



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



First Nations' post-counter map praxis

Francis Cadeau

Doctor of Social Sciences program, Royal Roads University, Victoria, Canada

Francis.Cadeau@royalroads.ca

**Paper prepared for presentation at the
“2019 WORLD BANK CONFERENCE ON LAND AND POVERTY”
The World Bank - Washington DC, March 25-29, 2019**



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



Copyright 2019 by author(s). All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Abstract

Historically, surveying and map making has represented power and authority versus Canada's First Nations counter map actions. A new era is proposed of 'post-counter mapping' by evidence gained from emerging First Nations Geomatics praxis. Experienced interviewee viewpoint's regarding recent counter-mapping: new geo-technological advances for geomatics practioners, new interests in reconciliation with Canada's First Nations, and in emerging post-counter mapping developments. This qualitative research derived from nine semi-directed interviewees, of geomatics knowledgeable professionals. The questions asked interviewees were about their counter map views: past, present, and future concerning First Nations mapping praxis that they knew. A triangulation of the interview dialogues provides new evidence as to a post-counter map praxis perspective. This offers data to the geomatics-reserve lands research literature towards Canada's First Nations' reconciliation.

Key Words: Counter mapping, First Nations research, Geomatics, Post-counter map praxis

This research study explores the emerging praxis in geospatial technologies over the past decade that has provided many new geospatial capacities for Canadian First Nations. 'Geomatics' is defined as the modern discipline which integrates... the disciplines of surveying, hydrographic, mapping, remote sensing & geographic information processing, often called geographic information systems or GIS'. (nrcan.gc.ca, 2017) First Nations in Canada are using geomatics in data collection-processing in location, cultural and environmental, projects with an emerging geomatics capacity being implemented in local communities.

This research coined 'First Nations Geomatics' contains a new generation of geomatics data types and tool abilities that provides new administrative and lands governance options. A decade ago most of newer geospatial technologies did not commercially exist. The changes in geomatics link to a new era in counter mapping capacity. The term of 'counter-mapping' (CM) was categorized by, (Peluso, 1995), as being an activist-geomatics practise. Research over the last 25 years has a recognized subject cited, (Brody 1981, Peluso, 1995, Rundstrom 1995, Tobias 2000, Poole 2003,) that provides a foundation to current praxis.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



The collective geospatial data and geo-technologies for (First Nations) reserve lands in Canada have been and are generally limited or shared within regional tribes or are contracted out as required. (Sullivan 2013) However, recent geo-technological changes and user trends have changed this practice. (Rainie, Schultz, Briggs, et al. 2017) The changing field of geomatics technologies has given better abilities for survey-mapping activities with GPS, LIDAR, Aerial drones, and assorted Mobile geo-data processing for local users especially to small and remote indigenous locales. A praxis in lands self-preservation and a defence of First Nations' lands claims have been the main focus of CM, but with these era geomatics tools, new mapping actions have arrived. (indigenousguardianstoolkit.ca, 2019)

There have been a number of counter map projects cited in Canada. (Brody 1981, Brealey 1995, Jarvis, Stearman & MacLean, 1995, Aporta & Higgs 2005) These past CM projects had impacts as to Canadian indigenous legal actions, as (Pulla, 2016) discusses in his counter mapping history review. Past CM was primarily about gaining a social justice for indigenous peoples and their communities, of their traditional lands, and in establishing their historical rights of resource claims. The counter mapping praxis has used, "appropriate the state's techniques and manner of representation to bolster the legitimacy of 'customary' claims to resources." (Peluso 1995, p.384) This struggle continues with a new geomatics tools today.

Background

The research about 'First Nations counter mapping' in its changes and implications to lands tenure and management has evolved over the past decade. These technology changes have and will support Canada's First Nations' in gaining new land governance capacities. The implications towards reserves lands tenure control and future lands administration with new geomatics abilities is the focus here. A qualitative study approach was taken to gain data from expert interviewees, to validate a proposed praxis era.

Lands management functions with geomatics applications used by reserve lands managers range in scope and complexity dependent on the reserve's lands tenure. A recent Canadian Federal study has detailed the wide gap within First Nations Geomatics ' that have 30% of very advanced abilities and 40% have little capacity'. (Hatfield Consultants, 2018) The underlying social justice issue is one of 'control' of reserve lands tenure geospatial data. In the 'counter mapping ' literature, examples of past survey-mapping efforts by indigenous peoples have been outlined as political actions of their tribes to establish land claims by a geomatics evidence against opposing colonial histories. (Hunt & Stevenson 2017, Olson, Hackett & DeRoy 2016). A commonality in these counter map activities has been pragmatic worldviews that asks:



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



What is the map narrative (CM) evidence of the mapping/surveying that supports their land rights case? (Barbeau, Cowan & Tsuji 2016, Chapin & Threlkeld, 2005, Aragon & Kessler 2017)

The emerging counter map praxis with geomatics technology to generate map-survey has product options, in how data is captured, processed, used and distributed as illustrated. (Engler, Scassa & Taylor 2013, McCarthy, Isogai, Gardner, et al. 2013). The era of direct digital data and local data capture via drones, cell phones, GPS, and geo-web apps has energized choices in 'counter map' praxis. (Radjawali, Pye & Flitner 2017) Over a past century, (Pulla 2016) outlined, the use of counter mapping to gain map evidence was an art and cartographic process. Today, First Nations' practise 'post-counter mapping' with newer geomatics technologies of Aerial drones, Lidar, and SLAM mapping tools that have great ability to create local mapping product narratives. These post counter mapping outputs are digital, with applications/data for the needed tasks. First Nations' reserves, who control their lands tenure with local geomatics capacity, are using modern geomatics in self-administration databases of the territorial claimed lands. (Stó:lō 2018)

Today, the direct to digital geospatial tools can quickly collect data and custom applications use local data with geo-web technologies that are fundamentally changing global indigenous lands management and governance capabilities. (McCall & Dunn 2012) The control of local geospatial data underscores a new process era in geospatial tools and local data in building local geomatics capacity. First Nations will have to address the geomatics capacity paradigm as noted by authors. (Pualani, Johnson, Pramono & Albertus 2012, Sullivan 2013, Tompkins & Ballantyne 2017, Rainie, Schultz, Briggs, et al. 2017) Links to newer CM in First Nations communities asks; how new geospatial abilities are potentially able to move towards better self-governing communities? (Pyne & Fraser, 2012) A geomatics capacity has to be implemented for Canada's First Nations but many good geomatics stories exist. (McCarthy, Isogai, Gardner, et al. 2013, Olson, Hackett & DeRoy 2016, Barbeau, Cowan & Tsuji, 2016, Tompkins & Ballantyne 2017)

Literature review

Today, geomatics capacity is an outlier topic for First Nations. Few articles discuss the overview of this complex CM topic in Canada. Many articles outline projects or processes, but some geomatics capacity cases do exist. (Olson, Hackett & DeRoy 2016, Hunt & Stevenson, 2017, Hirt 2012, Aragon & Kessler 2017, Knauer 2010)

The international capacity cases do note of many indigenous advanced geomatics plans, policies and control procedures that exist worldwide. The importance of the role that Geomatics has to indigenous



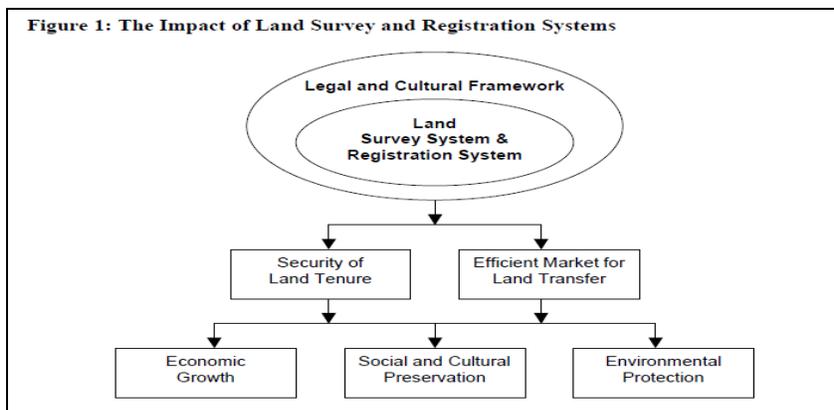
Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



self-governance is well cited. (McCall 2003, Sandström, Granqvist Pahlén, Edenius, et al., 2013, McCall & Dunn 2012). For Canada's First Nations, gaining geomatics tools to self-govern, to manage their lands, and gain self-governing paths from a geomatics capacity is an emerging topic in the communities.

The complex relationship of surveys-maps to reserve and territorial lands for First Nations in Canada has social, economic and political relationships that are of complex lands tenure relationships as identified, (Hickling, 2001), in a systems overview (below). The importance of geomatics abilities to control, to manage and operate reserve land tenure has multiple implications in its impact to Canada's First Nations.



Source: HAL Ref: 7065, 2001, P. 6

The literature of 'counter mapping' might be called various versions 1.0 to 3.0. The CM version 1.0 by communities to map their community lands of paper maps and data by cartographic map methods started in the 1800's. A review by (Pulla, 2016) proposed that century old CM was done by less technical means, without aerial photography and in little survey referencing of historical territory identification but it was done to maintain the cultural lands story. These past map efforts did produce landmark First Nations maps of cartographic value which future land claims and land disputes have used to fight and win their cases.

The 2.0 CM era of using modern map and survey methods with GIS developments started in the 1980's as acknowledged. (Brealey 1995, Jarvis, Stearman & MacLean 1995, Rundstrom, R. A. 1995, Chapin, Lamb & Threlkeld 2005,) These counter mapping examples started with a social justice movements that (Pulla 2016) outlined as an 'activist period'. The 2.0 CM era has evolved in CM theory with the newer mapping technologies and processes as 'participatory mapping' for local indigenous map creation. Local traditional territorial map discourses were incorporated with local geography to create CM products in land use and occupancy maps, of tribal mythology and of treaty rights/ land claims. Authors, (Ballantyne, Flanagan,



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



Anderson, et al. 2014, Hunter & Stevenson 2017, Ballantyne & Ballantyne 2017, and Sullivan 2017), all have framed the importance of land tenure mapping to geomatics and the emerging post-CM era issues.

The importance to First Nations in Canada, of the Calder SJC decision, (Calder. v. B.C. 1973), greatly influenced First Nations in CM, to provide evidences for their lands title cases. Other major First Nations lands claims as the: Mackenzie Valley Royal Commission, the Nisga and the Quebec Cree comprehensive land claims all helped to establish CM actions in Canada. These were all social justice agendas of CM maps/surveys aiding First Nations legal cases. (Peluso 1995, Tobias 2000, 2009, Poole 2003)

The 3.0 era proposed is a Post-Counter Mapping (PCM) that has new mapping options. In this praxis, it's a doing of self-owned surveys/maps with geomatics tools that can be distributed by any First Nations' community. The PCM products creation era takes indigenous, environmental and social justice positions in First Nations making 'their maps' for their own uses. The 2014 Supreme Court of Canada case (R. v. Williams), set the legal standard for the use and acceptance of counter mapping evidence. This decision has moved Canada into a Post-CM map era. Other post era examples as Quebec First Nations Cree's using a geomatics application to tell of storms and coastal issues along their James Bay lands. Map applications as Cree's along with other examples, use online mobile and reserve lands geo-web applications as the new norm. Several authors have discussed this evolving CM work in Canada. (McCarthy, Isogai, Gardner, et al. 2013, Bryan & Wood 2015, Engler, Scassa & Fraser 2013, Hunter & Stevenson 2017)

The Post-CM era has evolved over this last decade, in the advances of the geospatial technology as aerial drones, enhanced GPS, online, mobile photogrammetric and mobile Lidar capture. Events like the Google Indigenous Mapping workshops have highlighted the many geomatics and geo-web applications being developed by First Nations in Canada. Their developments to collect lands data, incorporate indigenous knowledge, using indigenous languages/culture, in local own mapping designs for local application, are demonstrations of administrative and territorial lands governance. New technical changes in Geomatics have provided new online photogrammetric and aerial imagery geo-data services, to create local tribal databases. These new abilities with same day data services especially from satellite data providers make for a post-counter mapping era. In dialogue with a map company president interviewee, he stated that, ' a job that use to take 30 days is now just 3 days.' (Cadeau 2018)



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



Consequently, new geomatics abilities for a reserve community, provides today's indigenous users with an ability to gain a control over their local data. In Canada, the reserve lands tenure data (cadastral survey registries) remains under a federal government control, (Ballantyne 2015, Sullivan 2013) but legislation maybe changing those arrangements. (Bill C86, 2019) A Canadian government action to United Nations Declaration on Indigenous Peoples, (UNDRIP) provides new potential for PCM too. UNDRIP impact of how legalities will lead towards new Post CM actions remains the unknown. (Echo-Hawk 2013) This is an evolving story in Canada with new UNDRIP legislation. (Bill C-262, 2019) Associated is the apology to Canada's indigenous peoples in 2013, it provides hope for new First Nations post-counter mapping and geomatics capacity-building with government institutions that aid in First Nations' reconciliation.

The Post-CM agenda of a day to day reserve land maps via geomatics tools/data is best illustrated by the Mississauga's of the New Credit First Nation, who use geo-technical map resources, to operate internal reserve lands administration. (McCarthy, 2013) The First Nations history of 'counter mapping' over the years developed much by local geomatics capacity, as (Pulla 2016), noted to past mapping operations. Geomatics technologies have changed allot since past 2.0 era counter mapping. (Brody 1981, Brealey 1995, Peluso, 1995, Poole 2003, Rundstrom 1995, Tobias 2000). First Nations communities can now decide with geomatics options: What data to collect and how to validate their map data, from a range of geospatial tools & data, then what maps do they will distribute? First Nations CM abilities vary, as does the size and scope of local mapping resources according to a new report. (Hatfield 2018) First Nations' counter mapping needs are constant, as is the political intent of the mapping, as a way to safeguard or to secure local indigenous lands. (Brody 1981, Jarvis, Stearman & MacLean, 1995, Aporta & Higgs 2005)

Study Intent

A test of a new counter map ideal was the study's focus, towards Canadian First Nations land claims that remains their social cause. The 'how' was generated by queries of; What geomatics tools create the local mapping products? The study intended to explore the pragmatic story, and gain new topic evidence. The study's limitation was that it was a small qualitative sample of practioners-scholars-indigenous agents to ask them about today's First Nations' geomatics praxis.

The sample size was not a large research pool but the study participants were chosen for their expertise in geomatics and in reserve lands tenure. This combination provided quality interviews, under a logical presupposition of discussing both geomatics and reserve lands over recent times. In a review of the



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



methods for qualitative interviewing, (Malterud, Siersma & Guassora 2016), outlined good researcher confidence that nine interviewees were sufficient given expertise backgrounds. This study was not going to be comprehensive from the sample size, but the logic was that First Nations-geomatics facts are known by all participants. The research goal was to gain data about the 3.0 era of CM, in new counter-mapping experiences and gaining new cultural understandings.

Research Question

The qualitative research tried to answer the core questions of: How has a Geomatics use changed over time as to 'counter mapping' activities? Second; What capacity issues frame the CM issue in: processes, content and in the style of implementation? Third; Where do participants see a 'post counter map' era ideal for First Nations' in Canada? Basically, the questions asked interviewees about a new counter map praxis. The quantitative data of the expert interviewees told us, about past, present and future praxis for First Nations. This dialogue was framed as: geomatics capacity, current and future counter map activities, local to national and post-counter mapping praxis.

Study Design

The study design was to discuss past to future 'counter map' ideas by a qualitative methodology, and in review of specific Canadian literature on the subject. This qualitative dialogue with geomatics experts; practioners, indigenous agents and academics, facilitated in interviews about their past, present and future perspectives on counter mapping. A proof of the past and future eras, from these persons aware about the Canadian First Nations reserve lands and geomatics will provided data of critical realism in exploration of historical, and futuristic issues about First Nations counter mapping.

The interview questions were of the 'how' and 'what' rather than 'why' orientations in a query about First Nations relationships and expectations towards the topic. This qualitative methodology hopes to gain a pragmatic view as Pulla's uses that 'our collective responsibility moving forward is to understand the interdisciplinary and applied social justice foundation from which counter-mapping emerged during the 20th century.' (Pulla's 2016, p. 291) The historical and current practice of CM does encompass many First Nations events over the past century. The narrative, of where it is now and where it is heading, tells a critical ethnographic story. The issue of local traditional indigenous knowledge, with new geospatial tools of online and direct data advances presents, an evidence in itself, a new counter mapping era.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



Research Method

The study method was a semi-structure interview method, to gain data input from very knowledgeable interviewees on the topic, using a semi-structured, two way phone interview with participants. The basic questions was about 'new counter mapping' from, Industry, Academic and First Nations experts, on what they knew. In conducting the phone interviews, several practical research items entered, 'the interviewer has a small budget and less time for travelling; looking for access to people on sites, which have closed or limited access... standardisation of the interview situation is not important..' (Opdenakker 2006, p.11) Given research study facts, phone calls were utilized with expert interviewees who answered all queries.

In the associated indigenous worldview of this study is, 'a two eyed seeing philosophy', (Marsh et al. 2015), that is one of a hybrid balance of indigenous and non-indigenous thinking. The two eyed seeing principles was part of this study, as an geomatics 'insider' person, exploring a First Nations community 'cultural' topic. Research ethics in this study were about: the indigenous topic, the control of geomatics information, First Nations' capacity in geomatics, and the political resilience of counter mapping. Also used, (Smith 2013), who put forth a holistic 'tidal pool model' that encompasses indigenous research ethics. Smith's model outlines the four levels of indigenous research state(s) of: 'a. survival, b. recovery, c. development and d. Self-determination with holistic processes for each of these research states as being of: a. Healing b. Decolonization c. Transformation, d. Mobilization practises.' (Smith 2013, p.121)

Analysis

The analysis of the interviewee dialogues found a number of issues, after conducting the interviews of; geospatial data access, mapping control, geomatics capacity, education-skills training, strategic planning, plus several outliner topics from the interviews data. The semi-structured phone conversations, had four general themes becoming evident. The analysis structure of the data, used Smith's 'tidal model', (Smith 2013), as a guide to assessing the data. Interviewee comments were placed into themes and of the four states outlined by Smith of: Healing, Decolonization, Transformation and Mobilization practise. Also, from the interviewee dialogues, four context factors were used to categorized data: principles, actors, new concepts and impacts. Out of this analysis matrix, several study insights came forth of: Who has to make changes? (actors) and How do interviewees view the changes of the geomatics-reserve lands era? (PCM)



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



Findings

The analysis findings were outlined in general terms and in implications for future research (ongoing doctoral research). The qualitative findings from the expert interviewee's had four themes of; Counter map praxis, First Nations geomatics, First Nations geo-futures and Post-counter map Futures.

Counter map praxis: The majority, 5 of 9 understood the history behind First Nations counter map praxis in Canada. Only 2 of 9 had little reserve lands praxis knowledge but all understood the legal principles behind the CM work and the actors involved. The counter map concepts of First Nations were known by all interviewees about the past CM land claims actions in Canada. The academics and industry persons had the best historical understanding about current geomatics technologies. There were many geospatial technical details stated as to the developments of geomatics use and in the impact of the mapping created. Changes in counter map process (geomatics) were discussed by the majority that lead to the next theme.

First Nations geomatics: In Canada's geomatics history, the majority, 5 of 9 understood about ongoing developments from geomatics technology. There was confusion as to particular First Nations geomatics cases, given the size and diversity of Canadian First Nations praxis. The geomatics cases told, varied from the study participants, as to knowing of current geomatics practise, in data processes and data collected by First Nations today. The First Nations interviewees did not know the scope of geomatics in CM but they did know the reasons for the mapping and the social justice reasons behind it.

The general consensus was that CM geomatics has enabled good mapping products to be done, by local experts of First Nations communities. The importance of maps and surveys at a local level, in having the geomatics technical capacity to do them, was stated by the majority. Reasons given in stating that, it was a way to defend land claims, control lands, and to gain territorial rights, Major Canadian cases known and cited, were of the Sto:lo, Cree, Nisga'a and Nunavut land claims. These cases illustrated the CM history and the use of geomatics, to generate mapping, by First Nations over the past thirty years by participants.

First Nations geo-futures: The majority, 7 of 9 agreed that First Nations' need to focus on a geo-capacity futures path in their development's today and in the future. This topic by interviewees was in geomatics-education and geomatics-skills training, for staffs, councils, and the next generation. A view by the First Nations participants was that better geomatics-education resources is the key issue. The ability to create self-own maps with local data was stated by the industry interviewee's as priority. Also, stated was the ability of First Nations to be able to 'jump ahead', given the power of geomatics today. As well, the easy



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



operability of geomatics tools, data and new online resources does provide greater mapping abilities than in the past. Key interviewee statements were that First Nations' need to adopt and to develop more local, online and mobile map abilities to enable them to do their own local maps. In interviewing one industry person, his phrase stated was, 'you map what you want to map now', of praxis today.

Interviewees saw new geomatic arrangements in First Nations capacity and support, as a priority need. A general statement by the majority of interviewee's foresees a future with Federal-Provincial changes, in geomatics education and skill training for First Nations communities. New geomatics continue to develop by and for First Nations' peoples/lands, in tools, in data and in distribution, that was seen as an evolution of the 'what you want' trend. The one outlier note was in the future loss of the professional map agents of: Who will be able to rule on what datasets/maps are valid? The easy user trends noted by industry persons was a key finding. It moved dialogue, to asking about future geomatics oversight means for First Nations communities. The oversight issue was noted as an issue by interviewee's, who see it as lack of leadership.

The lack of governmental and First Nations leadership in geomatics plans, partnerships, and in new legal frameworks (indigenous law) for lands tenure control and land claims process was stated by the majority of study interviewees. The lack of large capacity plans beyond the local reserve level was expressed by concerned First Nations and Academics interviewees. The land control issue that CM encompasses, was noted by all interviewees, especially with the emerging First Nations laws movement. This development issue was seen as where geomatics could be a driver issue, towards self-generated survey/mapping laws.

The impact of a First Nations geo-future was seen as a process by participants as a capacity building from 8 of 9 interviewees. A lone dissenter was a First Nations participant, who did not trust Governments nor First Nation leaders in moving forward in this mandate. The issue of reconciliation with First Nations was a comment made by the majority. Interviewees noted geomatics capacity should integrated into First Nations communities not just as haphazard plans. The majority saw plans towards geomatics education capacity as an incremental one. The future expressed, especially by Industry-Academics was one of supply-demand cycles determining the resources for geomatics and to its funding. The issue of geomatics education and geo-skills training was universally cited as the path for a First Nations' geomatics future.

Post-counter map Futures: The First Nations, use of counter mapping is part of their culture now, as one academic participant stated. A complete 9 of 9 interviewees saw the merits of a post-counter map era. All



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



agreed that it projected a positive outlook, for First Nations and could bring good relationships between indigenous and non-indigenous parties. Specific issues were noted; future reserve lands tenure changes, better funding for reserve geo-capacity, better geomatics education, and building new geo-partnerships.

Key comments were; a: developing a high level national First Nations mandate for geomatics policy and processes, b: developing an ongoing geo-capacity plan to fit the holistic First Nations' culture, c: gaining new lands management partnerships among First Nations agencies; (as there is no real plan from various First Nations groups seen), and d: relationships between the Federal-Provincial governments and First Nations' need work in reaching a future post-counter map vision. (reconciliation efforts being noted here)

The concept of PCM was accepted by the interviewees as put forth. Those exposed to geomatics from the academic community provided the best feedback as to a PCM era. The First Nations participants did see the merits of a PCM vision but also in new lands issues that PCM will have to deal with in the future. The issues of interest were, in new lands for First Nations, of additions to reserve lands and of complex lands claiming-tenure management needs. The collective interviewees' had no issue about a future view of a geo-future of the proposed PCM ideal. Most interviewees expressed their agreement that PCM geomatics was about; cadastral boundaries, geomatics education and new geo-administration apps that are expected capacity building parts for reserve communities. In PCM capacity building, specific queries were; What is needed for lands, to operate in co-management, in additions to reserve lands and in a reserve taxation?

The impact of PCM as an operational task, is doing better map work, that was seen as the PCM era, of 'now it takes three days instead of three months'. The speed and self-map abilities with new geomatics tools was seen as an ongoing issue. Another item expressed by First Nations interviewees, was that PCM is a way to 'decolonize', by gaining new geomatics abilities, to better manage and control their local lands. Better Geomatic tools and data options was seen as the future, especially in mapping, with direct to digital trends as noted by Industry-Academics familiar with the technology. A PCM view was noted as a good reconciliation path by gaining new data sharing relationships; in co-management, in solving reserve lands disputes, in better education-training partnerships, and in new legal developments within a PCM praxis.

Study Summary

The key findings and the implications for future research from this qualitative & literature study, provided by expert interviewee's, had four indigenous research state(s) & states, using (Smith 2013) tidal model of:



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



- Counter map praxis, found as a state of self-determination of survival and recovery, in a healing process within Canadian First Nations; that by a CM praxis this has moved some communities to a decolonization state. Healing, Decolonization and Transformation are working, given history.
- First Nations geomatics, found as a state of recovery & development, by using counter mapping to gain land claims, the research state is one of decolonization and transformation via geomatics capacity; in local mapping capacity seen as a priority, with funding, policy and resources needed.
- First Nation geomatics futures, found as an indigenous research recovery and development state that fits comments made about the use of geomatics capacity, as being research states that is at a decolonization and transformation stage with new geo-developments of local self-determination.
- Post-counter map futures, found as an indigenous research state as development/self-determining in comments of current geomatics (praxis) as a new transformation and mobilization practise of a future complex mapping mandate for First Nations communities that will be 'a gained consensus.'

Specific content for each of the four themes, from the interviewees noted topics in the majority;

- For future reserve lands praxis, First Nations need better geomatics education and skills training,
- Obtaining First Nations Geomatics tools and datasets for local lands management needs a plan,
- The development of new indigenous legal systems will need Geomatics (for digital sovereignty),
- New kinds of UNDRIP geo-based partnerships is foreseen in co-management of resource/ lands,
- Geomatics based applications in duty to consult, and ongoing land claims-dispute resolutions,
- New indigenous relations building with federal-provincial agencies, under UNDRIP legislation,
- In UNDRIP legislation, Canadian First Nations gain better local lands tenure/Geomatics services,
- Mapping resources to local First Nations Geomatics capacity as priority policy from interviewees,
- A post-counter mapping vision is seen as changing of institutional arrangements, yet unknown,
- Future research in First Nations Geomatics and associated topics needs a new research attention,
- First Nations Geomatics funding, policy and procedures needs more governmental resources,
- A PCM era ideal must incorporate traditional lands knowledge in gained leadership and vision.

In related to the counter map history, there was a past article, by Chambers (1998), outlining an agenda that is still valid today, for an emerging PCM era. Chambers identified 'five methodological challenges' that were faced in 1998 on counter mapping, that still seem to apply today for post-counter mapping, to:

'1. enable the realities and priorities of poor and marginalised people to be expressed and to be communicated to policy-makers,



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



2. enable trainers to facilitate attitude and behaviour change,
3. make normal bureaucracies more participatory,
4. build self-improvement into the spread of participatory methodologies,
5. enable people with power to find fulfilment in disempowering themselves' (Chambers,1998, p.280).

These past 'realities and priorities' remain for First Nations research in PCM, that is certainly a valid starting point, given the of Government of Canada promoting Bill C-262 (2019), UN Declaration on the Rights of Indigenous Peoples. The impact to First Nations in what this act means to future PCM praxis is unknown. Yet, an UNDRIP agenda does provide a new research avenue for First Nations-Geomatics. As, Walsham (2006), noted that 'all of us can learn a lot about our own country, and, ... The view that one 'knows' one's own country in any full sense is clearly wrong,' (Walsham, 2006, p. 323). This view is certainly a potential starting point in looking at the emerging First Nations PCM praxis.

Reserve lands geomatics research is rare as strategic planning for First Nations communities in Canada. The geomatics issue rests at local levels but needs national analysis as (Ballantyne 2015, 2010) indicated for Indian lands registry and survey processes. The Canadian government has reported recent about our indigenous geomatics. (Hatfield 2018). This report along with (UNDRIP 2008) provides an evidence to lead us to new PCM outcomes. The linking of reserve lands tenure, to local geomatics capacity, to gain new self-governing mechanisms is the unknown path for First Nations communities.

Geomatics for a decolonialising by using new mapping technologies provides a new counterinsurgency for First Nations' activists. Yet, a PCM praxis is about indigenous peoples controlling self-owned maps /surveys. The PCM era is a continuing development by First Nations in their collective vision according to the interviewees, who validated the PCM praxis ideal.

Conclusions

The literature on 'Counter mapping' has evolved since first coined by Pelosu (1995). The path of mapping actions by indigenous communities to gain and support lands rights actions has developed steadily. The use by First Nations was creating 'counter map' products to focus on lands claims and in the protection of tribal lands by communities. The new post-counter map by First Nations communities have taken on very complex applications and data mandates, in lands use planning and in environmental protection-services.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



The 'Post Counter Map' case is a continuation of CM history that (Pulla 2016), noted as old use of new geomatics tools. CM created counter map products, to oppose colonial forces, to be resilient and to have evidence in local and external reconciliation of a qualitative and quantitative value. This praxis can be expressed as ; "If we own our map, we own our story". (a post-counter map one) One interviewee stated, 'there needs to be more attention and resources provided to First Nations in Canada', which was a realistic comment. The specific issues discussed by participants of: land tenure, geomatics capacity and new geo-administrative resources were limited dialogues but they provided data into complex geomatics thinking. This research outcome left new questions, for new research of: What is the future path in a praxis for First Nations who have been marginalized? Second: Is the path to decolonizing state possible, with a geomatics praxis? The practical value of this praxis dialogue is in starting questions: What's the First Nations' future of PCM-Geomatics capacity that has resilient and reconciliation?

References

- Aporta, Claudio, and Higgs, Eric (2005). Satellite Culture: Global Positioning Systems, Inuit Wayfinding, and the Need for a New Account of Technology. *Current Anthropology* 46 (5): pp 729–53. <http://dx.doi.org/10.1086/432651>
- Aragon, Fernando M. and Kessler, Anke. (August 2017). Property rights on First Nations' reserve land, SIMON FRASER UNIVERSITY, Department of Economics, Working Paper Department of Economics, Simon Fraser University, Burnaby, British Columbia.
- Ballantyne, Ceilidh & Ballantyne, Brian (March 2017). Measuring informal housing & its socio-economic outcomes: First Nation reserves in Canada, World Bank Conference on Land and Poverty. *2017 WORLD BANK CONFERENCE ON LAND AND POVERTY*, The World Bank, Washington DC, March 20-24, 2017, pp 1-21.
- Ballantyne, Brian (2010). *Initiatives on Indigenous lands, Chapter 4 in Surveys, parcels & tenure on Canada Lands, (1st ed)*, Edited by Ballantyne, Dr. Brian, Public Works and Government Services Canada, p. 49-60.
- Ballantyne, Brian, Flanagan, Tom, Anderson, Terry, Jules, C.T. Manny and Lebourdais, Mike. (December 2014). *Establishing property rights systems, Chapter 3 in Building a competitive FN investment climate*, Retrieved from:www.tulo.ca Tulo Centre of Indigenous Economic, p.108-142
- Ballantyne, Brian. (February 12, 2015). Modernizing the Indian Lands Registry: An institution that matter, A wee study on modernizing the ILR pursuant to the Report of the Standing Committee on Aboriginal Affairs & Northern Development. March 2014, Surveyor General Branch, NRCAN, pp 1-20.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



- Barbeau, Christine D., Cowan, Don & Tsuji, Leonard J. S. (2016). Increasing the Adaptive Capacity of Indigenous People to Environmental Change: The Potential Use of an Innovative, Web-Based, Collaborative-Geomatics Informatics Tool to Reduce the Degree of Exposure of First Nations Cree to Hazardous Travel Routes. Chapter 4, Geospatial Technology- Environmental & Social Application, Retrieved from: <http://dx.doi.org/10.5772/103394>, pp75-98.
- Bill C-262 Government of Canada. (2019). United Nations Declaration on the Rights of Indigenous Peoples Act: An Act to ensure that the laws of Canada are in harmony with the United Nations Declaration on the Rights of Indigenous Peoples, Retrieved from: <https://openparliament.ca/bills/42-1/C-262/>
- Bill C86 Government of Canada. (2019). Retrieved from: <https://openparliament.ca/bills/42-1/C-86/>
- Brealey, Ken G. 1995. Mapping them 'Out': Euro-Canadian Cartography and the Appropriation of the Nuxalk and Ts'ihqot' in First Nations' Territories, 1793-1916. *Canadian Geographer* 39 (2) (Summer 95): pp 140.
- Brody, H. (1981). *Maps and Dreams: Indians and the British Columbia Frontier*. Douglas and McIntyre, Vancouver. British Columbia, CA.
- Bryan, J., & Wood, D. (2015). *Weaponizing maps: Indigenous peoples and counterinsurgency in the Americas*. Guilford Publications.
- Cadeau, F. (2018), Interviewees, Qualitative Study, DSOC 740, Royal Roads University, B.C.
- Calder et al. v. Attorney-General of British Columbia. [1973]. S.C.R. 313 Retrieved from: <https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/5113/index.do>
- Chambers, Robert. (1998). Beyond "Whose Reality Counts? New Methods We Now Need?" Institute of Development Studies, University of Sussex, Brighton, BNI 9RE, United Kingdom Studies in Culls., *Orgs. and Socs.* , Vol. 4, pp. 279-301
- Chapin, M., Lamb, Z., & Threlkeld, B. (2005). Mapping Indigenous Lands. *Annual Review of Anthropology*, 34(1), Retrieved from: <https://doi.org/10.1146/annurev.anthro.34.081804.120429> pp 619–638.
- Echo-Hawk, Walter R., (2013). *In the Light of Justice: The Rise of Human Rights in Native America and the UN Declaration on the Rights of Indigenous Peoples*, Fulcrum Publishing.
- Engler, Nate J. , Scassa, Teresa, and Taylor, D.R. Fraser. (Fall 2013). Mapping Traditional Knowledge: Digital Cartography in the Canadian North. *Cartographica*: Volume 48, Number 3. pp. 189-199.
- Flanagan, T., Alcantara, C., & Le Dressay, A. (2010). *Beyond the Indian Act: Restoring Aboriginal Property Rights*, Montreal: McGill-Queen's University Press.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



- Fraser, D. R. Taylor and Caquard, Sébastien. (2006). Cybercartography: Maps and Mapping in the Information Era. *Cartographica: the International Journal For Geographic Information and Geovisualization* 41 (1): pp 1-6.
- Geomatics. (2018). Retrieved from: <https://www.nrcan.gc.ca/earth-sciences/geomatics/10776>
- Google Indigenous Mapping workshops (IMW). (2018). Retrieved from: <https://www.indigenousguardianstoolkit.ca/community-resource/indigenous-mapping-workshop>
- Hatfield Consultants, (MARCH 2018). CANADIAN GEOSPATIAL DATA INFRASTRUCTURE (CGDI) USER NEEDS ASSESSMENTS. File No. - *NRCan-5000034704*: Part A – Canadian Stakeholders, Part B – Indigenous Communities and Spatial Data, Prepared for: NATURAL RESOURCES CANADA, OTTAWA, Canada
- Hickling, Arthurs, (2001). Technology Management, Strategy and Economics: Final Report Social and Economic Review of the Impact of Land Survey and Registration Systems on Canada Lands. Sullivan, Peter, ed.. *HAL Ref: 7065*, Prepared for: Legal Surveys Division Natural Resources Canada
- Hirt, Irene, (2012). Mapping Dreams: Towards the Recognition of Indigenous Geographical Knowledge. *Cartographica* 47(2): pp 105-20.
- Hunt, D., & Stevenson, S. A. (2017). Decolonizing geographies of power: indigenous digital counter-mapping practices on turtle island. *Settler Colonial Studies*, 7(3), 372–392.
- Indigenousguardianstoolkit, (2019). Retrieved from <https://www.indigenousguardianstoolkit.ca/>
- Jarvis, Keith A.; Stearman, & MacLean, Allyn. (1995). Geomatics and Political Empowerment: The Yuqui. *Cultural Survival Quarterly*, Issue 18.4,
- Knauer, Andrew. (2010). Land titling policies and economic growth: An empirical analysis of First Nations Land Management Act. Research Paper, Department of Economics, University of California, Santa Barbara, pp 1-26.
- Marsh, T. N., Cote-Meek, S., Toulouse, P., Najavits, L. M., & Young, N. L. (2015). The Application of Two-Eyed Seeing Decolonizing Methodology in Qualitative and Quantitative Research for the Treatment of Intergenerational Trauma and Substance Use Disorders,. *International Journal of Qualitative Methods*. 14(5), pp1-13.
- Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies, Guided by information power. *Qualitative Health Research*, 26(13), pp 1753- 1760.
- McCall M.K., and Dunn C.E. (2012). Geo-information tools for participatory spatial planning: Fulfilling the criteria for ‘good’ governance?. *Geoforum* 43, <http://dx.doi.org/10.1016/j.geoforum.2011.07.007>, pp 81–94.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



- McCall M.K., (2003). Seeking good governance in participatory-GIS: a review of processes and governance dimensions in applying GIS to participatory spatial planning. *Habitat international* 27 (4), pp 549-573.
- McCarthy, Daniel D. (2013). Collaborative Geomatics and the Mississaugas of the New Credit First Nation: Triaging Requests for Planning Development Consultation. *The International Journal of Technology, Knowledge, and Society* Volume 9, techandsoc.com, ISSN: 1832-3669, p. 1-15.
- McCarthy, Daniel D., Isogai, Andrea, Gardner, Holly L., Karagatzides, Jim D., Vandenberg, Skye, Barbeau, Christine, Charania, Nadia, Edwards, Vicky, Cowan, Don, and Tsuji, J.S. Leonard. (2013). Examining the Potential Use of the Collaborative Geomatics Informatics Tool to Foster Intergenerational Transfer of Knowledge in a Remote First Nation Community. *The Australian Journal of Indigenous Education*. 42, doi:10.1017/jie.2013.10, pp 44-57.
- Olson, Rachel, Hackett, Jeffrey & DeRoy, Steven. (2016). Mapping the Digital Terrain: Towards Indigenous Geographic Information and Spatial Data Quality Indicators for Indigenous Knowledge and Traditional Land-Use Data Collection. *The Cartographic Journal*, 53:4, pp 348-355. <https://doi.org/10.1080/00087041.2016.1190146>
- Opdenakker, Raymond. (2006, August). Advantages and Disadvantages of Four Interview Techniques in Qualitative Research [44 paragraphs]. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 7(4), Art. 11,
- Participatory GIS. (2018). Retrieved from: <http://www.srrmcentre.com/gis>
https://en.wikipedia.org/wiki/Participatory_GIS
- Peluso, N. L. (1995). Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. *Antipode*, 27(4), pp 383–406.
- Poole, Peter. (2003). Cultural Mapping and Indigenous Peoples: A Report for UNESCO. UNESCO.
- Pualani, Renee Louis, Johnson, Jay T., and Pramono, Albertus Hadi. (2012). INDIGENOUS CARTOGRAPHIES AND COUNTER-MAPPING: Introduction: Indigenous Cartographies and Counter-Mapping. *Cartographica* 47:2, pp. 77–79 doi:10.3138/carto.47.2.77
- Pulla, Siomonn P. (2016). Critical Reflections on (Post)colonial Geographies: Applied Anthropology and the Interdisciplinary Mapping of Indigenous Traditional Claims in Canada during the Early 20th Century. *Human Organization: Winter 2016*, Vol. 75, No. 4, pp. 289-304. <https://doi.org/10.17730/1938-3525-75.4.289>
- Pyne, Stephanie and Taylor, D.R. Fraser. (2012). Mapping Indigenous Perspectives in the Making of the Cybercartographic Atlas of the Lake Huron Treaty Relationship Process: A Performative Approach in a Reconciliation Context, Geomatics and Cartographic Research Centre (GCRC) / Carleton University, Ottawa, Canada, *Cartographica*, 47:2, pp. 92–104 doi:10.3138/carto.47.2.92



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



- Radjawali, Irendra, Pye Oliver, and Flitner, Michael. (2017). Recognition through reconnaissance? Using drones for counter-mapping in Indonesia', *The Journal of Peasant Studies*, Vol. 44, No. 4, pp 817–833, <https://doi.org/10.1080/03066150.2016.1264937>
- Rainie, S. C. , Schultz, J. L. , Briggs, E. , Riggs, P. , Palmanteer-Holder, N. L. (2017). Data as a Strategic Resource: Self-determination, Governance, and the Data Challenge for Indigenous Nations in the United States. *The International Indigenous Policy Journal*, 8(2), Retrieved from: <http://ir.lib.uwo.ca/iipj/vol8/iss2/1>, pp 1-29.
- Rundstrom, R. A. (1995). GIS, Indigenous Peoples, and Epistemological Diversity. *Cartography and Geographic Information Science*, 22(1), pp 45–57 <https://doi.org/10.1559/152304095782540564>
- Sandström, Per, Granqvist Pahlén Tina, Edenius Lars, Tømmervik Hans, Hagner Olle, Hemberg Leif, Olsson Håkan, Baer Karin, Stenlund Thomas, Göran Brandt Lars and Egberth Ambio Mikael. (Dec.2013). Conflict Resolution by Participatory Management: Remote Sensing and GIS as Tools for Communicating Land-use Needs for Reindeer Herding in Northern Sweden. Vol. 32 No. 8, *Royal Swedish Academy of Sciences*, pp 557-569.
- R. v. Williams, [1998]. Supreme Court of Canada (2014). 1 S.C.R. 1128. Retrieved from: <http://www.indigenousbar.ca/cases/williams.PDF>
- SLAM: Simultaneous Localization and Mapping. (2017). Retrieved from: <https://www.lifewire.com/what-is-slam-technology-2495534>
- Smith, L. T. (2013). *Decolonizing methodologies: Research and indigenous peoples*. Zed Books Ltd..
- Stó:lō Research and Resource Management Centre. (2018). Retrieved from: <http://www.srrmcentre.com/gis>
- Sullivan, Peter. (2017). A view to the future. Surveyor General, Ottawa, Retrieved from: <https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/pdf/Aviewtothefuture.pdf>, p.9.
- Sullivan, Peter (ed.). (2013). Parcel fabric renewal: Towards a community-based, cost-effective and timely land development framework. Canada Surveyor General Branch, Earth Sciences Sector, Natural Resources Canada, Edmonton. Retrieved from: <http://www.nrcan.gc.ca>, pp 1-48.
- Tompkins, Erin & Ballantyne, Brian (March 2017). Reconciling Indigenous lands with the Honour of the Crown: Certainty in bounds, security in parcels & equity in rights. World Bank Conference on Land and Poverty, 2017 WORLD BANK CONFERENCE ON LAND AND POVERTY, The World Bank, Washington DC, March 20-24, 2017, pp 1-20.
- Tobias, Terry. (2000). *Chief Kerry's Moose: A Guidebook to Land Use and Occupancy Mapping, Research Design and Data Collection*. Vancouver: Union of BC Indian Chiefs and Ecotrust Canada.



Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019



Tobias, Terry N. (2009). *Living Proof: The Essential Data-Collection Guide for Indigenous Use- and-Occupancy Map Surveys*. Union of British Columbia Indian Chiefs, and Ecotrust Canada. Vancouver, BC: Ecotrust Canada

United Nations, (March 2008). Article 27 of 61/295, United Nations Declaration on the Rights of Indigenous Peoples, (UNDRIP) Published by the United Nations 07-58681

Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, 15(3), pp 320-330