Historical Topographic Maps – Project Summary

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Overview

The project, distributed across several university libraries, adds approximately 1100 maps to our collective digital holdings, including most known sheets covering Ontario from the 1:63,360 and 1:25,000 national topographic map series. Ontario universities have contributed their support by supplying and scanning maps, georeferencing the digital images, creating metadata for the records, and developing the online geographical display of the maps.

Topographic maps at these scales are heavily used by researchers interested in examining changes over time, such as urban sprawl, transportation patterns, diminishing woodlots, or shoreline erosion.
The OCUL Geo Community is a forum for the exchange of information and ideas pertaining to maps, geospatial data, and other cartographic resources, both print and digital, within the wider Ontario Council of University Libraries community.

For more information and inquiries about the project please contact topomaps@scholarsportal.info.

Technical Specifications

The following presents the steps taken to digitize all of Ontario's public-domain historical topographic maps at the 1:25,000 and 1:63,360 scales. These technical specifications are presented as a set of scanning and georeferencing guidelines for the project. This can also serve as a useful reference for other institutions undertaking map digitization projects.

Digitization

Print maps were digitized at 600 ppi resolution and 24-bit colour depth with Colortrac feed-through scanners (models SmartLF Gx+ T56 and SmartLF SG), using standardized colour normalization and stitch correction processes. Manual quality control methods were applied to each digitized sheet to ensure images were straightened and cropped appropriately. Images were also manually inspected for the presence of scanning artifacts; affected images were either corrected or the sheet was flagged for re-scanning.

Derivative Images

ImageMagick software was used within a custom script to generate three different-sized derivative images for each digitized sheet in JPEG format. A 'large' JPEG derivative was generated by scaling the original TIFF image by 50%; a 'medium' JPEG derivative was generated by scaling the original TIFF to a 2000 pixel-wide image; and, a 'small' JPEG derivative was generated by scaling the original TIFF to a 204 pixel-wide image.

Georeferencing and Georectification

A total of 8 to 12 ground control points (GCPs) were established for each digitized map using ArcMap software (versions 10.1 to 10.5). Georeferencing and reprojection for each map was carried out using the Geospatial Data Abstraction Library (GDAL) functions gdal_translate and gdalwarp, respectively. A custom script was used to automate the conversion of ArcMap GCP files to GDAL format, as well as the georeferencing and warping processes. As part of the warping process, geotiffs were projected to the NAD83 datum, and into the appropriate UTM zone.

Tiled Web Map Generation

Each georectified image was transformed into a collection of tiled web maps using the gdal2tiles library within a custom script. Tiles were generated in Web Mercator projection (EPSG: 3857) for zoom levels 6 through 16.

All processing scripts may be accessed through the project Github repository.

Project Website

The project website was creating with the Hugo static website generator (https://gohugo.io/). It uses JuxtaposeJS (https://juxtapose.knightlab.com/) to compare images, and the elevateZoom-plus jQuery plugin (https://github.com/igorlino/elevatezoom-plus) to zoom into individual maps. The source code for the website is available on Github (https://github.com/scholarsportal/historical-topos).

Credits

Throughout the project, contributions varied across Ontario libraries and other organizations, with some providing maps from local collections, map scanning, georeferencing, quality assurance, metadata creation, data transformation, project management, and technical infrastructure. The following is a list of institutions and organizations that contributed to the project from 2014 to 2017.

- Archives of Ontario
- Brock University Library
- Carleton University Library
- Library and Archives Canada
- McMaster University Library
- Natural Resources Canada
- Queen's University Library
- Ryerson University Library
- Scholars Portal
- Toronto Reference Library
- Trent University Library
- University of Alberta Library
- University of Ottawa
- University of Toronto Libraries
- University of Waterloo Library
- Western University Library
- Wilfrid Laurier University Library
- York University Library

Individuals to thank:

- Colleen Beard (Brock University)
- Rebecca Bartlett (Carleton University Library)
- Ryder Burt (Carleton University Library)
- Joël Rivard (Carleton University Library)
- Lorraine Dubreuil (Emeritus, McGill University)
- Jordan Aharoni (McMaster University
- Victoria Balkwill Tweedie (McMaster University)
- Gordon Beck (McMaster University)
- Jason Brodeur (McMaster University)
- Katie Maloney (McMaster University)
- Jenny Ni (McMaster University)
- Ashleigh Patterson (McMaster University)
- Margaret Rutten (McMaster University)
- Bianca Chiarenza (Ryerson University)
- Noel Damba (Ryerson University)
- Dan Jakubek (Ryerson University)

- Jo Ashley (Scholars Portal)
- Jaiwei Chen (Scholars Portal)
- Kara Handren (Scholars Portal)
- Amber Leahey (Scholars Portal)
- Kaitlin Newson (Scholars Portal)
- Kevin Worthington (Scholars Portal)
- Charles Hill (University of Ottawa Library)
- Raphaël Pelletier (University of Ottawa Library)
- Sophie Routhier LeBlanc (University of Ottawa Library)
- Sarah Simpkin (University of Ottawa Library)
- Cheryl Woods (Western University Library)
- Trudy Bodak (Emeritus, York University)
- Neil Livingston (York University Library)
- Zarah Malm (York University)
- Rosa Orlandini (York University Library)
- Veronica Petta (York University)
- Artemisia Robins (York University)
- Marisa Thomas-Perrier (York University)

Special thank-you to the Ontario Council of University Libraries (OCUL) for providing the funding for the 3-year project. In 2017, OCUL is celebrating its 50th anniversary, and this project marks a tremendous achievement, recognizing collaboration in shared stewardship and preserving Canada's past.

About the Maps

Early topographical mapping in Canada was fragmented, with various agencies producing maps at varying scales. The areas mapped were unrelated, and the legends and colours used rarely matched up. This changed in 1904, when a standardized system of mapping was introduced, which officially became Canada's National Topographic System (NTS) in 1926. Over the next several decades, over 1100 maps were produced for Ontario alone in the 1:63,360 and 1:25,000 scales. This timeline provides a detailed history of the production of these maps.

Historical Timeline

1899-1902: The Boer War raises concerns in Canada about the importance of military maps for national defence.

1903: Major E.H. Hills, a British military mapping expert, publishes his "Report on the Survey of Canada." This report was commissioned by the Canadian Government, to determine whether existing topographical maps could be used for military operations. Hills' report is very critical of existing maps, and recommends the creation of a survey unit within the Canadian Army.

1904: The **Survey Division** of the **Canadian Army's Intelligence Branch, Department of Militia and Defence**, is formed. Surveying operations begin for the earliest maps in the 1:63,360 series.

1906-1914: An agreement between the Canadian Army and British War Office allows for British topographers to be loaned out to the Canadian Army's Survey Division. This agreement fills much-needed positions in the Survey Division. As a result, the earliest maps produced are extremely similar to the specifications of the British Ordnance Survey.

1906: The first topographical maps produced by the new Survey Division are published in Great Britain.

1912: The Department of Militia and Defence purchases printing equipment, allowing Canadian maps to be published in Canada.

1906-1922: Two other agencies become involved in contributing to map production: the **Geological Survey, Department of Mines** and the **Topographical and Air Survey Bureau, Department of the Interior**.

Note: the Department of the Interior was very rarely involved in the creation of maps in the Province of Ontario.

1922: The **Board on Topographical Surveys and Maps** is established, to created guidelines for a common set of map specifications that could be used by all agencies involved.

The first experiments using aerial photographs as a topographic tool are conducted by the RCAF.

1923: The sheet line numbering system for maps is adopted (this becomes the National Topographic System (NTS) standard numbering system in 1926).

The **Department of Militia and Defence** becomes the **Department of National Defence**.
All agencies agree to publish maps ungridded. The Department of National Defence retains permission to add gridding to sheets as required.

1924: The **Survey Division** becomes the **Geographical Section, General Staff, Department of National Defence**.

1931: Aerial photography is now widely used for all new topographic surveys and revisions. All photographs are taken by the RCAF.

1936: The **Geological Survey, Department of Mines** becomes the **Mapping Branch, Department of Energy, Mines and National Resources**.

1948: The national mapping agencies of Canada, the United States and the United Kingdom hold a joint meeting that concludes it is desirable to follow other NATO countries and switch map series from foot-mile scales to even representation fractions (1:25,000, 1:50,000 and 1:250,000).

1949: Canada decides to make the switch to even representation fractions.

1950: The last map is drawn in the 1:63,360 map series. Printing continues into the early 1950s.
The NTS 1:63,360 scale is changed to 1:50,000.

1954: The first aerial photographs are taken in Ontario for the new 1:25,000 topographical maps. These maps focus almost exclusively on urban areas.

1956: The first maps are published in the 1:25,000s series. All maps are surveyed and published under the direction of the Department of National Defence.

1960: Private surveying companies are contracted to take aerial photographs. From this time on, the RCAF is rarely involved in topographical surveys.

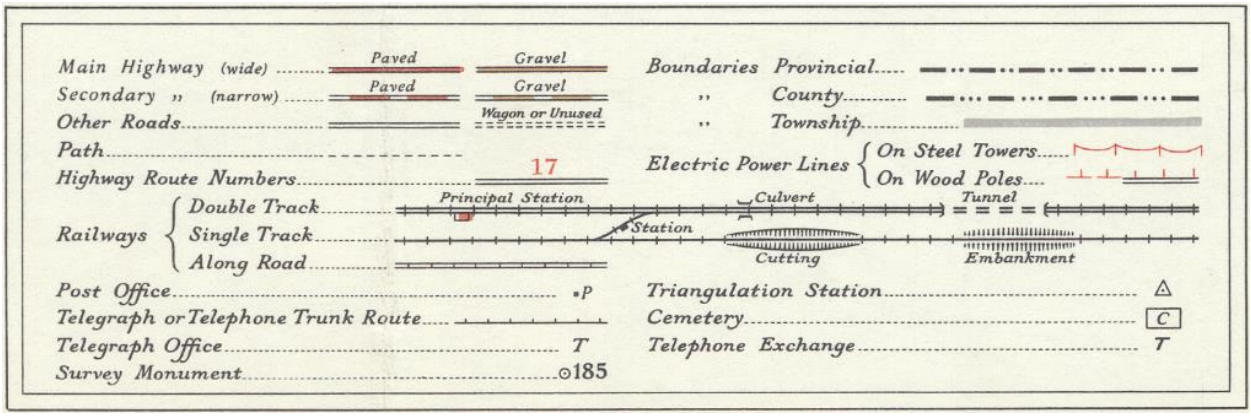
1964: Separate publication of non-gridded vs. gridded (military) sheets is discontinued. All sheets after this date are published using a UTM grid.

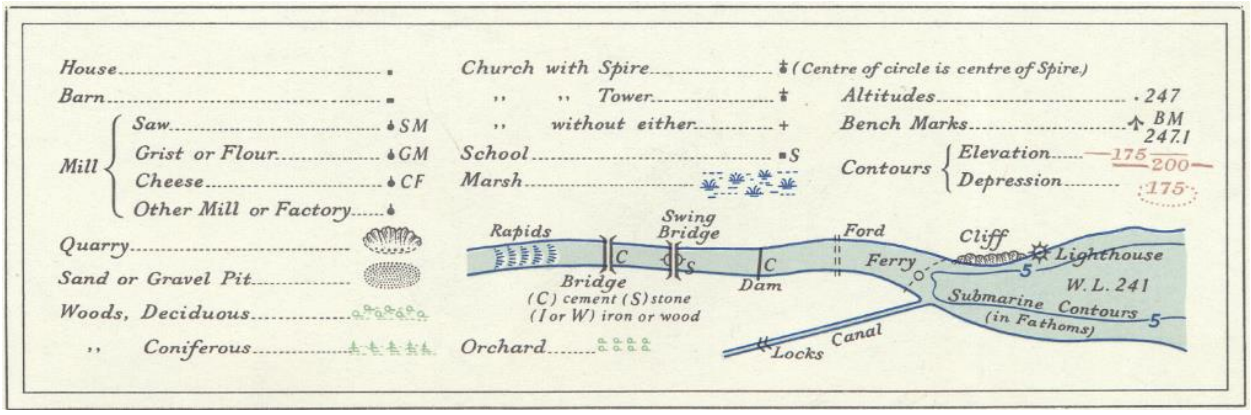
1974: The last aerial photographs are taken for the 1:25,000 map series, and the last revised sheet is published. Printing continued into the late 1970s.

Lettering and Conventional Signs

Original maps in the 1:63,360 series were printed in 5 colours:

- Black: lettering, cultural detail, geographic graticule
- Red: stone or brick buildings
- Blue: water features
- Brown: metalled (paved) roads, contours, spot heights and bench marks
- Green: wooded areas





By 1927, the use of red to indicate stone or brick buildings was stopped. From this point on, red was used to indicate paved roads. All other colouring remained largely consistent through to the end of the 1:25,000 series.

Detailed information on the lettering and symbols used in the creation of these maps is available in the resources listed below.

For more information, see:

Canada, Surveys and Mapping Branch. Cartographic Symbols and Specifications of the National Topographic System 1:25,000 – 1:50,000 / Spécifications des symbols cartographiques du Système national de reference cartographique. Ottawa: Surveys and Mapping Branch, 1977.

Dubreuil, Lorraine. Canada's Militia and Defence Maps: 1905-1931. Ottawa: Association of Canadian Map Libraries and Archives, 1992.

Dubreuil, Lorraine. Standard Topographical maps of Canada, 1904-1948. Ottawa: Association of Canadian Map Libraries and Archives, 1991.

Natural Resources Canada / Ressources naturelles Canada. Topographic Maps: The Basics. http://epe.lac-bac.gc.ca/100/201/301/weekly_checklist/2014/internet/w14-20-U-E.html/collections/collection_2014/rncan-nrcan/M114-35-2014-eng.pdf

L.M. Sebert. "The One Inch to One Mile Series of the National Mapping Program." In, The Canadian Cartographer 13, no. 2 (December 1976).

Sebert, L.M. and N.L. Nicholson. The maps of Canada: a guide to official Canadian maps, charts, atlases and gazetteers. Folkestone, Kent: Dawson, 1981.