Aboriginal Community Land and Resource Management:
Geospatial Data Needs Assessment and Data Identification and Analysis

Executive Summary

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1.0 Introduction

Makivik Corporation, created to represent the Nunavik Inuit following the 1975 James Bay and Northern Quebec Agreement, was awarded a contract by GeoConnections, a national partnership program led by Natural Resources Canada (NRCAN) to document the geospatial data needs and data sources for Aboriginal land use planning in Canada. Makivik Corporation expanded the project team by partnering with Strata360 in Montreal, Hatfield Consultants in Vancouver, and PlanLab Ltd. in Toronto in order to benefit from their extensive experience working on geospatial and planning issues with Aboriginal communities and organizations in Canada and worldwide.

New powers and authority have been afforded to Aboriginal communities across Canada through land claim settlements and through rulings in the courts. To re-assert their rights to their lands and their visions for how these lands are to be developed and conserved, Aboriginal communities are turning to mapping. The land use plan is now being widely adopted as a common planning tool for reconciling community visions with third-party interests.

Recognizing the growing field of mapping within Aboriginal Canada, the Federal Government targeted Matters of Importance to Aboriginal People as one of four priority areas within NRCAN's GeoConnections program. This focus was emphasized in an October 2006 Survey of Geographic Information Decision-makers prepared by Environics for GeoConnections.

For our study, a sample of ten Aboriginal land use plans from across Canada was chosen. Our intention was that the sample be geographically representative (Atlantic, Eastern, Central, Western and Northern Canada), as well as culturally representative (Métis, Inuit, First Nations). Our review documented the methodologies used in the plans and the data that were relied upon for their preparation, analysis and implementation. We coordinated and completed workshops with the groups to hear first-hand about each community's experience in completing its plan. It was decided to document not only data needs and data sources, but many of the higher-level stories that showed priority concerns for the communities. The results of this work are documented in our Volume One report, entitled “Aboriginal Mapping and Information Needs: Experiences from Ten Land Use Planning Process Across Canada.” Our Volume Two report “Data Identification and Analysis”, focuses on data (formats, quality, currency of data sets, etc.) and the identification of the most appropriate and authoritative sources.

Access to geospatial information is not a primary concern in Aboriginal land use planning; access to information is but one element of a set of complex issues that arise during the transition to self-government and the assertion of treaty and Aboriginal rights and title. In our report we look at how geospatial data are being used, but as well within the context of other themes identified as a priority by community practitioners. These include:

- Issues of access to data
- Lack of current use of web-based mapping
- Problems associated with locating and downloading geospatial data
- Lack of data standards and format issues
- Issues of access to satellite imagery
- Problems assembling and maintaining cultural data inventories
- Difficulties establishing and retaining geomatics capacity
- Concerns about data confidentiality and protocols
- Understanding land use planning in context of broader issues
- The need to continue the dialogue

Priority Data

Data priorities vary between each group in our study. Rather than using frequency of data found in the land and resource management plans, priority datasets were defined by the participating communities. Actual data use in the plans was not used to prioritize data as statistics would have misrepresented data priorities because of complexities including multiple repetitious sub-classes used per map and differences in focus among plans.

Nine thematic layers, identified by at least seven of the participating communities, were designated as high priority. Six thematic layers, identified by four to six communities, were designated as medium priority.

For thematic data, wildlife, cultural inventories and development data (forestry and mining) were the most commonly used and highest priority thematic data themes for the plans we reviewed. The highest single sub-class ranking was wildlife (13.6 percent). This was identified as a priority dataset by all ten communities. Summing the percentage of occurrences of data by sub-class, we found that 18.3 percent of all recorded thematic data was derived from community cultural use and occupancy studies; these normally are highly confidential in nature. Of equal importance are forestry and mining datasets, which comprised 18.1 percent of all recorded thematic data. Wildlife, cultural inventories and development data (forestry and mining) were the most commonly used and highest priority thematic data themes for the plans we reviewed.

CLASS	SUB-CLASS	PRIORITY	# GROUPS IDENTIFIED AS HIGH PRIORITY
Natural Heritage	Wildlife	HIGH	100%
Administrative/Development	Mining	HIGH	90%
Administrative/Development	Aboriginal Territories	HIGH	80%
Administrative/Development	Forestry	HIGH	80%
Administrative/Development	Land Use / Land Management	HIGH	80%
Administrative/Development	Tourism and Recreation	HIGH	80%
Administrative/Development	Conservation/Protected Areas	HIGH	70%
Cultural Heritage	Use and Harvesting Areas	HIGH	70%
Natural Heritage	Ecology	HIGH	70%
Administrative/Development	Fishery	MEDIUM	60%
Biophysical	Hydrology	MEDIUM	50%
Cultural Heritage	Travel and Trade Routes	MEDIUM	50%
Biophysical	Geology	MEDIUM	40%
Cultural Heritage	Archaeology	MEDIUM	40%
Cultural Heritage	Ceremonial and Sacred Sites	MEDIUM	40%

For framework data, only one sub-class was identified as a high priority -- roads. Road information is regarded as highly important because of the frequency of new road construction to service natural resource extraction, including forestry, oil and gas and mining. Three additional layers were identified by four to six communities and are therefore classified as a medium priority.

- Level of funding and public scrutiny varied among plans.
- Planning approaches varied, some being policy based, others operationally-oriented.
- Geomatics staff members in the communities were not always available to be interviewed.

CLASS	SUB-CLASS	PRIORITY	# GROUPS IDENTIFIED AS HIGH PRIORITY
Framework	Roads	HIGH	80%
Framework	Infrastructure	MEDIUM	60%
Framework	Administrative Boundaries	MEDIUM	50%
Framework	Hydrography	MEDIUM	50%

Important regional anomalies exist in the ranking of data priorities. Examples include a focus on forestry and tourism as a high priority for all groups in southern Canada, and mining being a high priority for all northern participants. In addition, land use and land management layers are seen as high priority across the board. However, these data layers are, in most cases, created or designated during the planning process.

Bathymetry and nautical information scored low. This is, no doubt, because the plans that were selected were land-based plans and not marine management plans.

The number of data layers used per community ranged from 51 layers to 146, with a mean number of 91.2 layers. The number of records varied between the plans for a variety of reasons, including:

- Plans are not inclusive of all geospatial data used to prepare the plan and the final maps.
- Issues being addressed are different depending on the plan.
- Different planning methodologies were used.

Most of the plans used 1:50,000 scale (54 percent) or 1:250,000 scale (42 percent) for their planning, consistent with NRCAN's topographic framework layers. Only three participants in the study, the Innu, Algonquin, and the Tsleil-Waututh used the data at scales between 1:12,500 and 1:20,000 to help inform site-specific planning.

Data Custodians / Suppliers

The largest amount of thematic data (46 percent) came from the Aboriginal groups. This was mainly contained in the cultural heritage class (use and occupancy data) and the administrative/development class (zoning information created as a result of planning process by the Aboriginal group). Provincial/Territorial governments were ranked as the second largest source of thematic data, with 36 percent of all records assigned to this source. Apart from government and the Aboriginal groups themselves, a very small percentage of thematic datasets (about 5 percent) were provided by industry, university and non-government organizations.

More then 95 percent of Framework data sources were governmental, with 55 percent from provincial/territorial sources and 40 percent from federal sources.

Frequency of Updates (Data Currency)

Most of the geospatial datasets used or needed for Aboriginal land and resource management and planning require yearly updates or updates every few years. Day-to-day plan implementation may drive the need for yearly updates; however, some groups suggested that there is a need for updates every few years to facilitate the review of plans, usually on a five year review cycle. No datasets were identified as requiring daily or weekly updates. Most of the datasets had not been updated since the plans had been created, especially in the communities where mapping capacity was unavailable.

Data Formats

Through the plan review and workshop verification, many types of data formats were identified by the communities, including shapefiles, tabular data, web service, raster, PDF, word documents, DGN, ESRI GIS (vector/raster), and even some unknown file formats. Shapefile format was used frequently for both thematic (82.7 percent) and framework (79.3 percent) data. Newer technologies such as web services accounted for a low percentage of data formats encountered during the review. Web services only accounted for 2.9 percent of thematic and 0.5 percent of framework data. One common frustration in the communities was data suppliers packaging their data in non shapefile format.

Data Access

Data used in the planning process from outside sources (not community-owned) were provided mostly by provincial/territorial and federal government departments. These datasets were accessed through free download (47 percent) or made available to the Aboriginal group upon request (49 percent).

Access through web services (WMS/WFS) made up only a small percentage of the total data used (about 3.5 percent). During the workshops Aboriginal groups stated that Internet access through direct download or FTP site was their most preferred data access method. We found that it is not likely that web-based data distribution mechanisms will play a significant role in Aboriginal land use planning process in the near future.

Data Confidentiality

Community owned data (Traditional Ecological Knowledge [TEK] and use & occupancy data), is highly confidential and was not being shared or was usually shared within a small group of users within a community. These data accounted for 18 percent of all thematic data and were ranked of high security importance.

On the other hand, most framework datasets are considered public information and were generally freely available with little or no user restrictions applied. Conditions were almost always tied, however, to the use of Provincial and Territorial framework data; these data had to be accessed through memberships, special information sharing requests or direct purchase.

A total of 54.5 percent of thematic data was identified as low security, in contrast to a much larger proportion of framework data (96.7 percent).

Datasets where cost is a factor in acquisition

All of the plans reviewed (except for the Tsleil-Waututh watershed plan), were initiated prior to federal government implementation of a no-fee pricing structure on all information products owned exclusively by NRCAN. Therefore, data pricing as a barrier to access will be significantly less of an issue for groups currently moving through a planning process than it was for the communities who participated in our study. For thematic data, 87.8 percent were available without cost, compared to only 48.6 percent of framework data. Despite some provinces now supporting free access to their provincial data, many regions, including BC and Quebec, routinely charge for access to provincial framework data. Datasets for which price was a barrier to access include Light Detection and Ranging (LIDAR) data, Digital Elevation Models (DEMs), and earth observation (EO) or satellite remotely sensed data.

Metadata

There was a significant difference in the occurrence of metadata between thematic (12 percent) and framework data (94.4 percent). Only one Aboriginal group participating in the study (Tsleil-Waututh) claimed that it did not use any data that were not accompanied by metadata. Unfortunately, a good portion of community based data (cultural heritage data) does not include any metadata. We added to our list of recommendations that GeoConnections investigate this large discrepancy between thematic and framework data to help organizations to meet CGDI metadata standards.

Missing Geospatial Data and Barriers to Access and Use

A high proportion of participants (78 percent) noted that some data were unavailable or inaccessible for their planning process. These data ranged from community and occupancy datasets to third-party development data (forestry, mining potential, oil and gas). Satellite imagery or remotely sensed data were also identified by seven groups as not-available or missing at the time of planning.

Several barriers to data access were identified numerous times during community workshops : cost, licensing; lack of capacity to manage/access information; incompatible data formats; bandwidth issues; data gaps; custodians reluctant to share; time consuming/difficult process to obtain data; no available metadata; lack of availability. However, the most frequent barriers mentioned were cost and licensing. The main barrier for framework data was cost (81 percent), while the main barrier for thematic data was security (77 percent). Confidentiality and intellectual property rights in relation to cultural data were the most frequently mentioned barriers to sharing geospatial data.

Recommendations

We have gathered together all of our recommendations from the two reports and ranked them by priority under three headings: a) Program Support to Aboriginals; b) Specific Actions for GeoConnections; and, c) Program Support for Other Government Departments and Industry. Within each of the categories, recommendations are listed by rank or priority (high priority listed first per category). Recommendations, however, retain their original numbering as found in the reports.

Recommendations: Program Support to Aboriginals

RECOMMENDATION NUMBER	RECOMMENDATION	RANK OF IMPORTANCE
20	GeoConnections should broaden information support strategies to look at what data are required to run Aboriginal land management programs effectively, not just what information is required for land use planning.	1
12	GeoConnections should formalize a support program to help offset the costs for the systematic inventory and updating of cultural inventories. Methodologies for use and occupancy studies should follow the general guidelines promoted by Terry Tobias in Chief Kerry's Moose and his new upcoming book.	2
13	GeoConnections should increase its programmatic focus on geomatics capacity-related activities.	3
17	GeoConnections should build on its phase 1 work supporting the training of the next-generation of Aboriginal geomatics professionals through the promotion of training centres, and provision of scholarships and bursaries for students.	4
18	GeoConnections should support regional training workshops, where trainers deliver courses to multiple communities at once.	5
16	GeoConnections should increase funds available to capacity funding programs, and provide a 50 percent matching of capital acquisitions for software, hardware and data.	6
10	Programs that are tailored to support Aboriginal communities should support the shapefile format.	7

Recommendations: Specific Actions for GeoConnections

RECOMMENDATION NUMBER	RECOMMENDATION	RANK OF IMPORTANCE
21	Working with Aboriginal organizations, GeoConnections should consider supporting communication using a variety of media to help continue the dialogue that was started with this work. The goal of this should be to help fill the information gap relating to methods, tools, information and success stories. Efforts could include supporting the creation of discussion boards, web sites, and workshops in partnership with organizations that are already committed to this sector.	1
14	GeoConnections should follow up on the 1990s Sustainable Communities Initiative Program to contact the 100 Aboriginal communities who received capacity funding and document lessons-learned and indicators of success for building and maintaining successful community-based mapping programs.	2
5	GeoConnections should develop data library templates and share best-practices for the orderly management and cataloguing of locally-secured data.	3
8	GeoConnections should encourage the standard use of icons on all government web sites to help lead users to a department's download-able geospatial data. (Icons could be a link to data in GeoGratis or other data portals).	4
6	GeoConnections should enhance the downloading tools for federal framework data, on both GeoGratis and GeoBase, to stitch tiles according to a user's defined study area (using NTS map numbers). This includes adding functionality to stitch together DEM data within user-specified boundaries (e.g. a traditional territory), and provide value-added information such as hillshade models.	5
7	GeoConnections should develop symbolization standards that are shared and packaged with common federal framework data.	6
2	GeoConnections should work with Statistics Canada to make available Statistics data for free access to Aboriginal communities.	7
9	GeoConnections should take a lead role in facilitating discussions about moving towards common data standards among the provinces and territories.	8
22	We recommend that GeoConnections look more closely at why there is such a poor metadata completion rate for thematic data.	9

Recommendations: Program Support for other Government Departments and Industry

RECOMMENDATION NUMBER	RECOMMENDATION	RANK OF IMPORTANCE
1	Government and industry should make investments that support provincial and territorial government efforts to make available development data (mining, oil and gas, forestry), perhaps with certain use-rights for Aboriginal communities under a consultation-accommodation framework.	1
4	Government and industry should tailor data distribution strategies to accommodate the downloading or consolidating of data locally, not connected to source.	2
3	Government and industry should work with other data custodians to pre-format and standardize geomatics-related data.	3
19	Government and industry should collect and share confidentiality agreements and intellectual rights agreements between communities and third parties via networks such as the Aboriginal Mapping Network	4
15	Government and industry should work with existing associations and networks such as the Aboriginal Mapping Network (http://www.nativemaps.org/) to promote Aboriginal geomatics and to promote Aboriginal geomatics support programs.	5

It is our hope that the two data needs assessment reports will be used by GeoConnections to help shape the focus and directions for their Aboriginal outreach programs. We also expect the documents to be of value to Aboriginal Canada by providing a source of information for those embarking on land use planning and a means to learn from the experiences of others.