ANNUAL CANADIAN CARTOGRAPHIC ASSOCIATION CONFERENCE 2019

Held in collaboration with the Canadian Institute of Geomatics & the Northern BC GIS Users Group

CCA2019 UNBC

Prince George May 22-24

Canadian Cartographic Association
l'Association canadienne de cartographie

CANADIAN INSTITUTE OF GEOMATICS
ASSOCIATION CANADIENNE DES SCIENCES GÉOMATIQUES

UNIVERSITY OF NORTHERN BRITISH COLUMBIA
PRINCE GEORGE, BC

MAY 22—24, 2019

MAPPING OUR VALUES: SOCIAL, HISTORICAL, AND NATURAL

esri Canada

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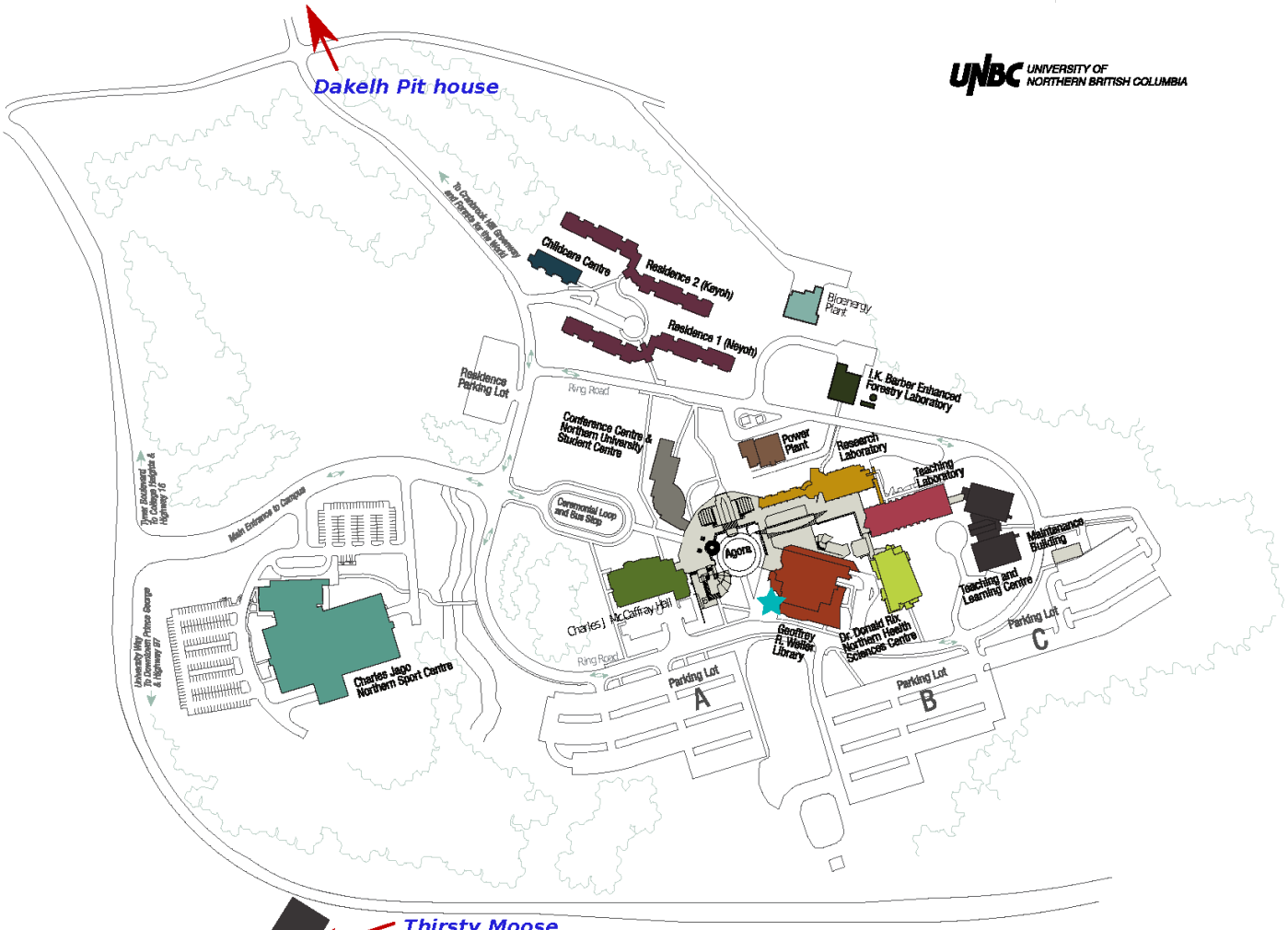
TDB

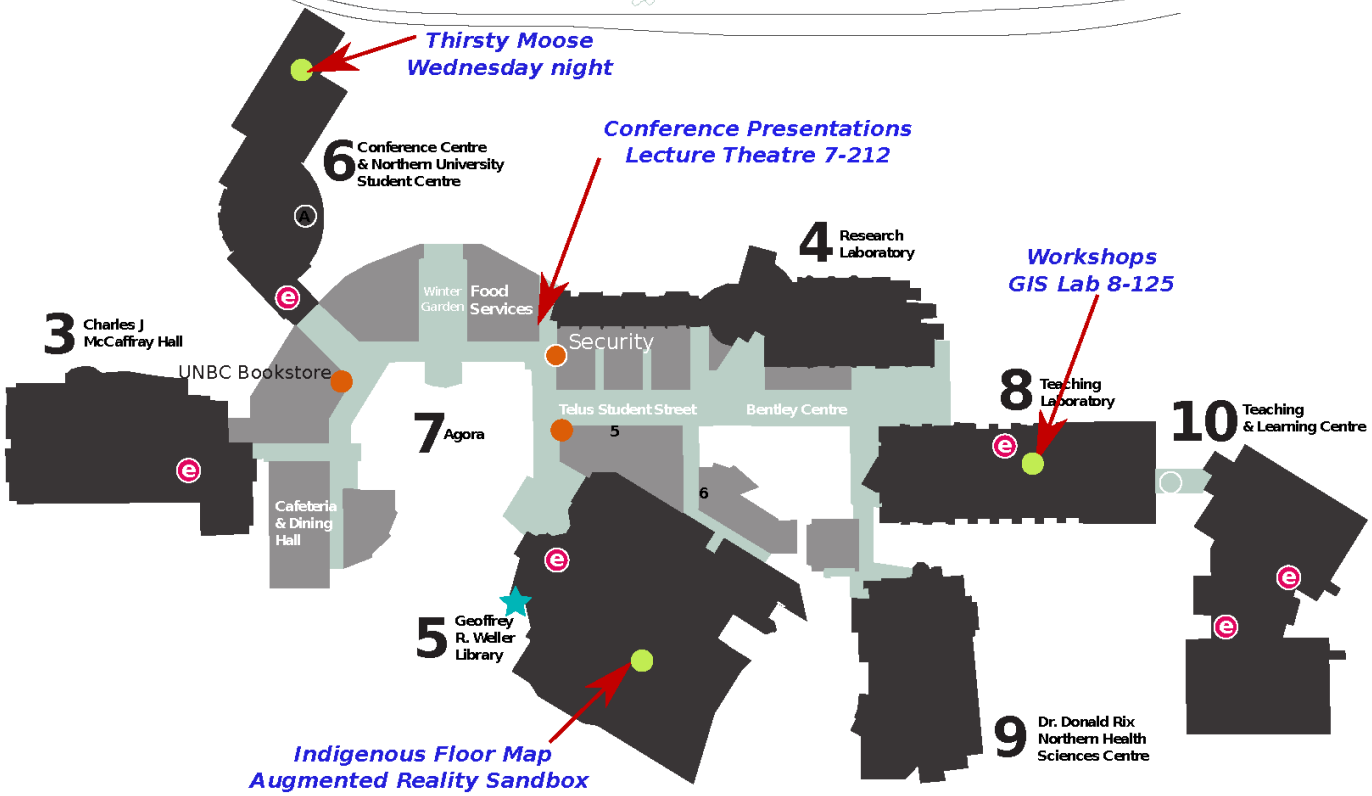
PRINCE GEORGE

UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA

UNBC Campus Map

CCA2019 UNBC
Prince George May 22-24





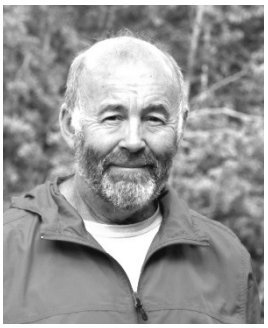
Welcome to CCA2019

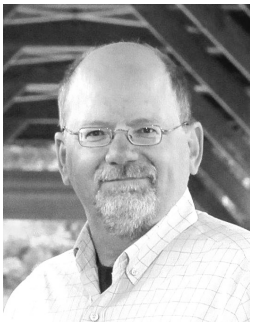
CCA2019 UNBC
Prince George May 22-24

Welcome to Prince George & UNBC, the northernmost city in Canada with greater than 50,000 inhabitants and the country's northernmost university. Prince George is the 'Spruce Capital' of Northern BC, situated at the crossroads of Highway 16, running East-West between Prince Rupert and Edmonton, and Highway 97, North-South linking the Lower Mainland with the Alaska Highway. The Indigenous name for Prince George is Lheidli ("where the two rivers flow together") as it is here that the Fraser and Nechako rivers meet. CCA2019 is being held on the traditional territory of the Lheidli T'enneh First Nation ("The People of the Confluence of the Rivers").

The UNBC campus, located on Cranbrook Hill 100 metres above the city below, was opened in 1994 with great local support to provide academic and professional training in Northern BC. It is aesthetically designed with direct access to hiking and biking trails and the potential to see wildlife and panorama views of downtown.

Technical workshops start the conference on May 22, organised by local northern BC GIS users, Scott Emmons and Alex Bevington involving remote sensing and GIS technology. The next two days feature 32 oral presentations including the keynote by Chris Brackley on the Giant Floor Map of Indigenous Canada, on display in the University's Geoffrey R. Weller library. The library is also hosting the augmented reality sandbox kindly provided by Eclipse Geomatics (Smithers, BC). Our first day wraps up with a wine tasting and banquet event at the Northern Lights Winery (Canada's northernmost), with generous sponsorship from local companies SparkGeo and TDB Consultants Inc. We also thank Esri Canada for their support. Our second day concludes with a downtown photo tour, and social event including PechaKucha slide shows. An optional field trip to the historic town of Barkerville on the Saturday wraps up the conference.





CCA Organizing Committee

Roger Wheate (UNBC), Scott Emmons (UNBC), Alex Bevington (BC Gov.), Dick Mynen (TDB), Dana Schwehr (SparkGeo, CEO Will Caddell), Audrey Faber (UNBC), Aita Bezzola (UNBC)
Program design by Karen Dietrich (UNBC)

Schedule at a Glance

CCA2019 UNBC
Prince George May 22-24

Wednesday, May 22, 2019	
8:15	Meet & Greet Coffee
9:00 & 10:45	Morning Workshops
12:15	Lunch
1:15 & 3:15	Afternoon Workshops
4:30	Guided walk to Dakelh Pit house along Greenway Trail
5:30	Icebreaker—Thirsty Moose Pub

Thursday, May 23, 2019	
8:00	Meet & Greet Coffee
8:30	Conference Welcome
9:00	Keynote: Indigenous Peoples Atlas of Canada
10:30	Sessions: Indigenous Mapping
12:00	Lunch
1:00	Session: Digital Technology & Data
3:00	Sessions: Online Mapping
5:30	Wine Tasting and Buffet—Northern Lights Winery

Friday, May 24, 2019	
8:00	Morning Coffee
8:30	Sessions: Health—Human, Wildlife, & Landscape
10:30	Sessions: Historical Mapping
12:00	Lunch
1:15	Sessions: LiDAR and Photogrammetry
3:00	Sessions: BC Mapping
5:30	Downtown Adventure
6:30	Social Event & PechaKucha

Saturday, May 25, 2019	
9:00—6:00	Trip to Historic Barkerville, BC

Wednesday 22 May—Schedule

CCA2019 UNBC
Prince George May 22–24

Time	Event	Location
8:15—9:00	Meet and Greet Coffee	Bentley Centre
9:00—10:15 concurrent sessions	Introduction to accessing and using freely available Remote Sensing Data: Google Earth Engine	8-127
	Enterprise Spatial Data Collection & Management using Open Source tools: QGIS	8-125 (GIS Lab)
10:15—10:45	Coffee Break	Library 2nd floor
10:45—12:15 concurrent sessions	Introduction to accessing and using freely available Remote Sensing Data: Google Earth Engine	8-127
	Enterprise Spatial Data Collection & Management using Open Source tools: QGIS	8-125 (GIS Lab)
12:15—1:15	Lunch Break	UNBC Cafeteria
1:15—2:45 concurrent sessions	Introduction to mapping using Open Source Software: QGIS Desktop	8-127
	Analysis of Remote Sensed imagery using free online tools	8-125 (GIS Lab)
2:45—3:15	Coffee Break	Library 2nd Floor
3:15—4:30 concurrent sessions	Introduction to mapping using Open Source Software: QGIS Desktop	8-127
	Analysis of Remote Sensed imagery using free online tools	8-125 (GIS Lab)
4:30—5:30	Guided walk to Dakelh Pit House	Meet at Bentley Centre
5:30—8:00	Campus Pub Icebreaker	Thirsty Moose

Thursday 23 May—Schedule

CCA2019 UNBC
Prince George May 22-24

Time	Event	All sessions in Lecture Theatre 7-212
8:00—8:30	Meet and Greet Coffee — Bentley Centre	
8:30—9:00	Welcome	
9:00—10:00	Keynote: Chris Brackley, *AsTheCrowFlies*	
	Cartography Royal Canadian Geographic Society — Indigenous Peoples Atlas of Canada: Mapping Nations Without Borders	
	Visit to the 8 x 11m Indigenous Peoples of Canada Giant Floor Map — UNBC Library	
10:00—10:30	Coffee Break — Bentley Centre	
10:30—12:00	Frank Tough, *U. Alberta* "Little is known of the interior" Historical cartographic sources as indications of the state's effective control over the Métis of the Île-à-la Crosse region	
	Karen Church, *UNBC* Dormant inland lifeways of Graham Island, xaadlaa gwayee	
Sessions: Indigenous Mapping Chair: Agnes Pawlowska-Mainville UNBC, First Nations Studies	Shane Doddridge, *Tŝilhqot'in National Government* On the Map: Colonial Adoption of Indigenous Toponomies	
	Mitch McFarlane, *Takla First Nation* Takla Nation's way of creating base maps for collecting information out on the land	
12:00—1:00	Lunch Break — UNBC Cafeteria	
1:00—2:30	Johanna Pfalz, *Eclipse Geomatics* Mapping in Motion: The Augmented Reality Sandbox	
	Erin Lemky, *Safe Software* Automation: The Efficient Cartographer's Trade Secret	
Sessions: Digital Technology & Data Chair: Monica Lloyd CCA, President	Ted MacKinnon, *Natural Resources Canada* A Coast to Coast look at Canadian Geospatial Data	
	Matt Sakals, *BC Government, FLNRORD* Remotely Piloted Aircraft Systems technology and photogrammetry	
	Karen Dietrich, *UNBC* Effects of Geographic Extent on Systematic Conservation Planning Outcomes (10 Minute Talk)	
2:30—3:00	Coffee Break — Bentley Centre	

(con't) Thursday 23 May—Schedule

CCA2019 UNBC
Prince George May 22-24

Time	Event	All sessions in Lecture Theatre 7-212
3:00—4:30	Scott Atherton, *City of Prince George* GIS on the hot seat: How the city of Prince George's GIS and Fire Departments work to save taxpayers money on insurance Lizzy Hoffmann, *Eclipse Geomatics* Collaborative Mapping: the Skeena Maps Portal Paul Heersink, *Esri Canada* Updating Online National Vector Cache Maps Monica Lloyd, *COGS* Annapolis Valley Trails Coalition: An Enterprise GIS Solution Ian Parfitt, *Selkirk College* Columbia Basin Watershed Network (CBWN) mapping (10 Minute Talk)
Sessions: Online Mapping Chair: Byron Moldofsky CCA, Treasurer	
5:30—9:00	Wine Tasting and Buffet — Northern Lights Winery 745 Pulpmill Rd, Prince George Drive yourself there or catch the rented bus from either the UNBC bus loop or downtown at the Ramada. Update will be given Thursday during the conference.

Friday 24 May—Schedule

CCA2019 UNBC
Prince George May 22-24

All sessions in Lecture Theatre 7-212

Time	Event
8:00—8:30	Morning Coffee & Snacks — Bentley Centre
8:30—10:00 Sessions: Health — Human, Wildlife, & Landscape Chair: Neil Hanlon UNBC, Geography	Erik Ellehoj, *Ellehoj-Redmond Consulting* Alberta Triple Prescription Program Atlas Kristen Hirsh-Pearson, *UNBC* Canada's Human Footprint; Finding the Wild, Intact, and Human Dominated Ekaterina Daviel, *Eclipse Geomatics* Northwest Infrastructure Mapping Project Hossameldin El Alqamy, *BC Government, FLNRORD* Using greater flamingo tracking and count data in delineating marine protected areas in the coastal zone of Abu Dhabi, UAE Jennifer Johnston, *Inspirit Cartographics* The Art and Science of Map Production (10 Minute Talk)
10:00—10:30	Coffee Break — Bentley Centre
10:30—12:00 Sessions: Historical Mapping Chair: Julia Siemer CCA, Past President	Byron Moldofsky, *U. Toronto* Lives in Motion: Analysing internal migration in Southern Ontario between 1861 and 1871 using GIS and cartographic techniques Jeff Clark, *Clark Geomatics* Hudson's Bay Company Heritage Trail Map (From paper to pixels to paper) Robert Cocking, *Geological Survey of Canada* The Highly Formalized Cartography of the Geological Survey of Canada Mark Jeffery, *goodwoodglobes* Reinventing the Globe
12:00—1:15	Lunch & CCA Annual General Meeting — UNBC Cafeteria

(con't) Friday 24 May—Schedule

CCA2019 UNBC
Prince George May 22–24

Time	Event	All sessions in Lecture Theatre 7-212
1:15—2:30	Sessions: LiDAR & Photogrammetry Chair: Chris Jackson, UNBC, Geography	Sean Lackie, *TDB* Left but Not Forgotten: Mapping Waste Residue Piles in British Columbia using LiDAR and Photogrammetry
		Emily Bornestig, *UNBC/TDB* The Process and Challenges of Producing High Resolution Orthoimages in the Thousands Using Agisoft Photoscan
		Ben M. Pelto, *UNBC* A Multi-faceted Approach to Studying Glacier Mass Change in the Columbia and Rocky Mountains, Canada
		Luizmar de Assis Barros, *UNBC* Assessing set-aside old-growth forests with airborne LiDAR metrics
2:30—3:00	Coffee Break — Bentley Centre	
3:00—4:30	Sessions: BC Mapping Chair: Ted MacKinnon, CCA, Vice President	Joe Burkinshaw, *SparkGeo* Shady Business: Adventures in Terrain Mapping
		Morgan Hite, *Hesperus Arts* Mt. Edziza Provincial Park Mapping
		Hunter Gleason, *BC Government, FLNRORD* Regional patterns in the influence of ocean-climate teleconnections on the timing and duration of MODIS derived snow cover in BC
		Wes Smith, *BC Government, FLNRORD* On Fire: A Glimpse into BC Wildfire Service Incident Mapping
5:30—6:30	Downtown Adventure — Downtown Prince George	
6:30—9:30	Social Event & PechaKucha — Hubspace 1299 3rd Avenue, Prince George	

Keynote Speaker

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Indigenous Peoples Atlas of Canada: Mapping Nations Without Borders

Chris Brackley, *AsTheCrowFlies*, Cartography Royal Canadian Geographic Society

At a time when the Canada's stated relationship with Indigenous Peoples is described as "Nation to Nation", two questions quickly arise. What are the nations that is Canada building relationships with; and where exactly are these nations? A good place to look for answers to these questions is in map drawers and spatial data warehouses. The language that defines national existence has long been cartography. Drawing border lines on a map creates a bounding box for a collective national identity, allowing a nation to say "inside these lines is where we live". And of course, bounding a nation on a map asserts the nation's possession of the land, saying "these lands are ours".

But the Indigenous peoples of Canada do not have simple contiguous borders defining either their national existence, or their possession of land. They exist as a disconnected patchwork of communities, reserves, treaty areas and settlement lands. So when Chris Brackley was charged with developing the cornerstone map for the Indigenous Peoples Atlas of Canada in collaboration with the project's partners; The Assembly of First Nations, Inuit Tapiriit Kanatami, The Métis National Council, and the National Centre for Truth and Reconciliation, the challenges were many.

Chris' keynote talk will explore how he faced and overcame these challenges. Where did the data come from, and how was it categorized, and grouped? With a credible suite of data collected, what cartographic tools did he use to meaningfully show Indigenous Nations within the Nation of Canada? The talk will conclude with a hands on visit to the 8 x 11m Indigenous Peoples of Canada Giant Floor Map.

Chris Brackley is a cartographer, who has been making maps for the last twenty years. Inspired by a love of the nature, and the topographic maps that reveal the interconnection of the natural world, Chris started "improving" canoe tripping maps by manually adding historical sites, modern management areas, and whatever other information he could find in the 1990s. By the end of that decade, he had begun making maps of his own, drafting them manually with pen and ink. Eventually trained at Sir Sanford Fleming College as a digital cartographer, he started his freelance map-making company, As the Crow Flies cARTography in 2004. Since then, As the Crow Flies has made maps with a wide range of focuses and intents. They have worked with environmental organizations, making maps to educate and inspire politicians and the general public to greater protect the natural world. They have made fanciful maps to accompany books and films. And for the last eight years, Chris and As the Crow Flies have been making all of the cartographic content for the Royal Canadian Geographical Society, and their national magazine Canadian Geographic. In this role Chris has created hundreds of maps for the magazine, and a dozen Giant Floor Maps (8 x 11m), with three more currently in development. He lives in Limehouse Ontario with his wife and two children.

Chris Brackley
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Conference Workshops

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MORNING & AFTERNOON WORKSHOPS

Workshops for the conference are "hands on" workshops. Each workshop has an introductory session and a more advanced session. If you wish to participate in the introductory sessions you will need to bring a laptop (if you want to go through the materials), but for the more advanced sessions will make use of the computers in the GIS Lab at UNBC. Detailed information and pre-workshop requires online at cca-aac.org.

Introduction to accessing and using freely available Remote Sensing Data: Google Earth Engine

Alexandre Bevington, Research Earth Scientist, Omineca Region Ministry of Forests, Lands, Natural Resource Operations and Rural Development

9AM: Recent case studies from British Columbia
Using EO Browser, Planet, Landsat/Sentinel Look, NASA Worldview
Tour of recent wildfires, floods, forest harvesting, and glacier change
10AM: How to get more from online tools
Exporting and downloading imagery
Integrating into presentations
11AM: Visualization
Create animations, gifs and videos

Analysis of Remote Sensed imagery using free online tools (involves computer programming)

1PM: Introduction to GIT and Google Earth Engine
Large area mosaics, LandTrendR, Change over time, Image classification, etc.
3PM: Introduction to time series analysis
Export time series data from Google Earth Engine and analyze using "R" statistical software

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Enterprise Spatial Data Collection/Management using Open Source tools: QGIS

Scott Emmons, GIS Analyst, UNBC

9AM: Introduction to FOSS4G (Free and Open Source Software 4 Geospatial) enterprise software stack
Interactions of different pieces of software: Server OS, Relational Database install and setup PostGIS, Desktop QGIS, Web based data delivery
9:30 : Working with Open Standard data types
OGC data models and standards, Personal spatial databases (Spatialite – GeoPackage), shareable encapsulated data
10 AM: Creations of Enterprise spatially enabled Relational Database
Tools for creation of databases, addition of spatial data to database, analysis (overlays) inside the database
11 AM: Versioning data with your Enterprise spatially enabled Relational Database
Plugins, Tables organization for versioning, Testing your versions
11:30: Field Data collection using open source software (Geopaparazzi)
Android emulator, Forms, Data collection, import of data into QGI

Introduction to mapping using Open Source Software - QGIS Desktop

1PM: Introduction to FOSS4G (Free and Open Source Software 4 Geospatial)
Description of integrative approach to software development, Methods of installing QGIS and related software, Installation of software on attendee's laptops, Loading of a variety of vector data types
2PM: Navigation of the software
Panels, Menus, Processing Tools, Linkages to other software, Plugins
3PM : Create a simple map
Print Composer, Exporting a georectifiied Map, Creating a Web Map, Creating a 3D web Map

SESSION: INDIGENOUS MAPPING

"Little is known of the interior," Historical cartographic sources as indications of the state's effective control over the Métis of the Île-à-la Crosse region
Frank Tough, Faculty of Native Studies/University of Alberta

In the landmark Métis rights case, R. v. Powley, the Supreme Court of Canada employed the concept of effective control to determine the temporal benchmark for ascertaining if particular practices (e.g., hunting) were integral to a Métis way of life. If practices that were integral to a Métis way life had not been explicitly extinguished by the Crown prior to 1982, then today, such activities are protected constitutionally as Métis Aboriginal Rights. The determination of the date of effective control is an empirical problem requiring detailed historical research. In contrast to Crown claims to sovereignty, several interrelated activities can serve as criterion of the state's ability to establish effective control in new areas. The capacity to count the resident population (i.e., censuses of who inhabited the region); an enduring police presence with the ability to enforce laws and regulations; the investment and creation of public infrastructure and services; notable exploration and surveying activities (accurate and comprehensive maps of where); and enforceable changes to property rights (regulations concerning land use and ownership) can all indicate state intrusion followed by developing a presence in a region. To date, the case law does not suggest such a rigorous approach to assessing historical facts relating to the presence of government agents in frontier regions. With respect to the contemporary need to clarify Métis Aboriginal Rights, this analysis will focus on historical cartographic sources as a means to demonstrate the state's spatial knowledge of the Île-à-la Crosse region as one test of its effective control.

Dormant inland lifeways of Graham Island, xaadlaa gwayee
Karen Church, UNBC

For 22 years I was a resident of the Charlottes/xaadlaa gwaayee (Haida Gwaii, British Columbia). My two children were born and raised there, and I was trained in forest archaeology by xaadaas/local people, and registered professionals. For ten years I was the head archaeologist and heritage program manager for the Haida Tribal Society, and during the archaeological and cultural land values studies that we conducted under contact to logging companies and the Province, I learned from the land and my local colleagues. Together, we traversed hundreds of kilometers and identified thousands of culturally modified trees (CMT), which are protected artifacts within this rainforest. Understanding this landscape as I did, as industrial logging continued to destroy archaeological/cultural trail evidence, and the rainforest in general, I worked to find protection for heritage trails and the specific inland xaadaa culture they represent, which had gone dormant. None of the governments would officially recognize and protect the trails, in part because the trails are no longer visible, even though the CMTs were signposts along them. In this talk I will demonstrate where one such trail is located. I shall describe the landscape archaeological approach I used to do indicate where the trail is, which employed a GIS to contain, map and analyse the results, and Google Earth to provide three dimensional views.

On the Map: Colonial Adoption of Indigenous Toponomies
Shane Doddridge, Tŝilhqot'in National Government

Maps are commonly in error due to outdated or poor quality data, and most drivers who blindly rely on their vehicle's GPS will know this well, but it is rare to hear of when maps are so in error as to outright exclude communities of several hundred people. This has been a reality for six First Nation communities in British Columbia's Chilcotin region for decades. British Columbia's gazetted names database has never included these communities which is why Google Maps, not to mention most other published maps, have passed them by. Neighbouring colonial localities of lesser note, however, often with fewer services and no central cluster of homes, are considered major landmarks in the Chilcotin and are on most maps of the region. This is of particular concern in emergency situations where responders are often unclear of their destinations, but more than that, it is simply a gross misrepresentation of the human geography in the Chilcotin. Together these six communities form the Tŝilhqot'in National Government – a tribal council now known worldwide for their victory at the Supreme Court of Canada in 2014 where Aboriginal land title was acknowledged to exist, unextinguished, for the first time. In the wake of that decision, the Province of British Columbia and the Tŝilhqot'in Nation signed the Nenqay Deni Accord, a document outlining a shared vision with immediate and ongoing steps to achieve that vision in the spirit of lasting reconciliation. The recognition of Tŝilhqot'in place names, beginning with the names of the six major Tŝilhqot'in communities, was outlined in that document as being an important step towards that lasting reconciliation. The six Tŝilhqot'in community names were adopted into the official gazetteer by the Province of British Columbia on May 3rd 2019, and are now, quite literally, "on the map." This presentation explores that story.

Takla Nation's way of creating base maps for collecting information out on the land
Mitch McFarlane, *Takla Eirst Nation*

With the growth of activities and staff in the Lands Department of the Takla Nation, GIS data management has been expanding at a rapid rate. Field data collection is an important part of the spatial data management. In combination of the existing Open Source tools we have been using to manage our information, we are using an application called "Geopaparazzi" for field work. I will be illustrating the steps to use this customizable application from create of basemaps, vector overlays to data collection and integration.

SESSION: DIGITAL TECHNOLOGY & DATA

Mapping in Motion: The Augmented Reality Sandbox
Johanna Pfalz, President, Eclipse Geomatics

The Augmented Reality (AR) Sandbox is an interactive, three-dimensional, augmented reality exhibit that can be used as an educational tool to explore the importance of water, hydrology, earth science, and environmental studies. Eclipse Geomatics constructed the Sandbox using open-source software developed by the UC Davis' Keck Center for Active Visualization in the Earth Sciences and everyday hardware to model and project a real-time representation of geographic terrain including a visualization of an elevation model with contour lines and a colour map onto the surface of the sand. As the sand is moved, the elevation model projected onto the sand changes with it, simulating real time land use situations. When an object is held above the sand (representing a cloud), a visualization of rain appears and flows down the slopes in a simulation based on real models of fluid dynamics. The Sandbox creates a highly tactile and stimulating learning experience for educators, students, and scientists. Eclipse Geomatics has partnered with the Bulkley Valley Research Centre to initiate an educational watershed-based program highlighting the Sandbox and its features.

Automation: The Efficient Cartographer's Trade Secret
Erin Lemky, Safe Software

Join this session to find out how cartographers are using FME to automate map creation. Maps deliver critical information for the people who need them, but creating and maintaining them can involve a great deal of manual effort. In this presentation, you'll see a round-up of the automations other cartographers are using to make their jobs easier and present beautiful, high-quality maps for end users. Topics will include integrating data from a wide range of sources including vector, raster, DTM, and tabular data from open source, open standards, and proprietary systems; quality checking the data before it becomes a map; tools to prepare the data, including coordinate system reprojection, generalizations and styling; and generating outputs to share for desktop and web cartography. You'll also catch a glimpse of some of the latest tools in FME that cartographers are excited about. Attendees will walk away with an overview understanding of what kinds of tasks they can automate to increase the efficiency and quality of map making.

A Coast to Coast Look at Canadian Geospatial Data
Ted MacKinnon, Natural Resources Canada

The concept of open data is not new, and Governments all across Canada have been unlocking the potential of open data for Canadians through new innovative online portals, and expanded datasets. Taking advantage of new technologies, some have been able to prioritize easy access to the data that the Canadian geospatial community can utilize to create third party products, while others are just getting started. This presentation aims to highlight organizations that are clear open data leaders, as well as some of the relatively new portals, and share some of the great data sets are available to the cartographic community.

Remotely Piloted Aircraft Systems technology and photogrammetry
Matt Sakals, BC Government, FLNRORD

Remotely Piloted Aircraft Systems technology and photogrammetry software can be used in concert to create orthophotographs and digital elevation models that can be used to map features of value. Even consumer-grade RPAS can be used in this manner but with some cost of accuracy. The objective of this research was to compare the accuracy of various RPAS (consumer through commercial grade) and post-processing photogrammetry software in a mixed open and dense forest area. On a single day, 14 flights with seven different aerial systems were conducted over a test site with 28 marked and RTK-GNSS surveyed positions (position error = 0.01 m); ten flights were conducted with the same predetermined flight route. Data from each flight was processed with both with and without ground control by 7 different photogrammetry applications or online services. Products derived from ground-controlled solutions are compared with respect to absolute positional error; products derived from non-ground-controlled solutions are compared for relative positional error. Including an analysis of non-ground-controlled solutions provides information on the accuracy of methods that are commonly used in rapid, reconnaissance-level mapping typical of natural resource management operations. Final results will provide an indication of the level of accuracy to be expected from various popular drone platforms and photogrammetry applications in forested environments. Ultimately, this will lead to decision support where the desired level of accuracy can determine the required RPAS and post-processing application combination.

Effects of Geographic Extent on Systematic Conservation Planning Outcomes
Karen T. Dietrich, MSc Candidate, UNBC

Conserving biodiversity is principally achieved through the designation of protected areas, guided by the process of systematic conservation planning. The aim of conservation planning is to identify networks of protected areas that represent regional biodiversity. The process involves using spatial data to identify conservation priorities and inform landscape-scale decisions. These analyses, however, are typically conducted at inconsistent scales and are frequently misaligned with the jurisdictional scope and scale of management decisions, as ecologically-relevant boundaries do not necessarily match opportunities for management actions. The inconsistencies in the planning extent could reduce the effectiveness and efficiency of conservation planning. In this study we will use SCP to evaluate how protected area selection varies when working at three nested scales. By contrasting the planning extents and scales, we will ascertain whether they influence conservation planning effectiveness, and quantify the efficiencies resulting from repeated regional analysis. We expect to find that scale dependence is demonstrable in conservation planning, and that the inclusion of spillover data outside a given jurisdiction better informs conservation priorities of the target landscape. Further, the study results are intended to demonstrate how broader-scale analyses enable planners to see how neighboring factors affect biodiversity priority areas, and provide a framework for keeping landscape-scale planning embedded within the regional-scale analyses.

SESSION: ONLINE MAPPING

GIS on the Hot Seat: How the city of Prince George's GIS and Fire Departments work together to save taxpayers money on insurance
Scott Atherton, City of Prince George

In 2013 Prince George Fire Rescue completed a Fire Underwriters Survey. The Fire Underwriters work with Municipalities to establish a risk grading based on the Fire Department, Fire Safety Control, Water Supplies and Emergency Communications. Ultimately the Insurers use the grading results from the Fire Underwriters to determine the insurance rates charged within the municipalities. Fire pre-plans were determined to be a relatively low cost, low impact item that would result in a high likelihood of the Fire Underwriters keeping Prince George at its current grading level. The fire department approached the City of Prince Georges' GIS Department for help with creation and distribution of these Pre-Incident Plans. This resulted in the creation of a secure, self-service mapping platform for use by the City of Prince Georges Fire Department.

Collaborative Mapping: The Skeena Maps Portal
Lizzy Hoffman, Information Specialist, Eclipse Geomatics

Many small conservation organizations collect spatial data but lack in-house GIS capacity, limiting their ability to use and manage this data. The Skeena Maps Portal, developed by the Skeena Knowledge Trust, provides an online, publicly accessible platform for basic mapping, spatial data management, and collaboration for organizations operating within the Skeena Watershed. The Skeena Knowledge Trust's purpose is to become a comprehensive source of information on wild Pacific salmonids in the Skeena watershed, including water quality, habitat, and population data. The Skeena Maps Portal is one of the tools the Skeena Knowledge Trust develops and maintains to improve information management related to Skeena watershed wild salmon. Users of the Skeena Maps Portal can view and download spatial layers and view, create, save, and print maps. In addition, the Skeena Maps Portal can be used for long-term spatial data management, sharing, and archiving. The Skeena Maps Portal allows users to upload and store spatial data, either publicly or privately. Private data storage allows users to manage sensitive data and securely share it with collaborators. The Skeena Maps Portal currently hosts over 100 spatial layers and more than 30 maps, with data sourced from the BC and federal governments, local organizations collecting environmental data, and historical reports.

Updating the Online National Vector Cache Maps
Paul Heersink, Esri Canada

Esri Canada has developed an automated process for updating an online national vector cache map using the latest in contributor data. This presentation will discuss the process and software used to do so.

Annapolis Valley Trails Coalition: An Enterprise GIS Solution
Monica Lloyd, NSCC COGS

Annapolis Valley Trails Coalition (AVTC) manages and maintains the 110 km of former rail line trail recently branded the Harvest Moon Trail. It runs from Grand-Pré to Annapolis Royal through little towns, agricultural fields and along the Annapolis River. The trails coalition has one co-ordinator who knows there is a better way to manage assets and improve data collection efficiencies but he needs our technical how-to help.

Over the course of the fall semester, students at COGS (Centre of Geographic Sciences) explored scalable Enterprise GIS solutions to manage trail assets. They modelled and built a spatial database and integrated it within desktop and web GIS solutions. A considerable amount of work the trails co-ordinator does is in the field. Part of the project involved exploring field mobility options and testing workflows in the field and with integrating data back into the spatial database. Once assets were mapped, students' final task was to build web mapping prototypes displaying such things as user counts or basic trail assets. Students wrapped up the project with a final presentation of their work to the AVTC stakeholders. This presentation will cover the various stages of teaching and learning we experienced while building a GIS for a real-world client.

10 Years of The Selkirk College – Columbia Basin Watershed Network Mapping Program
Ian Parfitt, Selkirk College

Since 2008 Selkirk College's Geospatial Research Centre (SGRC) has provided the Columbia Basin Watershed Network (CBWN) with mapping support. Selkirk and CBWN have developed a process for helping member watershed groups identify mapping needs and scoping projects. Selkirk then hires a co-op student from the college's Advanced Diploma in GIS to work with CBWN member groups over the summer. Maps showing threats such as forest or mineral tenures or assets such as trails dominate. General information maps are also popular: a map showing all the main watersheds around Kootenay Lake has been used the Friends of Kootenay Lake as a fund and awareness-raising tool for many years. We have also developed web applications and a physical model of a wetland that was 3D printed. The partnership has lasted for 10 years because all partners benefit. The students benefit through the experience of working directly with a client – the watershed group – to use their new GIS and cartography skills. They learn project management skills including time management and communications. The member group receives a tool that can help them meet their stewardship objectives. Selkirk faculty are able to provide mentorship and technical support to the students while extending their expertise to the wider community.

SESSION: HEALTH - HUMAN, WILDLIFE & LANDSCAPE

Alberta Triple Prescription Program Atlas
Erik Ellehoj, Medical Geographer/ Analytical Cartographer, Okaki Health Intelligence

The purpose of the Triplicate Prescription Program Atlas is to provide an overview of provincial TPP medication utilization. The College of Physicians and Surgeons of Alberta (CPSA) is responsible for the production and contents of the atlas with support from Okaki Health Intelligence. Provincial utilization data is presented for two analytic classes of medications: opioids (including codeine containing medications) and benzodiazepines (including zoplicone and zolpidem). The source of the information on medication utilization is dispenses from community pharmacies found within Alberta's Pharmaceutical Information Network (PIN). The atlas presents the data as tables, graphs, and maps .

Canada's Human Footprint; Finding the Wild, Intact, and Human Dominated
Kristen Hirsh-Pearson, MSc Candidate, UNBC

Canada is one of the signatories on the Convention on Biodiversity and its Aichi Biodiversity Targets. With these ambitious conservation targets, there is a need to better understand the distribution of threats to natural systems across the Canadian landscape. Global footprint maps have shown Canada as relatively 'wild' however, the threats mapped represent only a subset of threats relevant to Canada as the country still lacks a national scale cumulative threat study. Mapping threats to biodiversity on a national scale will help determine what systems are most intact and which areas are heavily threatened. Here we use geospatial techniques to build on existing global studies by including additional threats relevant to Canada, using a higher spatial resolution of 300 meters we create baseline data with the first Canadian Terrestrial Human Footprint map. Generally, we find that the southern part of Canada is experiencing higher levels of threat than northern ecosystems. However, our results reveal that Canada has less intact lands in the north than previously thought. Further results of this project will be important for the future of natural resource management and conservation planning in Canada .

Northwest Infrastructure Mapping Project
Ekaterina Daviel, Information Specialist, Eclipse Geomatics

The Northwest Infrastructure Mapping Project was initially completed in 2014 for a partnership of conservation groups based in the Skeena River watershed at a time when multiple proponents were vying to construct pipelines to supply the buzzing liquified natural gas (LNG) export industry on the northwest coast of BC. Five years later, the map is being updated with current constructed and proposed developments within the energy, mining, forestry, communication, and transportation sectors. The purpose of the project is to overlay current and proposed development with salmon habitat and provide a sense of potential cumulative impacts arising from industrial activities across northwest BC. Spatial information was sourced from DataBC and the map was assembled using QGIS software.

Using greater flamingo tracking and count data in delineating marine protected areas in the coastal zone of Abu Dhabi, UAE
Hossameldin El Alqamy, BC Government, FLNRORD

Systematic conservation planning is essential in the justification and design of protected areas, especially in an era where every piece of land or water is at a high premium. We used satellite tracking data and regular monitoring of Greater flamingos into the spatial prioritization planning tool Marxan to identify the most important zones for the conservation of the greater flamingo and many other species of waterbirds and marine habitats in one of the economically important areas in the coastal zone of Abu Dhabi. Locations from 11 satellite tracked flamingos and monthly count data since 2009 in the Bul Syayeef area showed a predominant use of a relatively small area which when integrated in Marxan provided optimum boundary with minimum cost. Marxan identified 1, 5, 10 and 15 ha planning units and provided the best solution with 15 ha. The reduced total area of 145 km2 is nearly 40% of the originally proposed area for protection, is more pragmatic and easy to establish, given the high importance of the area for economic development. Using approximately the same boundary, the proposed area was declared a Ramsar site in September 2016 and was subsequently declared a protected area through a government decree in September 2017.

The Art and Science of Map Production
Jennifer Johnston, Inspirit Cartographics

This presentation looks to challenge the conventions of modern day map making. I explore what constitutes as "modern" and how this is reflected in current methods of map production. I use the definition of cartography as the art and science of map production and look at what happens when we lean too far towards either extreme. I use examples to demonstrate the short coming of too art heavy and too science heavy in order to arrive at the conclusion that cartography and map production should strive to balance the art and the science for a better quality product.

SESSION: HISTORICAL MAPPING

Lives in Motion: Analysing internal migration in Southern Ontario between 1861 and 1871 using GIS and cartographic techniques
Byron Moldofsky, U. Toronto

The locational stability of families and individuals in nineteenth-century southern Ontario has been found to be less static and more dynamic than originally thought. This project identifies a sample of individuals and families who researchers were able to link between the 1861 and 1871 Canadian Census records. We map a variety of demographic factors based on the published aggregate census tables, and then explore ways of mapping the movements of those folks who migrated within the study area, in the context of those demographic attributes. Simplification techniques such as regionalization analysis to group together migration source areas by similar attributes, and edge bundling techniques to simplify the visualization of origin-destination flows are some of the methods explored.

Hudson's Bay Company Heritage Trail Map (From paper to pixels to paper)
Jeff Clark, Clark Geomatics

Originally a First Nations route for hunting and trade, the HBC adopted the trade route during the 1850s. The HBC's fur empire in western North America depended on this trail, securing Canada's reach to the Pacific. The map design focused on the historical awareness of the area, the character of the landscape and providing visual clarity. Using public domain data, state-of-the-art cartographic techniques, image processing workflows and a dash of black art, a map was published that represents the culmination of effort by all those involved in resurrecting this 170 year-old trail.

The Highly Formalized Cartography of the Geological Survey of Canada
Robert Cocking, Geological Survey of Canada

I will cover the history of Cartography at the Geological Survey of Canada, from pen and ink, pencil crayons and scribe coats to relational databases, science language and complex symbology. This talk is accompanied in the map gallery by 42"x36" maps showing bedrock and surficial geology of BC and the Yukon .

Reinventing the Globe
Mark Jeffery, goodwoodglobes

Historically, two-dimensional world maps, with their inevitable distortions in the sizes and shapes of the oceans and the continents, have reflected the social and cultural assumptions of the times in which they were created. Even as technology took us from the era of the two-dimensional page into that of the two-dimensional screen, little changed: the world map remained distorted. Finally, now, as we enter an era in which maker robots can take us into the third dimension, we have a way to banish these distortions to history. Since the Earth refuses to be flat, let it be round. I'm on a quest to carve beautiful, tactile, fully three-dimensional maps and globes out of wood. Based in the mountain town of Rossland, British Columbia, I've been looking for a way to reflect new social and cultural assumptions - more environmentally aware, more conscious that this planet is our home - by carving the world into wood using CNC router technology .

SESSION: LiDAR & PHOTOGRAMMETRY

Left but Not Forgotten: Mapping Waste Residue Piles in British Columbia using LiDAR and Photogrammetry
Sean Lackie, TDB Consultants Inc

The Canadian forestry sector is undergoing a period of rapid change due to the advancement and increasing affordability of modern geospatial technologies. To support field operations, and to anticipate changing legislation within British Columbia regarding the measurement of waste residue as a product of logging operations, the presentation describes a case study performed by the Scaling and Remote Sensing departments at TDB Consultants comparing traditional field survey methods to both airborne LiDAR and photogrammetrically derived point clouds. The process of waste pile formation is first described, along with a brief history of provincial legislation and field mensuration, before detailing the collection and processing of LiDAR and photogrammetric data to be used within a GIS for volumetric calculation. The potential of using OBIA techniques to create automatic classifiers for feature identification in large datasets is also explored. Finally, the practical utility of aerial collects using fixed wing aircraft vs. UAVs within a business setting is examined .

The Process and Challenges of Producing High Resolution Orthoimages in the Thousands Using Agisoft Photoscan
Emily Bornestig, UNBC

With a total project area of 4363 km2 (more than 1.5 times the area of all of Luxembourg), producing 2136 orthoimages of the area surrounding BC's Kootenay Lake (clipped to 1:2500 scale tiles at a 10 cm resolution) presented a host of challenges to be identified and surmounted. The overall photogrammetric orthomosaic processing in Agisoft Photoscan had to be broken down and handled in smaller portions rather than all at once. Approximately 15,000 air photos were taken at two different altitudes – low for urban areas, and high for wilderness. I explored different approaches in search of the most efficient workflow while endeavouring to produce the highest quality product, including different ways of portioning up the project area, examining the effectiveness of processing images from one or both altitudes at a time, and how to process as many orthoimages as possible at a given moment. I addressed several challenges along the way, including difficulty aligning images along the borders of different flight paths, misalignments found during the quality-checking stage, and some inherent weaknesses in the software, such as a 'swirling' effect on densely forested areas .

A Multi-faceted Approach to Studying Glacier Mass Change in the Columbia and Rocky Mountains, Canada
Ben M. Pelto, UNBC

Glaciers in the Canadian Columbia River Basin are in a state of retreat in response to climate change. Regionally, sparse data limits our ability to understand and quantify present and future changes to the alpine cryosphere. We collected seasonal glaciological field data and conducted airborne light detection and ranging (LiDAR) surveys over a series of 80 glaciers and six alpine catchments across the Columbia and Rocky Mountains. These data allow us to quantify the individual components of seasonal mass change: winter snow accumulation and summer snow and ice ablation. Our data consists of measurements of glaciological mass balance, glacier ice thickness from ground penetrating radar surveys, ice velocity, and LiDAR DEMs from our bi-annual LiDAR surveys. In tandem with our DEMs and ice velocity measurements, our ice thickness observations allow us to resolve glacier ice dynamics, critical to modeling future glacier response to climate change. We present maps visualizing snow accumulation, glacier mass loss, ice velocity, and ice thickness to highlight our multi-faceted approach to study glacier change. We demonstrate how these disparate, in-situ and remote sensing measurements can be combined to assess the current response of glaciers in the Canadian Columbia River Basin to climate change.

Assessing Set-Aside Old-Growth Forests with Airborne LiDAR Metrics
Luizmar de Assis Barros, MSc Candidate, UNBC

Old-growth forests provide a variety of services to human populations such as water, carbon storage and ecotourism. Despite the value of old-growth forests, this resource is constantly under anthropogenic pressure. Old-growth management areas (OGMAs) are legal restrictions meant to retain old-growth forest attributes in managed landscapes. However, it is uncertain if this strategy has set aside forests with characteristics/attributes expected in old-growth forests. While researchers have attempted to measure and evaluate different forest attributes and succession, the effectiveness of OGMAs in retaining old-growth forests in a managed landscape has rarely been tested. In this work, I applied LiDAR delivered metrics to estimate attributes of old-growth forests (ex. height, canopy cover, vertical complexity, understory density) and develop an index for old-growth forests. This index can aid in tracking the location and quality of old-growth forest in the landscape based on quantitative and transparent evaluation of forest structure, which solves the problems of multiple definitions of old-growth forest. This research brings light to OGMAs' definition and their evaluation through the use of a relatively new technique, LiDAR. More importantly, the identification of the amount and location of old-growth forests over the landscape can aid to the conservation of this rare resource and its services .

SESSION: BC MAPPING

Shady Business: Adventures in Terrain Mapping
Joe Burkinshaw, SparkGeo

While working on a trail map for Squamish, BC, Joe discovered that mapping terrain was trickier than he had initially thought. This talk describes the real life process that went into creating a better map. It will provide an outline of the tools, processes and data used, along with some of the project's peaks and troughs.

Mt. Edziza Provincial Park Mapping
Morgan Hite, Hesperus Arts

In rural British Columbia, the conventional topographic mapping at 1:50,000 scale, from Natural Resources Canada, is now difficult to obtain and the maps are no longer updated. Yet more recent mapping either does not exist, or involves large formats which are expensive to print. A new approach, utilizing 11 x 17" paper permits hikers to inexpensively print the topographic coverage they want at a scale better than 1:50,000. I will describe a pilot project which mapped Mt. Edziza Provincial Park into twenty-eight map sheets at 1:35,000 scale. I will talk about data sources, software, printing issues, some alternatives for the future, and the portability of this approach to other essentially trail-less crown lands in BC.

Regional patterns in the influence of ocean-climate teleconnections on the timing and duration of MODIS derived snow cover in BC
Hunter Gleason, BC Government, FLNRORD

We use the twice daily Moderate Resolution Imaging Spectroradiometer (MODIS) snow cover product to understand the regional influence of the Oceanic Nino Index (ONI) and Pacific Decadal Oscillation (PDO) on snow cover in British Columbia (BC). We apply a novel LOWESS interpolation to the MODIS time series of Normalized Difference Snow Index (NDSI) values to derive the timing and duration of snow. We confirm the general consensus from many previous studies that both ONI and PDO have significant impacts on snow cover in BC. We add to this knowledge by performing seasonal and regional analysis using established hydrozones, and explore variation in our results by elevation bins of 500 m. We calibrate and validate our method with in-situ snow observation data. The optimal NDSI thresholds for the start and end dates were 15 and 10, and the mean absolute error between the two datasets was 8.5, 5.9 and 14.3 days for the start, end and duration of snow cover, respectively. In general, the onset of snow is poorly correlated with both ONI and PDO, whereas snow ablation and duration are strongly negatively correlated. The largest magnitude linear relationships are in the southwest of the province, with the strongest relationships found in the Coast Mountains between the duration of snow and the summer ONI values (-24.7 ± 4.2 d °C-1). These relationships vary spatially and with elevation in BC and provide insights for seasonal forecasting of river levels, drought and wildfire and other natural resource applications.

On Fire: A Glimpse into BC Wildfire Service Incident Mapping
Wes Smith, BC Government, FLNRORD

The Province of BC, for two consecutive years, has experienced record wildfire seasons. A coordinated emergency response has been multi-agency and involves tens of thousands of human resources. From RCMP to firefighters, and from finance clerks to Directors, Geomatics products and staff have played a significant role in the response.

With BC Wildfire Service (BCWS), on-site geomatics support presents a challenging and rewarding experience for deployed Geomatics staff. As a technical specialist in the Plans section of the ICS system, GIS specialists typically work alone, providing support for all geomatics needs. A high daily volume of data that is processed from many sources (from field-collected data to satellite imagery), short timeframes, and map distribution (in a variety of formats) require a clear system that is both precise and flexible. Cartographic products are generated from both templates but can be custom, but they must be always be effective—and there is a lot on the line.

As a Temporary Emergency Assignment Management System (TEAMS) member with BCWS, I have enjoyed many deployments and have been influenced by the systems put in place to ensure data is captured, processed, and disseminated to those who need it. This short talk would provide a brief overview of these systems, including the following: receiving and processing data, producing maps useful to the crews in the field, and how maps are shared to emergency responders.

PECHAKUCHA

PechaKucha 20x20 is a simple presentation format where a presenter shows 20 slide images, each for only 20 seconds.

Akami-Uapishk^{U}-KakKasuak-Mealy Mountains National Park Reserve, Labrador
Ted Mackinnon, Natural Resources Canada, NS

Located in the East Coast Boreal Natural Region of Labrador, Akami-Uapishk^{U}-KakKasuak-Mealy Mountains National Park Reserve, is one of Canada's newest Parks, created to help protect over10,000 square kilometres of a stunning landscapes, vegetation and wildlife. This presentation will cover the geography of Akami-Uapishk^{U}-KakKasuak-Mealy Mountains National Park Reserve and include photos and maps created (from several field trips to the region) that helped form the Park.

Mapping Prince George from Fort to Present
Roger Wheate, UNBC

Based on a presentation given in 2015, I describe the mapping of PG rom a 19th century fort to present using maps, aerial photos LiDAR and satellite images, culminating in a reconstructed view from 10,000 years ago.

A Tour of BC from Satellite Imagery
Alex Bevington, BC Government, FLNRORD, Prince George

Free optical and radar satellite imagery has transformed the way we see and understand the world around us. This presentation highlights annual cloud-free satellite images of British Columbia to increase our understanding of landscape changes over this 40+ year period

CCA2018 at COGS
Monica Lloyd, Centre of Geographic Sciences, NS

The CCA met a year ago at COGS in Lawrencetown, Nova Scotia. We had a great conference, with a distinct maritime flavour incorporating lobster dinners and craft breweries, as well as excellent presentations, which included keynote talks by Marcel Morin, Mike Goodchild, and Ken Field.

Saturday 25 May—Schedule

CCA2019 UNBC
Prince George May 22–24

Time	Event	Location
9:00—6:00	Trip to Historic Barkerville 1880's Gold Mining Town Come to what was once the Cariboo region's largest and most important town. It is made up of original intact buildings from the Gold Rush era as well as street performers, variety shows, stage coach rides, court sessions circa 1880, Chinatown and food/drink. Trip involves a two hour bus ride south and east into the Cariboo Mountains.	Barkerville, BC