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CARTOGRAPHIC RESISTANCE: LEVERAGING SPATIAL KNOWLEDGE TO SUPPORT NATIVE AMERICAN CULTURAL PERSISTENCE

by

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CERTIFICATION OF APPROVAL

CARTOGRAPHIC RESISTANCE: LEVERAGING SPATIAL KNOWLEDGE TO SUPPORT NATIVE AMERICAN CULTURAL PERSISTENCE

By

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DEDICATION

I dedicate this dissertation to my life partner, mentor, and inspiration to be a better human Jey Strangfeld. I appreciate her ability to recognize instantly by my voice if I am having a tough day. Jey is the first in our family to earn a Ph.D. and thanks to her I have the chance to earn my degree. Thank you for all your support and sacrifice.

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Abbreviations

1. ARPA	Archaeological Resources Protection Act
2. BIA	Bureau of Indian Affairs
3. BIE	Bureau of Indian Education
4. BLM	Bureau of Land Management
5. BOGS	Branch of Geospatial Support
6. CalFire	California Department of Forestry and Fire Protection
7. CALNAGPRA	California Native American Graves Protection and Repatriation Act
8. CALTRANS	California Department of Transportation
9. CDPR	California Department of Pesticide Regulation
10. CIBA	California Indian Basketweavers' Association
11. CIMCC	California Indian Museum and Cultural Center
12. CPR	California for Pesticide Reform
13. CRM	Cultural Resource Management
14. DOI	Department of the Interior
15. DWR	Department of Water Resources
16. ESRI	Environmental Systems Research Institute
17. FEMA	Federal Emergency Management Agency
18. GIS	Geographic Information System
19. GSA	US General Services Administration

20. IRMP	Integrated Resource Management Plans
21. ITC	Intertribal Timber Council
22. K-12	Kindergarten through 12th grade
23. MOU	Memo of Understanding
24. Mp4	MPEG Layer-4 Audio
25. NAHC	Native American Heritage Commission
26. NEPA	National Environmental Policy Act of 1969
27. NHPA	National Historic Preservation Act of 1966
28. NTGISC	National Tribal Geographic Information Support Center
29. PL	Public Law
30. STEM	Science, Technology, Engineering, and Mathematics
31. TEK	Traditional Ecological Knowledge
32. TYA	Tribal Youth Ambassadors
33. USACE	United States Army Corps of Engineers
34. USFWS	United States Fish and Wildlife Services
35. USGS	United States Geological Survey
36. WebVTT	Web Video Text Tracks
37. WIFI	Wireless Fidelity

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I want to thank my amazing committee members starting with my advisor Kathleen Hull. After changing my research focus from Maya archeology in Belize, she gave me one last chance to work for a Ph.D. For that I will always be grateful. Thank you, Robin DeLugan, for letting me talk your ear off about my research and always having a new book for me to check out. Thank you, Anne Zanzucchi for teaching me about critical pedagogy, helping me find connections within my research, and having great tea in your office. Finally, thank you Jeff Jenkins, for teaching me how to publish an article and including me in fun research adventures in Yosemite National Park. My committee has helped me in too many ways to list here but I truly feel I have four chairs and four life-long friends.

I want to thank my best friend Ann Strahm for the emotional labor and being the lead cheerleader when I need it most. Lastly, I want to thank my fellow graduate student and friend Rocco Bowman for listening to me complain and joining me for weekly Zoom writing sessions so I could finish. I am so lucky to have friends like these.

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2018	Locational map for Robin Maria DeLugan, et al. The Familiar and the Strange in Heritage and Tourism Encounters. *Journal of Anthropological Research* 2018, 74:444-449.

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2010	Guest speaker for Environmental Sociology – Global, Regional, and Local Water Conflicts, Pacific University, OR

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2015 Presenter CGIA GeoSummit 2015. Employing GIS to Characterize Active and Potential Riparian Floodplains for Habitat Restoration, Merced, CA

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2013 Presenter, COM.Geo. Progress Report on Quantifying Existing and Potential Floodplain Environments for California's Coho Salmon Using LiDAR Technology – San Jose, CA

2011 Presenter, ESRI International Users Conference. Communicating Watershed Health Improvements with GIS – San Diego, CA

2011 Poster, GIS in Action. Hunting for Wetlands – Using Topographic Moisture Index to Map Potential Wetlands on a Watershed Scale – Portland, OR

2010 Presenter, NW GIS User Conference. I Have LiDAR! Now What? Two Cases Studies Using LiDAR for Environmental Management – Spokane, WA

2010 Poster, GIS in Action Clean Water Services Shades the Day Using LiDAR to Calculate Shade – Portland, OR

2010 Poster, 2nd Annual Pull Together. Tualatin River Watershed Garlic Mustard and Japanese Knotweed control sites – Portland, OR

2009 Presenter, NW GIS User Conference. Generating Shade Credits: Using GIS to Support Cost-Effective Water Quality Management – Sunriver, OR

2006 Presenter, Environmental Leadership Watershed Stewardship Monitoring Results and Adaptive Management Recommendations for Stakeholders – Eugene, OR

PROFESSIONAL EXPERIENCE

2009-11 Water Resource Specialist (GIS)
Clean Water Services – Hillsboro, OR

2007-09	Water Infrastructure GIS Technician Portland Water Bureau - Portland, OR
2007	Cartographer Oregon Department of Forestry – Salem, OR
2006	GIS Technician Lane County Public Works – Eugene, OR
2005	Watershed Technician Intern Siuslaw Watershed Council – Mapleton, OR
2005-06	Watershed Technician Intern Long Tom Watershed Council – Eugene, OR
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2020-21	California GIS Council, founding member Tribal Working Group
2020-21	Engaged Teaching & Learning (CETL) Anti-Racist Pedagogy Working Group – Merced, CA
2018-21	Tribal GIS Education Outreach Committee – Albuquerque, NM
2018-21	Tribal GIS Conference Committee – Albuquerque, NM
2020	Valuing Black Lives Taskforce Student Support subcommittee, Merced, CA
2020	Engaged Teaching & Learning (CETL) Remote Instruction Workshop Merced, CA
2019	Sustainability and Social Justice Learning Community – Merced, CA
2011	Public Sector Sustainability Coordinators Committee – Portland, OR
2010-11	Portland Regional Land Information System (RLIS) – Portland, OR
2010-11	Citizen Participation Organization – Hillsboro, OR
2010-11	Portland LiDAR Consortium – Portland, OR
2010-11	Partners for a Sustainable Washington County Community, Beaverton, OR
2009-11	The Willamette Partnership – Hillsboro, OR
2010	Tualatin Basin Weed Watchers Workshop – Banks, OR

2010	4-County Conservation Weed Management Area –Portland, OR
2010	Natural Resources Conservation Service (NRCS) GIS Workshop, Hillsboro, OR
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AWARDS

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2016-21	Pacific Sociological Association
2018-21	Tribal GIS
2017-21	Society of Conservation GIS
2014-21	California Map Society
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2009-18	Urban and Regional Information Systems Association
2015-18	Association of American Geographers
2015-16	Society for American Archeology
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2011-16	Society for Conservation Biology

ABSTRACT

This dissertation intersects three lines of scholarship, each of which contributes to answering the primary research question: how and why Native Americans in some communities in California are creating counter maps using Geographic Information Systems (GIS)? First, this dissertation explores California Native communities' approach to spatial knowledge production and the benefits and risks associated with mapmaking. Ethical concerns related to past and present research modes are identified and alternative methodology is implemented to uplift both the data and the voice of the cartographer. Second, this study explores the power of maps by understanding the process of mapping and the embedded proposition found in State and other official maps, and compares these elements to Native GIS users' alternative or counter maps. One significant motivation for counter mapping is to maintain or reassemble social memory by organizing cultural spatial knowledge for the community. The third research thread examines the praxis of counter mapping through the lens of critical pedagogy as a response to and way of disempowering of US colonial systems. By investigating paradigms in knowledge production, cartographic encounters, goals of Native sovereignty, and cultural continuality, I posit that using GIS has substantially increased Native power in education, land tenure, and cultural persistence. By way of conclusion, I distinguish motivations for creating Native-centered GIS maps and outline future research based on my study.

CHAPTER I

MAPPING NATIVE CALIFORNIA

This doctoral dissertation investigates how and why Native Americans in some communities in California are creating counter maps using Geographic Information Systems (GIS). Applying cartographic visualization techniques is an effective way to communicate Indigenous values that sustain cultural persistence and facilitate decolonial intervention of the prolonged colonial project. Substantive ways of representing Native places, such as storytelling (Duarte and Belarde-Lewis 2015), art (LeTourneau and Pagini 2019), and physical land markers (Burnett 2009), have been enhanced by mapmaking using GIS technology. Native mappers are expanding their cartographic skills by learning the latest technology from US government resources (Palmer and Rundstrom 2013), Native and Non-native sponsored workshops and conferences, and peer-to-peer sharing of data and techniques among Native communities (Palmer 2009). Maps are powerful tools of inscription embedded with propositions that help sustain power, thereby providing the mapmaker with the ability to circulate information concurrently with authority (Latour 2011; Wood 2010). Therefore, Native mapmaking repositions the map to work for Native values such as sovereignty, self-determination, and cultural sustainability among other goals (Eades 2015; Wood 2010). GIS mapping is increasingly used to support social justice initiatives (Pavlovskaya 2018), cultural and natural resources management (Hébert and Brock 2017; Sidiq 2021) in Native communities, schools, and youth programs. The mapping process is a conduit for knowledge sharing that reifies traditional ways of knowing and therein creates specific approaches to integrating Native epistemology with spatial technology. Current Native mapping practices can be understood in relation to the history of the Bureau of Indian Affairs and its use of GIS.

A Brief History of the Bureau of Indian Affairs and GIS

GIS is both a system and an approach to organizing and interfacing with spatial information. The system comprises computer hardware, software, and data. The spatial information organized within the GIS is comprised of thematic data layers and is connected to a coordinate system (Figure 1). Each line, point, or polygon feature on a GIS map is linked to a

database or tabular file called an attribute table, similar to a spreadsheet. Each row in the attribute table represents a feature and associated columns comprise statistics, names, and other associated textual information relative to a specific spatial variable. Hundreds of editing and analytical mapping tools (computer codes) accompany a graphic map layout where map layers are visualized, and spatial data are synthesized to produce maps.

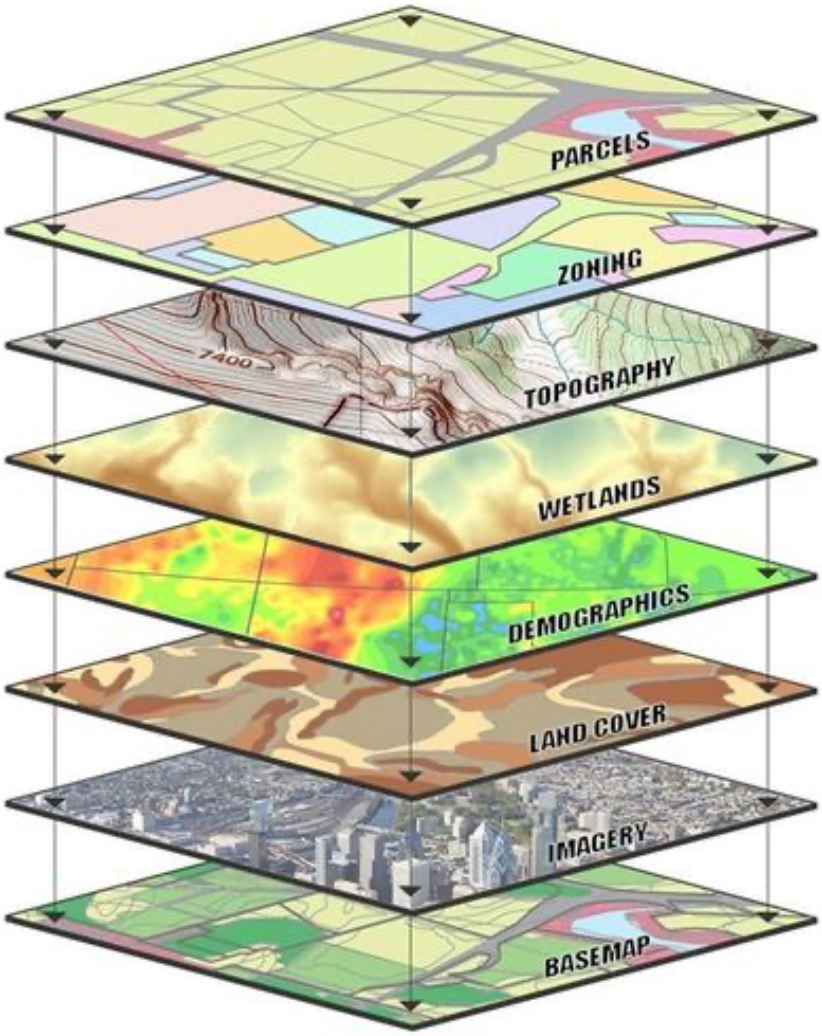

Figure 1. GIS data layers visualization, USGS public domain

Prior to the establishment of an official agency, Indian relationships were administered by the Continental Congress and were overseen by the Committee on Indian Affairs directed by Benjamin Franklin in 1775. The earliest institutionalization of Native American and

US government relations was established in 1789 when such relations were delegated to the Office of Indian Trade in the War Department in what the first superintendent Thomas McKenney referred to as the "Indian Department." In 1824 the Office of Indian Trade was renamed to the Bureau of Indian Affairs (BIA), and in 1849 this agency was transferred to the newly formed Department of the Interior (DOI)

Today the DOI has many bureaucratic divisions that concentrate on specific Native American management areas. The BIA now includes the Office of Trust Services, and within this office is the Branch of Geospatial Support (BOGS) previously called Office of Trust Services Geospatial Support. BOGS' mission since 2015 is to consolidate the responsibility of GIS system support and administer training directly to tribal governments. In addition, BOGS provides geospatial data management for other branches of government working with Native people and their lands. This includes the Bureau of Land Management (BLM) and US Fish and Wildlife Service (USFWS) in their effort to oversee forest management, oil and gas development, irrigation, and flood control among other tribal land management applications[1].

In its many incarnations, the BIA has progressed in the management of Indian-related spatial data since the 1970s. In the beginning, the federal government insisted on its paternalistic style of serving Native people. That is, the BIA preformed all the GIS functions without consulting or, many times even informing, the Native people of their actions. One of the first applications for GIS use was to organize timber sales on tribal land (Palmer and Rundstrom 2013). In this way, the BIA could spearhead GIS development and create efficacy in accessing 5.5 million acres of forested Indian land (Palmer and Rundstrom 2013). By 1975, however, Congress wanted the BIA to move from an autocratic model toward a standard of Native self-determination. Lawmakers passed Public Law (PL) 638, the Indian Self-Determination and Education Assistance Act of 1975. However, the BIA continued to defy this movement until the mid-1990s (Palmer and Rundstrom 2013: 1146). Monies gained by timber sales gave windfall profits to private harvesters and mills. Moreover, the federal government timber sale assessments were siphoned away or "lost" to corrupt practices (Palmer and Rundstrom 2013). In the late 1970s northwestern tribes convened a political arm called the Intertribal Timber Council (ITC) to redress BIA non-compliance

[1] Bureau of Indian Affairs Background and History. www.bia.gov/bia/ots/geospatial/background-and-history. Accessed September 27, 2021.

and advocate for a government-to-government relationship with regard to timber sales and GIS databases (Palmer and Rundstrom 2013). The development of GIS and all the earlier spatial database software versions were generated with resource extraction single-mindedness that reflected colonial systems and gave little support to Native people and their land (Palmer and Hanney 2010).

By the 1980s Congress began to divide the budgeted funds between the BIA and federally recognized tribal governments. Although more money was earmarked for hiring more Natives in forestry jobs, these positions were low wage and insufficient to address poverty (Palmer and Rundstrom 2013). Conversely, the "BIA Natural Resources Division swelled to 575 employees, 96 percent of whom were in forestry" (1989: 89). With this increase in labor came an upsurge in GIS development, and this was combined with newly established Integrated Resource Management Plans (IRMPs) to customize exploitation of natural resources (Palmer and Rundstrom 2013). In the 1980s, large GIS databases were created by digitizing USGS maps and other hardcopy sources and classifying data in thematic layers (Rundstrom 1995). This included data on transportation infrastructure, water sources, and political boundaries. As noted by Palmer and Rundstrom (2013), many of the GIS layers and databases were envisaged for BIA management and control, not with Native peoples' interests in mind.

By the 1990s and into the early 2000s, BIA trust obligations were receiving poor reviews and critiqued on its self-oversight model that inherently reduced service to their charge, Native people (Gordon et al. 1997). President Bill Clinton led efforts to change the nature of US government agencies by moving to a partnership political model. This treated tribal governments as independent nations by which to negotiate, thus moving away from a paternalistic relationship, despite BIA resistance. The BIA's reaction was to slow internal data development and direct GIS services and turn instead to distribution of ArcGIS software and technical support (Palmer and Rundstrom 2013). The BIA transition from preforming GIS functions for tribal communities to gatekeeping the technology prompted Native GIS users to take control of their data and training.

In 1996, Elouise Cobell was the lead plaintiff in a class-action lawsuit against the DOI and the Department of Treasury. The lawsuit claimed mismanagement of Native funds and the plaintiffs were awarded $3.4 billion in 2009. More than half of the settlement was allocated to address the fractionated ownership of Native lands. That is, to redress the loss of property of Native landowners and decedents had sustained through a myriad of services. Today, the Office of Trust Services provides

real estate services and infrastructure support using Cobell settlement monies and US congressional funding. GIS systems are integrated in the Trust Services to assist in managing Native services. This retooling of GIS services to tribal governments reduced some direct control of GIS data by the BIA. Paradoxically, however, control of GIS for Native communities has been maintained by creating a dependence on Environmental Systems Research Institute's (ESRI)'s ArcMap and related software. ESRI contracts license agreements for GIS software with the BIA and, in turn, the Bureau verifies federal status of Native GIS users.

Geographic Information Systems and California Native Mappers

Native California GIS users are mapping current and historic cultural and natural resources. Databases are populated with spatial records from non-tribal sources; for example, historical archives found in academic institutions, museums, state and federal agencies, and archaeological reports. Internal Tribal sources of spatial data are added to the databases from Tribal elders, archives, and newly excavated cultural materials on and off Native Trust lands. Maps are created from these databases to show known cultural sites and proposed land development and extraction projects. These databases and maps are used to inform decision-making relevant to the National Historic Preservation Act (NHPA) and National Environmental Policy Act (NEPA)[2]. For example, Section 106 of the NHPA requires agencies to consult with local Tribal governments.

Another application of GIS is to update Tribal spatial data for State databases related to political boundaries. Many GIS maps produced and maintained by Tribal governments have the same map layers[3] However, when new information is revealed about Tribal presence in areas not currently reflected in the State maps, revised GIS data are forwarded to the California Native American Heritage Commission's (NAHC) GIS specialist who updates State maps. This government-to-government exchange of information is especially significant because of the NAHC mission and responsibilities. The NAHC was established by statute in 1976. It's nine-person governing body guides the agency in cataloging and protecting California Native cultural resources, including administering

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[2] See www.achp.gov/sites/default/files/regulations/2017-02/regs-rev04.pdf

[3] A map layer is a GIS database containing sets of point, line, or polygon features representing a specific type of real-world entities such as postal codes, land use, or political boundaries. A layer contains both the visual representation of each feature and a link from the feature to its databases attributes.

the California Native American Graves Protection and Repatriation Act (CalNAGPRA)[4].

Additional maps are produced to support grant applications for Native communities. Grants are available from federal agencies, such as the BIA and Bureau of Indian Education (BIE), and State agencies including the California Department of Transportation (CALTRANS) and California Department of Water Resources (DWR). The grants can support infrastructure projects for clean water, electricity, and Wi-Fi access. GIS-generated maps provide a visual medium of communication and add a sense of legitimacy for Native applicants when applying for State funds.

Like Western government GIS users, Native agencies track COVID-19 metrics such as outbreaks, hotspots, and vaccination rates. Maps are included in government-to-government and private company contracts or memoranda of understanding (MOU). A unique application of spatial technology in Native communities is when Native child services organizations use GIS to keep track of children in foster care who move from home to home. Mapping all the foster home locations within a school district can assist in keeping a child in the same school during relocation. In addition, GIS is used to recruit new foster homes in areas with the most need, thus minimizing disruption for Native students.

There are two main conduits for establishing GIS in California Native communities. The first is through secondary education, often a community college that offers GIS classes. Additional training is accessed through BIA-sponsored training, including online modules and multiday workshops. Native-owned nonprofit organizations have also developed training programs and conference workshops to serve Native GIS users. The largest conference in the US is called Tribal GIS; the largest in Canada is called the Firelight Group, based in Vancouver.

The second source of learning GIS is from tribal members working for state and federal agencies. Their careers require GIS skills, and they receive supplementary training from their employer. Tribal members use these skills to educate community members on the usefulness of GIS and often volunteer to organize software licenses, hardware procurement, and training for their community. Additional GIS education sources are Native cultural centers that have on-staff or hire an external GIS educator. Some of these cultural hubs apply for grants to lead and educate Native youth groups in learning GIS. This exposure to GIS can be in STEM-focused workshops or part of summer youth camps.

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[4] See NAHC website: nahc.ca.gov Accessed September 1, 2021

There are many obstacles to procuring and maintaining GIS, but as the technology moves from desktop processing to web browser-based processing, the need for expensive computers is decreasing. Nevertheless, this transformation is heavily reliant on high-speed internet. Access to good internet is a significant challenge in rural areas where many Native communities reside. The learning curve is high for GIS technology and requires time and training to execute it even at the most basic level. It also requires ongoing training as the technology changes. The leading software maker ESRI has made strides to simplify the GIS interface and expand access to a broader audience. Computer technology requires time to learn and resources to access. This makes developing and staffing a program difficult.

The consolidation of spatial data using GIS entails a growing list of benefits for Native communities. Like Western municipalities, Native governments have implemented GIS to inventory and map community assets including transportation structures, land parcels, and green infrastructure (e.g., parks, lakes). In the evolution of GIS use, additional applications have been developed by other tribal agencies, including Cultural Resource Management (CRM) departments. Though US government agencies using GIS are more prevalent and supported than tribal agencies, some Native users have developed the same skills and experience using GIS. This phenomenon has created a method of communication between Native and non-Native administrations. Nearly all the significant California state agencies have tribal liaisons with whom GIS information is exchanged or referenced. This is an essential tool for Native sovereignty in that both parties have the same technology to produce government-recognized maps.

Collecting spatial information about current and historic land and its people by community researchers and student learners is part of the land-based teaching in Native epistemology (Simpson 2017). This knowledge of place is curated and shared with community members vertically to future generations through schooling, home-based learning, and ceremony wherein elders share knowledge through storytelling and important historical events are acted out or expressed through song.

Mapping projects are also conducted for student youth programs as a way to reinforce Native connection to the land. The tactile process of marking where ancestors live(d) and the awareness that one's relatives for thousands of years walked along the same river and traveled the same trails invokes a sense of belonging indifferent to current colonial landscapes. To map an ancestral homeland is an action of bonding and a function of learning. Counter maps are used in the classroom as an alternative or in addition to colonial maps. These maps are shared with

instructors to support lessons for both Native and non-Native learners. Organizations like Lessons of Our Land build map templates of Native places as curriculum for instructors to customize teaching Native history using maps.[5]

Why Native California?

The geographic parameters of this dissertation are limited to the unceded lands and Native communities that reside within the colonial boundary of California. Approximately 720,000 Native people live in this area, with 110 Tribal governments that are federally recognized. A limited number of Native communities have invested in GIS technology and have a dedicated professional staff to produce and maintain Tribal spatial data. Some communities are small and cannot support a GIS staff person; therefore, they hire contractors to utilize GIS for specific projects. There are various levels of GIS practice among these communities, depending on access to software and computers, financial support, and expertise in spatial technology. In this research, I reached out to communities that are actively using GIS. This regional approach provided a range of participants based on Tribal economics, population, and geography.

During this research the State of California and Native communities are collaborating to remove statues and placenames that are offensive to Native people. In addition, Governor Newsom issued an official apology to Native Americans for historical violence and displacement of Native people. Some tribes are winning recognition and receiving land back from the State. Universities and K-12 schools are implementing Native perspectives and studying both Native American history and contemporary presence in California. GIS is an essential tool in teaching and researching that support social change in California.

This research originated from a combination of my 20 years of GIS experience and desire to understand how spatial technology is being used to support Indigenous people. I am in a relatively unique position to connect with Native GIS users because of my formal training and experience in geography. The ability to "talk map"[6] with other cartographers has eased cultural distrust and opened doors to this relatively small group of Native cartographers. All my initial tribal contacts have come from attending conferences and visiting Tribes in Oklahoma and New Mexico. This is an example of the small and connected group that makes up Native GIS professionals. Also, I am

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[5] See Lessons of Our Land website: lessonsofourland.org Accessed September 1, 2021

[6] This is a colloquial term sometimes used by GIS users to express the process of discussing map production.

currently a member of the National Tribal Geographic Information Support Center (NTGISC) Educational Outreach Committee, where I perform tasks to network with instructors who teach spatial technology to predominantly Indigenous learners.

I attended a Tribal GIS conference in November 2018 where a high school student gave a presentation on how she used GIS to support social justice projects in her youth group. The Tribal Youth Ambassadors had received a grant for GIS training and spent time during summer camp collecting data, producing maps, and advocating for change. This was the moment I recognized the uniqueness of Native GIS users and how altering the proposition of the map to (re)enforce Native presence is profound. She has embodied Native epistemology, learned the oppressors' tool, and directed the power of maps to bring attention to her community and, by extension, to the greater Native society.

Counter Mapping and Indigenous Knowledge

Counter maps are born from and are a response to subjugation in the past involving uneven power interactions. These inscriptions are wielding of power to (re)remember times and places before dominating polities invaded and induced forgetting. Just as state maps are intentionally made to replace pre-colonial memories, counter maps are essential in retrieving cultural identities that have been mapped over and forgotten. Counter mapping does not occur at the beginning of the resistance—mapping knowledge is witnessed over time. The technology is adopted to subvert the dominant narrative and support a new narrative informed by the past. One can always question the archives with new information or perspectives, because the whole truth is not archived (Ricoeur 2004). The counterproposition introduced in maps seeks to access the untold, incomplete, or generally forgotten place.

Previous studies on Indigenous counter mapping have often concentrated on specific propositions like land sovereignty (Taylor 2008; Willow 2013), Indigenous rights (Rye and Kurniawan 2017), or mapping traditional knowledge (Scassa et al. 2015). In addition, counter mapping studies have focused on a particular society or geographic location. In this study, I start with the premise of GIS technology as a tool to support Native goals in California and highlight the motivations behind the many ongoing applications and successes of Native counter mapping. Understanding counter mapping in such Native communities can lead to larger implications including cultural survivance and what Leanne Simpson (2017) calls radical resurgences. She defines this forward-thinking concept as a “nonhierarchical relationships between land and

bodies, bodies meaning the recognition of our physicality as political orders, and our intellectual practices, emotions, spirituality, and hubs of networked relationships" (Simpson 2017:44).

The counter map explores a myriad of propositions that are informed by Native perspectives and values. In particular, mapping, as a form of empowerment to Native peoples, helps visualize the effect of reestablishing or continuing a connection to both the land and the proud tradition of belonging to a rich and complex society. Indigenous epistemology, the investigation of what distinguishes justified belief from opinion, offers a multiplicity of systems that bring meaning to the world. Indigenous epistemologies relevant to spatial thinking are characterized by a permanent land base worldview, whereas Western or Christian thinking is temporal and seek converts and control of any land base (Deloria 2003). Thus, different life-worlds and cosmologies produce different expressions of spatial thinking. Rundstrom (1995:45) references some general First Nation "geographical understandings" and argues:

> the Western or European-derived system for gathering and using geographical information is in numerous ways incompatible with corresponding systems developed by Indigenous peoples of the Americas; and GIS technology, when applied cross-culturally, is essentially a tool for epistemological assimilation, and as such, is the newest link in a long chain of attempts by Western societies to subsume or destroy Indigenous culture.

Contrary to the perceived risk of assimilation through technology, the threat of GIS changing core beliefs and tradition is minimal and will be further explored in next chapter. The incommensuration of indigenous life-worlds can be reframed as equal exchange of knowledge in effort to decolonize indigenous ways of knowing.

One such "corresponding system" is how Indigenous peoples interweave with nature, especially the symbiotic bond with flora and fauna. Instead of humans twisting, molding, and many times destroying nature for their own purposes, Native epistemology "typically empowers nature as a force that manages all of us" (Rundstrom 1995:46). Rundstrom also notes this belief is a "reciprocal appropriation," not a mythical "being one with nature" often implied by outsiders.

GIS is a graphic data storage platform with analytical capabilities. However, practitioners struggle to capture the "relatedness" between humans and the abiotic environment that is commonly "ubiquitous" for Indigenous people. It is the "culture-specific" elements that often are

sidelined. Rundstrom (1995:47) states that "[a]t present, GIS does not capture relatedness but constructs it." To understand this assertion, one must first recognize GIS separates spatial variables into graphic layers and then places data on top of each other to “reconstruct” the various real-world elements. The construction of a GIS map is first commissioned by an interested group then prepared by cartographers who have power over the final product. Without cultural input from “the mapped,” relatedness and other epistemological important elements are marginalized and, over time, forgotten.

Counter mapping is one of many strategies to re-incorporate culture taken by force. The past is not supposed to be relived or exactly replicated repeatedly, but the stochastic event of colonialism introduces an unnatural break to continuity. Not a complete break—people still live in, and their memories still inform, the present. Therefore, memorials, artifacts, and landscape mark this “postmemory” that:

> strives to reactivate and re-embody more distant political and cultural memorial structures by reinvesting them with resonant individual and familial forms of mediation and aesthetic expression. In these ways, less directly affected participants can become engaged in the generation of postmemory that can persist even after all participants and even their familial descendants are gone. [Hirsch 2012:33]

In the past, colonial cartography was dominant and only superseded by updated settler maps. Now, Indigenous maps are disrupting these colonial mechanisms. Cartography is a powerful means of communicating. Settlers use maps to define territory, include and exclude peoples, and manage human and natural resources, among other authoritative functions. Counter mapping is not simply alternative mapping; it inherently visualizes the rejection of dominant premises.

Dissertation Map

This dissertation has five chapters, each of which supports the primary research question: How and why are Native American in some communities in California creating counter maps using Geographic Information Systems?

The second chapter reviews the theoretical underpinnings used to analyze the intersections of Native spatial knowledge and the application of GIS technologies, as those elements inform the production of counter maps. Broadly, the power of maps is examined as a practice of resistance

to, and liberation from, hegemonic cartographic convention. I look for hybridizations in map production and building upon Turnbull's (2000) “transmodern spaces" in which the fusion of traditional knowledge and western technology is considered more of an active form of mediation, and less a product of marginalized people (Palmer 2012; Turnbull 2000). More specifically, I demonstrate the connection between counter mapping and Indigenous knowledge (Duarte and Belarde-Lewis 2015; Engler et al. 2013; Rundstrom 1995, Watson and Huntington 2008), decolonization of geographies (Hunt and Stevenson 2017; Willow 2013), and empowering tribal communities (Eades 2015; Johnson et al. 2005, Rye and Kurniawan 2017). By linking map theory and applying such theory to collected data, this research demonstrates the complexity of the use of GIS by Native communities to produce maps that resist colonial power.

In addition to map theory, I examine and offer further evidence on how counter mapping benefits both individual practitioners and Native communities by using Native centered maps to teach. Critical pedagogy is the synergy created when critical theory interlocutors support education dialogue. Peter McLaren (2015: 27) writes that it is "the production of critical knowledges leading to praxis in its social, spatial and geopolitical contexts." In this space, ideas informed by evidence are employed to examine the uneven access to education and, by extension, access to complete societal membership. Exercising critical theory is the subsequent step after "naming the problem and demonstrating it," thus extending the context to include experiences other than “whitestream” logics systems (hooks 2014). At this moment of naming and visualizing inequality, counter mapping instills Native authority onto the land and works to narrow the power disparity.

Critical pedagogy is both "rhetoric and a social movement" for Indigenous communities seeking social reform and, possibly, revolution (Grande 2000). Researching to reveal underlying sources of cultural disparities is an important part of educational discourse and deserves a critical review. Critical pedagogy is a pillar in the struggle to restructure unjust societies and reduce the effects of the ongoing colonial project. By not inserting Native viewpoints into mapping, cartographers risk reproducing homogeneous repressive practices. In addition to applying critical pedagogy and spatial knowledge production frames, I look for instances of “alternative geographic frameworks” described in Goodchild and colleagues’ (2010) work on respatialization of referenced data. For example, are counter maps solely referenced to US political boundaries, or do some maps refer to historical Native borders or include Native placenames?

In the third chapter of the dissertation, the focus turns to methods and methodology that prioritizes equitable exchanges of knowledge and builds relationships with Native cartographers. I introduce a method in which cartographers are interviewed in tandem with their maps and spatial databases in what I call a "map-interview." This approach engages the mapmaker, who is positioned between the authority requesting the map and the targeted audiences for whom the map is intended. Next, I review theoretical discourse on how reciprocity as a methodological framework is more than transactional and should be approached as a positive shared experience.

In the fourth chapter, data are presented from the map interviews focused on Native-centered counter maps in California. Maps and databases are presented, except when unauthorized to reproduce Native maps. In this chapter I present data that emerge from the map-interviews to help explain how and why Native cartographers are using GIS in California. General themes include protecting cultural and natural resources and organizing spatial data for use in visualizing injustice and empowering Tribal members.

In the final chapter, I summarize the more significant implications of this project, including how GIS is leveraged for Native independence and cultural survivance (Vizenor 2008). In addition, I evaluate how decolonial methodology is used in data collection, including the design, implementation, and critique of the map interview. Lastly, I conclude this a treatise on future research directions and possible future projects inspired by three years of dissertation fieldwork.

CHAPTER II

INSTILLING THE POWER OF MAPS

In this chapter, I explore frameworks that are key in conceptualizing the complexities presented in this research. Moreover, I introduce works from scholars to buttress these theoretical discussions and contextualize the links between Indigenous discourse and spatial technology. In this study, I found counter maps produced by Native cartographers: (1) address inequities and promotes social justice; (2) retrieve and maintain cultural traditions; and (3) support Native centered education and pedagogy. These themes are not mutually exclusive, nor are they an exhaustive list of counter mapping applications. First, however, I expand on the power of maps to understand the force and counterforce of the cartographic endeavor.

The Proposition Entanglement

Ian Hodder explains that entanglements "aim to allow a materialism but embedded with the social, the historical, and the contingent" (2012:96). The sense of place and connection to an area such as Yosemite Valley and all its things are examples of entanglement. Native groups (contingent) meet routinely (social) to maintain their connections to both times past (historical) and forge new entanglements in the future. Entanglement is a theoretical approach to understanding the relationships between material culture or "things" and humans. Hodder organizes material culture discourse to study the dependencies humans have on material culture and vice versa, especially how things are used in a social context. Humans' social constructs try to classify things unwieldy and untidy, even using things to manage other things. In this respect, maps are things, and thus, counter maps perform as another thing used by humans to direct perceptions and life. Hodder's idea is not to disentangle completely, but to understand the complexity and view interactions between humans and things in a more encompassing way.

Maps, through human interaction, can take the form of claiming or creating possession of things. What Hodder calls the "sensory relationship" describes the manufacturing of a sense of ownership to the thing that can be developed in person or via maps, from a distance "[by] naming and marking it has become more fully owned" (2012:24). To reenforce the claim after marking it, modifying, or working the land to

serve to one's own partiality further transforms the place to property. Hodder's writes "[t]hus land in the United States that 'belonged' to Native Americans was grabbed by European colonizers at least partly through the idea that it had been worked – that the sweat and toil of labor in clearing, planting, weeding, harvesting created a relationship of ownership between people and land" (2012:25). A property title always includes a map to see and show the thing, the ownership, and once entered the system of laws, the power. Tax lot maps certify possession and permit law enforcement to defend and control on the owners' behalf the mapped land and everything within it. Admittedly, this is a very Western concept of identification and ownership.

Maps have attributes that help sustain the imbued authority. Bruno Latour (2011) reflects on the advantages of mobile inscriptions in his article "Drawing Things Together." He writes that maps are "immutable when they move; thus, once a map is drawn, it is easily transported, reproduced, scalable, and flat" (Latour 2011:65). These qualities give the mapmaker the ability to distribute information in sync with power. Furthermore, the combination of visual aid (map) and descriptive text provides a persuasive synergy. Latour writes that "the text is not simply 'illustrated,' it carries all there is to see in what it writes about. Through the laboratory, the text and the spectacle of the world end up having the same character" (Latour 2011:69). Beyond the parchment on which the map is inked are the intentions of the transcribers and the power behind them. Once released into the world, a map is a static reference and another node in what Ingold (2010) refers to as a "meshwork." These relationship networks lead to and emerge from materiality that begin to explain the power of maps.

Maps (things) depend on humans. People imbue maps with power through symbols and biased representation. Denis Wood's (2010) treatise *Rethinking the Power of Maps* develops the concept of map propositions, an assertion communicated visually and factually on a map. In this premise, maps are not simply scaled-down versions of everything in the real world; rather, they represent *some* certain objects in *some* certain places. The emphasis highlights that what is not symbolized is missing. Adding more uncertainty and messiness, symbology on the map is incomplete or distorted to marginalize representation of some entities and thereby direct focus on a specific set of objects. If this is the case, then maps are made to forward agendas and exert authority over what is mapped. Wood writes that "were maps mirrors of reality [this] would have been an uncontestable conclusion, but maps are propositions—that is, they are statements that affirm or deny the existence of something" (Wood 2010:41). I note here that map representation is an incomplete, scale-

manipulated indication of the natural world by humans compared to the real world for accuracy.

Furthermore, a proposition means a statement or assertion that expresses a judgment or opinion. To begin unraveling the many propositions of maps, we must recognize the power dynamics embedded in spatial knowledge production. "Power is the measure of work. Which are [sic] what maps do: they work" (Wood 2010:1). One measure of map work is the function of force through distance (Wood 2010:1). Authority references official maps as a pillar to assert strength. *You cannot be there*; a map works to show where you are and provides an orientation of the many contextual variables that are also put to work. What gives authority to these maps? The ability to transmit real action in the place the maps represent. "Transmission of authority is what maps are about" (Wood 2010:61). Mapping can replace the physical use of force by implying social force behind the inscription of the map. The propositions of the map can be challenged, but the assertion is captured on the map. The more the map is distributed and referenced, the harder it is to refute.

Mapping is active and decisive. Maps have long-term ramifications and can initiate change in mass. The object itself symbolizes the joining of knowledge and authority. To map is to propose an action onto people by people. To be mapped is passive and threatens agency. People on the receiving end of a cartographic encounter are more likely to be misrepresented and, in many cases, excluded. Separating the material map from its agency is a fruitless endeavor. Pinney (2005:257) notes that "in configuring materiality as objectness, it accidentally champions one half (objects) of a binary whose other half (subjects) it wishes to attack." In other words, to interpret a map is to account for the material object and the intention to and from the subject. An analytical approach, dividing an object into fragments to understand its components, is critical, but considering the map without simultaneously contemplating its agency is incomplete. The "purification" of the object is post-humanist and is missing the human reaction to the object. By virtue of being created, a map has had collaboration behind the production. Relatedly, both the map, as an object, and the things on the map that are represented on the map plane are subjected to "growth" (Ingold 2000). Tim Ingold argues that like growth in animals and plants, in "the making of artifacts, the mind is understood to place its ideal forms upon nature" (2000:52). That is, the more maps are engaged with by humans, the more meaning is given to the map itself and the things that are mapped.

Humans depend on maps. Maps have the power to mediate cultural practices and work on visualizing the spatial relationships between things. J.B. Harley's (1989) essay "Deconstructing the Map" is a seminal

paper calling for a critical look at the power behind the map through a review of linguistics, semiotics, and iconology. Thus, Harley points to the dependency we have on maps; we rarely question the cartographer's rendering of objective truths that maps appear to establish. Harley references Foucault's (1995)[7] panopticon metaphor to describe the "manufactured power" that is created to "control lives" when supported by the full force of the state's institutions. Emanuela Casti points to a cartographic theory that helps explain the myth of maps' accuracy. *Ionization* is a "map's propensity to be accepted by virtue of its mere existence *and* to influence communication quite independently of the cartographer's intentions" (Casti 2015:3 [emphasis original]). By leveraging the tools used to render Western maps and rendering the power of proposition behind the cartographic enterprise, new spatial production can disrupt the dependence on colonial maps.

Another approach to spatial thinking is spatialization and respatialization (Goodchild and Janelle 2010). Spatialization is the building of skillsets that contribute to visualization, pattern detection, and the compilation of scientific comprehension (Skupin and Fabrikant 2003). Respatialization, on the other hand, evaluates specialized or historical spatial variables and transforms them into contemporary formats, increasing their value (Goodchild et al. 1993). In other words, spatial knowledge that is not unambiguously spatial can undergo a spatial transformation to reveal patterns, relationships, and previously unforeseen information that was not immediate in the original format. For example, books or oral stories with spatial references can be mapped to enhance the original text or spoken word form.

Representing *all* objects in a place on a map is an impossible task. To produce a legible map, cartographers filter phenomena to meet the goals of asserting power over people and materials in places. Mapping compartmentalizes parts of the complex system that are represented to examine their attributes. However, isolating the represented object from context may keep the target of the power, the map reader, from recognizing the entirety of place and the inner workings of the system (Brody 1981). The concealed effect of presenting singularity in maps is the threat of what Cole Harris (2002) calls "cartographic erasure," by mapping away the values that detract from the "dominant powers'" ambitions. To retrieve cultural representation, memory, and control over the landscape, Indigenous peoples must leverage the power of maps to reinhabit Native geographies and (re)map back onto the land (Barnd 2017; Goeman 2013).

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[7] Translated from French in 1977: Deleuze, Gilles, and Claire Parnet. "Discipline & Punish: The Birth of the Prison." Trans. Alan Sheridan. New York: Vintage (1995).

Counter Mapping

Official maps or state maps instill a sense of authenticity by incorporating a significant amount of detailed data. However, authority, and its propositions, manipulate and reduce the entire disclosure of data. States use the power of maps to undermine 'customary' land uses by local constituents and take control of resource management (Peluso 1995). For example, natural resource-rich countries look to partner with global companies to sell raw materials. However, facilitating the extraction of natural resources and leasing of land to corporate entities or private individuals leads to unbalanced land management. This results in Native peoples losing access to subsistence resources because of the transition to unsustainable practices, including overharvesting (Bowen 2020) and contamination (Rock and Ingram 2020).

In response to governmental maps foregrounding the extractive use of land and removal or marginalization of Native representation on the ground, new maps are produced. Non-state maps attempt to add value to cultural resources and challenge administrative maps and their narrow propositions. A counter map is another voice that disrupts what Joel Wainwright (2009:170) refers to as "the intelligibility of modern power relations." Counter-mapping "greatly increases the power of people living in a mapped area to control representations of themselves and their claims to resources" (Peluso 1995:387). The counter map explores a myriad of propositions that are informed by Native perspectives and lived experiences. In particular, as a form of empowerment to Native peoples, mapping seeks to reestablish a disrupted connection to the land and the traditions of a rich and complex society.

Leila Harris and Helen Hazen (2005:115) define counter-mapping as a means "to contest or undermine power relations and asymmetries in relation to cartographic products or processes." Using the same GIS software and producing the same quality of maps as State actors, but with different goals, reduces the advantage historically enjoyed by Western governmental agencies and their cartographic teams. A counter map can bring clarity and collective harmony, as Kosek (1998:5) writes:

> A community does not just make a map, but rather…a map helps to make a community, both reflecting and producing social relations. The process of mapping helps naturalize and communicate a dominant idea of who belongs within particular boundaries and who does not, who may make decisions on behalf of the community and who may not.

The act of counter-mapping is similarly referenced as community mapping (Perkins 2007; Zardiny and Farshad 2021) or participatory mapping (Chamber 2006; Saadallah 2020). Methods and goals of mapping determine variations of counter-mapping.

When reviewing counter mapping accounts, it is critical to deconstruct the history of power centers and identify the intent of original mapping projects. In such an exercise, the proposition embedded in predominantly Eurocentric maps becomes apparent. In the book *Weaponizing Maps* (Bryan and Wood 2015), what first seems like an anthology of Indigenous map stories from the Americas is instead a tightly scripted thesis on deviant militant uses of map power against Indigenous communities that have used maps for Native land rights. Bryan and Wood (2015: xvi) carve out an encompassing characterization of Indigenous mapping as "the broad field of practice used to make maps of, for, and occasionally by Indigenous peoples for a broad range of political purposes." As mastery of counter maps has spread over time, various Indigenous communities have shared their experiences with other Native groups and have since organized, some internationally, to promote land rights and human rights. This movement is not lost to State authorities. Thus, the data collected to advocate for land tenure and cultural independence make Indigenous communities visible and their maps vulnerable to misuse.

The Risk of Counter Mapping

How does participating in the cartographic encounter risk transforming the Native mapper's intentions and changing the initial framework based on sovereignty into an ownership system that favors the Western state? When agreeing on property lines, does this reinforce the settler's claim, a claim not only on the physical land but also a cultural entitlement? Some Native mappers prefer a different method and use *spheres of influence* to mark historical presence. This technique visualizes where people occupied the land before colonialism—a form of cartographic resistance that includes overlapping areas that were shared between adjacent Native communities. Inserting statements or titles that clearly acknowledge *unceded lands* is a powerful reminder of the corrosive nature of the cartographic encounter. As Wainwright and Bryan note, "persistent inequalities are reorganized, yet sustained, through recognition of Indigenous difference in terms of bounded land claims. In this way, Indigenous land claims are made commensurable with development" (2009:155).

Another methodology problematic to counter mapping is when a Western-produced topographic map is presented to non-cartographers in the Native community to question *where they go* and *how they use the land*. The method of Native people marking Indigenous spatial knowledge onto a Western-produced base map is referred to as a "map biography" (Willow 2013). This ethnographic approach was used by anthropologist Hugh Brody while embedded with the Beaver Indians in the late 1970s. The initial purpose was to understand the land-use patterns of this Canadian subarctic society and how an oil pipeline would impact this community's lifeways (Brody 1981). However, Native community members are asked to situate their position on the colonial map, reinforcing the hierarchy on the landscape in favor of the dominant culture. Brody recounts the ambitions of provincial government maps depicting the potential of extraction, "it became harder and harder to imagine that Indians could find any room on the white man's crowded maps" (1981:117).

In the introduction to *Mapping Our Places*, Jim Enote, a traditional Zuni farmer and director of the A:shiwi A:wan Museum and Heritage Center, makes the argument that land and the people who belong to it have been "remapped" or mapped over, thus leaving out the traditional land use, place names, and history before colonial settlements (Scott et al. 2005). Places were renamed and placed on official government maps with the intent of removing old memories of places with settlers "discovering," naming, and mapping to instill colonial power over the land and its people. Clay Scott and colleagues point out that mapping is not just the work of GIS operators but works in tandem with "cultural practitioners" (Scott et al. 2005:12). GIS is only as good as its data; thus, the keepers of traditional spatial knowledge are an important source and conversations? should be seen as an exchange of knowledge and experience and not simply information? extracted without respect to agency.

One method to reclaim agency and resist the official map and all that it enforces is to appropriate the spatial technology and map back against the dominant power. However, with Western technology adoption, Native communities' risk epistemological assimilation (Rundstrom 1995). Should Western societies share GIS technology with non-Western cultures? This paternalistic view of technology questions if "developing countries" would be served by GIS or somehow misuse this technology. Peter Kyem (1999) argues that the adoption of GIS will have little effect on "elements of a culture such as customs, language, music, and recreation that have no objective bearing on human well-being, truth, or falsehood." On the other hand, will flooding a cultural group with Westernized GIS practices risk destroying cultural identity? According to

Kyem, non-Native technology has more influence on the "domain of thought" like science and philosophy, in which cultures seek to expand and develop no matter the origin of the technology (1999:71). In other words, cultures will embrace technology to support societal goals but will not abandon core cultural practices to mirror the culture in which the technology originated.

A counter map is used in response to, or from a lack of, an official map and such a map also exerts a force on the land and people living in an area. One unexpected result of counter mapping is that it may induce a false sense of obligation to map a place to keep it. Therefore, the map is produced under defensive conditions in which power relations are uneven (Brody 1981; Wainwright and Bryan 2009). In addition, Native communities that prioritize themselves on the map through counter mapping could experience increased State force in the form of land use laws and taxation, thus reversing the intention of the map (Brosius and Russell 2003; Hodgson and Schroeder 2002). Though counter mapping can bring a level of risk, such risk often does not outweigh the threat of undermining tribal sovereignty, cultural tradition, and social memories if counter maps are not produced.

Maps and Memories

Cartographic practice is a means to stabilize memory and support cultural persistence. In particular, as a form of empowerment, mapping can reestablish or continue the connection to territory and important cultural places. By adopting the tools of the dominant culture, the subaltern may inscribe resistance from the periphery in the form of maps, diagrams, and art that challenge centers of power. Maps are more than spatial elements organized and recorded for reference by people seeking guidance. Maps are agreed on spatial relationships, at least for the cartographers, and are a force and authority in peoples' collective memory (Halbwachs 1992). To map is to propose an action onto people by people. To be mapped is passive and threatens sovereignty. People on the receiving end of a cartographic encounter are more likely to be misrepresented and, in many cases, excluded. Stronger social memories take over weaker ones by "blotting out" and "muting" (Fentress and Wickham 1992).

One method of representing a place and denoting a history or memory is the use of place-memes. This term refers to a unit of cultural information about a place like placenames and is "a holistic and high-level device for examining the evolution of human-defined places" (Eades 2015:24). Place-memes are shorthand references to intellectual, spiritual,

or material artifacts for the next generation. This practice might help ensure cultural continuity by preserving and leveraging local and Indigenous languages, life-worlds, and named places, thereby serving to "repair broken continuity, or re-tie them where they are frayed" (Eades 2015:11).

Place-memes relate to philosopher Paul Ricoeur's (2004) three stages of historiographical functions. The first is the documentary stage, in which testimonies and archival evidence are assembled. This stage explores testimony both as "declarative" and "representational" in the form of "narrative, rhetorical device, and images" (Ricoeur 2004:161). A place-meme enlists these exact mechanisms, capturing historic meanings and delivering memorable testaments. The second function Ricoeur describes is "explanation/understanding" that addresses the "why" and "because" while escaping duality (Ricoeur 2004). Once the data are archived, the raw data are contextualized to illuminate the human-defined place in full theoretical terms.

Finally, the representative stage secures the data in a "literary or written form of discourse" (Ricoeur 2004:136). Paradoxically, "securing" the data, history, or memory freezes ideology and represents the information in the political environment at the time. Testimony may appear logical given the political climate, but as the recording, mapping, or writing ages, the information becomes antiquated and potentially loses its intended effect. Additionally, the representation is just one of many interpretations with embedded propositions; therefore, other "truths" are less secure. Without maintenance and distribution, these less powerful and less supported memories are forgotten. Place-memes provide flexibility for other narratives, counter-narratives, and counter maps.

The representation behind the map does not end with symbols, lines, and boxes; mapping a place produces a degree of entitlement, an assertion of power to be protected (Wood 2010). However, Ricoeur (2004: 166) reminds us that "the employment of a told story, moreover, reinforces the semantic autonomy of a text, whose composition in the form of a work gives it the visibility of something written." In other words, the production of a communicated narrative—be it text or map—is an assessable exertion of force.

Moreover, maps derive and transform testimony in spatial representation. Atlases are used to help inform the present and, in doing so, provide insight and stability to our relationship with our past. Though the map-reader is not physically present in the mapped place when viewing a map, the reader imagines the place and the communities that live there. A combination of tour and map provides a deeper understanding of place. Place has many meanings; in this instance, place

is seen as “an actual location where many different relationships have overlapped over time, producing a dense, richly textured sense of life” (Massey 1995:180).

In an attempt to contest political mapping and its power, some cultural preservation groups engage in less divisive political research and education by making a map or giving a tour of historical and memorable places. Activists temper sensitive topics and concentrate on meaning and truth. The cartographic approaches of moderating or softening the iconography to reduce the “emotional response” thus remains dedicated to the idea of trustworthy truths is a non-confrontational strategy (Gutman 2017). Subsequently, this approach supports a memory-focused narrative that avoids becoming a victim's story.

Michel-Rolph Trouillot notes that “a map may have a chance to help visualize the war within the war” by symbolizing the many constituents on the ground (1995:37). Thus, answering questions such as where they have been, where they are going, how many are there, and many more contextual attributes. What is unique in mapping is the ability to envision and consume multiple values and alternate perspectives all at various scales. The idea to include more history and simultaneous histories for the narrator's contextualization and to inspire the chronicler to provide the play-by-play of every event witnessed while empathizing with the subjects is the key to equality in history (Trouillot 1995). Like maps, history books are a representation of past events, and like with all representations, actual events and real people are excluded.

Mapping is one of the many ways societies preserve memories, which also include public celebration, landscape modification, and inscription. Mapping is a powerful instrument that memorializes spatial relationships and organizes data into “a visual concept, a constructed or projected image, referring to and bearing information about something outside itself” (Fentress and Wickham 1992:17). This allows a map’s “visual concept” to be treated as a mnemonic device like text. Instead of textual “memory of words,” however, it is the visual “memory of things” (Fentress and Wickham 1992:17). However, much like books, maps have goals of communication and risk favoring some information over others. Maps can locate and memorialize dominant memories at the expense of others' lived experiences. A history book, like a map, represents past events, and like with all representations, it is only a version of actual events and real people. A map, like text, permits some social stability in memory, much like a reunion at a marked location to celebrate a collective memory.

Memory narrators experience tasks similar to the cartographers' charge in capturing and communicating historical “truths.” In creating a

map—and thus the power (action) of mapping—the map will inherently silence people, places, and the history depicted in the mapped area. Values of others are discarded while the dominant historical "facts" are recorded and often enshrined with the weight and authority of the official map. Trouillot (1997:49) writes that "silences are inherent in history because any single event enters history with some of its constituting parts missing. Something is always left out while something else is recorded."

Education and Pedagogy

One essential pillar to Native sovereignty and cultural continuality is educating the next and future generations and passing on traditional ways of thinking and living. Because maps provide a powerful visual representation of the land and can communicate Native values, they are increasingly used to teach students. There are three points of pedagogical entry in this thesis. First, teaching within the community as an act of social justice and cultural persistence. Second, there is an increase in GIS training by and for peers using Native-centered context. Third, maps can be used to create content for classroom lessons that include Native history and land-based learning for Native and non-Native students. Pedagogy, in the perspective of my dissertation, has two implications. The first addresses research methods that start from the place of inclusion, empowerment, and opportunities. I explore decolonizing research practices in Chapter 3, but in this section, I consider the ways Native Americans are teaching and learning Western spatial technology in a critical pedagogy framework.

Critical pedagogy is the synergy created when critical theory interlocutors support education dialogue. Peter McLaren (2015, 27) writes that critical pedagogy is "the production of critical knowledges leading to praxis in its social, spatial and geopolitical contexts." In this space, ideas informed by evidence are employed to examine the uneven access to education and, by extension, access to complete societal membership. Exercising critical theory is the subsequent step after "naming the problem and demonstrating it," thus extending the milieu to include experiences other than "whitestream" logic systems (hooks 2014). At this moment of naming and visualizing inequality, counter mapping instills Native authority onto the land and works to narrow the power disparity.

Critical pedagogy is both "rhetoric and a social movement" for Indigenous communities seeking social reform and possible revolution (Grande 2015:6). For example, reproducing knowledge in a way that includes the learners would, in effect, empower the learner, thereby supporting that person or group in retaining all the rights and privileges

of "being more human" (Freire 1996). Critical pedagogy is a pillar in the struggle to restructure unjust societies and reduce the effects of the ongoing colonial project. By not inserting Native viewpoints into mapping, cartographers risk reproducing homogeneous repressive practices. Through mapping, Native communities have another approach to empowering themselves and their peers and preserving knowledge for future generations.

Many Native American societies were disrupted by European and later Euro-American settler colonialism and genocide (Dunbar-Ortiz 2014; Wolf 2006). Native survivors and future generations are burdened with historical trauma as a result. To this day, Native Americans are still reading school textbooks that depict Native peoples as "savages" and Native people are purposely absent in teaching US history in an authentic way (Knowles 2012; Simpson 2017). Critical pedagogy strategies are essential in closing the gap for Native communities that struggle to stay connected to their rich history and maintain stability in a dominant society that is still marginalizing Native culture. In addition, Native centered teaching helps to provide the dominant society with a more truthful telling about the nation's past and present.

One such approach is articulated by Sandy Grande (2015) in *Red Pedagogy*, in which she describes as "historically grounded in local and tribal narratives, intellectually informed by ancestral ways of knowing, politically centered in issues of sovereignty, and morally inspired by the deep connections among the Earth, its beings and the sprite world" (2015:53). Similarly, Keith Basso's (1996) study with Western Apache, examines the wisdom of elders and how they know their land, in what he terms "place-making." In similar fashion, *Red Skin White Mask* author Glen Coulthard (2014) introduces "grounded normativity," a term to explain "the modalities of Indigenous land-connected practices and longstanding experiential knowledge that inform and structure our ethical engagements with the world and our relationships with human and nonhuman others over time" (Coulthard 2014:13). This approach challenges Western political and economic systems, nationhood, and boundaries. Likewise, Leanne Simpson (2017:46) argues that "the processes within nation-based grounded normativities destroy the structures of colonialism because they perpetually shift power back." Unlike Western bureaucracy, these Native processes work as preventive approaches and rotate power to the most qualified within a group to advise on community circumstances. The practice benefits the community first and curtails individual accumulation of power and wealth.

Red pedagogy is rooted in Gerald Vizenor's (2008) concept of "survivance," which challenges the cultural disruption of Native societies

and subscribes to the notion of "active presence" in response to the "legacy of victimry" (Vizenor 1998:15). This framework encourages continuation and rebuffs the empty benevolences demonstrated by the ongoing colonial project. Grande's thesis also confronts the cultural conditions of Native survivance within the struggle of "whitestream education". In doing so, she identifies and challenges many "colonial logics" systems, including the over-emphasis of young voices and individual expressions over those of the elders and collective voices.

Spending many hours producing maps about places conveys a deeper sense of belonging. Becoming more familiar with the land by mapping it reinforces the connection and, in turn, empowers people to defend that connection. For Native people, the Western educational approach is applied to learn about Western concepts, but this pedagogical method reduces the holistic approach traditionally used by Native groups (Simpson 2017). Learning about place has pedagogical implications while also stabilizing historical events for Native groups. Lessons derived using land-based pedagogy is provocative and can be found in other cultures, including some US learning environments. Cited in Scott and colleagues' book on Indigenous mapping, a Native mapper named Peter Tuluk points out that "nothing can match personal experience, nothing can match it, not books, or computers, not video" (2005:135). Chain memory helps us remember in sequence. This can be achieved using oral history; however, inscription, including maps, can bring a sense of durability to the information. Given the pressure of erasure on some Native cultures, teaching people how to preserve information to back up traditional storytelling is ideal (Scott et al. 2005).

Summary

Maps are instruments to visualize real things in time and places. Peoples' interactions with things produce a sense of possession, like living on and working the land. Thus, maps reinforce the claim by marking property boundaries and directing US laws and enforcement to protect land entitlements. Maps assert force from a distance and work to convey a proposition that implies social authority. Between the continued interaction with a place and the collaboration of creating and circulating a map, more meaning is afforded to both the map and things depicted on the map. Mapping filters the totality of objects and people in places, and therefore, much of the complexities and populace are left off the map plane.

Counter mapping redirects the power of maps and offers a different perspective of land tenure and, therefore, at least partially, contests the

official maps propositions. In other words, people who do not capitulate to the dominant colonial view are inserting themselves back from the margins of state maps using the same technology and tools as western cartographers to resist erasure. This (re)mapping supports Native sovereignty by incorporating language, place names, and historical presence to both protected and dispossessed land. However, counter mapping can attract unwanted attention, and the Tribal community GIS data are vulnerable to exploitation.

Maps help enshrine and visualize culturally important places for Native communities by documenting and preserving intellectual, spiritual, and material artifacts for future generations. Storytelling and walking the land are an essential form of pedagogy to teaching life lessons and traditional ways of knowing. Elders act as memory narrators, but because of disruptions in communicating wisdom and history, other means of passing knowledge to future generations are being pursued. GIS, along with filmmaking and oral histories, are supplementing storytelling.

One of the primary reasons some California Native communities embrace GIS tools is the ability to organize spatial data engaged by Native learners. Armed with the power of maps, some Native educators and activists teach land-based curricula informed by grounded normativity and critical pedagogy methodologies to unsettle colonial logics and structures. These approaches reinforce the connection between land and people and, thus, stabilize historical places and events for future generations.

CHAPTER III

DECOLONIAL METHODOLOGY AND NATIVE RESEARCH

The challenge in researching how and why Native Americans in California are using spatial technology is that there is an uneven power dynamic throughout the history of cartographic collaboration. Asking GIS users about their cartographic work can cause apprehension because some of the data are for Tribal members only. Paradoxically, most people in the GIS community are eager to share their geospatial knowledge with whomever will listen, especially if people inquiring can speak the spatial language. This interaction is known colloquially as "talking map," an exceptional understanding of cartographic language shared between people to discuss mapping experiences. This idiom is a conduit to communicate individuals' experiences and to engage in and learn about spatial knowledge production. In this "talking map" space, I can reach out to fellow mapmakers and ask about their process using GIS.

In this chapter, I recognize differences in conventional academic approaches to research and elaborate on the decolonial methods to move from what Adam Gaudy (2011) terms "extractive research"—studies that seek to obtain Indigenous data with the intent of translating those data for university audiences with little regard to costs to Indigenous people who provide the information. As an antithesis to this approach, I examined rules of engagement by tribal members to safeguard against unbalanced exchange of knowledge. Direct and purposeful deviation from standardized, positivist methods contribute to the Indigenous methodological canon to support people and amplify their voices.

I ask myself: why should people want to participate in interviews about how they wield map power? My answer is couched in the concept and action of reciprocity – to be reciprocal is part of honoring one another. Yes, I am building knowledge in Native cartography, but I want that knowledge to be accessible and meaningful to individuals and tribal communities that have volunteered their time and expertise. This study includes gathering many Native perspectives on cartography in the community and synthesizing relevant information that will be shared with Tribal communities.

In search for a common language among Native cartographers and other GIS users, I turn to the language of space and place communicated by storytelling, written accounts, and spatial technology (Cresswell 2015).

Organizing spatial data in a format that is respected in Western power structures yet is also embraced by many Native nations is one intersection that opens the interchange of knowledge. The ability to "talk map" with Indigenous GIS users creates a pathway to communication. Thus, to take full advantage of this specialist language, I employ what I refer to as a *map interview*. It is building from J.B. Harley's (1989) work on deconstructing the map and is defined as "read[ing] between the lines of the map" and "through its tropes to discover the silences and contradictions that challenge the apparent honesty of the image" (Harley 1989:3). This interview method deconstructs the map *with* the originator of the map to both reveal the intention and present evidence of the shift in power utilizing a Native-centered GIS.

A Story About Building Relationships with Native GIS Users

Recruiting participants to share their maps and experiences in spatial knowledge production is grounded in building relationships over years, both outside California and in my study concentration in California. I initially attended the small Tribal GIS conference of approximately 175 people in Albuquerque, New Mexico in 2017. The conference is where primarily Native GIS users learn spatial technology techniques with Indigenous applications. There is a two-hour block of presentations allocated for the cultural application of GIS. During this time block, I listened to speakers talk about how they used GIS to map and (re)map places that contradicted the dominant cartography.

What stood out was the context and aim of the mapping projects. The presenters emphasized the assumption that attendees knew why they were mapping Native-centered phenomena on the land. They were mapping to support Native sovereignty, land tenure, and indigeneity on the landscape, inserting power among their peers that was being reciprocated with cheer and follow-up questions. At this moment, I wanted to know the inner workings of Native spatial production and what makes it different, if at all, from Western motivations of mapping.

At this conference, I had no set agenda and did not know anyone or have any specific goal other than to just listen. I noticed some people putting equipment away before the lunch break and asked if I could help carry something. A woman, whom I later learned was one of the conference co-founders, smiled and started directing me to help. After finishing the job, she asked if I wanted to join the crew for lunch. This group was the heart of the Tribal GIS organization minus the other founding member, which is the woman's husband. I was introduced to the Oklahoma Choctaw Nation Cultural GIS manager who organized the

cultural GIS session. During this time, I offered my positionality as a graduate student and GIS expert in an Interdisciplinary Humanities program in California. I spent the rest of the conference with this core group, including going to dinners, setting up and breaking down conference equipment, and being introduced to many Native mapmakers.

The following spring, I called up the Cultural GIS manager in Oklahoma and asked if I could visit and see his GIS shop. He lived in California as a child, so he enjoyed talking about the state and often described the difference between Oklahoma and California. I explained that I grew up in Tennessee and that there are many similarities to Oklahoma. At first, he was unsure if he could host me for a whole week because of his many responsibilities, but soon agreed to host me and show me the ways his Tribe used GIS.

In Shawn Wilson's book *Research Is Ceremony*, he seeks to weave together Native epistemology and ontology by employing relationality in which "relationships do not merely shape reality, they *are* reality" (2008:7). Building and maintaining meaningful relationships is methodologically sound and corresponds to Native research paradigms. In my research, I continually look for opportunities to build and sustain relationship such as when I visited the Choctaw Nation. I joined the GIS manager to teach a Native youth group how to cook traditional food over a fire pit. Since I also have professional experience as a chef, I was eager to participate, but instead of "passing on my culinary knowledge," I helped fetch water, set up tables, and clean, while also developing a stinging sunburn. I listened and watched while 7- to 17-year-old children made Wak Nipi (skewed meat), Nyni Nipi (fish wrapped in a cornhusk encased in clay), Walukchi (boiled blackberries with flour and corn dumplings), and frybread.

I asked: how is fried bread a traditional food? The GIS manager told me it is something they made during the Trail of Tears (1831-1877) forced relocation, and they needed to use flour and oil sometimes given to them to survive. This experience was not part of my research plan and did not directly connect to this research, but profoundly affected my methodological skill-building. Later, when the GIS manager showed me the GIS of the many Trail of Tears routes, some they had recently rediscovered, I imagined the frybread being prepared along with foraged food.

Native Paradigms in Research

I worked with Native cartographers who chose to share the process of and motivation for creating a Native-centered map. I met with and

interviewed Native cartographers to explore the diversity of counter-maps and what drives their decision-making when constructing new maps. Also, I examined the perceived and realized risk of producing counter maps, and the benefits resulting from building and sharing culturally rich maps within the group, between groups, and with the general public.

Jay Johnson and Soren Larsen (2013) argue that research methods situated in critical theory lead to a hybridized learning exchange with other cultures. Using democratized methodology can provide the structure needed to reimagine the "guiding conventions of academia" and create a space of equal positioning to explore different cultures (Johnson and Larsen 2013). In other words, the inadequate comparison to, or the inability to be judged by, the same standard of Indigenous life-worlds and Western frameworks can be reframed as an equal exchange of knowledge, once dominating power is subdued or withdrawn.

> Indigenous approaches to research in Indigenous issues are not meant to compete with, nor replace, the Western research paradigm; rather to challenge it and contribute to the body of knowledge of Indigenous peoples about and for themselves, and for their own needs as peoples, rather than as objects of investigation [Porsanger 2004:105].

Glen Coulthard (2014:22) points to a land-based theoretical structure used to inform Native knowledge practices called grounded normativity: "ethical frameworks generated by these place-based practices and associated knowledges." This grounding looks to set the tone in communicating Native knowledge and benefits decolonial approaches. In other words, there are many ways to engage in society; grounded normativity is a Native ethical stance that seeks to sustain relationships to land and support Indigenous freedom. Part of Native freedom is to transmit knowledge to future generations vertically (Eades 2015). Leanne Simpson underscores this idea in her book *As We Have Always Done.* wherein she writes that "I want my great-grandchildren to be able to fall in love with every piece of our territory" (Simpson 2015:7).

In my work, I foreground the Native voice by embracing Indigenous scholars and convey the interviewee's experience within the construct of the Western academic environment. There is a risk when synthesizing information vulnerable to Western ideology and presenting such information in a hybridized Native and Western format. In communicating this research, I am not the voice of Native GIS users; rather, I rely on community-engaged research to support my conclusions. The "paradigm shift" in Indigenous research is to feature traditional

knowledge and refrain from over-interpreting the data (McGregor 2010). It is a balance between recognizing Native epistemology and axiology without completely translating them to Western paradigms, thus treating it as secondary knowledge production.

Eve Tuck (2009) challenges the research framework that societies are relegated to the singularity of their oppression or historical plights. It is the dominant narrative and, consequently, a starting place to "explain contemporary brokenness" (Tuck 2009:413). In other words, people experiencing inequality, including what bell hooks describes as white supremacist capitalist patriarchy, are subject to a general theory of change. Tuck explains how the theory of change is used to guide research in assisting to "operationalize the ethical stance of the project" and drives researchers to prioritize exploitation in order to document the change or difference. Reinforcing the victims' story generates political empathy and perhaps monetary support for research (Tuck 2009).

The counter to research compelled by oppression is to position the study such that it underlines prospects beyond subjugation and less on the prosecution of the offenders (Rebell and Wolff 2008). This is not to say sources of tyranny need not be documented, but rather, that contemporary strategies should support the research. For example, attributing all that is wrong in a Native community to only the consequences of settler colonialism are incomplete and, in many cases, continues the colonial project. Tuck offers an evolutionary framework designed to reposition the subjects from "communities as damaged." She is repositioning the framework to a desire-based approach wherein she explains that researchers "are concerned with understanding complexity, contradiction, and the self-determination of lived lives" (Tuck 2009:416).

In the groundbreaking book *Decolonizing Methodologies*, Linda Tuhiwai Smith asserts that research with Indigenous peoples should be respectful, ethical, sympathetic, and useful (Smith 1999). Similarly, during their work with Canadian Aboriginal people, Danielle Tessaro et al. (2018) formulated the "five Rs" of research in an Indigenous research context: (1) respect; (2) reciprocity; (3) relevance; (4) responsibility; and (5) relationship. Respect refers to the need to recognize and respect Indigenous cultural norms, values, and a holistic worldview. Reciprocity means that research must be mutually beneficial to the researcher and the local communities while listening to participant's voices and accommodating their needs and goals. Likewise, the research topic and method should be relevant to the Indigenous community. The researcher has a responsibility to recognize and uphold Indigenous values, practices, and ways of knowing. Finally, relationships between the researcher and

Indigenous community members, the community as a whole, and the culture are crucial bonds between the previous four Rs.

Reciprocity as Methodology (A Shared Experience)

The act of reciprocity is to exchange beneficial action that rewards participation in an agreed manner (Maiter et al. 2008). In Indigenous research, the mutuality extends past a transactional relationship and takes the form of respect for local community norms. In other words, researchers are to carry more of the burden of understanding and practicing decolonial methodology and curtailing Western stylistic inquiry. Atilla Paksi and Ilona Kivinen (2021:204) suggest "methodological flexibility" that makes use of "several alternative data collection, analysis and presentation techniques congruent with Indigenous ways." In addition to mediating actions, reciprocity is an "ethical stance" that demonstrates a commitment to people who are engaging with the research (Trainor and Bouchard 2013). Part of the interchange is in the way researchers look for ways to include Native epistemologies while communicating. One example is to use "place-based reasoning" to highlight respect for the land and its people (Laluk 2021:55).

Sustainable relationships are the crux of community research. Therefore, designing a process whereby people are involved for as long "as needed" or including a large number of participants in which reciprocity is unmanageable is antithetical to Indigenous methodologies. The relationship to participants should be planned prior to and throughout the research and sometimes afterward (Kovach 2009). In reciprocity, there is not an intersection of strangers but a building of trust and friendship. In reviewing their research with Northern Cree, Janelle Baker (2016:113) noted that people "have shared their time, wisdom, friendship, humor, stories, and sometimes their food and homes with me." In understanding all that is shared, why would Native people want to collaborate? In general, Indigenous collaborations can provide an "understanding of community needs" and "help towards gaining respect for Indigenous approaches and knowledges" (Edwards et al. 2020:10). In the research of this dissertation, partnerships led to revealing and disseminating the power of Native maps that apply to the broader peer-to-peer network of Native communities.

As part of more than three years of research, I participated in reciprocal praxis that is "beyond the concept of quid pro quo arrangements, crafting a stance of reciprocity" (Trainor and Bouchard 2013: 998). I listened to people in the different communities and gave what I had with few expectations. For example, I currently serve on the

Tribal GIS Education Outreach Committee, where I work with Tribal members throughout the US on providing GIS training and information on resources for Native teachers and students. In this capacity, I assisted in the reconstitution of the organization's newsletter, where I contribute content and recruit Native GIS users to participate by sharing their experience with the larger Native community. A similar example is when the California GIS Council wanted a Tribal working group; I hosted a Google Doc and participated in creating a charter.

Finally, I traveled to the California Indian Museum and Cultural Center (CIMCC) to present on how to navigate federal, state, and county pesticide websites. The Center's youth summer camp is making maps of places where basketry material is poisoned by pesticide overspray. The group suspects there is a link to mouth cancer of elder basketweavers.

Map-Interview Method

In what I call a map-interview, I reflect on the construction of the map *with* the cartographer. A map-interview focuses on the person producing the representation on the map and their process of mediating cartographic power. The assertion of cartographic force is divided between the solicitor and designer of the map. They both have a level of responsibility in deciding map details to communicate the map proposition that targets the audience effectively.

In this novel twist to traditional interviewing, I seek to reveal the root motivation for creating a counter-map and how the cartographer negotiates their tasks while interacting with their counter-map. Mapmakers are prone to provide as much detail as possible. Still, in the case of Native data sovereignty, they must use discretion and follow protocols that are in place to protect Tribal spatial information. In the map-interview, triangulation of evidence is not prioritized as part of a decolonial approach. Outsiders are not privy to many of the maps, and therefore, the interview relies on partial maps or verbal descriptions of the map from the cartographer.

The map-interview method aims to protect the voice of the mapper and provide the opportunity to talk about the construction of a map via storytelling while reengaging with their work. In the map-interview, I ask a series of questions starting with the mapmaker’s attitude toward GIS technology and to what extent GIS is used in Tribal operations. I inquire about rules Native cartographers must follow that shape what is allowed on the maps for non-tribal viewers versus tribal viewers. After learning about the participant’s knowledge of GIS, a map is presented by the cartographer whereby a more profound explanation about symbology, data

sovereignty, and the intention of their map can be discussed. Ideally, this approach creates space for Native cartographers to explicate decisions related to representation, traditional knowledge, and propositions forwarded in the counter map. Mapping and sharing one's interpretation of current and historical landscapes permits the cartographer to communicate Native spatial knowledge for the benefit of the community (Chapin et al. 2005). The final questions probe how their map relates to the larger tribal community and what other map projects they are planning in the future.

GIS is an increasingly popular technology for managing tribal assets independent of non-Tribal government agencies (Chapin et al. 2005; McMahon et al. 2017). As part of building relationships and engaging Native GIS users to participate in a map-interview, I attended conferences and join international, national, and state GIS organizations focusing on Native GIS praxis. Attending the foremost Native GIS association, Tribal GIS, I continue to meet people who notify other GIS users of this research. This chain referral recruitment strategy promotes initial participants to draw more people into the study (Allen 2017). Centers of calculation are places where geographic data are assembled and cultivated to be "used to act at a distance" (Travis 2013, 53). To locate California Native GIS users producing cultural maps, I contacted centers of calculation within the group.

Native cultural centers provide many services to the community, including but not limited to youth development (Maduram 2011), museum curation (Shannon 2014; Twair 2014), and social support (Browne 2014). In this setting, GIS is not the prominent tool for visualization of Native culture but can be utilized if either GIS training is provided to the staff or a community member has the technical skillset to produce maps for the Center. To date, I have developed relationships with approximately 20 Native GIS users throughout California and many more in other states.

Initially, I planned to transcribe the interviews using Dragon Professional transcription software combined with F4 Transcription Pro. However, due to the 2020 COVID-19 pandemic, I conducted my interviews over Zoom video communication software. This service includes a voice-to-text document generator that produces an unedited record of the interview. Within a day of completing an interview, I received a rough transcript as a Web Video Text Tracks (WebVTT) file. I then performed a first pass edit for text clarity and clerical errors, with particular attention to Tribal names and places. A second pass was performed in sync with the Mp4 video recording to edit for accuracy. Topical subsections were used to coordinate interview questions with the answers.

The qualitative methodology of coding uses inductive reasoning to examine interview data by meticulously examining each line of transcript text and "symbolically assigns a summative, salient, essence-capturing and evocative attribute for a portion of language-based or visual data" (Saldaña 2015). This process is not analysis, but rather, a method that supports and informs analysis (Basit 2003). The premise is based on letting the data speak for themselves by pulling phrases from the transcript and looking for similar patterns. Natural parameters are present and are based on the questions asked during the interview. However, interview answers can deviate from the initial question set and, thus, present opportunities for more meaningful exchanges from unexpected perspectives. Coding is not an exercise in processing data to meet a hypothesis, but rather, is a tool to uncover and develop meaning from the volumes of interview data.

This approach to coding promotes heuristic learning and works best if applied both during the data collection phase and after all the data are gathered (Saldaña 2015). Recognizing patterns in the data as they are collected creates a solid foundation and allows for adjustments and room for new concepts to emerge from the text. It is vital that coding is not used to simply highlight categories but to build a nexus: "It leads you from the data to the idea and from the idea to all the data pertaining to that idea" (Richard and Morse 2013:154). This application of organizing data auto-constructs concepts by aggregating similar perspectives that lead to the next level grouping of data.

In Vivo ("in that which is alive") is the most prominent type of coding applied in this study and is based on the premise of the research question. I asked why and how Native cartographers use GIS to create maps that are Native-centered; thus, I focused on their words and how they chose to express reasons for visualizing community values while using Western technology. The gleaning of specific phrases and important points protects the voice of the participants while supporting the intention of this research. I employed attribute coding or descriptive coding to organize the names of Tribes, State and Federal agencies, location, and demographic information. However, In Vivo coding is the base coding method that supports the grounded theory model.

Grounded theory was first presented by Barney Glaser and Anselm Strauss (1967) in *The Discovery of Grounded Theory* as an organizational approach to qualitative data development, analysis, and theory development. This process seeks to build data from communications between people experiencing a phenomenon and scholars theorizing to understand connections within the study (Corbin and Strauss 1990). The "grounding" indicates the foundation of the data is derived from authentic

experiences that are compared and expanded on with other experiences and knowledge. This method moves past the restrictive positivism and emphasizes safeguarding the participants' "view of reality" (Charmaz 2000: 510).

Summary

Methodology in this research is based on relationships with tribal community members and a deeper understanding of past and present power dynamics. In effort to decenter colonial approaches to ethnography and participant interviews, I deemphasized my positionality as a researcher and focused on supporting Native GIS organizations. I also participated in educational outreach committees and initiatives that strengthen Native communities. Finally, I explored Native researchers' frameworks to shift toward paradigms that counter exploitation and damage-centered narratives. This shift is demonstrated by purposeful, meaningful, and shared experiences of reciprocity.

The map-interview method respects agency of the mapmaker and their craft. In search for deeper meanings and motivations for using maps as a force, I seek to protect the Native voice and reduce over-interpretation of the data. Thus, the codes used to examine the interview transcripts support my grounded theory approach to make connections within and between participant's map-interviews. Map-interviews were transcribed in their entirety, and only minor edits were made as necessary to allow for readability. There were no edits to substantive wording. Chapter 4 will demonstrate these techniques as I present how and why Native GIS users in California are making counter maps.

CHAPTER IV

NATIVE AMERICAN MAPPING

Interviewing Participants

Participants in this study have GIS experience ranging from 3 to 30 years and have created multiple counter maps. All seven interviewees are currently working with Native communities in California. I have afforded participants with synonyms to safeguard their identities. Sensitive Tribal data were not collected but, some sensitive information was acknowledged to exist and, therefore, I have taken extra steps to avoid Tribal affiliations. In addition, interview responses were only edited for clarity and context.

Arthur and Jack do not identify as Native but work extensively with Tribal members to produce spatial knowledge with and for Native communities. Jack has many years of experience producing Native-centered curriculum for K-12 schools, where he incorporates maps as a vital learning medium. Arthur has a degree in GIS technology and works for a California tribe as a GIS technician. Natasha and Jasmine are associated with a community cultural center that focuses on supporting young Natives in education and community activism. Dylan is an ethnobotanist for a federal agency and elder of his tribe, where he is working for federal recognition. Likewise, Dawn works for the State of California and seeks recognition for her tribe. The final participant, Carol, has reunited with her tribal roots and uses GIS to research family history and teaches at a local university.

At the beginning of each map interview, participants were asked how they learned about spatial technology and how long they have been GIS users. As noted above, there is a range in years of experience with GIS, but all participants are college-educated and acquired GIS skills in classes or on-the-job training. Next, cartographers were asked about the advantages and disadvantages of using GIS. All mapmakers agreed that organizing large amounts of data and visualizing it are the best benefits of GIS. However, the cost of starting and maintaining GIS is a limiting factor in expanding use in Tribal communities. In all cases, participants expressed concern over data security and data sovereignty that might threaten the tribe. Each interviewee noted a level of tension between wanting to create an extensive, accurate, and complete map and not wanting to expose culturally sensitive spatial knowledge to non-Natives with a history of practicing Native erasure and assimilation.

Participants were not asked directly about counter maps; instead, what constituted a counter map was determined from conversations about their motivations for making the map. Cartographers were asked about specific maps, in most instances while looking at and referring to their maps. Arthur could only refer to public maps used as part of his map because of strict protocols in data sharing. He responded to one question by noting that "this question I am really inclined to just not answer since describing differences to any boundary will almost by definition give out details of the boundary." In another instance, Dylan did not wish to be recorded and answered questions by using talk-to-text and then emailed the answers. During this portion of the map interview, the GIS users discussed their motivation for creating maps and who they wanted to see the maps. Most maps are for Tribal government officials or members of the community. Some maps are for the general public to bring attention to Native issues or inform California's school curriculum. Groups of maps are also presented to support federal recognition requests, and such maps range from plots of cultural sites to historic trail maps that show the extent of Native affinity before European colonization.

Next, I asked participants how they think GIS mapping will benefit their community in the future. Overwhelmingly, cartographers felt that capturing and organizing cultural data will protect such data for future generations. Additionally, they expressed that using Native narratives and maps is critical in teaching history and traditional relationships to the land. Two objectives emerged in teaching Native spatial knowledge: (1) teaching Tribal history to young Native people connects them to their rich history that is incomplete or absent in Western schools; and (2) teaching non-Native people Tribal history will counter the mythical colonial-settler origin narrative. Natasha explained her approach when teaching Native teens: "We're preparing the kids for the challenges that they're going to face in the future if not just today, so I think that blending of culture and technology is really a critical piece for them moving forward."

The last discussion was about if and how they share data or GIS techniques with other Tribes. Data are shared with adjacent communities based on interest in historical overlapping land use. Cultural resource monitoring is the primary driver of data sharing with both US and Tribal governments. All participants have attended conferences to talk about how they use GIS. Also, peer-to-peer workshops at Tribal GIS conferences are popular for inspiring new Native-centered GIS applications.

I have organized my findings into two main sections that relate to my research questions. I was permitted to share many of the maps referenced in the map interview.

Why and How are Native Communities Using GIS?

Geographic Information Systems are the leading technology to perform spatial analysis and create web-based or hard copy maps. Federally recognized Tribal governments are eligible for subsidized ESRI software, and non-federally recognized Tribes can obtain cost relief for the technology through a non-profit or use opensource alternatives. When she started helping her Tribe, Dawn explained that the "software itself was outdated" and, in some locations, the internet signal is weak so "downloading the latest upgrade can take forever." Furthermore, after securing a grant for GIS software, she was faced with locating adequate hardware: "I found some very old servers that would support GIS." Software and hardware procurement is challenging for some non-federally recognized California Tribes, but as the leading GIS software moves to web-based platforms, desktops computers are being replaced by less expensive laptops, computer pads, and smartphones.

Another aspect of building and maintaining GIS technology is initial and ongoing training for Native users. Many of the cartographers I interviewed learned basic GIS skills from a college class. Arthur was part of a government internship and had the opportunity to learn GIS skills. "I was like right out of college, and they let you kind of cycle through different departments at FEMA. One of them was the GIS one as it was like the most interesting." Dylan's remembers when a college professor advised him: "When I was in college in natural resources, we had the option of taking an ArcGIS class. Our instructor told us it wasn't required, but he highly recommended it because, all things being equal, the person who had the GIS skills was the one who would get the job."

Other sources of training came from STEM-themed grants for youth groups. Natasha is committed to empowering young Natives by guiding research projects that address injustice and doing what Dylan describes as to "revitalize and preserve" cultural history. One of the first projects that led to learning and using GIS was to build a California Indigenous history kiosk that featured information from Tribes that was separate from State-provided historical narratives. Though the kiosk did not materialize, the data were collected and stored in a database to support it. Natasha decided to construct exhibits that offered Native-produced knowledge; however, she needed an effective way to communicate the youth groups' research "so we came up with the project of working with our Tribal youth group to teach them GIS and to start building the foundations for those exhibits." GIS-produced maps are a powerful way to communicate information.

GIS Helps Communicate Data Visually

GIS maps help communicate by representing things on the land to understand better what happened in a place over time. When previously unmapped spatial data are collected and represented on a map plane, the map strengthens a sense of validity from the researcher and mapmaker to the intended Native and non-Native audiences. Jasmine created counter maps that try to bring attention to inequities: "It was almost kind of, to be used as a little bit of like a shock factor to, you know, create like this urgency and need for change." Dawn thinks about how maps can support Native narratives since "mapping can illustrate pretty much just about any story you want to tell…being able to illustrate that properly with the proper layers and having proof, evidence, that you know your point is being made." GIS is the primary method used by US agencies, institutions, and researchers and is acceptable in litigation.

One powerful example of transforming textual spatial data using GIS is when a youth group decided to map the genocide of California Native people "just because the visual of it has so much power." Natasha referenced a mapping project based on the book *An American Genocide* by Benjamin Madley (2016) (Figure 2). The power of maps is demonstrated by moving the data from ledgers to the map plane. Natasha noted:

> I think it's easier to communicate, and that's something that's very critical to me and representing Native perspectives, is that people have a sense of how we feel and our emotions, and that's why I think the genocide map really speaks loudly is because when you see the whole State of California lit up pretty much with all the dots and all the places. You really get a sense of the tragedy, and you know how overwhelming those acts were to the people, Indigenous people here. I think that that's how it speaks volumes visually, and you know I respect Ben Madley's research, but being a California Indian and reading his book, while it's the best research, thoroughly documented, it really doesn't express a lot of emotion and, you know, knowing my great grandmother survived [the massacre at] Bloody Island, but sitting there and reading the facts that he presents, there's something missing in that presentation. And so, I think it's important that you know that the maps help us. Help us express that.

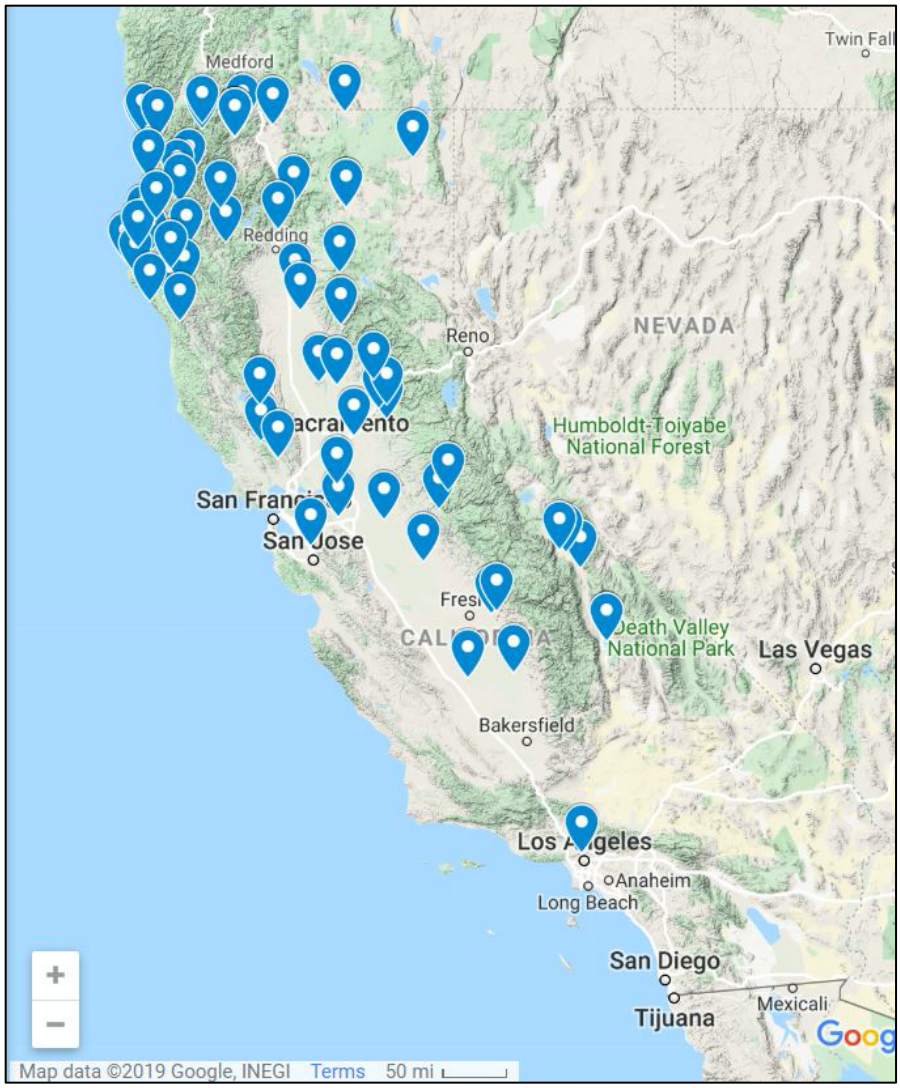

Figure 2 Partial California Native American Genocide Map

The book's author made some smaller maps, but the youth group wanted to show all of the places their family and other Tribal members were killed for reward money from the State of California. The goal is to underscore the vastness of the genocide and then populate the database with more personal detail to communicate the humanity of people murdered.

At the same time, Native cartographers are concerned that maps need to be easy to read because people may get confused if the map is complicated. Tribal governments and community members are the primary audiences of Native GIS counter maps. Dylan explained the approach he takes when making maps for members:

> For people who are not mapmakers, maps have to be made very simple [accessible] so that the message is understood by [whomever] is looking at a particular map. The set of maps that I'm making are pretty basic. I've deliberately kept the data simple. I don't have multiple sets of data in these maps because they'd be too confusing. I'm making these maps primarily for Tribal members who do not have a background in mapmaking, and so I just have to make the maps very basic and very simple so that they are understood by pretty much everyone.

GIS maps efficiently present a lot of data all at once. Still, Native cartographers must decide if maximizing the data, like the genocide maps, is more effective than showing focused maps for novice map readers.

GIS is Good for Organizing Spatial Data, But There is a Risk

Native cultural resources are frequently being unearthed, literally, due to land development and construction, and figuratively, from archives and museum collections. Professional archival software is available but is designed for curation and does not always to support Native persistence. All of the features of the material culture that are found in archives can be linked to GIS attribute tables, including photographs, size and locational attributes, oral histories, and stories of the cultural material. In addition, GIS tools can be used to support people to aggregate, analyze, and visualize the spatial knowledge linked to Native culture. For example, Carol learned about mapping in college and used mapping techniques to teach students spatial concepts using maps. When she decided to start researching her Native ancestral lineage, she used GIS: "I felt like there was so much information between all the documents I come across…for me it is easier to understand, place and people in time all attached together." The map legend in Carol's GIS project (Figure 3) includes some of the diverse map layers found in many Native-centered projects. One notable use of GIS in mapping is marking where data were collected. As revealed in the map legend, the mapmaker shows the location of interviews with elders and where she first encountered Tribal songs.

Aggregating sensitive cultural data into the GIS database poses a level of risk that information will be accidentally shared or stolen. Jack references the anxiety felt by all participants when he stated,

> I think it's yeah, no, it's really interesting. I guess the danger or risk in maps is inputting information into tangible form

> and then people from outside the community saying, you know, thanks for the information we're going to take this and run with it.

Dylan reiterates,

> The data isn't given out for fear that the data would somehow make it into another person's hands who could cause harm or damage to cultural resources...even theft, and so there's a great deal of sensitivity in retaining this information in a confidential manner for the Tribe.

All participants expressed reservations about the security of the internet, and so, they avoided cloud storage of sensitive cultural data online. Natasha agreed with Arthur about safeguarding Tribal data: "We don't use ArcGIS Online…none of it's on the internet at all." Arthur agrees with Carol about only sharing what was already public, she states, "that's the least sensitive information because it's published in books and on websites, so they're public." However, there is still a level of risk in having a collection of public data contextualized in a GIS. As a result, many Tribal cartographers make a formal request to the Tribal governing body to approve any sharing of maps or data.

Nearly all participants interact with state and federal agencies to protect cultural and natural resources. All state and federal agencies have a policy to consider and safeguard Tribal data. One such state institution is the California Native American Heritage Commission (NAHC) that catalogs and protects certain types of Native cultural resources. Dawn commented on her level of trust in different government agencies, noting "I would send this map to the California Native American Heritage Commission without any hesitation…Bureau of Land Management some of this data." NAHC is a protected clearinghouse that archives information for both federally-recognized and non-recognized California Tribes.

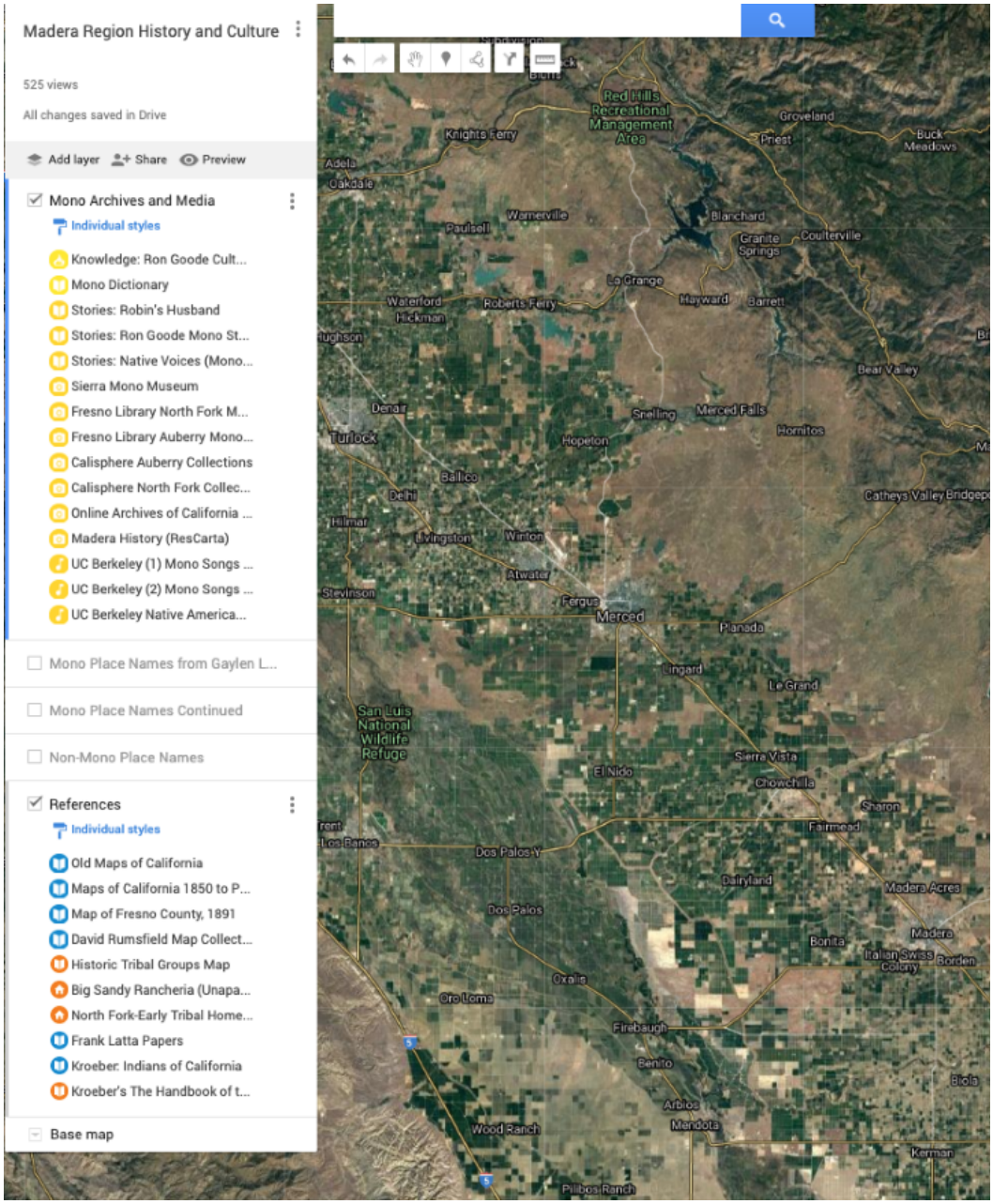

Figure 3 Map legend from a cultural research project using GIS

GIS is a Good Teaching Tool

Teaching Native history and traditional ways of knowing is essential in maintaining the social memory of the Tribal community. Western history is dominant in educational institutions and is known to suppress Native experiences and perspectives (Grande 2015; Simpson 2017). Successfully using GIS to gather and analyze data can lead to a

Native-contextualized curriculum that can present previously unknown or suppressed cultural history. GIS also supports further spatial production when data layers are combined to make new layers centered on Indigenous knowledge.

The Native youth group Tribal Youth Ambassadors (TYA) from Santa Rosa, California, implemented research projects targeting the non-Native community. As the group progressed in public awareness campaigns, subsequent projects turned to education in California Native history. In one example, a high school student started a California Indian history database but needed more researchers and funding to launch the project. Jasmine had the experience of having poorly informed teachers embarrass her and other Native children in the local public school. This experience inspired the effort to disrupt the American history curriculum.

Natasha points out some differences about teaching Native people using maps: "Local Tribes do not self-describe their geography in this way and feel suspicious of this forced categorization…for us, it was kind of like a Trojan Horse." That is, teaching only Western cultural geography can lead Native students to see their spatial knowledge as secondary. She explains that teaching cultural history is more inclusive of Tribal language, and information is communicated in a way similar to how students learn from their family and community elders. Natasha's vision is to "crack the structure of the curriculum." For example, she notes that "we thought if we could put [curriculum] in a form that the kids recognize" and add "more substantive content" that would be more conducive to learning. The goal is to create "layer[s] that could be place-based, but also layer oral history on top." This is called a place meme. This initial idea and project led to applying for and receiving a grant to teach young researchers GIS skills.

One of the first counter maps produced was the *California Indians You Should Know* map (Figure 4). In this project, the young GIS users researched the history and created a map of the most influential Native figures. Natasha explained this map is inspired by the fact that Western school history books only present information on three or four California Indians such as Elsie Allen[8] and Toypurina[9]. Natasha illuminated, "we wanted to feature historical and contemporary figures and give kids more options." GIS is dynamic and easily updated with new data. Also, different combinations of *important people* can be created to highlight subsets of

[8] Elsie Comanche Allen was a Pomo basketweaver from Cloverdale Rancheria. She was known for teaching basket patterns and techniques in support of basketry as both a tool and an art form.
[9] Toypurina was a Tongva medicine women who helped lead a revolt against the Spanish Mission San Gabriel in 1785.

the entire database. For example, highlighting important figures who were prominent after the 1950s or displaying influential women.

Figure 4 Map of California Indians You Should Know, California Indian Museum and Cultural Center (CIMCC) Poster 2014 ESRI Users Convention

Why are California Native Americans Making Counter Maps?

There are many reasons why counter maps are created by Tribal cartographers using GIS. In this section, I evaluate four categories of map proposition that are revealed in the map interviews. These groupings are not mutually exclusive and are compelled by the motivation of Native cultural survivance.

One defining element of counter-mapping is that not everyone wants the map produced and distributed. These factions often include government officials, corporations, non-Native landowners, and other non-Native stakeholders. One powerful application of Native counter maps is the ability to make visible the breaking of the Federal laws by the groups mentioned above. These laws protect Native cultural and natural

resources, but identifying breaches is often relegated to Tribes. For example, the Archeological Resources Protection Act (ARPA)[10] prohibits excavating or extracting archaeological resources from federal lands or lands controlled by Tribes without consent from the local Tribe and Native landowner. GIS maps are a legitimate and forceful way of showing where cultural sites are located near non-Native expansion and extraction projects. GIS is used to track where cultural resource sites are located and to supersede or refute maps that do not show these locations.

Counter Maps Targeting Inequities and Promoting Social Justice

Native communities in California primarily advocate for their Tribal interests, but some institutional inequities are encountered at the state and national levels. Native communities and cultural centers have collaborated with academic allies to bring attention to the discriminatory representation of all Natives. For example, in California, more than 100 K-12 schools use Native-themed mascots and imagery as stereotyped nicknames. One of the most offensive names and imagery is "redskin." A California Tribal youth group trained GIS users to participate in mapping all schools using racist Native mascots (Figure 5). Jasmine remembers working on this map, noting "what we did is we took the individual mascot for each school and used that as the icon for that particular school." After the map was finished, students showcased the map at the 2015 ESRI User Conference. Soon after, Natasha targeted state leadership to make changes: "We blew it up, and we sent it with the governor's liaison…and she hung it in the [governor's] office, and it wasn't long after that Governor Jerry Brown signed the bill banning 'redskin'." Most participants have made counter maps that address inequities by showing encroachment on cultural sites, misappropriation of Native culture, or potential harm to natural resources.

[10] As amended in 1988

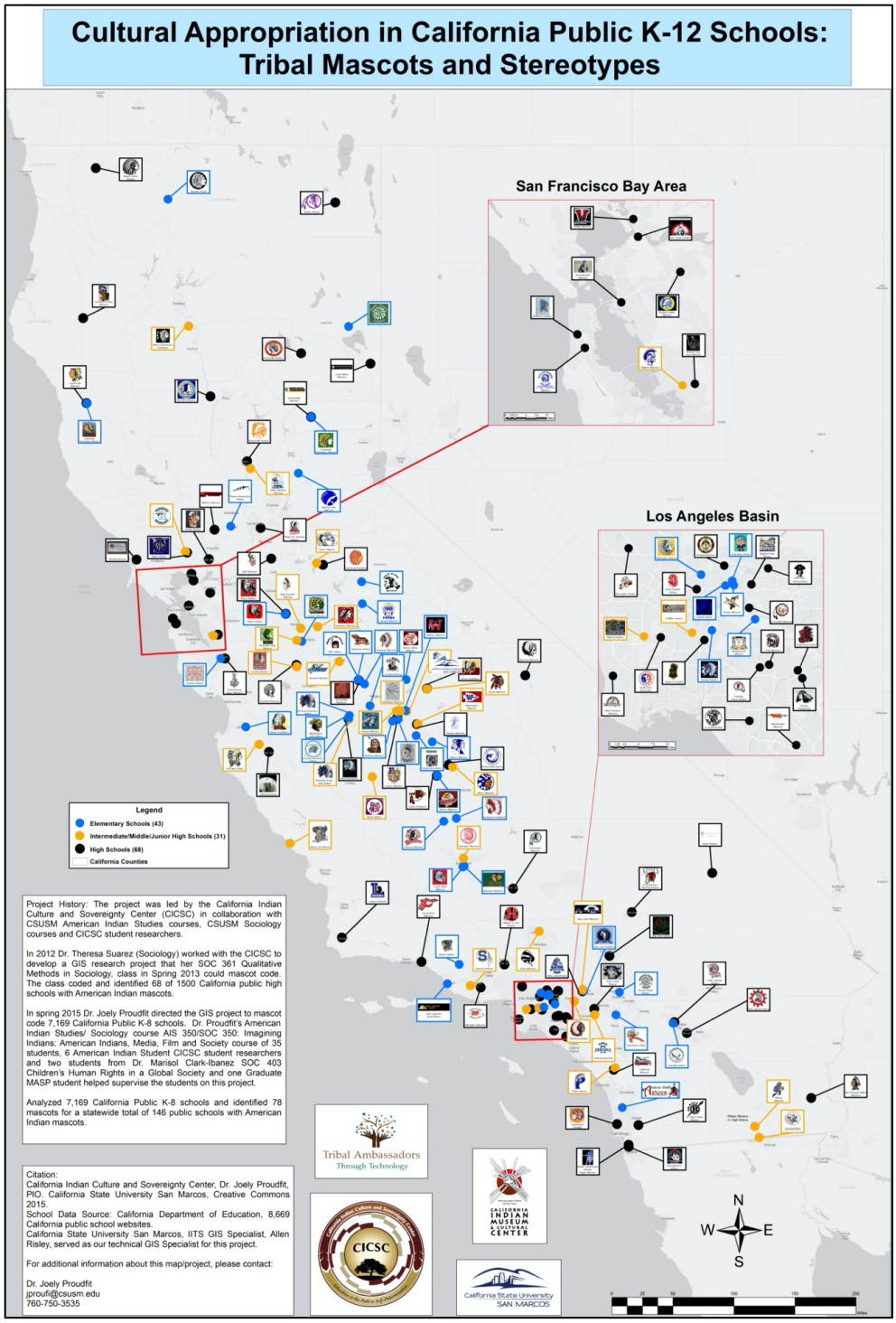

Figure 5 Cultural Appropriation in California Public K-12 Schools: Tribal Mascots and Stereotypes map

One example of traditional uses of natural resources is gathering grasses and other materials to weave baskets. Many Native individuals of some Native groups continue the strong tradition of basket weaving as demonstrated by the California Indian Basketweavers' Association (CIBA) website[11]. Basketmaking material can be found in forests and riparian areas. Some basket material is located in or near state-managed parks and roadways as well as farms and wineries in California. However, approximately 200 million pounds of pesticides are used annually in California to control invasive vegetation and insects[12]. Data on the location and chemicals applied in California are stored in the county and state databases that are difficult to navigate to extract pesticide use locations. Such data are also incomplete because the reporting of pesticide use is on a volunteer basis in some cases. The most popular way to apply pesticides is via aerosol from a single backpack sprayer, tractor, or airplane equipped with a floater sprayer. This method risks overspray or drifting, and the chemicals are windblown from the intended target to nearby vegetation. It is common to find basketmaking material in areas adjacent to pesticide treatment that basketweavers visit.

Jasmine and other TYA members learned of elder basketweavers developing mouth cancer. Almost certainly, given the toxic nature of these chemicals and the intensity used in and around crops and thruways, noxious residuals are common[13]. The youth group started building a GIS database to track pesticide use in areas where basket material is collected to bring attention to this and other injustices. Jasmine talks about what inspired her to make this map:

> I think we all noticed that a lot of basketweavers in our community we're getting mouth cancer because…you put the reeds in your mouth, and the reeds have pesticides on them. Climate change is a huge issue that we work to try and educate people about—creating awareness and educating people about why Tribal ecological knowledge is so important and trying to find a solution to climate change. I think this pesticide map is kind of one step in that direction.

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[11] California Indian Basketweavers' Association (CIBA): ciba.org Accessed September 1, 2021

[12] California Department of Pesticide Regulation (CDPR), cdpr.ca.gov 2018 Pesticide Use Report Highlights, Accessed September 1, 2021

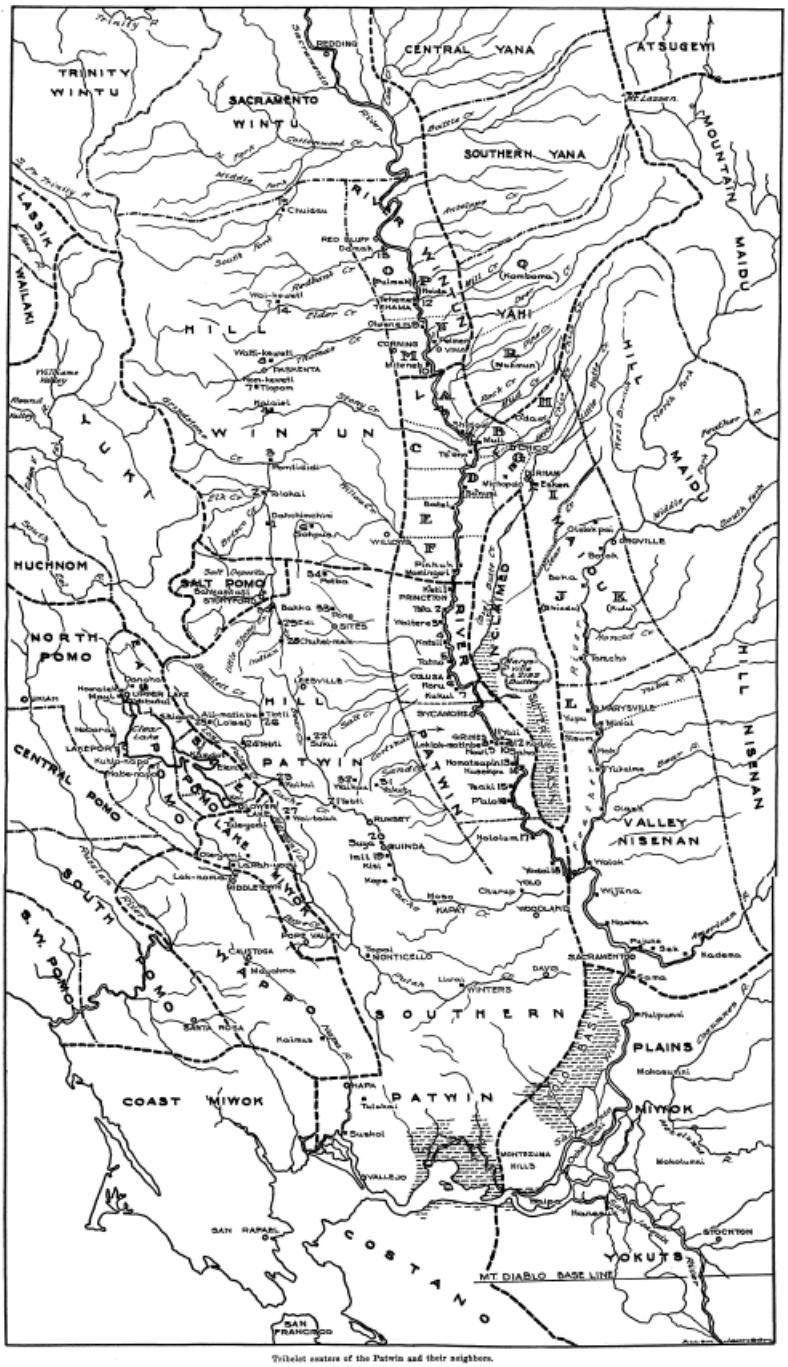
[13] California For Pesticide Reform (CPR), pesticidereform.org Pesticide Use Data and Maps, Accessed September 1st, 2021

This map has sensitive cultural data and is not available to the general public. A significant obstacle was to show where potential overspray was occurring without showing where basket material is being collected.

Counter Maps are Used to Preserve Cultural Resources

All participants used GIS to organize and map cultural resources including sacred sites, traditional cultural properties, and archaeological sites. When asked, how they thought their map helps support your culture," participants described their mapping projects as a way to strengthen the community by providing more information about the Tribe. When I requested a map interview with Arthur to learn about a GIS cultural map he prepared, he informed me that I could not copy or view any Tribal maps. His maps are an aggregate of public maps combined with private Tribal archives, and he stipulated that we could reference the public maps as a surrogate. He stated: "I integrated both of those maps together to create one kind of whole map." *The Patwin and Their Neighbors* (Figure 6) and the *Southern Territory of the Wintun Linguistic*

Stock (Figure 7) maps are two of three documents referenced during the interview.



Tribelet centers of the Patwin and their neighbors.

Figure 6. The Patwin and Their Neighbors (from Kroeber 1932)

Figure 7. The Ethno-Geography of the Pomo Indians (from Barrett 1908).

Native cartographers used three main strategies to avoid sharing exact locations of cultural sites. The first is to reference already published documents and maps, as demonstrated by Arthur's mapping project. A second approach is to decrease the map's scale, making it difficult to pinpoint specific cultural sites. Small-scale maps, like a continental map, show less detail whereas large-scale maps display greater detail. Dawn references her GIS map, noting "well, the scale of this map is pretty high

level, so even if you are trying to find that dot." This method still shows cultural resources on the ground but reduces the risk of information being shared with unauthorized people.

During a map-interview, Dawn shared a GIS map referencing cultural sites near a dam project (Figure 8). She notes that "they're going to repair it and expand it, make it higher, and so I got a mapping of their before and after water levels… I wanted to have a presentation to get support by the community." She attended a public meeting where the US Army Corps of Engineers (USACE) provided public disclosure of the

project. Dawn wanted to show the USACE representatives the presence of cultural resources in the area without the public seeing specific locations.

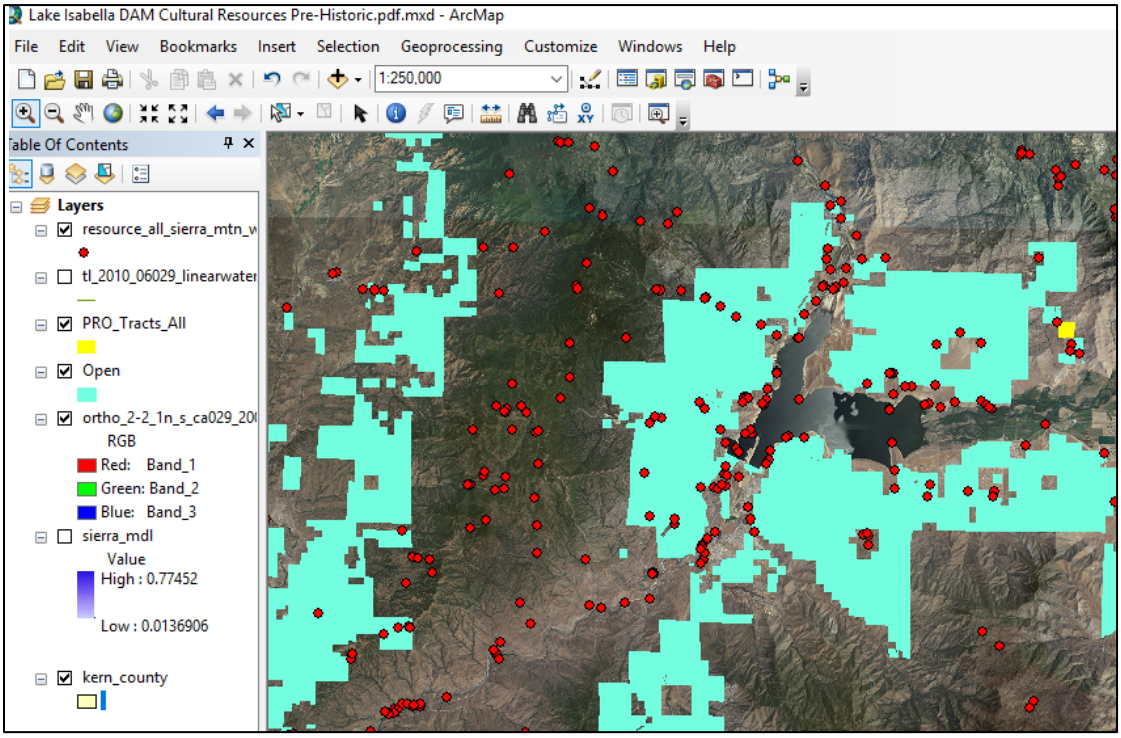


Figure 8 Lake Isabella Dam Cultural Resources Prehistory GIS, Yellow = Tribal Allotment/Public Domain Land, Red = Recorded Pre-historic sites, Light Blue = BLM Open Lease Land

Dawn disclosed her motivation for preparing the GIS map as "being able to illustrate [the cultural sites] properly with the proper layers and having proof, evidence that you know your point is being made." As a result of her map targeting the conflict of land use and cultural sites, formal consultation was initiated. Dawn reflected on what happened after the meeting:

> After that meeting, the Corps of Engineers realized "oh, you do have some very important information here. And can we get some of that mapping data from you?" And so, that to me was like, okay, we can do this, but we need to have a consultation meeting, and we ended up getting a programmatic agreement with the US Corps of Engineers. And also, we leveraged the federally recognized Tribe next door to us, the [undisclosed] Tribe. And they help us to engage with the Corps of Engineers on a more government-to-government level.

A third mapping technique applied by Native GIS cartographers is to exchange map element types. GIS maps are composed of three primary map element types: points, lines, and polygons. Points can be symbolized as a dot or an icon, for example a small picture of a house to represent a dwelling on the map plane. By replacing a point with a polygon that represents an area, the purpose of the map is conveyed while lowering the risk to the resource by unauthorized people. GIS buffering is a technique wherein only information within a polygon is visible on the map plane; therefore, not disclosing sensitive data beyond the focal area. For example, Jasmine talked through ideas on safely providing spatial data to Tribal members, showing basket material sources and potential pesticide over-spray. Two ideas considered were to have a Tribal member-only GIS layer representing harvesting areas and replace the point map element with a less precise polygon map element:

> I think we're still unsure about putting the list on, like, the general public map of where resources are and, like, what can be gathered at which park because we don't necessarily want to encourage gathering outside of the Tribal community. Because you know it's a cultural practice. So, I think we're still debating about that a little bit on whether or not we want to have that be kind of, like, in a protocol layer. In terms of, like, it can only be unlocked by Tribal members.

> And so, we're still thinking about that. For this map, in particular, we've been doing polygons rather than icons.

These three cartographic techniques work well to share spatial knowledge while reducing the risk of unapproved use of Tribal data. Similar mapping techniques are employed to both communicate about and protect natural resources.

Counter Maps Illustrate Traditional Ecological Knowledge

Traditional Ecological Knowledge (TEK) is the umbrella term that describes the many ways Indigenous people interact with, and benefit from, the natural environment. TEK includes sustainable harvesting techniques and knowledge of environmental cycles, and it is intertwined with cultural ceremonies. This knowledge system supports the symbiosis between people and the natural landscape, avoiding over-extraction and pollution. Additionally, TEK is passed on generationally for Native people and, more recently, shared with non-Native land managers.

Participants are aware of competing uses for land and how extractive industries sometimes employ local community members. Dawn recognizes that "there's a fracking industry…some folks locally wanted jobs; we need jobs." However, some extraction methods create waste byproducts that poison land and water, reducing or destroying natural resources accessed by Native people. Dawn's Native-centered counter map shows the risk to the local watershed of concern and makes clear other industries, especially agriculture and recreation, will also be affected. The map has the added force of displaying other stakeholders' interests in the land and leverages their concern. GIS counter mappers can choose to include other stakeholders left off the dominant extraction industry's map.

Local Natives reside on the land, and this proposition is embedded in the map by showing the proximity of potential contamination to cultural and natural resources. Owners and investors in these industries often do not live on the land from which they want to extract resources and are not under threat of environmental repercussions in the immediate future. Dawn revealed her motivation in making this map, as she "couldn't see opening up a brand-new dirty kind of hazard industry into a really pristine environment that so culturally rich."

TEK-focused GIS maps are ideal for capturing and storing plant and animal locations for preservation purposes. Dylan's map represents natural resources excluded from non-Native land management maps (Figure 9). Using GIS, he can counter timber harvesting maps that

suggest the board-feet of lumber is the only valuable commodity on the landscape.

> The [undisclosed] Tribe established a Tribal herbarium in January 2020. As the Tribal botanist, I go out and collect plants and press them. Once dried, I mount them on herbarium sheets and store them in archival cabinets. Information is compiled in a database which includes scientific, common, and Tribal names of the plants. The plant vouchers are excellent teaching materials as young and old alike learn more about plants and the role plants place in traditional culture for food, medicine, and other uses. The points on the map are just the beginning. Many more plants will be collected over the years as we train our young people to learn about plants and how to use them sustainably. We want to instill within our future generations a desire to care for them and advocate on their behalf.

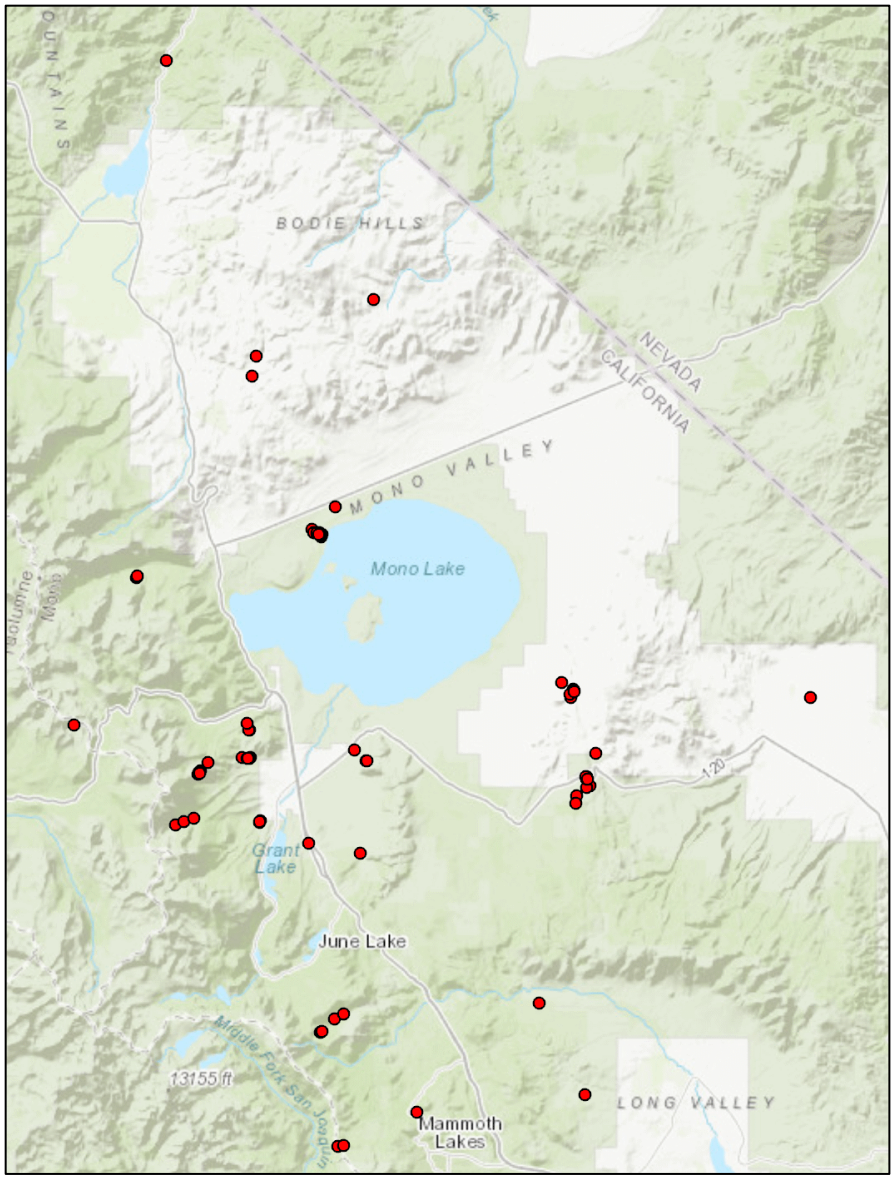


Figure 9 GIS map of 2020 Herbaria Collection sites.

In addition to identifying natural and cultural resource locations, GIS maps track TEK-informed conservation projects by Native land managers. One important application is traditional burning to suppress non-Native plant species and reduce the overgrowth of vegetation that fuels larger and hotter fires. Dylan prepared a map showing the *Suube Tuna'e* (Grey Willow Burn) restoration project (Figure 10). Like other participants' maps, the proposition is to demonstrate how Native people are successfully managing natural resources using TEK approaches.

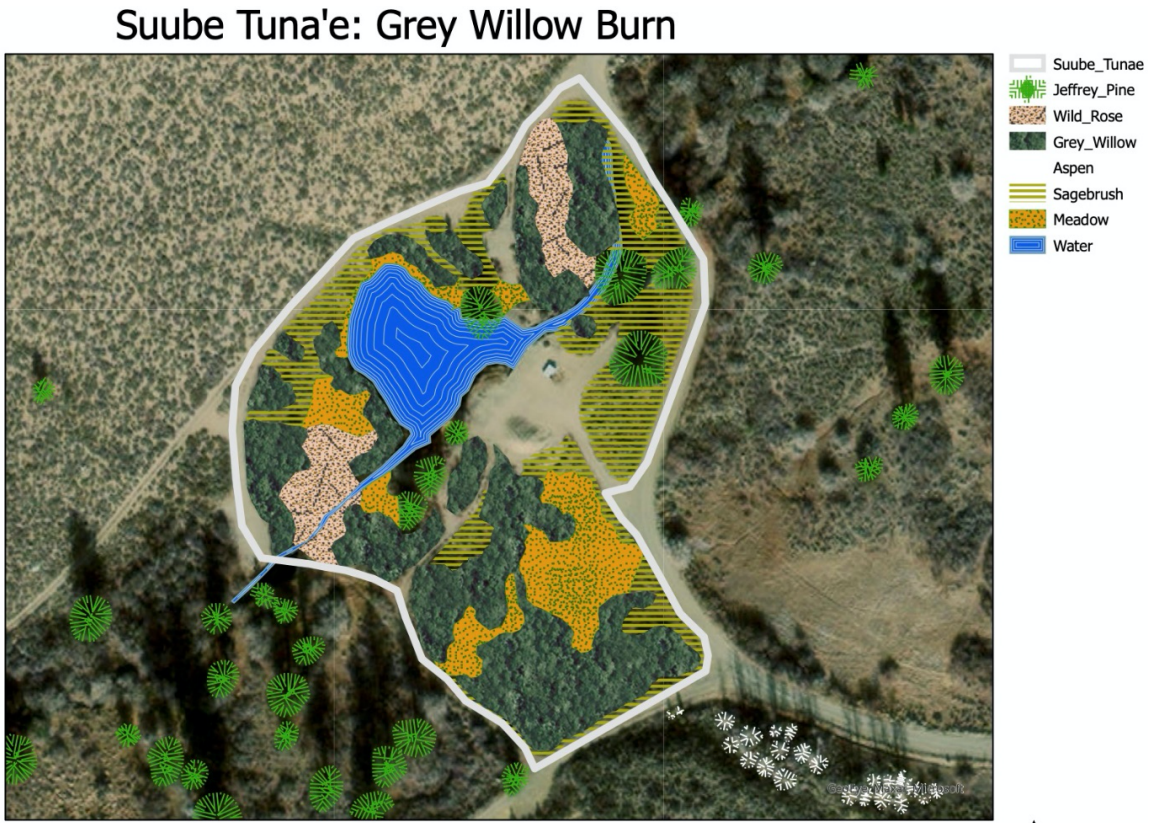


Figure 10 Map of Suube Tuna'e Restoration Project

This restoration project map is a way to communicate techniques of land management but also to counter the non-Native colonial narrative that Natives have not managed the land responsibly. Instead of allowing Natives to take over management of the land with TEK fire stratagems, agencies are adopting the techniques and continuing to manage the land with the federal agency's interests driving the practice.

Some maps are used to protect cultural sites during emergencies like wildfire. Dylan provided a typical illustration of working with California Department of Forestry and Fire Protection (CalFire) to manage fire while protecting cultural sites:

> For example, I may take a map of cultural resource items and apply a buffer to it so that we could give this information to an agency fire suppression crew. So that they would know areas that are sensitive and that they either avoid these areas or make sure that they enter these areas with a cultural resource monitor so that they know how to fight fire within a sensitive area. This reduces the chance for a bulldozer to blade through a culturally sensitive area. There

> are some risk considerations in doing so, but I think one of the important things is that we're giving this data to a federal agency which has policies on the dissemination of sensitive materials, and so there's some degree of confidence that the agency will not allow this information to make it into the hands of the general public.

State and federal wildland firefighters are generally focused on fire containment, property loss, and safety and health of residents; having to consider cultural sites makes firefighting more complicated.

Counter Maps are for Education

Every participant in this study uses GIS maps to support education curriculum or as skill-building for Tribal members. There are two direct ways GIS supports Native education. First, maps produced by GIS software are used in history, geography, and Native studies curriculum and can be modified to provide specific Tribal context. For example, Jack collaborated with professional mapmakers and Tribal leaders to revise the map included in Alfred Kroeber's (1925) *Handbook of California Indians* detailing Tribal "territories" in California (Figure 11). Jack discussed his motivation for updating this map: "I was doing a lot of professional development with teachers and curriculum development…and working with some GIS cartographers at National Geographic." He wanted the magazine cartographers to adjust the symbology to reflect a Native perspective of borders by mapping the spheres of influence with less emphasis on discrete border lines. Jack recalls the interaction:

> Can we use hatch lines or arrows or overlapping colors? Or just labels without any borders to try to get at the dynamics, you know, the inner relationships among and between people? The National Geographic response was, this is a direct quote from the women at National Geographic, she said, "Nah, you know, cartographers like to have solid lines on their maps." Yeah, today, really? So, we did, we did succeed in achieving some changes in the map. They had these really precise, you know, they just need thin red borders between all of the Tribal homelands. And we said, well can we make that broader and softer and grayer and you know they said "yes." But that final product still tends to reinforce this inaccurate view of Native cultures as self-contained and rigidly bound.

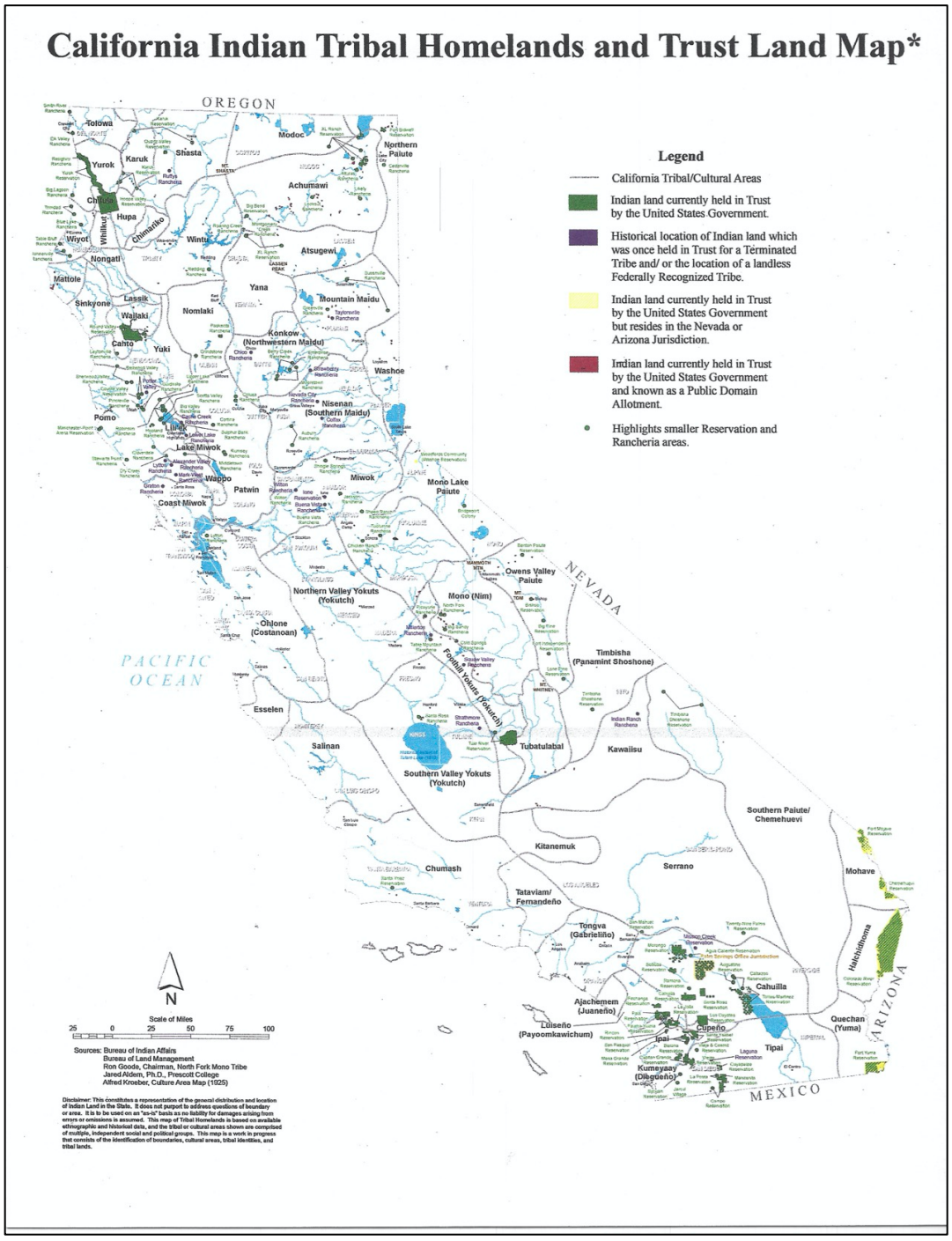


Figure 11 California Indian Tribal Homelands and Trust Land Map

A fourth iteration of the Tribal Homelands map—and others that do not enforce borders—are listed under "Lesson Resources" on the Lessons of Our Land website[14].

A second application using GIS for Native education that participants describe is teaching people how to use mapping tools for knowledge production. Half of the participants require training new GIS technicians to maintain Tribal data and create new spatial knowledge. However, participants expressed concern that GIS will not interest future generations. Natasha talked about this anxiety: "Building up the infrastructure of Tribal folks doing Tribal GIS is really critical." Other participants expressed their desire to teach GIS to Tribal members for spatial knowledge production, but time and money were limiting factors due to inconsistent funding for GIS infrastructure.

One avenue for skill-building and spatial knowledge production is youth groups and summer camps that prioritize technology training. Jasmine is involved in a youth program that taught GIS to Native youth. Consequently, the group has created many counter maps and received a White House award presented by Michele Obama. Jasmine reflected on how she started learning GIS:

> I think it was, it was more my mom told me I was going to learn it, so I did. My mom came across GIS through the Tribal GIS organization. They were telling her about GIS, and she was like, "wow, this would be a great skill for children to learn." Geoff[15] taught me how to use GIS. I think I was probably maybe 12 or 13. And then we started teaching everyone else who is in the [youth group], and that's when we came together and started making projects, and it was definitely more like a project-based learning skill.

Summary

Overall, GIS use is stable in California Tribal communities that can sustain the computer infrastructure and train new operators. Cartographers apply spatial technology by visualizing and teaching culture from a Native perspective and creating and safeguarding spatial data. Motivations for creating counter maps include combating inequalities and preserving cultural and natural resources. Tribal teachers are presenting GIS maps to teach Native and non-Native people

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[14] Can be found here: lessonsofourland.org, accessed September 1st, 2021.
[15] Geoff (pseudonym) is a Native GIS consultant and instructor.

about colonial encounters that are often missing from the non-Native school curriculum. Additionally, cartographers provide learning resources and training to encourage Native learners to create spatial knowledge relative to their own experiences as an alternative to existing maps.

CHAPTER V

GIS WORKS FOR CALIFORNIA NATIVES AMERICANS

This dissertation is about observation of, and intentions to support, people engaging in GIS mapmaking that reflect Native values and propositions. While building relationships with many communities in California and beyond, I recognized several recurrent motivations for creating and organizing Native spatial knowledge. Some maps are inspired by a desire to notify and influence leaders about land stewardship, misuse, or protection. One recurring phenomenon in talking to mapmakers is the intertwining of cultural traditions and sustainable land use practices that is referred to as grounded normativity (Chapter 2). These Native practices are antithetical to many discrete or fragmentary approaches adopted by Western organizations. Moreover, non-Native led approaches are often extraction-centered and determined by capitalistic goals. In other words, Native motivations to manage natural resources are part of an obligation to the land they occupy. These differences are reflected in the propositions of maps produced by Native cartographers.

The motivations of marking and claiming the land is explained by Ian Hodder's concept of "sensory relationship" (2012:24). Both Western and Native land stewards compete to manage, and therefore *mark*, the land by means of land restoration. While similar goals are agreed on between the Western and Native land stewards, like healthy ecosystems, Native land managers seek to also restore the historical relationship, or what Hodder describes as "dependencies," between the Tribal community and the "things" on the landscape (2012:2). Dylan's Suube Tuna'e map (see Chapter 4) is a prime example of marking and working the land. The traditional burn restoration project was featured in a TEK conference fieldtrip where mapmakers distributed the restoration project map. Elders led ceremonies and provided testimony to a group of state and federal land managers on the connections between the tribe and the restored area. The combination of tour, testimony, and map is an example of Eades's (2015) place-memes through which people recognize the intellectual, spiritual, or material artifacts associated with a named place and "repair broken continuity, or re-tie them where they are frayed" (Eades 2015:11).

I recognized the pattern of how GIS is slowly being incorporated by Native individuals and, later, Tribal governments to consolidate Tribal spatial data. With the formation and growth of peer-to-peer GIS support

organizations, spatial technology is increasing at a steady rate. Consequently, Native GIS users are effectively organizing data and producing maps that reinforce Tribal goals and push back on non-Native ambitions. It is this act of consolidating data and visualizing "things" on a map plane that facilitates the planning for, and allocation of force on, the landscape.

Furthermore, GIS is used by Tribes to unite Native spatial knowledge that has been suppressed and scattered. One example is Carol's map (see Chapter 4) where she has researched her family history and used GIS to organize spatial data and produced new knowledge. In her project, she performed what Michael F. Goodchild et al. (1993) call respatialization, which evaluates specialized or historical spatial variables and transforms them into contemporary formats, increasing their value (Goodchild et al. 1993). When I reviewed her map legend (see Figure 3), it is clear she maps where she heard Native stories and where she collected archive data as new spatial knowledge production.

In additional acts of counter mapping, lands that have been mapped by US organizations are (re)mapped by Tribal cartographers. What is initially done as resistance to State dominance of land occupancy is later viewed (?) as a form of empowerment for current and future generations of Native people. For example, Sandy Grande's (2000:3) book *Red Pedagogy* offers a framework that rejects "whitestream education" and what Vizenor (1998:15) calls "legacy of victimry." The act of mapping for critical learning can be explicated, like in Natasha's map of *California Indians You Should Know* (see Figure 4) in which successful Native people are highlighted and remembered. A counter map can also be implicit in empowering Native youth. For instance, Jasmine's map of *California Native American Genocide* (see Chapter 4) depicts areas where Native people thrived for hundreds of years and in many cases still live. The story of genocide has been "whitewashed" in Western history books, but when young Native mapmakers (re)map California with the places Natives were attacked, (re)mapping brings a sense of action to the forgotten injustices. Ricoeur (2004) explains the stages of historiographical functions in which the first stage is to assemble evidence and declare or represent it in the form of "narrative, rhetorical device and images" (2004:161). By reexamining the history of California, Jasmine and other Native researchers continue to assemble elements of place-memes to maintain and distribute Native memories in the form of counter maps.

In this dissertation, counter mapping was shown to increase the visibility of Native presence and therefore expand the influence of "the people living in the mapped area to control representations of themselves

and their claims to resources" (Peluso 1995:387). Propositions forwarded in counter maps are expanded for pedagogical strategies for teaching both Native and non-Native learners (see Chapter 2). In this research I interviewed mapmakers about how they used GIS maps to teach in classrooms. In the *California Indian Tribal Homelands and Trust Map* (see Chapter 4), Jack's objective was to show both Native and non-Native students the extent of Native communities in the state. The message or proposition for Native students is to show their inclusion in a long, rich history of communities that still live and contribute to society. Simultaneously, for non-Native students the message is of (re)introduction of Tribal communities that experienced erasure and whose presences is an important part of contemporary society.

Many of the map propositions are similar, in that Native persistence and survivance is underscored either by the content of the map or the fact Native cartographers are continuing to produce spatial knowledge. Some archaeologists have also combined ethnohistory methodology and demographic research to support the idea of an extensive history of Native communities in time and place (Hull 2009; Schneider and Panich 2019). Collecting data from archives and research and aggregating such data with Indigenous sources inspires more reasons to counter map.

In this research, I extend the connection between mapping and memory for Native communities by examining theoretical frames of memory and place and apply them to explain motivations for counter maps. A powerful and lasting use of map force is found in retrieving and reviving Indigenous naming conventions that were replaced by colonial settlers. The act of reinserting Native names to places seeks to reverse-engineer colonial acts of cartographic erasure and assure Native and non-Native alike that Turtle Island (American continent) was never *terra nullius,* empty lands.

As detailed in this dissertation, Native cartographers are leveraging a powerful geographic technology to make visible Native communities of the past and present. In so doing, they are building a future that includes land and cultural sovereignty and continues restorative practices, such as critical pedagogy, for future generations. Denis Wood (2010) reminds us that maps work and mapping a place creates a degree of entitlement, an assertion of power to be protected. The influence of colonial maps, and the force behind them, are still at work determining the next route for potentially damaging oil pipelines or locations for the next uranium mine. As long as Native peoples are being marginalized and made to live in or near dangerous extraction projects,

counter maps and the force behind them will continue to work for the health and wellbeing of people in Native communities.

This is exemplified in Natasha's map for which she moved data about genocide from ledgers to a map that simultaneously displayed current city names and political boundaries. This visualization exposes the frequency of genocidal acts and informs the map reader of how close and how many occurrences are near familiar places. This image elicits reactions from map readers and makes them reflect about their memory of a place in California, now with a new conception and testimony of mass killings. Natasha's next step is to add more tribal and personal information to the database. Her mapping project serves to bring attention to suppressed memory of American genocide but also to highlight the presence of people and societies before and after the state sanctioned event. The value in returning Native people back to the map is demonstrated when students learn more about their ancestor's long history of living and thriving for thousands of years and how they are a part of a rich legacy. One quite unexpected element that emerged from this study is the restorative power experienced by mapmakers when documenting injustices and the ability to (re)map their community.

Future Research

This research explored avenues of how GIS is being used and the motivations and power behind mapmaking for Tribal goals. Several research questions can be supported or derived from this study. One important line of future inquiry is to apply the map-interview method to non-Native mapmakers who intentionally or unintentionally map against Native interests. For example, the authority behind reducing Bears Ear National Monument produced maps with specific goals in which Native communities would be affected. Similar map-interviews could be conducted with cartographers from energy companies trying to extract resources from the Artic National Wildlife Refuge. Another application of the map-interview method could focus on environmental organizations that share many of the same values as Tribal communities that work to preserve and restore ecosystem services.

In one conversation with a Native GIS consultant, outside California, who has provided GIS data as evidence in many successful court cases, stated, "if you combined a law degree with a GIS certificate you would be in high demand" (G.C., personal communication, 2020). Spatial data in text form can be dense and hard to comprehend; therefore, presenting the data in map form can bring clarity and attention to the most important details to Native plaintiffs' argument. G.C. further

explained the advantages of having a GIS expert on the plaintiff's side to both produce a map and explain the data. Future research should include interviews with lawyers representing Tribal interests and GIS experts who testify, using my map-interview method, to explore and interpret this growing practice.

Another line of inquiry based on this dissertation is to study the total cost of training, recruiting, and retaining a GIS specialist in Tribal government. What are the limiting factors and what can be done to mitigate those factors? A holistic study into the hidden cost of GIS training could support grant funding for education institutions and promote outreach from the GIS industry.

Overall, this research will provide additional scholarly insight for the next iteration of researchers interested in how the power of maps are used to support Native goals.

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APPENDIX

APPENDIX A

MAP-INTERVIEW QUESTIONS

Questions About GIS

1. What Tribes do you identify with?
2. What got you into GIS?
3. How do you think mapping helps communicate information?
4. Do you map differently for different people? Why? Can you give an example?
5. Did someone ask you to make this map? How did this come about?
6. Who do you want to see this map? Why?
7. Do you think other people will want to use your map? Why?
8. Is there data on this map that you do not want certain people to see? Why?
9. Did you use GIS to make this map? What other technology did you use?
10. How is this map different than other maps you make?
11. Have you trained/taught other people to make GIS maps?

Map Presentation Questions:

12. When did you begin preparing this map?
13. What inspired you to make this map?
14. What is the main point of this map?
15. Do you feel this map is made to clarify or add missing data to another map?
16. What are the sources of the map layers in this map?
17. Do you make different versions of this map for other people?
18. Do you use different symbology other than stock symbols?
19. Were there people that did not want you to make this map? If so, why do think that?

Final Questions:

20. Are you planning to make more maps like this?
21. Do you think this map helps support your culture? How?
22. Do you feel this map helps your community? How?
23. How do you think this map will help future generations in your community?
24. Do you think other people in your community should make maps like this? Why?
25. How does it make you feel mapping land where your ancestors stood?

26. Do you think you would share this map with other Native communities?
27. How do you feel about the support from the BIA?
28. Where else do you get support for GIS?
29. How many people know how to use GIS in your community?

Demographic Questions:

30. What is your gender identity?
31. How old are you?
32. What is your highest education level?