

# 12

## Implications

### GIS AND THE STORIED LANDSCAPE

**A**t present we are in the midst of a revolution in the way we as humans experience and think about the world. The new tools of the Internet and ever more pervasive and sophisticated computers impact everything we do. In this context, I would argue, the potential transformation of indigenous landscape ecological concepts by mapping, based in European conventions of the nature and representation of space, and by the seductive and powerful tools of contemporary geographic information science and GIS must be carefully considered. What is the impact of GIS representation, and of global positioning units, on the experience and understanding of place?

An uncritical use of GIS to record local knowledge of land has the potential to transform that knowledge in the image of standard international and national geographic understandings of landscape and cartographic conventions, as Rundstrom (1995) cautions. As I suggest in Chapter 9, some types of knowledge are very difficult to render in GIS. GIS naturalizes, for example, an aerial bird's-eye view, which may or may not be "natural" to the community whose knowledge is being represented; a traveller's path mediated by known landmarks may better represent the emic perspective.<sup>1</sup> Similarly, locales which shift or have indefinite or gradational boundaries, what

one might call “ephemeral patches” or “fuzzy patches,” respectively, cannot be adequately represented by the conventions of GIS, being neither points, polygons, or vector lines, nor a specified set of geo-referenced cells. The probability that caribou may be encountered in a given area of the Richardson Mountains, for example, is neither spatially nor temporally determinate, but rather is probabilistic, though it may have considerable significance to the prepared and aware Gwich'in hunter.

This has caused considerable difficulty in some of the applications of GIS, as, for example, attempting to delineate polygons that should be avoided in mining exploration in the Sahtú region in the Canadian Northwest Territories (Boran Tracz, pers. comm., December 2006). Landscape effects are crucial here, but specific localities may, and often do, shift through seasons, and do so with less predictability over longer periods of time. Seasonality causes relatively predictable shifts in northern landscapes; a river as a concept is a “permanent” year-long feature, but the meaning and nature of a river in practice may shift dramatically over the seasons and even over shorter time periods, as the flowing river is covered by a mantle of ice of various characteristics which are significant for travellers and fishers, or gravel and sand bars are submerged or above water and the navigable channel shifts. The suite of relevant features along a drainage is also dynamic over longer periods of time, as sloughs are cut off, new channels formed across old wetlands or forested islands, and so on.

Despite these caveats, GIS and mapping have been widely embraced by local indigenous groups, partly as a way to legitimize and render visible their interest in the land and their knowledge of it, as in land claims or environmental impact contexts; and partly to engage in land-use planning and co-management with government and industry representatives or in the management of indigenous-owned lands and resources. Mapping was significant in the Gitksan-Wet'suwet'en land claims case *Delgamuukw vs the Queen*, where an atlas representing Gitksan and Witsuwit'en interests in the land was an important part of the plaintiffs' evidence. The Gitksan organization the Strategic Watershed Analysis Team (aka SWAT) and the successor Gitksan GIS Department have logged large amounts of information about the biophysical and cultural resources and sites of the traditional territories. Their efforts required them to make decisions about landscape units on the basis of received categories, such as biogeoclimatic units as developed by the BC Forest Service, as well as deciding how to code and delineate relevant categories, such as grizzly bear habitat or berry potential, in ways compre-

hensible to the British Columbia Forest Service and other agencies, obviously imposing a certain level of abstraction and analysis in the production of resulting maps.

After the appeal decision in the Delgamuukw court case recognized unextinguished aboriginal rights in areas of British Columbia where treaties had never been signed, a number of British Columbia First Nations undertook projects to attempt to make evident their interests in the land, most while continuing to pursue land claims in order to gain a stronger and more lasting recognition of their special relationships and rights to their homelands. As with legislated efforts to integrate TEK (traditional ecological knowledge) in northern Canada (Nadasdy 1999, 2003; Stevenson 1998), the parameters of the projects, the language of communication if you will, was set by resource management agencies, and involved standard mapping and planning paradigms. As previously discussed, it is difficult to render experiential knowledge, or a “dwelling perspective” as Ingold (2000) would put it, through such abstracted spatialized mapping conventions. Another issue that arose was who would be able to access this detailed but decontextualized knowledge. Issues of fuzzy boundaries (Ignace 2000), and appropriateness of sharing sensitive or sacred knowledge were complicating factors. How, for example, do you prevent a landing for yarding timber to be constructed at a sacred site if you don’t want to tell those who do not understand its significance exactly where it is? Or how do you prevent non-local hunters from coming in and hunting out your moose if you reveal where mineral licks or good hunting lookouts are? Detachment of knowledge from its social and cultural context may allow its unauthorized or inappropriate use by outsiders or the government (cf. Weinstein 1998). This results in strategies to deliberately obscure exact locations of significant places, which has the unfortunate effect of distorting the understanding of landscape possible from the maps and associated spatial databases, and which may, therefore, reduce discussions to vague generalities. The reasons for this are certainly valid, but the maps’ usefulness is then limited for efforts such as educating community members about the land, which underscores the problems that result from people no longer being able to move on the land as a way of gaining knowledge about it.

Several local groups have experimented with innovative ways to render traditional information about their homelands or traditional territories through GIS, especially GISs enhanced with multimedia, one of a range of technical approaches called “qualitative GIS” (Elwood 2006). The Confederate Salish and Kootenai Tribal Preservation office has shown its approach to rendering

seasonal information in its GIS in a conference presentation at the American Anthropological Association meeting and at the ESRI Users Conference (Cross 2000; Sam 2005). The Tulalip Tribe in the Puget Sound Region of Washington State is another group that has made creative use of GIS and related multimedia technologies, for planning purposes and to communicate about the land and its history to Tribal members (Metzler et al. 2002; Tulalip Tribes n.d.). The Wimidji Cree of the James Bay region in Quebec have recently been involved in a participatory GIS project with researchers from McGill; coming to grips with the basic and abstract set of “feature types” in the local geographic ontology has proved a sensitive and challenging aspect of the work which is foundational to the applications which may be made of GIS in local contexts (Sieber 2008).

However, for the most part it appears that representation of indigenous perspectives may indeed be constrained by the framework of the technology and the institutional framing of interaction between indigenous peoples and government. The Aboriginal Mapping Network is a group that facilitates communication among indigenous users of GIS and mapping. A recent perusal of their website (<http://www.nativemaps.org/>) suggests that at present there is a considerable discussion of technical aspects of GIS, sharing of databases, and of techniques for interfacing with government and company “referrals,” but little critical content. (“Referrals” are requests for input in various planned development efforts on lands where local aboriginal groups hold interests, that is, their traditional homelands, residences, trails and harvesting areas.) Effectively, the site presents a relatively mainstream approach to GIS as a tool in dealing with government, other users, and administration of indigenous reserves or homelands. Little about the present constitution of the site consisted in critique of GIS paradigms, or discussions of how better to render indigenous understandings of and interests in land through GIS technologies, though they have sponsored several conferences that have dealt with such issues in past years.

GIS does have the effect of divorcing people from land, through mediated, abstracted and indirect experience. GIS eliminates experiential knowledge of land, which is deeply held by indigenous peoples to be the most important way that people must learn about the land. GIS makes land an abstracted thing, a representation, not a locus of power and agency. This is a deep quandary to cultures that are based in the experiential human relationship to homelands. Rundstrom's (1995) arguments about loss of control of the recipients of knowledge of the land, when it is configured as “spatial data”

in GISs, are important. This loss of appropriate context and control in the transmission and access to knowledge about land abrogates moral elements of the human–land relationship, which lies at the heart of many indigenous cultures, ways of life, and world views. Rundstrom’s discussion of performative and inscribing cultures is also of interest, highlighting the performance of knowledge of the land in the transmission process through such media as contextualized storytelling, dance, or song, versus a technological artifact of geographic knowledge that exists as a disembodied and de-contextualized representation accessible to anyone under a wide range of circumstances and in many contexts.<sup>2</sup> More recently Renee Puilani Louis (2008) has made similar points about the performative nature of Native Hawai’ian cartography.

These are quandaries for contemporary indigenous people. In the unequal cross-cultural encounter with states and their various bureaucracies and organs of government, and with industries and other outside interests, supposedly culture-free and universal, “objective” portrayal of the land is the common language imposed, as are the epistemological underpinnings of local knowledge, just as national languages such as English or French are also imposed in these dialogs. This means that pressure to produce technically trained and locally connected indigenous people who can frame their own knowledge in a language that can participate in these unequal dialogs is overwhelming; the hope is that local people will be able to find a way to represent their important truths in a medium that is fundamentally inimical or antithetical to the truths that need to be represented, and in an absence of social and experiential context. The kicker is that if indigenous people do not participate, they will be deemed to have had no interest in the land, and others will take or impose at will in accordance with their institutional mandates or for corporate or personal gain.

Therefore, various tribal consultants, lands and resources departments, and so on, have attempted to find ways to use GIS and other tools of contemporary political negotiation and land management to meet their collective goals (e.g. Ping 1995; Roddan and Harry 2000). In the transformed context of sedentary reserve, village, or community life, many efforts seek ways to retain and transmit essential truths about culture, language and homeland through alternative media, such as computer multimedia applications and enriched GIS renderings of the locations and spatial and temporal patterning of aspects of the land. Some of these efforts have the inherent difficulties that Nadasdy (1999, 2003, 2005) has pointed out in his cogent, and rather

discouraging, discussions of resource co-management and use of TEK in the Yukon.

To some degree, as Rundstrom (1995) reminds us, adoption of GIS is strongly encouraged or almost imposed by agencies such as the United States Bureau of Indian Affairs (BIA), who adopt a modernist perspective on abstracted planning (e.g. employing contemporary land-use planning and urban-town planning paradigms) that requires a decontextualized objective dataset to be able to make “rational” decisions. Adoption of GIS by indigenous groups is also explicitly encouraged and facilitated by ESRI, the leading GIS commercial software company, who may donate initial software and training to enable tribal or First Nation groups to adopt GIS. Roman and Carruthers (2000:3) write:

Unlike industry or government's gradual embrace of GIS technologies, First Nations are not being given the time to adapt the technology for local applications. There is currently intense pressure for native groups in the province to “hit the ground running” and become proficient with GIS tools overnight. Whether it is for treaty negotiations, litigation, cultural, or resource management applications, First Nations are becoming creative in how to deal with these pressures, adapt the technology, and tell their own stories through maps.

A romantic and romanticized depiction of the past does not serve contemporary indigenous peoples, who have to live with the hard realities of the present, including the shifts in social and economic contexts and complex interactions with numerous outside forces and peoples, including international markets, powerful corporate actors, and national as well as regional or local governments. Change may bring opportunities as well as challenges. New technologies, though inevitably transformative, may be considered vital tools for present and future self determination. However, the nature of the transformations induced by new technologies must be carefully considered and recorded, and an evaluation of what is lost or gained in translation must be carried out so that implications and alternatives may be explored, and foundational and/or deeply significant insights regarding the land and human relationship with it are not lost.

Some groups have worked with professionals who have tried to create database structures that will work for the recording of cultural information,

including land information, typically in formats that include multimedia. One such collaborative project from western Australia is described by Andrew Turk and Kathryn Trees (2000). Other groups innovatively develop what will work for them, within the inevitable constraints of human, technical and financial resources (e.g. Roddan and Harry 2000), sometimes as facilitated by other indigenous groups such as the Aboriginal Mapping Network, as described by Roman and Carruthers (2000). A group of Native Hawai'ians is active in creating culturally sensitive place databases and in spearheading the reclaiming of Native Hawai'ian place names in the Islands (Louis 2008).

Various groups in the Canadian Northwest Territories have used GIS and multimedia digital technology to render aspects of local understanding of landscape. The Sahtú Atlas (Auld et al. 2005) and the Prince of Wales Northern Heritage Centre's Iḁā Trail interactive website are two such efforts, which combine images of land, animals, and people and text stories. Other ways of presenting the storied landscape digitally through the Internet can be seen with the virtual museum display from Doig, BC, which is not based in GIS. It too features hyperlinked text, images, sound files and video in an attempt to convey local history and values in land, prominently including Elder's voices (Attachie et al. 2006; Hennessy 2006; <http://www.virtualmuseum.ca/Exhibitions/Danewajich/>). The Dane-zaa have their own history of maps, depictions of trails to heaven, one of which is figured on a prophet's drum head and its story is one of the highlights of the site.<sup>3</sup>

Nonetheless, there is evidence that the presentation and understanding of the landscape are being changed through the necessity of communicating local interests to non-local parties in ways they can comprehend, and by the adoption of "tiling"-based mapping conventions. Communication with younger generations about the land is also using more mainstream modes based on written texts, multimedia, and mapping, although northern Elders continue to express the value of experiential learning through being on the land as superior to virtual learning about the land. In the case of the Sahtú Atlas, for example, the mapping tools and GIS expertise of the professionals influenced the ways that information about the land was conceptualized and shaped for communication with Sahtú beneficiaries and other readers of the atlas. Photographs, and written versions of some key "located" cultural information, accompany maps where deemed relevant. Complexities of the territory system or local land knowledge can be obscured by tidy maps comprised of colourful polygons with firm boundaries. Nesting of different types of resource sites, for example, such as berry patches or fishing sites,

may be obscured by attribution of large areas to a single group, quite aside from more subtle factors such as contested areas, which belong more to the internal political arena. When boundaries were originally learned by memorization of named places and their associated stories from relatives and Elders, reinforced over many years, and by travel over the land to the named sites as Dinim Gyet describes (Chapter 3), and then reinforced in the feasthall, the resulting understanding has a different and much finer grained character than transferring mapped boundaries to a site on the ground via GPS. Subtle and progressive shifts, such as shifting gravel bars and resulting fishable eddies, or the exact location of harvestable berries or roots are not well described by georeferenced and bounded polygons or GPS points, though their location and significance can be plain on the ground to those who know how to locate them.

Often significant sites are best understood and located by reaching them from the old trails or waterways and can be missed by those (such as myself) attempting to locate them from mapped localities printed out from GIS databases, using a GPS for navigation from contemporary logging roads. A disconnect develops between recorded stories and the place-on-the-ground. The example that comes to mind is my attempt to locate the named site Milkst ('Crabapple') along the Telegraph Trail, a major access trail to the Upper Skeena in the late nineteenth and twentieth centuries. In the 1990s a logging road was pushed through past the formerly isolated village site of Kuldo (Galdo'o), obscuring the old trail and its landmarks. Although my companion and I found the general flat below Kuldo Creek and walked around for several hours, we were unsuccessful in locating any crabapple trees, and it appeared that we had not actually reached the site where Beverly Anderson and Mike McDonald had interviewed the late Geoff Harris Sr. (Luus) and videoed him talking about the area in 1987. It remained unclear upon reviewing the videotape whether they had actually been at the site with crabapple trees when the tape was originally recorded.

Tim Ingold's discussion of wayfinding, navigation, mapping and map-making is relevant here (Ingold 2000, Chapter 13). I was navigating using a GPS, combined with an understanding of topographic maps, travelling with a companion who had walked the old and now obscured Telegraph Trail, but who was, like myself, not Gitksan, and who did not have stories and experience to guide us to the place we sought. I subsequently flew up the Skeena in a float-plane, recognizing the flat and what we had seen on the ground and inferred from the maps from the air, briefly achieving the bird's-eye view.

I still could not locate crabapple trees. Claudio Aporta (Aporta and Higgs 2005) has interesting comments on the use of GPS in Igloolik in the eastern Canadian Arctic, and on traditional wayfinding skills. Aporta (pers. comm., 2002) investigated Inuit wayfinding and navigation skills for his PhD dissertation, and also engaged in a community place name and trail mapping project, using a GPS and simple computer program for recording place and trail information. Among the topics he investigated while in Igloolik was the ways that GPS units were used by local people. He found that they were widely accepted, as compasses are useless in the area because it is too close to the magnetic pole, and poor visibility often makes travel difficult or impossible if landmarks (or “icemarks”) cannot be discerned. Though younger men not skilled in the exacting Inuit science of wayfinding might be quite dependent on GPS units to locate themselves or travel to specific destinations, older men had a more nuanced use of the units. While they appreciated the ability to know where they were when visibility was poor, they used their traditional knowledge of wind, current, and ice conditions to choose travel routes that were easier and faster than straight line routes, avoiding difficult traverses of rough or dangerous ice. For them, the GPS complemented rather than replaced traditional knowledge of land and ice, and how to travel.

In part, the widespread adoption of GIS and Western mapping conventions by Canadian indigenous people can be seen as the result of a power imbalance and the people’s need to present their knowledges in a language and form that can be understood and accommodated by governments and industry (e.g. Aboriginal Mapping Network website; Native Geography, 2000). Such presentations are required for land claims, and are the language of land-use planning. None of the groups I work with have strong control of much of their traditional homeland, but must work within settlement terms, and within the authority of provincial or territorial and federal governments. The process of interacting with governments, of presenting claims and then pursuing management or co-management objectives, allows some things to be said and understood, and others not (cf. Nadasdy 2003, 2005). It also creates the need for local people to become technically trained and conversant with various approaches to managing land and economic development. This creates a group of people who have perhaps shifted to or internalized a mapped—rather than storied—approach to the Land, converting homelands and places at least in part into bounded spaces and labelled dots and lines.

Local GIS departments, renewable resource councils and other local infrastructure begin to use these admittedly powerful tools for their own

purposes, and in the process, knowledge is inevitably transformed (cf. Rundstrom 1995) though it is difficult and perhaps inappropriate to pass judgment on this process in the abstract. Recognizing the non-relational and abstract character of the standard geographic and topographic paradigms on which standard GIS and mapping conventions are based (Rundstrom 1995; Goodchild et al. 2007; Couclelis 1992; Usery 1993) local groups have made innovative attempts to find ways to use these tools to represent the complex realities of a local and indigenous world view and sense of the Land through the seasons (e.g. Cross 2000; Sam 2005; Metzler et al. 2002; Tulalip Tribes n.d.; Roddan and Harry 2000; Burda et al. 1999; Collier and Rose 2000), as have other local organizations described in the “participatory GIS” literature (cf. Elwood 2006). Some groups have pioneered the use of interactive maps that use multimedia to attach narratives, toponyms and photographs to specific sites, creating “cultural atlases” to convey information about the land through multimedia on websites or CD ROMs (e.g. Prince of Wales Northern Heritage Centre *Idaà Trail* website and *Inuvialuit Place Names* website; Gwich’in Social and Cultural Institute *Place Names Map*; Navajo presentation at 1996 Dene Language meeting; Topkok 2000; Attachie et al. 2006; Hennessy 2006; Fletcher 2001), as a surrogate, to some degree, for being able to visit the site with knowledgeable people through direct experience.

The mapping efforts produced by indigenous groups attempting to have greater leverage in their interactions with states and industry are sometimes described as “countermapping.” The Strategic Watershed Analysis Team, a Gitksan GIS and mapping unit, was explicitly engaged in a countermapping project, to assert, assess and make evident Gitksan knowledge of their traditional territories, inscribe both names and the social system on the map, and to create the technical expertise necessary to regain control of resources or effectively intervene to protect Gitksan interests in the land in the face of government and industry activities. To this end, a huge amount of creative field time was undertaken, and a great deal of mapping done. The unreliability of technology such as GPS units under trying field conditions, and the difficulties of logistics and funding, made the undertaking challenging, and the complex internal and external political climates further affected the ultimate use of much of the mapping. I interacted with SWAT in the 1998-2000 period, spending time in the field, and discussing questions of how one might input traditional resource values, as well as examining some of their output maps. High-profile publications and appearances underscored the potential of the culturally grounded approach they championed (Burda

et al. 2000; Collier and Rose 2000; Pinkerton 1998), but ultimately, lack of resources and funding, and political climate, limited the impact of their mapping in inscribing alternative visions of the land and its development “on the ground” in northwest BC. Although considerable mapping was done, dramatic consequences in terms of economic development and empowerment proved more elusive.<sup>4</sup>

Sui and Goodchild (2003) present the concept of GIS as “media for communication” and employ a McLuhan-based “tetradic” analysis of it as media, which Crumplin (2007) extends to examination of two specific case studies, one in an American city (Minneapolis) neighbourhood, and the other a complex landscape-level land-use study in Kerala State in India, involving both peasant settler farmers and *adivasis* (tribal peoples), and government and technical agencies. A medium for communication may be seen as a “language”; the kicker is that language shapes what can be (easily or readily) said. This is in effect another instance of the weak form of the Whorfian hypothesis,<sup>5</sup> and relates once again to issues of cross-linguistic communication. One could see the shift of geographic knowledge to GIS as yet another type of language shift impelled (largely) by government policies and the need to interact with these (cf. Roman and Carruthers 2000), this time in the arena of land claims, planning efforts, and dealing with referrals regarding corporate initiatives to engage in development on indigenous lands, particularly with regard to impact-benefit analyses and environmental impact assessments. One can only do analysis in terms of what can be input to the system; otherwise participants simply talk past each other, to paraphrase Crumplin (2007). There are fundamental tensions between personalized, experiential “trail-based/storied” knowledge of land and abstracted spatialized depictions generated on computers.

It is nonetheless true that where information is culturally very relevant and input with categories that correspond to local ones, people, especially elders, may very quickly apprehend the potential of, for example, a laptop computer with GPS input of local place names (Aporta presentation to NS 390 class, fall 2002). Many important questions remain regarding both the impact and desirability of converting traditional knowledge, including knowledge of land, to new media, and transmitting it in new ways. The desirability of doing this depends very much on specific situations and contexts, community values, and alternatives for carrying knowledge forward.

Many efforts that are ostensibly community-driven may not deeply question received paradigms of representation in GIS or in web-based representations,

either because GIS experts or information technicians are non-local, or because local people have been trained in systems that do not reflect local categories and ways of presenting information as “the” way of doing GIS or computer multimedia. Lynn Usery (1993), in an early theoretical paper on feature-based GIS that employed Rosch’s category theory<sup>6</sup> (e.g. Rosch 1981), comments that the features of a GIS need to be the basic level categories of the user group, a point also made in a seminal paper on geographic ontologies by Mark and Turk (2003). The persistent and insistent need to respond to data and situations framed by outsiders, and to configure knowledge in ways comprehensible to these outsiders, framed often as “science” and seen as “modern,” drives communities toward relatively standard ways of using GIS, often with the addenda of elders meetings, interviews carried out by community interviewers, and attractive photos of people and land. This qualitative information may be variably reflected in the GIS, but might not impact the analytical approach deeply enough to reflect more fundamental local ways of understanding and valuing the land. Some aspects are simply incommensurable with the empiricist presumptions of scientific methodologies that underlie GIS. Inconsistency and under-resourcing, and divides between technically trained and leadership (i.e. “elites”) and other community members, can create problems for the stability and effectiveness of local control over, creative reconfiguring, and use of GISs.

Nadasdy’s perceptive and unsettling analysis of incorporation of traditional ecological knowledge into resource and land management in the Yukon raises concern about whether participation in resource co-management actually extends state power into indigenous communities by enforcing the boundaries of the problems under negotiation, and constraining the kinds of input and connections among them which could be received (Nadasdy 1999, 2003, 2005). Similar questions certainly can be raised about the effects of mediating knowledge of the land through computer databases and GIS generated maps. In my own experience, there is a huge difference in being on the land with an elder, learning about place through observation, movement, and story, and attempting to recreate such experience through computer screen mediated graphics and sound bites. Elders and knowledgeable people in Deline, Northwest Territories, though they appreciate the utility of GIS and other technical tools in interfacing with government and outside interests, strongly believe that the way to preserve and transmit their land-based knowledge is, simply, on the land (cf. Johnson et al. 2005). This was also the way that Gwich’in advisors felt was appropriate for me to learn about

Gwich'in knowledge of the land, as I describe in Chapter 7, travelling on the land, experiencing it in different seasons, in the company of people who know the land from a lifetime of experience, and through the words of their elders. In Traditional Knowledge, the importance of the skill, knowledge and intelligence of the "viewer" or knower is what create informed analysis, a nuanced understanding of land.

Indigenous people have long employed representations of land, often contextualized with story, or sometimes drawing maps in snow or dirt to illustrate story. In one of the few studies of "cultural cartography," Pentland (1975) presented and analysed northern Algonquian mapping traditions. The maps he reproduces are detailed and nuanced depictions of riverine travel routes, and there are clear differences in attention to aspects of the land and waters in the features that Cree from the Hudson Bay lowlands around Norway House chose to include in their maps, in comparison with standard NTS maps of the same area. Pentland discusses the significance of the Cree maps in terms of wayfinding and navigation, including alternate routes of travel and a nuanced classification of rapids. The classes of rapids also included information about fish resources. Rundstrom (1990) described Inuit and Inuinait (aka Copper Inuit) maps as "performance," that is, as a quintessential use of mimicry to communicate the nuances of land. The accuracy and extent of Inuit maps amazed Europeans, who used them widely for navigation and as a base for their own mapping efforts. Kaska guides depicted the route up the Liard River from Lower Post, BC to Frances Lake for geologist George Dawson in 1887, drawing a map on a canvas canoe cover, and naming all of the lakes and tributary streams (Dawson 1987:105B). Moore (2002:233-234) comments that these names are still in use today.

Indigenous maps, as with some historic Medieval European mapping conventions (Edgerton 1987), may also serve spiritual purposes and express spiritual understandings of the nature of the world. The Dane-zaa (Beaver or Dunne Za) tradition of visionary depictions of the trail to heaven, often painted on leather drum heads as in Figure 3 in Ridington (1981:354) and Doig River First Nation (2007), is one such indigenous mapping tradition. In his classic ethnography *Maps and Dreams*, Brody (1988:259-269) describes the amusing yet poignant cross-cultural encounter between white and native maps and mappers during a community hearing to discuss pipeline routing.

Ingold (2000) argues that the person at home on the land, in their home land, does not need a map, and he argues with the convention of describing the knowledge of place held by those who dwell there a "mental map." He

argues that a map implies abstract space, which separates people from the land and from the knowledge of region accumulated through movement along many pathways of experience and memory. Ingold calls the movement through place “mapping,” which he distinguishes from any end-product artifact, that is, a map.

Craig Candler (2000) in his talk “Maps, Dreams and GIS” gave a thoughtful critique of the constraints of relying uncritically on GIS for First Nations in the same area described in Brody’s ethnography, detailing ways that GIS could constrain or transform how people understood the land. My concerns with representation of traditional knowledge through GIS are several: I am concerned that it reifies knowledge, pins it down, in the same manner as Agrawal (1995) described for traditional knowledge databases. Moreover, as I and others have described, locales may shift in precise georeferenced terms, but nonetheless retain their importance and essential characteristics. One may need to know a precise point to be able to encounter power, or know the site where a particular supernatural event is recorded, but need to designate a large polygon to avoid encroachment on such a power site by industrial activity or those without knowledge. One may need to know the exact location of a resource patch to be able to harvest a particular plant such as spiny wood fern, and generalized associations of the species with, say, a land or forest cover type is useless to the would-be harvester. The level of abstraction and generalization is totally inappropriate to the activity. Most likely a harvester would need to know a set of sites and the social rules of access, as well as seasonal considerations and also the access routes to get to the sites, in order to be able to harvest the plants. A skilled harvester would also be aware of characteristics of the sites where the fern rhizome or a valued medicine is found, and would be alert to potential resources of similar sites if he or she needed to find the plant, showing the resourcefulness of the engaged person on the land. In other instances, large and indefinitely bounded areas may be the relevant level of specificity, as when Marianne Ignace (2000) described a whole set of special sites, connected by the travels of a supernatural ancestral figure and explicated in traditional narratives, in the Marble Canyon/Fountain Lake area east of Lillooet, BC. This too was difficult to input into the TUS (Traditional Use Study)<sup>7</sup> database for GIS output required by the traditional use study format set by the BC Forest Service.

Another realm of difficulty is mapping the sacred, as in the example discussed by Ignace (2000) above. Given that there are strong concerns about how and to whom to communicate sacred knowledge (see Rundstrom 1993

and Gulliford 2000 for thought-provoking discussion of these issues), such information is often not recorded on maps or in GISs, or is presented in such a way as to diffuse actual locale, to protect sites from inappropriate or dangerous intrusion (cf. Weinstein 1998). It may well be that such knowledge is incommensurable with databases and hard rendering on Western style maps. If GIS-mediated depictions supplant more experience near understanding of land, there is a risk that the sacred will drop out of sight, or will be rendered in such a distorted and blurred way as to mislead. The depiction of land that is shared with outsiders and reified through electronic and printed maps and data may offer an incomplete picture. Interestingly, when Davidson-Hunt and Berkes (2003) sought to render Shoal Lake Anishinabeg landscape terms on landscape drawings, the community members rejected depictions that did not include both sites of human activity and supernatural associations, underscoring the risks of presenting only secular data. In my own Gitksan research, I have been told about sacred kinds of sites, but Dinim Gyet warned that it was dangerous to indicate the locations of such sites, as the unprepared might be at significant risk if they encountered a *sbi laxnok*. Although mapping specific sites is inappropriate, Gitksan understanding of landscape definitely includes the notion of powerful places, and that must not be overlooked simply because it does not appear on the map.

Although I express concerns for how translations into GIS-compatible terms may affect traditional knowledge of the land, one can also see the adoption and use of GIS and Web technologies as another instance of the resilience of indigenous peoples in the face of new contexts, needs, and opportunities. Thinking about GIS and the effective use of GIS-generated maps and databases in contemporary land claims and co-management contexts made me think of the use of maps in an earlier era to communicate essential aspects of indigenous homelands, as the carefully labelled maps by Michael Inspiring Bright and other Gitksan presented in *Tribal Boundaries in the Nass Watershed* (Sterritt et al. 1998).

According to Crumplin and others, GISs have the potential to empower and democratize, as well as to disadvantage and alienate (e.g. Crumplin 2007; Pickles 1995 and authors therein; Elwood 2006; Rundstrom 1995). As the critical and participatory GIS literature (Elwood 2006; Crumplin 2007; Duncan and Lach 2006) makes clear, what can be expressed or recorded through GIS is at least in part a question of database and study design, and group goals; if the community controls how data is recorded and structured, there is a real possibility of ownership and empowerment. A

remarkable multifaceted community driven study of habitats and toponyms in the Northwest Territories shows the potential that such studies can have in sensitively exploring the nuances of environmental knowledge without being dominated by the constraints of the technology (Legat et al. 2001). This Dogrib (Tłı̄chǫ) study of habitats and environments in the West Slave area of the Northwest Territories was inspired by concerns for the potential impacts on a large area of sensitive tundra and taiga on the Canadian Shield when the diamond prospecting boom of the early 1990s suddenly made real the possibility of widespread industrial impacts on very sensitive environments which are the homeland, and source of caribou and other foods, for the Dogrib people. The study initiated by the Dogrib Treaty 11 council was entirely community run, and almost all of the researchers were also Dogrib, including language experts and the GIS coordinator, and unfolded over a period of four years. The importance of careful linguistic work, recording of narratives, and visits to significant areas chosen by community members in each of the community areas gives a real richness and authority to the information recorded. The information recorded places the highly specific site information into contexts of narrative, of general habitat types, of travel routes and needed resources for travel, and in relation to caribou, the most important animal for the Tłı̄chǫ people. It also enfolds all within the concept of *dè*, the Land. They describe *dè* as

a term which is usually translated as land, however the concept is much broader. Dè is much closer to the scientific concept "ecosystem," except where ecosystem is based on the idea that living things exist in association with non-living elements, the Dogrib term *dè* is based on the idea that everything in the environment has life and spirit. (Legat et al. 2001:3, footnote 12)

The material will form the basis of a long-term monitoring effort to assess the environmental health and integrity of the region, and identify any impacts from industry or climate change.

Still, in the balance, GIS cannot replace the landscape of experience, though it may offer complementary perspectives, and we must be cautious of uncritically accepting the representation and novel analyses while letting the reality slip away. As of yet, GIS, though useful and powerful in its own right, cannot convey the depth and power of the storied landscape, which unites

knowing subjects with a rich and powerful land that embodies history, and which through the strength of direct experience, teaches both about itself and the person who lives, moves, camps, and dwells there. The bandwidth of virtual perception is so much less than the multisensory and effortful engagement with the land itself. The richness of social context which includes other people and other beings on the land, and the immediate consequences of action, are likewise absent from the representation, of which we are largely passive audience.