Knowledge. In *Encyclopedia of Global Archaeology*, edited by Claire Smith, pp. 3814–3824. Springer, New York.
- Canuto, Marcello A., Francisco Estrada-Belli, Thomas G. Garrison, Stephen D. Houston, Mary Jane Acuña, Milan Kováč, Damien Marken, et al.  
2018 Ancient Lowland Maya Complexity as Revealed by Airborne Laser Scanning of Northern Guatemala. *Science* 361:eaau0137. DOI:10.1126/science.aau0137.
- Chase, Arlen F., Diane Z. Chase, John F. Weishampel, Jason B. Drake, Ramesh L. Shrestha, K. Clint Slatton, Jaime J. Awe, and William E. Carter  
2011 Airborne LiDAR, Archaeology, and the Ancient Maya Landscape at Caracol, Belize. *Journal of Archaeological Science* 38:387–398. DOI:10.1016/j.jas.2010.09.018.
- Cohen, Anna S., Sarah Klassen, and Damian Evans (editors)  
2020 Special Collection: Reflections on Archaeological Lidar. *Journal of Computer Applications in Archaeology* 2–3.
- Deloria, Vine, Jr.  
1969 *Custer Died for Your Sins: An Indian Manifesto*. Macmillan, New York.  
1997 *Red Earth, White Lies: Native Americans and the Myth of Scientific Fact*. Fulcrum, Golden, Colorado.
- Fernandez-Diaz, Juan C., and Anna S. Cohen  
2020 Whose Data Is It Anyway? Lessons in Data Management and Sharing from Resurrecting and Repurposing Lidar Data for Archaeology Research in Honduras. *Journal of Computer Applications in Archaeology* 3:122–134. DOI:10.5334/jcaa.51.
- Fernandez-Diaz, Juan Carlos, Anna S. Cohen, Alicia M. González, and Christopher T. Fisher  
2018 Shifting Perspectives and Ethical Concerns in the Era of Remote Sensing Technologies. *SAA Archaeological Record* 18(2):8–15.
- Friberg, Christina M., Gregory D. Wilson, Dana N. Bardolph, Jeremy J. Wilson, John S. Flood, Scott D. Hipskind, Matthew D. Pike, and Duane Esarey  
2021 The Geophysics of Community, Place, and Identity in the Mississippian Illinois River Valley. *Journal of Archaeological Science: Reports* 36:102888. DOI:10.1016/j.jasrep.2021.102888.
- Gould, Peter G.  
2016 On the Case: Method in Public and Community Archaeology. *Public Archaeology* 15:5–22. DOI:10.1080/14655187.2016.1199942.
- Grebenkemper, John, Adela Morris, Brian F. Bryd, and Laurel Engbring  
2021 Applying Canine Detection in Support of Collaborative Archaeology. *Advances in Archaeological Practice* 9:226–237.
- Haney, William M.  
2016 Protecting Tribal Skies: Why Indian Tribes Possess the Sovereign Authority to Regulate Tribal Airspace. *American Indian Law Review* 40:1–40.
- Nelson, Peter A.  
2021 The Role of GPR in Community-Driven Compliance Archaeology with Tribal and Non-tribal Communities in Central California. *Advances in Archaeological Practice* 9:215–225.
- Nicholas, George, and Julie Hollowell  
2010 Ethical Challenges to a Post Colonial Archaeology: The Legacy of Scientific Colonialism. In *Archaeology and Capitalism: From Ethics to Politics*, edited by Yannis Hamilakis and Philip Duke, pp. 59–82. Routledge, London.
- Thomas, David H.  
2002 *Skull Wars: Kennewick Man, Archaeology, and the Battle for Native American Identity*. Basic Books, New York.
- Thompson, Victor D., Philip J. Arnold III, Thomas J. Pluckhahn, and Amber M. Vanderwarker  
2011 Situating Remote Sensing in Anthropological Archaeology. *Archaeological Prospection* 18:195–213. DOI:10.1002/arp.400.

Wadsworth, William T. D., Kisha Supernant, Ave Dersch, and Chipewyan First Nation  
2021 Integrating Remote Sensing and Indigenous Archaeology to Locate  
Unmarked Graves: A Case Study from Northern Alberta, Canada. *Advances  
in Archaeological Practice* 9:202–214.

Warrick, Gary, Bonnie Glencross, and Louis Lesage  
2021 The Importance of Minimally Invasive Remote Sensing Methods in Huron-  
Wendat Archaeology. *Advances in Archaeological Practice* 9:238–249.

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