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Mapping Indigenous Depth of Place

MARGARET WICKENS PEARCE AND RENEE PUALANI LOUIS

INTRODUCTION

Indigenous communities have successfully used Western geospatial technologies (GT) (for example, digital maps, satellite images, geographic information systems [GIS], and global positioning systems [GPS]) since the 1970s to protect tribal resources, document territorial sovereignty, create tribal utility databases, and manage watersheds. The use of these techniques and technologies has proven to be a critical step for protecting cultural sovereignty by communicating the importance of Indigenous cultural knowledge to people outside the community. However, the inappropriate use of these tools negatively affects the expression and preservation of cultural heritage and cultural survival because of differing ontologies and epistemologies. This is not to imply that these techniques and technologies are inherently inappropriate for Indigenous cartographic representation; rather, we perceive them as flexible and capable of being adapted to suit traditional Indigenous cultural geographies if used in an informed way. Thus far, Western cartographic techniques and technologies have overwhelmingly been used to present positivist representations of space, although some mapmakers are beginning to expand these tools in innovative ways. This article contributes to this expanding dialogue by calling for a focus on cartographic language as a potentially useful means of incorporating Indigenous and non-Indigenous conventions in the same map. To illustrate this, we look at the example of *ahupua'a* resource management in Hawai'i and demonstrate how the innovative use of cartographic language can better express Indigenous cultural knowledge of natural resources.

The protection of Indigenous cultural knowledge and cultural sovereignty continues to be a challenge that unites Indigenous people worldwide and was most recently acknowledged and defended in the Declaration on the Rights of Indigenous Peoples adopted by the UN General Assembly on 13 September 2007. The declaration notes Indigenous peoples' shared histories

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of colonization and dispossession of traditional territories and resources and reaffirms Indigenous rights to self-determination as an inherent human right. Fundamental to such self-determination is the right to protect cultural knowledge and the responsibility of states to recognize, respect, and protect such knowledge, as stated in Article 13 and Article 31:

> Indigenous peoples have the right to revitalize, use, develop and transmit to future generations their histories, languages, oral traditions, philosophies, writing systems and literatures, and to designate and retain their own names for communities, places and persons.
>
> Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.[1]

The declaration is an exciting step forward for defense of Indigenous cultural knowledge, yet the way to explain and represent the importance of such knowledge to the non-Indigenous public is often a struggle because that knowledge is inherently spatialized.[2] Indigenous cultural knowledge is processual, situated, and incorporated into the landscape through place names and stories expressed in the meanings, connections, and interrelationships of those place names.[3] In Indigenous societies, the communication of this knowledge is also spatialized, through the diverse forms of Indigenous traditional cartographies. Consequently, any effective representation of that cultural knowledge to people outside the community must also be spatialized. As a result, Indigenous mapping has emerged since the 1970s as a movement that utilizes the power of maps for visually explaining and defending issues that arise from cultural use of territory, including land claims, natural resources, and sovereignty.[4] Maps are now fundamental to Indigenous self-determination and perceived to be essential tools for portraying Indigenous environmental, political, cultural, and socioeconomic landscapes. Particularly in the last decade, interest in and implementation of cultural mapping projects for Indigenous communities has exploded.

Cultural mapping has been a major topic of interest at conferences and forums, including the International Forum on Local Cultural Expression and Communication (Dominican Republic, March 2003), the International Forum on Indigenous Mapping (Canada, March 2004), the Intertribal GIS Indigenous Mapping Conference (Cherokee Nation, March 2005), and the Indigenous Mapping and Representational Politics Conference (Cornell University, March 2006). Implementation of cultural mapping projects among the Maya, Kalahari San, and Inuit peoples, among others, addresses the need to preserve cultural knowledge for future generations while protecting such

knowledge by controlling access and establishing research protocols in Indigenous communities.

These projects overwhelmingly apply Western cartographic language by using GT to represent Indigenous cultural knowledge. Methodological approaches to Indigenous mapping have varied depending on the particular political and cultural context in which they arise, from the traditional land-use studies of Canada and Alaska to the participatory mapping programs of Asia and Africa and the implementation of large-scale tribal GIS programs in the United States.[5] Issues of ontological and epistemological differences in cartography and map symbolization between Indigenous communities and those who design, market, and provide instruction in GT (including GIS software) generally have not been addressed. As a result, Indigenous cultural knowledge is often distorted, suppressed, and assimilated into the conventional Western map. This practice of locating cultural knowledge without expressing the spatial meanings and interrelationships of that knowledge preserves "only a superficial cultural diversity through its products, ceremonies, and performances whose meaning will be diluted through secular decontexted performances."[6]

In addition, mapping Indigenous cultural knowledge in general leaves such knowledge vulnerable. In their 2005 study, which created an ethnographic record of Navajo wayfinding and narratives of place, Kelley and Francis reflected on this question: "Doesn't putting this kind of information in the 'ethnographic record' endanger the society's traditions, its very self-perpetuation? From the maps that American Indians drew for the earliest European colonizers to today's Geographic Information System maps of current indigenous hunting-gathering areas, the 'putting on the record' always seems to accompany indigenous loss of resources and the oral tradition itself."[7]

Despite substantial literature that expresses concern about such distortions and dilutions, little has been offered in the way of solutions. The presentation of cultural knowledge through traditional Indigenous cartographies as a means of communication to non-Indigenous communities is not an option. When Indigenous cartographies are removed from the context of their knowledge space and placed in colonial conditions, Indigenous maps do not convey the same level of power and authority naturally conveyed by the Western maps. The need for Indigenous communities to adapt Western mapping techniques for the representation of local knowledge remains essential to both the preservation of Indigenous cultural diversity and the realization of Indigenous self-determination in the face of global change. Given that necessity, what can be done to improve the uses of cartography in the future?

We assert that geospatial techniques and technologies are not inherently inappropriate for Indigenous cartographic representation; rather, we perceive them as flexible and capable of being adapted to suit traditional Indigenous cultural geographies if used in an informed way. We suggest that informed use can be achieved through an emphasis on cartographic language, that is, by focusing on the structures of the map and the mapping process and finding ways to shape those structures in order to convey the

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structures of Indigenous cartographies. In this article, we explore the use of GT in the communication of Indigenous cultural knowledge, the implications of mistranslating such knowledge, and the potential we see in cartographic language for overcoming such mistranslations. We demonstrate the way that such an approach would improve mapping of Nu'alolo Kai, an Indigenous natural resource management area in Hawai'i on the island of Kaua'i and, by extension, improve non-Hawaiian understanding of the significance of cultural knowledge at that place.

Mapping and Indigenous Peoples

All cultures engage in some form of mapmaking.[8] Mapping, like language, is a cultural process that reflects the ontological and epistemological structures of that culture. As a result, different map traditions develop separately in different cultures and are the unique manifestations of needs for spatial tools in that particular time and place.[9] When one society expresses spatial concepts by using the rhetorical structures of another society's cartographic tradition, it is a process of cartographic translation in which information is inevitably lost. The history of the mistranslation and misrepresentation of Indigenous cartographies into Western cartographies virtually defines the history of Western colonization and coercion of Indigenous peoples.[10] The roots of this mistranslation are evident when non-Indigenous and Indigenous cartographies are compared.

INDIGENOUS MAPPING

Indigenous cartographies are as diverse as Indigenous cultures, from Hawaiian performative cartographies to Navajo verbal maps and sand paintings and the Nuwuvi Salt Song Trail.[11] Indigenous mapping may be gestural, chanted, or inscribed in stone, wood, wall, tattoo, leaf, or paper. Indigenous maps may be used to assess taxes, guide a pilgrim, connect the realms of the sacred and profane, or navigate beyond the horizon. Clearly, Indigenous cartographies are process oriented as opposed to product dependent. Rundstrom uses the term *process cartography* to differentiate Indigenous cartographies from Western cartographies.[12] Process cartography is an incorporative, as opposed to an inscriptive, practice that places emphasis on the process rather than on the artifacts that result from the process. Process cartography connects oral, written, performative, and experiential modes of mapping as a means to transmit situated Indigenous cultural knowledge from one generation to the next.

Indigenous processual cartography often incorporates the landscape as an extension or part of the map. The map extends from the community into the landscape through inscriptions on trees and rocks, drawings on the ground, or dance and ceremony. Indigenous processual cartography also often emphasizes the significance of storied place names and the recitation or visiting of those named places for recollection of situated stories. Finally, Indigenous processual cartographies also differ from Western cartography in

that they emphasize experienced space, or place, as opposed to the Western convention of depicting space as universal, homogenized, and devoid of human experience.[13]

Despite these differences, many communities have looked to new GT as holding the potential to overcome these profound inadequacies. As a result, GIS and GT as the primary mode of Indigenous mapping have gained particular strength, fostered by the rise of Indigenous GIS conferences and special Indigenous sessions at GIS conferences worldwide, the Environmental Systems Research Institute's (ESRI's) integration of tribal GIS to the ESRI Conservation Program, and resources freely available through the Aboriginal Mapping Network. Advocates of GT have written that participatory GIS and 3D modeling make powerful applications for Indigenous self-determination because of their perceived flexibility and "democratizing" process that fosters public participation.[14]

The increasing application and advocacy of Western GT for mapping Indigenous lands has not been without its criticism. In 1995, Rundstrom wrote that "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 cultures."[15] Drawing on the work of Don Ihde and Bruno Latour, Rundstrom pointed to the role of GIS as not merely a technology but a technoscience, a kind of knowledge in which the "technology has become the embodiment of science and its precepts."[16] Embedded in this technoscience, GIS epistemologies are "potentially toxic to human diversity" because they deemphasize, ignore, or devalue concepts that are of central importance to Indigenous epistemologies, including the ubiquity of relatedness, the value of nonempirical experience, the need to control access to levels of geographical knowledge, and the value of ambiguity over binary thought.[17]

When Indigenous cultural knowledge is represented by Western GT, there is often a loss of meaning, even if those technologies generally support the mapping needs of a community. As Fox writes,

> spatial information technology is useful for enabling local groups to regain control of their resources, map the boundaries of their customary lands, and communicate information on their traditional resource management practices to outsiders and decision makers; it is useful for mapping the material aspects of culture and relating these to spatial structure; and it can assist in the resolution of spatial conflicts. . . . The chief failing of this technology has been its inability to further our understanding of the cultural logic that lies behind the relations of space.[18]

The cultural logic that has been left behind by the encoding of Indigenous knowledge in GIS, writes Fox, includes concepts of scale, time, and "boundaries and areas and the preservation of continuity between them."[19] More recently, Kyem returned attention to the epistemological limitations of GIS mapping projects in non-Western communities, such as his Ghanaian case

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study, and concluded that although "the technology remains a poor medium for resolving ideological conflicts that are usually sustained by values," GIS is "more effectively applied to manage within-system conflicts than disagreements that occur between individuals and groups located in different sociopolitical systems."[20]

But is it possible to transcend these barriers for effective use of this technoscience called GIS? David Turnbull writes that technoscientific knowledge must be reframed, not discarded: we must be "committed to the idea that technoscience can be and should be other than it is."[21] This reframing is necessary for cultural survival:

> How can we have technoscience that does not dominate nature but is compatible with it, that does not exploit and demean people but enhances their lives? How can we develop new criteria to achieve these ends and how can we ensure that these criteria are implemented? . . . How can we ensure that we do not impose a universal monoculture either biologically or socially? How can we reframe science and technology in such a way that we encourage biological and cultural diversity? Our survival is dependent on both.[22]

Overcoming the limitations of any technoscience requires a break from modernist science, not through postmodernism, as Turnbull writes, but through the transmodern, "a way station at which some kind of synthesis of the two can be achieved, without the excesses of either" the modern or postmodern. The solution, as Turnbull frames it, is to create a "shared knowledge space in which equivalences and connections between differing rationalities can be constructed. Communication, understanding, equality and diversity will not be achieved by others adopting Western information, knowledge, science and rationality. It will only come from finding ways to work together in joint rationalities and in knowledge spaces constituted through these joint rationalities."[23]

Some scholars are actively working to change GIS and GT to accommodate epistemological diversity. McLaffery and Kwan have both maintained that GIS practices can be transformed through the development of new analytical methods for mapping feminist experience.[24] Kwan, for example, uses the oblique angles of 3D to emphasize a feminist point of view in the spaces of the map and encodes linear trajectories with different hues to depict the changing lines of emotion that affect women's experiences of place in the city.[25] We agree with these innovative uses of GT and suggest that another way in which epistemological differences can be better expressed through GT is by focusing on the structures of cartographic language.

Western Cartographic Language Revisited

Western knowledge and science shapes the structure of Western cartographic language, from the smallest part of the symbol to the overall look of the map and the ways in which the map is used. From the initial categorization of a

geographical entity as a point, line, area, or volume, an ontological structure and epistemological assumption has been established in the map. Graphic variables, the marks that form the vocabulary of cartographic language, also establish an ontological structure. For example, for paper maps, these variables are spacing, size, perspective height, orientation, shape, arrangement, hue, saturation, and value. For animated maps, there are the variables of duration, rate of change, order, display date, frequency, and synchronization. All these variables encode the level of measurement at which a geographical phenomenon has been categorized through their "syntactic rules." This language is flexible, and cartographers have reexamined and redesigned the form, range, and depth of these variables to accommodate technological change and the consideration of other concepts such as scale and uncertainty.

Other elements of cartography such as typography, projection, perspective, the foundations of information design, and the format of graphic media, all contribute to the map's ontological structures. Perspective, for example, refers to the point of view from which a cartographic scene is portrayed. Typically perspective is interpreted as the map's spatial point of view, whether the geography is expressed from a plan, profile, or oblique angle. However, perspective may also be interpreted as the map's temporal point of view, whether the geography is expressed in spring, summer, winter, or fall. Expressing this point of view in the map is one technique for removing the illusion of a place as both disembodied (orthogonally rectified plan perspective) and seasonless space. Epistemology and ontology are also manifested in the layout and design and the media and materials of cartographic language. The use of specific techniques such as figure/ground, micro/macro, and small multiples all communicate specific ontological structures in the map, as do the limitations or variety of media and materials incorporated into the map and the mapping process.

In sum, cartographic language is composed of a multitude of ontological assumptions, any of which may be altered in order to express a geographic concept better. We call for a transformation of cartographic language in all of its dimensions, from graphic marks to the topologies, interrelationships, media, and distribution of those marks, in ways that are epistemologically and ontologically meaningful for Indigenous cultural knowledge. This transformation would consist of both the expansion of existing techniques and the creation of new techniques (for example, new categories of graphic variables) that would better serve Indigenous communities. In so doing, we would be rethinking cartographic language for epistemological change as it has been so often rethought for technological change in the past. In the following section, we explore one example of what that cartographic transformation might look like and how it would improve on existing Western cartography to convey a sense of traditional resource management at an Indigenous Hawaiian place.

Potential Cartographic Languages: An Example from Hawai'i

Hawaiians understand place as a multidimensional metaphysical continuum that ranges from the heavenscape through the landscape on to the oceanscape.

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It is also a repository for cultural knowledge. Knowledge of place is not only limited to the senses of sight, hearing, taste, touch, and smell but also incorporates other more abstract "senses" that are linked to intuition, place, time, and connection to the past, present, and future.[26] These more abstract senses are a critical part of Hawaiian spatial-knowledge acquisition, symbolization, and transmission and can only be accessed through various cultural practices, including prayer, ceremony, visions, and dreams.

From a Hawaiian perspective, all natural and cultural resources are interrelated and culturally significant. They believe the *ʻāina* (land) is alive, embodied with a spiritual essence, and that they are genealogically linked to it as their *kulāiwi* (homelands).[27] Hawaiians honor the *mana* (spiritual power or essence) of their *kulāiwi* through the act of naming.[28] Hawaiians named all parts of their environment, thus making their individual attributes of each known. For example, although there were no distinct altitudes that separated the various layers of the heavens, each was named according to function. Land regions were named according to their physical characteristics and the type and size of vegetative growth. Ocean regions were similarly distinguished according to their physical characteristics and the resources each provided.

This "depth of place" knowledge is not confined to the boundaries on land, but is inextricably intertwined with the spiritual realm. All parts are interrelated, extend vertically and horizontally in every direction, and directly impact one another. Even though Hawaiians transformed space into personalized place by naming the various strata of the heavens, regions on the landscape, and depths of the ocean, the boundaries of these sacred and profane places are generally considered to be fluid. There are no specific altitudes that delineate the margins of heaven. They were distinguished based on observable phenomena. Likewise land and ocean regions were often defined by the type and size of resources. Even political land boundaries were not separated by distinct lines but rather by a buffered area.

Depth of place is also reflected in the way Hawaiians personalized the natural environment by associating *kinolau* (physical manifestations of gods) with various natural features and by distinctively naming various elements of nature. For example, Lono, noted as the god of fertility, "was seen in the skies in the form of dark clouds or lightning [or] as steam billowing from active volcanoes. On land, *Lono* would manifest himself as a pig or a *kukui* tree. In the ocean, he would take the form of the *humuhumunukunukuapuaʻa* fish."[29] Different places were given distinct, place-specific names for wind, rain, stars, cloud types, lava formations, and ocean wave movements that describe not only their individual traits but also the specific phenomena associated with them. For example, "*Ka makani kā ʻahaʻaha laʻi o Niua'* alludes to 'the peaceful *ʻahaʻaha* breeze of *Niua* that drives in the *ʻahaʻaha* fish.' In this example, *ʻahaʻaha* refers to both the fish and breeze of the same name. Fishermen knew that when this breeze blew, it was the right time to launch their canoes in search of the *ʻahaʻaha* fish."[30]

Hawaiians express depth of place through various performative mapping practices, including *moʻolelo* (narrative historical accounts), *ʻōlelo noʻeau* (proverbs), *mele* (songs), *hula* (dances), *kiʻi pōhaku* (petroglyphs), *kalaina*

(carvings), and *lei* (garland) making, *kapa* (bark cloth), and *kākau kaha* (tattoo) design. It is also expressed in mapping on the landscape through the traditional political boundaries of the *ahupua'a*.

AHUPUA'A RESOURCE MANAGEMENT AND MAPPING

Hawaiian political boundaries, formalized by the early 1600s, organize the islands into levels according to geographical and political relationships. In this system, an *ahupua'a* is a land unit divided according to the distribution of resources and extends from the mountain ridges out to the sea. The word *ahupua'a* originates from the way the boundary was mapped on the land by an *ahu* (stone pile) surmounted by the image of a *pua'a* (pig). This land division, with its variable plant zones from the rainforest down to the beach and marine zones from the shore to just beyond the reef, ideally provided the necessary resources to sustain life for the communities that reside within them.

Ahupua'a were considered complete ecological and economic production systems; however, when environmental conditions changed and an *ahupua'a* lost a particular resource, residents would trade for this resource with their neighbors from other *ahupua'a*. Most community members carried out routine tasks such as the production of food, the building of various shelters, the making of clothing, and the construction of tools, with the belief that the *akua* (gods) were pleased with the results of their labor and constantly provided divine guidance in all their pursuits. Thus, every aspect of a day in the life of a Hawaiian involved an intimate relationship with the spiritual essence of the place where they lived. This system of resources management was integral to the Native Hawaiian way of life, and its legacy still remains a significant element in the lives of those who reside in Hawai'i today, Hawaiian and non-Hawaiian alike.[31] The marked boundaries of the *ahupua'a* were not intended to restrict travel between divisions; rather they encoded the way the *ahupua'a* were to be used. *Ahu* indicated to the populace which resources were freely available, required permission, and were restricted according to one's birthright or status. Most significantly, the locations and meanings of *ahu* were designed to be flexible and move with the shifting locations of resources with environmental and seasonal change.[32]

When the Hawaiian government under the Hawaiian monarchy switched to private property under advisement of Western counselors, *ahupua'a* boundaries were translated into a Western concept of boundary, thus distorting their meaning and function. The Hawaiian concept of boundary as inclusive and fluid—adjusting to changing environmental conditions with the seasons for the equitable distribution of natural resources—was misrepresented as a non-Indigenous concept of boundary as an exclusive, fixed line. Large landowners with capitalistic ventures inevitably evicted all people who lived within their boundaries because they were under the impression that everything within their boundaries was their property. This mistranslation of the meaning of *ahupua'a* replaced traditional Hawaiian resource management with the modern land-use planning view of land and ocean resource management as separate systems. The mistranslation is also written on the Western map

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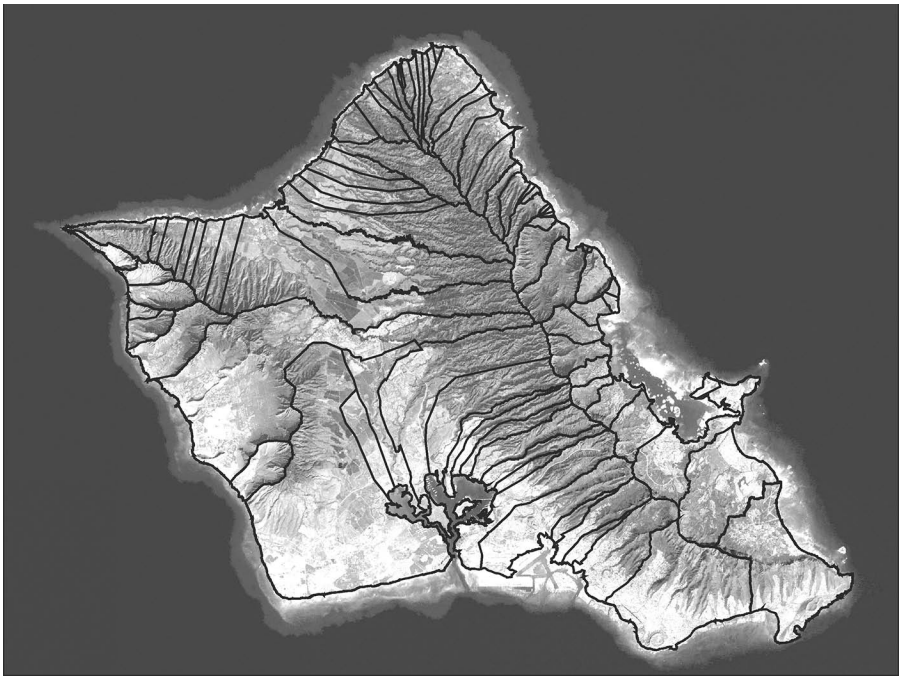

FIGURE 1. *O'ahu Ahupua'a land divisions. Map by Renee Pualani Louis, 2006.*

today, as in the example from the island of O'ahu in figure 1. The lines that delineate the boundary are a solid overlay that ends at the coastline.

To restore sustainability and *ahupua'a* resource management is no small task. It requires active participation and long-term commitments from all community members including government, corporate, commercial, and private landowners in order to integrate *ahupua'a* principles and practices within a modern government organizational and legal framework. It also requires mapping capable of expressing *ahupua'a* depth of place. In the following section we will explore how that might be possible in the remapping of Nu'alolo Kai, an *ahupua'a* on northwest Kaua'i.

MAPPING DEPTH OF PLACE AT NU'ALOLO KAI

Nu'alolo Kai is a half-mile-long narrow strip of shoreline on Kaua'i, located at the base of steep cliffs that quickly rise to nearly one thousand feet. It has a wide fringing reef at the northeast end that provided the Hawaiians that lived at this fishing village with the sustenance of aquacultural abundance. To supplement their diet, Hawaiians also terraced the perched valley of Nu'alolo 'Aina located approximately one hundred feet above the northeast end of Nu'alolo Kai. Inaccessible by land, Nu'alolo 'Aina was reached by ladders set up at Alapi'i Point. Alapi'i literally means the path (*ala*) that one clings to (*pi'i*) and describes how a person had to cling to the cliff face to traverse it.

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Nu'alolo Kai is a part of the Nā Pali Archaeological District and is listed on both the national and Hawai'i registers of historic places. Since 1996, the State Parks Nu'alolo Kai Archaeological Resource Management Project has uncovered "numerous archeological and culturally significant sites including terraces, burial sites, house sites, walls, *heiau* and a water cistern."[33] Archaeologists believe the area was continuously occupied since the arrival of the first Polynesians in Hawai'i, nearly eight centuries ago, until the turn of the twentieth century when the population moved to Hanalei and Waimea.[34] Since that time, this well-preserved cultural complex has been overgrown with mostly alien vegetation due to inattention.

The depiction of Nu'alolo Kai on a conventional Western map is shown in figure 2. The map combines the US Geological Survey (USGS) map with a shaded relief created from a USGS ten-meter Digital Elevation Model (DEM). Figure 3 depicts the same region from a USGS Landsat image of Kaua'i. In Western convention, both maps are oriented with north at the top and presented in an orthogonal perspective, that is, an aerial perspective that has been adjusted such that there is no single point from which the map is projected. From these two maps, we gain a sense of Nu'alolo Kai as a fixed location in space, a uniform, homogenous, gently sloping beach without people. Neither map gives any indication of Nu'alolo Kai as a place of seasonal changes so significant that traditionally the mapping of this place was always in motion.

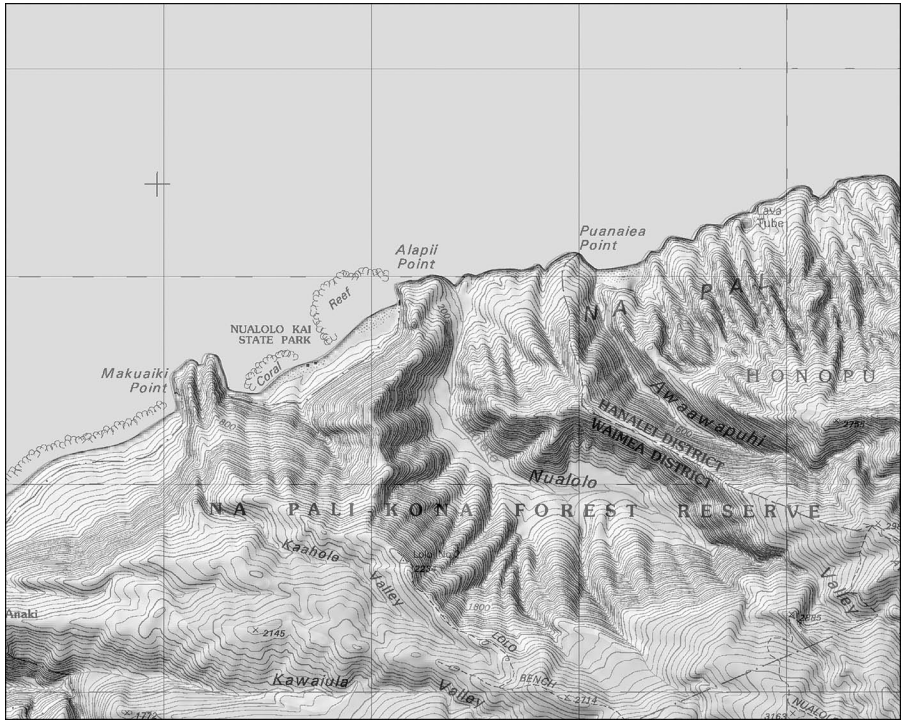

Figure 2. *Detail from US Geological Survey topographic map with shaded relief. Map by Renee Pualani Louis, 2006.*

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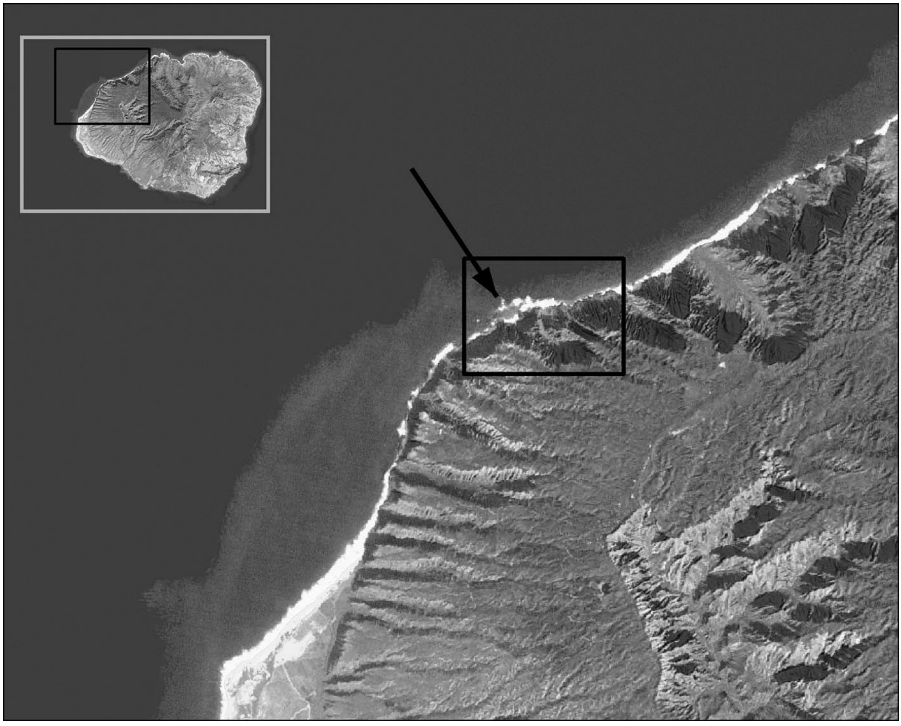

Figure 3. *US Geological Survey landsat image of Kaua'i. Map by Renee Pualani Louis, 2006.*

To reincorporate the seasonal and cyclical variations that defined both mapping and resource management at Nu'alolo Kai, we worked with the same digital geographic data sets used in the creation of the maps in figures 2 and 3 to map Nu'alolo Kai in a different way, altering some dimensions of cartographic language in order to express some of those missing elements of place. First, we addressed the question of perspective, shifting it from the orthogonal, aerial perspective to an oblique angle, shown in figures 4 and 5. By shifting to the oblique, the viewing angle of the map reader shifts from the "view from nowhere" to one that is situated in place. Oblique perspective also allows the map reader to see the sheer cliff line, with its complex interaction of shade and shapes, which dominates the landscape but is largely invisible in the orthogonal, aerial perspective. By shifting perspective, we were also able to address the map's orientation. The conventional map of Nu'alolo Kai is oriented with north at the top, and the map reader looks down at a shoreline, which appears to be accessed from the interior and whose central place-making features, the cliffs, are invisible. But Nu'alolo Kai is only accessible from the water, and thus it is always viewed from this angle, which looks toward shore.

The fixed, seasonless, and timeless space of the map was addressed through a focus on the dimension of lighting. With the viewing angle in

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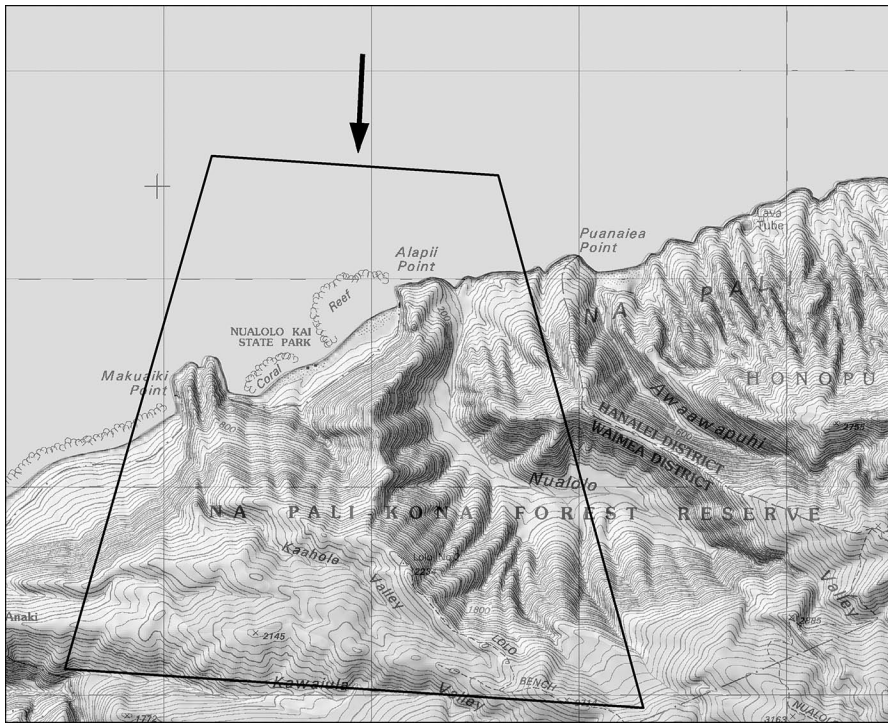

FIGURE 4. *View angle of Nu'alolo Kai oblique perspective. Map by Renee Pualani Louis, 2006.*

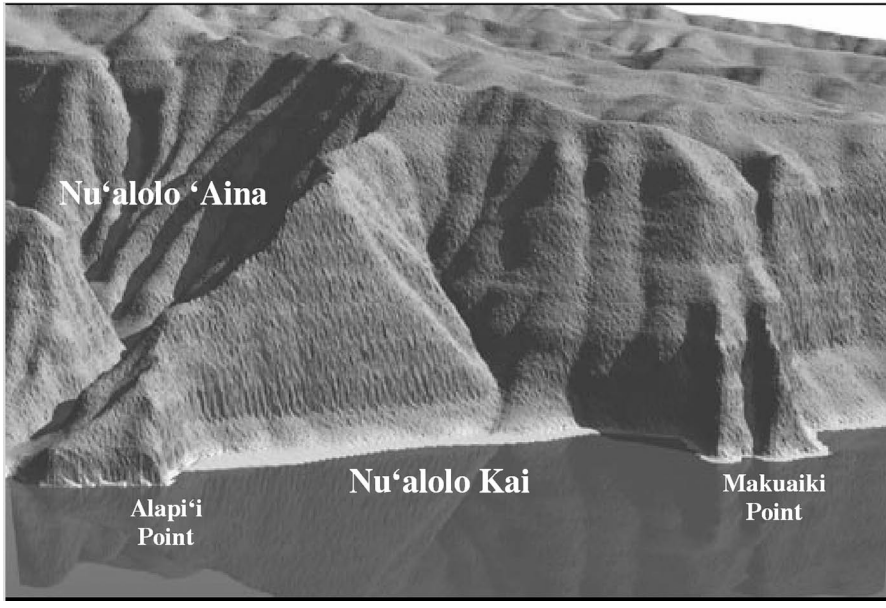

FIGURE 5. *Nu'alolo Kai oblique perspective using the VNS2 program. Map scene by Everett Wingert, 2004.*

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place, the sun's movement was animated and rendered across a southwest portion of Nu'alolo Kai (see fig. 6), at one angle and position to represent summer (fig. 7) and one for winter (fig. 8), including different times of day for each seasonal rendering (5 AM, 8 AM, 12 noon, 4 PM, and 7 PM). These maps demonstrate the significance of seasonality to representing depth of place. In the summer maps in figure 7, the sun is high and illuminates all parts of the landscape. In the winter maps of figure 8 in which the sun is low, portions of the landscape receive no sunlight (in particular the area near the black dot in figure 6). This lack of sunlight is an important element in an understanding of Nu'alolo Kai as a place, for in winter the ground never dries, thus promoting the germination and sprouting of *ilo* (worms or maggots). The Hawaiian term for this time of year is *ho'oilo* (to cause germination or sprouting). *Ho'oilo* is also the time of year that the Milky Way is prominent; Hawaiians affectionately refer to the Milky Way as *ilo* because it looks like a big worm in the night sky.

Resources at Nu'alolo Kai are not only shaped by sun angle, but they are also shaped by the shifting tides. As the tide recedes, marine resources trapped in various tidal pools are gathered as part of the day's food preparation. Generally speaking, women and children harvested the seaweed and shellfish from the reef and shoreline; and men did most of the offshore fishing by using traps, nets, and hook and line. Both men and women purposely left part of their catch at the *ko'a* (fishing shrine) to ensure continued aquacultural bounty. To represent the significance of tides, the map of Nu'alolo Kai was re-rendered from the shoreline looking out to sea or toward a northeast direction (fig. 9) to show the daily cycle of tides across the reef system that fronts Nu'alolo Kai (fig. 10) at different times of day (5 AM, 8 AM, 12 noon, 4 PM, and 7 PM). These maps depict the average high- and low-tide levels in accordance with the limitations of the software; ideally, these tides should also be depicted in terms of their seasonal differences in summer and winter.

Reimagining Cartographic Language

These animations draw on a few aspects of cartographic language in order to portray depth of place at Nu'alolo Kai. Line symbols such as the contour lines and the park boundary, which represent a fixed boundary and a static or unchanging landscape, have been removed and replaced with shaded areas only. The shift to a low, oblique perspective, almost profile, overcomes the disembodied space of the conventional map and illuminates the identity of Nu'alolo Kai as a place defined by cliff and sea. This quality of situatedness is echoed in the orientation of the map as that of an actual observer looking from the water to shore. These shifts in perspective and orientation remove both the authorlessness of the map as well as the human emptiness of the place: we see Nu'alolo Kai from someone's point of observation, which provides the map reader with a feeling of being situated in the map. By including us in the map's space, the animation draws on one quality of traditional performative cartography, that of connecting the mapmakers with the audience by incorporating everyone into the map. The shifts in temporal perspective created by the animation overcome the seasonless space of conventional mapping of Nu'alolo Kai.

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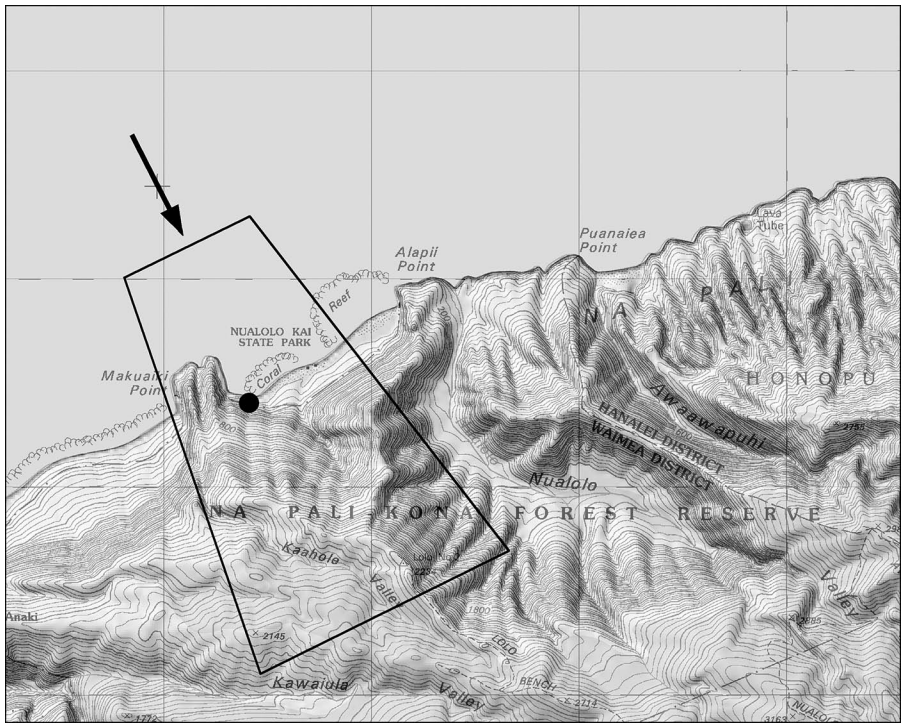

FIGURE 6. *View angle Nu'alolo Kai animation frames. Map by Renee Pualani Louis, 2006.*

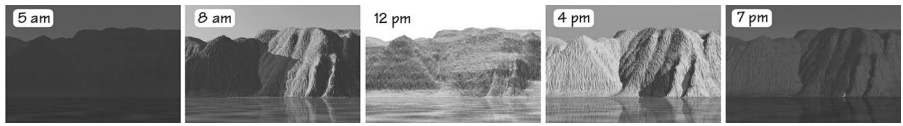

FIGURE 7. *Nu'alolo Kai animation frames that illustrate the movement of the summer sun by using the VNS2 program. Map scene by Everett Wingert, 2004.*

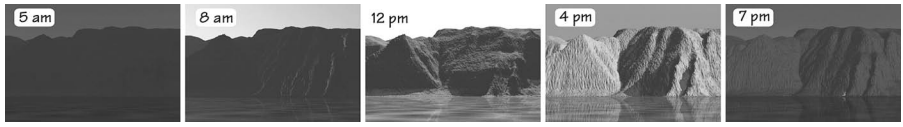

FIGURE 8. *Nu'alolo Kai animation frames that illustrate the movement of the winter sun by using the VNS2 program. Map scene by Everett Wingert, 2004.*

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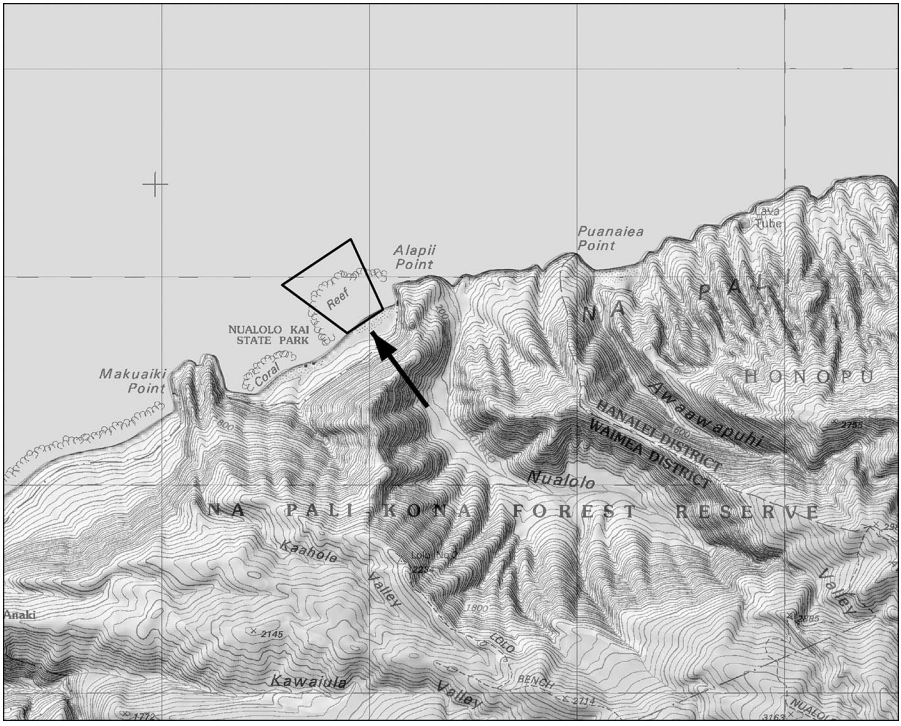

FIGURE 9. *View angle Nu'alolo Kai reef front animation frames. Map by Renee Pualani Louis, 2006.*

FIGURE 10. *Nu'alolo Kai reef front animation frames that illustrate the daily tidal cycle by using the VNS2 program. Map scene by Everett Wingert, 2004.*

Finally, the use of lighting as not fixed, as in conventional practices of shaded relief, but as shifting by time of day and season, brings in depth of place.

As demonstrated here, GT is flexible and can be used to express Indigenous conceptions and representations of place more powerfully than are currently used by either Indigenous or non-Indigenous mapmakers. Such improvements do not necessarily require new geographic data sets; rather we emphasize that existing digital data, as in the USGS data of these animated examples, can better depict Indigenous place merely through a careful consideration of form, that is, the way that cartographic language is used to represent that digital data. Although these maps more accurately express nuances of Indigenous depth of place, cross-cultural misrepresentation lingers. In traditional Hawaiian

cartographies, Hawaiian spatial knowledge is represented through integrated and interactive performances of oration and brings the cartographer, the subject matter (the place being portrayed), and the map reader together in the same place at the same time. In Western cartography knowledge is represented through performances of inscription that physically and temporally separate the place and the cartographer from the observer.

In the animated maps presented here, the landscape remains devoid of story and the human dimension. The maps continue to privilege sight as the sense by which the map reader learns about the seasonal spatiality of tides and ignores the other sensory dimensions such as the sounds of the tides' changing rhythms and the rustling in the winds as they stir the leaves and grasses, or the nuanced shifts in smell from the tides' ebb and flow. With audio technology now easily incorporated into animated cartography, and scented GT emerging, such sensory expansion of the maps is technologically within reach.[35]

Thus, these animations may be improved and reworked for the human and storied content of the visual dimension, the performativity of the map's structures and their connection of reader and mapmaker, and the incorporation of other sensory mappings in order to represent completely the Hawaiian understanding of the depth of place. However, through these visual depictions of Nu'alolo Kai as embodied, situated, fluid, and experienced, they bring us one step closer to representing appropriately the *ahupua'a* as a resource management system.

Envisioning Indigenous Cartographies: An Agenda for Indigenous Knowledge

The problem that faces Indigenous peoples worldwide is to find a way to incorporate Western GT and cartographic multimedia while minimizing the mistranslations, recolonizations, and assimilations of conventional technoscience. As Stone writes, "Map or be mapped."[36] We recognize that any re-representation of Indigenous knowledge by using Western cartographic techniques will entail some loss of information in translation.[37] But we believe that by making that translation more accurate through a theoretically informed and innovative application of cartographic language, the combination of "traditional wisdom" with "modern technical know-how," we can demonstrate the effectiveness of GT and multimedia as tools not only for protecting cultural sovereignty but also for articulating exemplary cartographic practices for the shared knowledge space of the transmodern.[38]

Through the informed practice of cartographic representation—innovation rooted in tradition—we envision a future in which Indigenous communities formulate their cultural mapping programs in a way that protects and fosters cultural sovereignty, maps the Indigenous without leaving the Indigenous behind, and simultaneously transforms the way non-Indigenous people read, interpret, and make use of maps of Indigenous cultural knowledge. In so doing, we hope to overcome the chasm of cultural miscommunication between the Indigenous and non-Indigenous worlds that so often manifests in loss of territory and cultural rights under colonial conditions.

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