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Some geomatics of forest conservation by indigenous groups: A survey & appraisal

abstract

Over the last decade, geographic information systems, remote sensing and other geomatics tools providing decision support have been used in a number of forest conservation conflicts involving indigenous groups. In some cases, more traditional communities with less access to post-secondary education have been marginalized by the use of digital technologies -- as lands and environmental conditions were more 'precisely' (or reductively) mapped and assessed. But in other cases, marginalized groups have been quick to assert particular experiences and relationships to local experiences of place, the landscape, and stewardship of resources. Remote sensing dies not necessarily negate local knowledge. G.i.s. has been used to create and assert very new kinds of maps -- sometimes with more links to traditional experiences than to the scientific worldviews of the twentieth century. In examining a number of conflicts around rainforest destruction and conservation involving indigenous and tribal communities, a typology emerges of modes of uses and relevance of (rapidly changing) technologies. A number of questions emerge around the role of geomatics, and geographic information systems in particular, in ongoing efforts of indigenous communities in knowing and stewarding territories (Brandt, E. 1995) and natural resources.

1. How have the new digital geomatics aided in, or detracted from, the position of indigenous communities vis-à-vis control of territory and management of resources?

2. How have the new digital geomatics been appropriated to assert local experiences be they more traditional or more contemporary?

3. How have local notions of space been transformed by spatial digital spatial technologies?

4. How engaged have indigenous communities been in development of and adapting software for their particular experiences and needs?

5. What cultural, social and political tensions have emerged with increased use of spatial digital technologies by indigenous communities? Are there cultures and politics of 'g.i.s.' and other geomatics tools that are transforming local cultural and political relationships?

*

"[I]t is the map that engenders the territory[.]"
Jean Baudrillard (1983: 2)

"Historically, forests have also been the outposts of 'outlaws' and 'outcasts' and the base for many an opposition force to imperalistic powers...Mapping of forest resources is therefore an intrinsically political act[.]"
Nancy Peluso (1996: 383)

"Oh yes, Indians made maps. You would not take any notice of them. You might say such maps are crazy. But maybe the Indians would say that is what your maps are: the same thing. Different maps from different people -- different ways."
Hugh Brody. ((1981) 1983: 45 - 46)

Introduction

The previous quotations represents two ends, an early and a later period, of the paradigm that has dominated the emergence of geomatics developed by and for indigenous and tribal communities (Poole 1995). These two perspectives embody some tensions, a contradiction perhaps, since the emergence of geographic information systems ('g.i.s.'), increasingly

in conjunction with processed satellite imagery, over the last two decades ago. Hugh Brody's project, while he was working with semi-nomadic peoples of northern British Columbia in relationship to a proposed pipeline, was to see more acknowledgement of and respect for indigenous cartographies in land use decisions made by indifferent and or even not sympathetic metropolitan agencies and corporate entities. Brody's acknowledgement that `Indians' had their maps for their own needs was only a tentative step in decolonisation of the world of cartographies and geographical data bases -- one that often devalued the experiences and needs of indigenous communities. The French philosopher Jean Baudrillard's almost concurrent work hinted at the more radical, and today largely unfulfilled potentials, of critical mapping for asserting over land and resources by marginalised groups (Jarvis et al. 1995). But knowledge is not exactly power and maps (nor data bases), alone, allow communities to better manage and protect their territories and resources. Yet these two themes, at times allied and at other points at odds, continue to dominate much of the work by indigenous communities in supplying, organising, using and even more actively appropriating digital data on environments of interest.

Discussing ways to untangle the knots that these hopes and agendas, that increasingly appear simplistic and naive, is the function of the discussion that I bring to you today. Re-examined as a range of largely unfulfilled projects, we may have the basis for devising a more critical paradigm for indigenous geomatics. There can be new and better ways for determining how traditional and contemporary knowledge, converted to digital data, might be more satisfactorily used by specific groups and for particular interests and projects. This discussion focuses on

- ❖ use of **geomatics** as linked practices involving
- remote sensing (such as satellite imagery);
- geographic information systems; and
- decision support

- ❖ for **forest conservation** as in
- protection of traditional sites, resources and management practices;
- assertion and codification of priorities for conservation (and development (Smith 1995)) by indigenous communities;
- planning and design of protected areas by indigenous groups[1]; and
- sustainable forest exploitation I(including often contentious extraction[2])

and management defined in terms of the perspectives and priorities of indigenous groups.

The information here and my conclusions are only tentative. The field is changing quickly and there are a considerable number of projects and data bases that, for a range of reasons, have not been available for review. However, I have been tracking geographic information systems involving indigenous and tribal groups, as well as traditional knowledge, for over fifteen years in both doctoral studies and after and in advising a number of agencies and nongovernmental agencies -- a few of which have been controlled by indigenous communities. And I am from and remained based in British Columbia, a region with some of the most advanced uses of geomatics by and for indigenous communities[3] -- though an area exceptional in the extent of First Nations land and resource ownership remaining unrecognised by the state.

In carrying out this initial survey of indigenous geomatics for forest conservation, I have had to give up on being comprehensive -- even around the relevant websites. I have, however, spent many hours trying to stay current on what is on the net -- often visiting sites where I have other indications of more extensive data and architectures than were reflected in this relatively public arenas. Instead of being conclusive, I am going out layout a series of questions and outline some more extended means to make some conclusions. My underlying argument in this discussion is one that those of us here will find disappointing but not surprising. Indigenous communities continue to be marginalized in the increasing use of geomatics. For every data base and website that promotes indigenous control of traditional lands and resources, there are perhaps ten with information on those same things that support metropolitan or more global control at the expense of marginal groups. The other half of my bad news is that those data bases that do promote indigenous control and management of geographic information systems (for control and protection of territories and resources) often use standardised software. These architectures have often been used in ways that are not particularly innovative not reflect the location nor the nature of the traditional knowledge. However, there are some notable exceptions[4].

From an intuitive standpoint from searching the web in late February 2001, I have made the following (tentative) conclusions related to forested areas and respective resources.

- The overall rate of adoption and increased use of geographic information systems, and related geomatics technologies, by indigenous and relatively communities may well be lower than comparable use by government agencies, corporations and nongovernmental organisations (for the same areas). This is particularly the case in more affluent regions of the world.

- For every data base developed and controlled by an indigenous group or agency, there are perhaps ten to twenty to even fifty data bases with information on the same territories and resources. These metropolitan data bases can that undermine aboriginal jurisdictions and activities.

- Most databases on forests and related biodiversity, unless controlled by a specifically indigenous organization, still barely service indigenous communities and effectively obscure knowledge of traditional links to spaces and resources. For example, the recent analytical data base on biodiversity, developed by the National Institute for Amazonian Research ('The most prominent scientific institute in the Amazon rain forest') (Santos et al. 2000) largely functions to obfuscate local knowledge and specific links between highly culturally specific ethnoscience, territories and (highly political) decision-making.

- Digital geographic practices are often being employed for various kinds of decolonisation of spatial information involving indigenous and other relatively traditional communities. But aspects of some of the use of data and management practices contact biases that are deleterious to certain kinds of traditional knowledge. In other words, some of these geomatics practices and associated approaches have barely been decolonised.

- I suspect that if indicators of these mixed were weighed, the geomatics of the last decade have contributed more to **slowing** decolonisation, of local knowledge, than to supporting more forest conservation by indigenous groups. In other words, the advent of digital geomatics over the last two decades has **not** yet contributed to a net increase in control over their forest lands and resources by indigenous groups and organisations. This situation may force more indigenous organisations to develop their own geographic information systems -- but this is often in the context of disadvantage. In western Canada, this situation has allowed

a number of First Nations groups to obtain short-term funding from the Government of Canada around land claims and conflicts over particular resources.

- In addition to the data bases controlled by indigenous organisations, there are a far greater number of sources of digital geographical information from non-governmental organisations engaged in forest conservation programmes. These data bases and related websites often pay some lip-service to indigenous people but typically promote different priorities that in some cases could be argued to be 'neocolonial'. Conflicting notions of and priorities for conservation between localised and indigenous conservation values and practices in contrast to more globally oriented metropolitan environmentalism[5] tend to be obscured. This lack of highlighting (and admission) of cultural difference in forest conservation priorities tends to devalue the (minority) perspectives of indigenous communities -- often further contributing to their marginalization (even in the guise of solidarity and alliance-building). Half-hearted and superficial support for indigenous communities, in a corner of a web page, can translate into some additional credibility for that group with little understanding for or benefits to those groups.

- Most of the geomatics data of relevance to indigenous communities is not intended for and will not available for general access on the web. Yet to some extent optimal information diffusion, in this decade, tends to translate into better understanding of and support for particular positions as related to resource management priorities. Private and communal information often heavily linked to family histories and delicate negotiations usually should not be made freely available on the web.

- Supposedly asocial scientific data such as on endangered species, for which indigenous communities can have a stake, can be used to obscure relationships to traditional communities and knowledge. Often listed under the rubric of 'biodiversity' (Giri et al. 2000), this data is increasingly available and tends to dominate knowledge of forest areas and resources.

- Expanding technologies and protocols for metadata are necessary for asserting indigenous presence in, links to, and priorities for geomatics.

Metadata are the tags that tell us about the origin of and restrictions on particular pieces of information -- in other words the information on the information. Metadata hold keys to controlling and asserting forest conservation data in ways that are consistent with the priorities of indigenous communities. As this layer of information expands in the coming years, there will be a better basis to identify, challenge and correct biases in data bases -- and to identify needs for better data including for more traditional knowledge.

Problem statement

Tracking geomatics activities oriented to and developed by indigenous communities is difficult. There are many reasons to not share information or to choose to not make easy access to the world, at large on the web, a priority. The largest website on geomatics by and for indigenous communities is effectively part of an advertising and marketting strategy for the maker of the most commonly used g.i.s. software, ArcInfo[6]. Nonetheless, the publicly available geomatics projects by indigenous people do give some indications of directions in the field.

In their 1995 essay entitled "Bridging the space between indigenous ecological knowledge and New Zealand conservation management using geographic information systems," Laituri and Harvey outlined only two phases at the beginning of indigenous geomatics. In stage one, there is an appropriation of indigenous knowledge (Bell 1979, Tabor & Hutchinson 1994, Grenier 1998) into non-native management systems. In stage two, there is creation of geographic information systems that will incorporate, more systematically, local knowledge of indigenous communities. But there was little discussion of a stage three: of consolidation of cartographies, through geomatics, that supports the cosmologies (Reichel-Dolmatoff 1976), worldviews, cultures, and priorities for social development (including conservation), of particular indigenous communities. Nor was there mention of what might be a fourth, more aggressive, phase of an indigenous geomatics: centred on local knowledge but actively appropriating other, sometimes formerly dominant, cartographies into its architectures (reflecting 'native' priorities). Without such a trajectory, in a long-term agenda, will it be worthwhile for most indigenous groups to invest significant financial, institutional, educational and personnel resources in g.i.s.? I doubt it. At the same time, most development of geographic information systems by indigenous organisations has been short-term and provisional -- often

leading to limited benefits and under-employed geomatics technicians. For forest conservation efforts by indigenous communities, what might be some longer-time goals for the use of geomatics?

Forest conservation initiated by indigenous communities

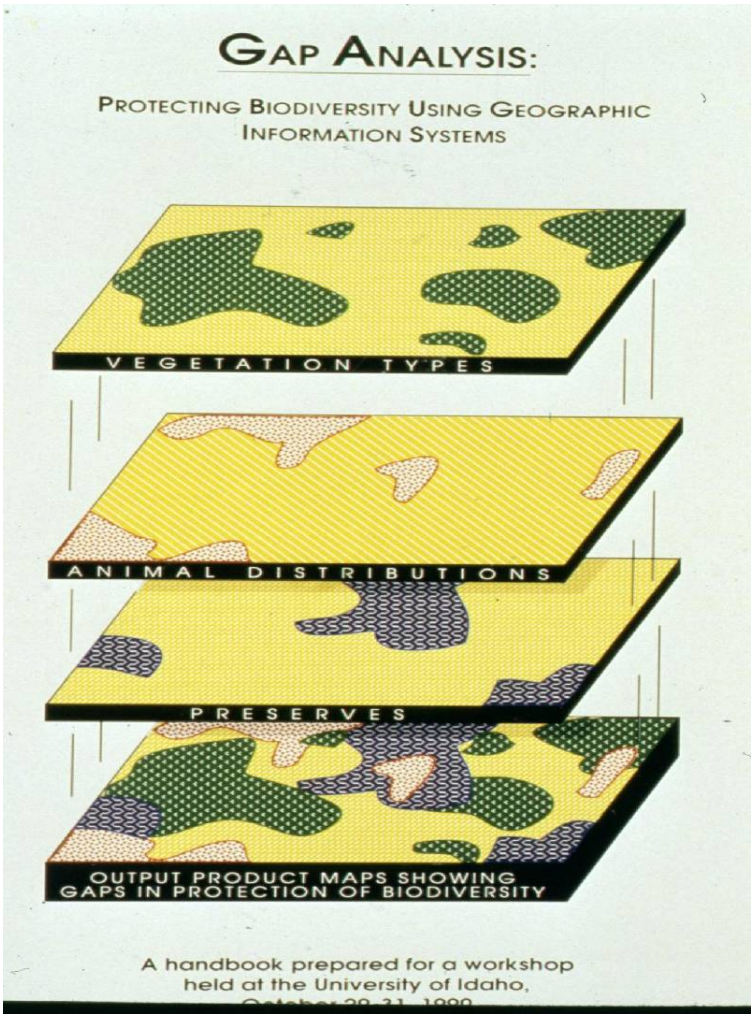
Forest conservation has been one of the projects where indigenous groups have excelled in competing with corporate and (non-aboriginal) government bodies for creation of cartographies (and assertion of particular world and political views). So far, there been many uses of geomatics in the various subprojects around trying to consider remaining ancient forests and forested cultural landscapes (projects that have often only partially overlapped).

- For indigenous and tribal communities, **cataloguing traditional knowledge that is being forgotten** is typically a priority.

- Similarly, **tracking complex sets of knowledge of forests, plants and wildlife** become a priority (Ingram 1990, 1992b). Today, there are numerous forest conservation initiatives, using geomatics, that are oriented to maintaining particular resources such as salmon[7] and for maintaining and protecting certain spaces and resources associated with particular social groups (Rocheleau et al. 1995).

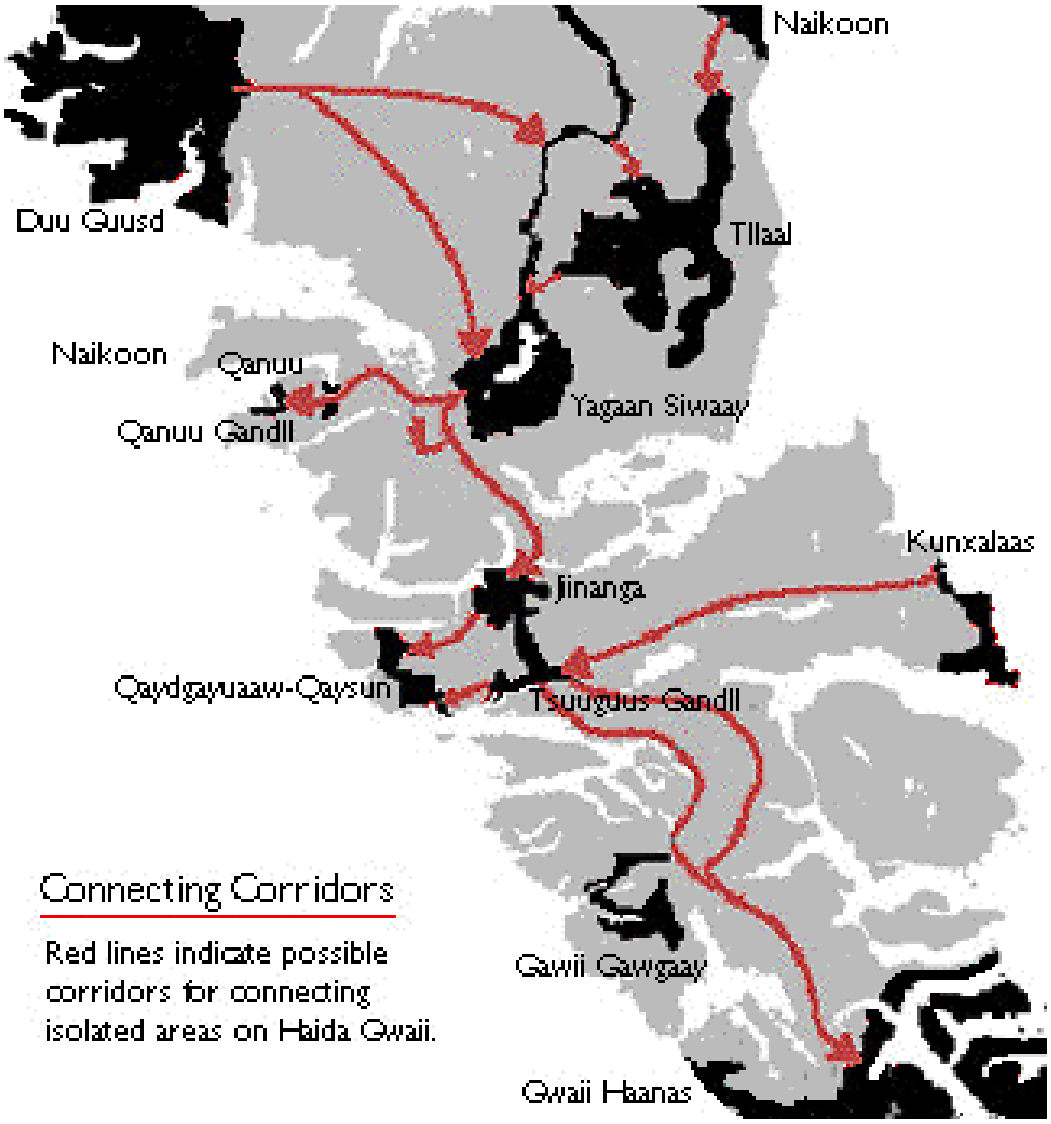
traditional crab-apple gathering site, the ownership and stewardship of which, is still transferred matrilineally by the Haida (Kiit, Burnaby Narrows, Burnaby Island, Gwaii Haanas National Park Reserve and Haida Heritage Site, British Columbia, Canada)

- **Identification, monitoring and protection of important areas for conservation**, in contexts where there are conflicting development and conservation priorities, continues to be one of the most important uses of geomatics for indigenous communities (Ingram 1991, 1992a, 1994). Often this is in conjunction with specific knowledge of sacred sites and other areas of importance -- traditional information that is too often discounted without maps, science and precise maps.



Council of the Haida Nation Protected Areas	
Area (ha) approx	
Qanuu Gandll	80
Kunxalaas	2,780
Qanuu	290
Gawii Gawgaay	3,650
Kumdis Slough	1,34
Nang Xaldangaas	5,620
Tsuuguus Gandll	1,700
Yaagan Siwaayl	10,910
Jinanga	1,790
Tllaal	16,690
Qaydgayuaaw-Qaysun	2,180
Duu Guusd	149,540

8



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- **Reassertion of stewardship and territorial claims**, with geographic information systems providing the basis for extensive document, is a growing tendency for more technologically savvy groups (Ingram 1995a, 1995b, 1995c).

- G.i.s. and decision-support for determining **goals for sustainable exploitation** remain a talked about but largely unfulfilled project.

- Digital copies of maps become an easy way to **share maps and exchange a broader range of related information.**

the Aboriginal Mapping Network

The uses listed above relate to short-term needs and the more common uses of geomatics for forest conservation in the world today. But geomatics could provide some other functions for compilation and computation with the following information:

- localised knowledge,
- specific cultural and language groups,
- culturally based links between text-based, graphic and aural information, and
- modelling and projections based on local management principles.

But such potentials would require some clearer cross-cultural goals and some new data base architectures.

Architectures of culturally defined space and spatial data

The data and computational architectures of data bases and decision support, that we see today, are limited in terms of the potentials. For geomatics tools and practices to be developed that better serve indigenous communities around forest conservation, some clear goals and priorities are necessary. The following are a few of the choices that are necessary -- ones that could different markedly between regional and district contexts and priorities -- for the design of particular data bases.

local <--> global

How localised and how globalised should a cartography, data base and set of maps be? Does a community, group or particular office have the resources to be globally oriented and what are the benefits of this? At the same time, how specific should the ethnoscience be and how unique should be the architecture. Extensive local specificity could limit the users and the impact of the data base.

indigenous <--> metropolitan

Like global versus local, how specifically indigenous should the information and computations be for a data base and cartographic system -- and what are the advantages of some standardisation? Indigenous people could produce indigenous software that might only be relevant in the immediate vicinity -- which poses some advantages and drawbacks.

adaptive <--> inflexibly designed

Should a data base and field for a set of computations be heavily designed or be more adaptive -- and be developed incrementally?

public <--> private knowledge

Who should have access to the information and in what forms? What information should be public? And what information should be private? What information might at times need to be easily available as in public and what information should stay private?

The previous questions are typically asked in any design for a system of spatial information. But they have rarely been considered, clearly, in more careful strategies for decolonising geomatics oriented to indigenous communities (and forest conservation). With answering the previous queries

as a prerequisite, we could begin to explore the following questions for particular groups, contexts, problems and projects. New approaches, training priorities and material, and even software, could be developed to support more fully indigenous-oriented initiatives in geomatics. In trying to answer these questions, we have a basis for identifying policies and approaches to working towards forms of geomatics, and data bases in particular, that would more explicitly, and perhaps fully, serve indigenous communities and interests associated with reliance on local knowledge and cartographies.

Query 1
How have the new digital geomatics aided in, or detracted from, the position of indigenous communities vis-à-vis control of territory and management of resources?

This is a difficult question to answer because technologies and even data bases, alone, do not improve the position of indigenous communities nor the prospects for having more acceptance of particular worldviews and cartographies. None the less, there are some indications that geomatics, again mainly geographic information systems and global positioning are helping groups track otherwise neglected aspects of the forest and to locate those things more precisely. One way to answer this question, more comprehensively, would be to track a number of indigenous geomatics projects and to identify whether and how their operationalisation began to translate into legal and management gains.

Query 2
How have the new digital geomatics been appropriated to assert local experiences and cartographies be they more traditional or more contemporary?

Have indigenous geomatics largely functioned to discount indigenous cartographies and for colonising respective communities into accepting metropolitan cartographies at the expense of their own? Most of us would hope not. But this prospect, for some groups, is real. One way to explore this question is to identify characteristics of local cartographies and see if and how they are recorded and imbued in the data bases developed by and for indigenous communities.

Query 3
How have local notions of space been transformed by spatial digital

spatial technologies?

This is a subquestion of the previous query. Local cultural experiences of geographical space tend to become particularly standardised after information is entered into such matrices as the universal transmercator. In contrast, local cartographies tend to be particularly detailed about certain aspects of the forest and adjacent ecosystems and landscapes. There is a similar process at work around the transfer from local to metropolitan languages. We can certainly query indigenous data bases, when they are made available to us, to see how much of this particular kind of local knowledge actually is recorded and is available.

Query 4

How engaged have indigenous communities been in development of and adapting software for their particular experiences and needs?

This question is particularly straightforward. Where is there software, macros and websites designed partially or fully by individuals from indigenous communities? How have these individuals worked to insert the perspectives and priorities of their communities into systems design? Has there been a clear sense of choice around how certain design decisions support or undermine local cartographies and traditions of spatial information.

Query 5

What cultural, social and political tensions have emerged with increased use of spatial digital technologies by indigenous communities?

A new compilation of and pattern of social access to spatial information (especially around resources that are unevenly owned) should have direct impacts on social dynamics in indigenous communities. What have been the impacts of new data bases? Who uses those maps and how? What overt and effective restrictions are there on access and how does this accept economic, political and cultural life?

Query 6

Is there a culture and politics of 'g.i.s.' and other geomatics tools that is transforming local cultural and political relationships?

Another way to frame this question is that of whether there is a new group of geomatics users who are influencing social and political

life in respective indigenous communities? Are there two or three people savvy with this technology or is it available to larger portions of respective communities? Are local schools getting access to this information? Can elderly people provide information on an ongoing basis as they recall other information of importance? Are this interested in listening to, relying on and supporting local cartographies or in bringing the more standardized uses of such standardized softwares as Arc|Info into local life.

Conclusions:
Towards an ethnography of indigenous geomatics design & use

In concluding, I want to leave you with some practical problems that for many communities overshadow the still esoteric questions about software design and even support for modes of thinking. The young man below has been the manager of the Lake Lavu Conservation Area -- a protected forest watershed initiatied by local families on Fergusson Island, south of the Trobriand Islands, in Papua New Guinea. Virtually all of the conflicts over forests[10] in that country involve struggles over ass That village is a two days walk from the closest electrical generator and there are effectively no geomatics tools that could work for long (and are available for him to use). He has had a limited local education. He does take field notes however and is acutely aware of local perspectives on the forest -- partly because other information and cosmologies have rarely made it to that village.

I think that hyper-marginalized communities such as his are what much of the work in indigenous geomatics should be intended. But any geomatics -- any recorded information -- that could be left in that village or even linked to nearby villages or the provincial capital, remains a luxury. In contrast, most of the indigenous communities that have the electricity, government funding or corporate grants have already lost much of their cultures and resources. Questions of priorities in system design and biases in software are all some groups have left and are the only way to begin in try to revive their cartographies.

In tracking developments in indigenous geomatics in the coming years, websites will only give limited clues and most of the key information, in deed the data base architecture, will remain guarded as that traditional information has been before. Without this shielding that older information

would probably not survived and this could well be the case for the era of the supposedly easy access to information on the web. And even with sincere contact, the new network of aboriginal g.i.s. technicians may not have time to way to share much information with outside researchers. One of the advantages of geomatics for indigenous communities, in fact, is that information can be more selectively shared and transferred -- consistent with priorities for social development and conservation. Still, these questions need to be asked (especially by indigenous users) and new, more responsive software developed -- when those needs are articulated locally and linked to traditional cartographies.

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Notes

All websites cited are as of 24 February, 2001.

[1] For one set of guidelines to support indigenous communities initiatives in protected area planning and establishment -- one that curiously omits discussion of geomatics -- see IUCN - World Conservation Union / WCPA - World Commission on Protected Areas WWF - World Wide Fund For Nature PRINCIPLES AND GUIDELINES ON INDIGENOUS AND TRADITIONAL PEOPLES AND PROTECTED AREAS http://panda.org/resources/publications/sustainability/indigenous2/

[2] Roy Ellen, University of Kent at Canterbury, INDIGENOUS KNOWLEDGE OF THE RAINFOREST: PERCEPTION, EXTRACTION AND CONSERVATION http://lucy.ukc.ac.uk/Rainforest/malon.html

[3] http://members.tripod.com/~DiscoveryForest/GISResources.html#FN

[4] One exception if the following. "Innovative GIS Solutions, Inc., (IGIS), is an independent Native American owned company founded on values and virtues inherent to Native Tribal people. Innovative GIS's goal is to develop and maintain strategic teaming relationships with governments, private industry, and key individuals to provide natural resource managers, Tribal leadership, and government professionals with state-of-the-art, cost effective geographic information technology solutions. This site contains lots of good information including an interesting paper that presents an overview of issues and requirements for implementing and applying geographic information systems technology." http://members.tripod.com/~DiscoveryForest/GISResources.html#FN

[5] The Native Forest Network barely mentions indigenous people in its notion of 'native forests'. http://www.nativeforest.org/home.html Another example is at http://www.nfn.org.au/

[6] Also see http://www.esri.com/conservation/links/native.html

[7] Kim Taylor & Jill Silver. Hoh River Floodplain Inventory: Integrating GIS and GPS To Redefine Floodplain Management

http://www.esri.com/library/userconf/proc98/PROCEED/ABSTRACT/A532.HTM

[8] Marguerite Forest. 2000. Connecting Corridors. http://www.spruceroots.org/Corridors.html

[9] Marguerite Forest. 2000. Connecting Corridors. http://www.spruceroots.org/Corridors.html

[10] For one example of the kinds of intensifying struggles over forests and traditional lands, see http://forests.org/pngforest.html