

Canadian Watershed Boundaries

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IDENTIFICATION_INFORMATION

Citation:

Citation_Information:

Originator: Canada Land Inventory Level-I Digital Data

Publication_Date: not specified

Title: Canadian Watershed Boundaries

Edition:

Geospatial_Data_Presentation_Form: Map

Publication_Information:

Publication_Place: Canada

Publisher: Geogratis/Natural Resources Canada

Other_Citation_Details:

Online_Linkage: [HTTP://geogratis.cgdi.gc.ca](http://geogratis.cgdi.gc.ca)

Larger_Work_Citation:

Citation_Information:

Originator:

Publication_Date:

Title:

Publication_Information:

Publication_Place:

Publisher:

Online_Linkage:

Description:

Abstract:

This coverage was digitized from a published Environment Canada Map depicting active and discontinued hydrometric stations operated by Water Resources Branch from 1972 to 1977. The coverage depicts primary, secondary and tertiary drainage basins across Canada.

The data was digitized by Lands Directorate in the late 1980's and were revised by Water Survey of Canada before digitization. Therefore the boundaries and delineations may not be exactly as found on the published map series.

Purpose:

Supplemental_Information:

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1972

Ending_Date: 1977

Currentness_Reference:

Status:

Progress: Complete

Maintenance_and_Update_Frequency: None planned

Spatial_Domain:**Bounding_Coordinates:****West_Bounding_Coordinate:** -135.1725**East_Bounding_Coordinate:** -63.0678**North_Bounding_Coordinate:** 67.0469**South_Bounding_Coordinate:** 41.3913**Keywords:****Theme:****Theme_Keyword_Thesaurus:** None**Theme_Keyword:** Canada, watershed, hydro**Place:****Place_Keyword_Thesaurus:** None**Access_Constraints:**

None

Use_Constraints:See Geogratis User Agreement for Digital Data, online at <http://geogratis.cgdi.gc.ca/e>**Point_of_Contact:****Contact_Information:****Contact_Organization_Primary:****Contact_Organization:** Natural Resources Canada**Contact_Person:****Contact_Position:****Contact_Address:****Address_Type:** mailing and physical address**Address:****City:** Ottawa**State_or_Province:** Ontario**Postal_Code:****Country:** Canada**Contact_Voice_Telephone:****Contact_Facsimile_Telephone:****Contact_Electronic_Mail_Address:****Hours_of_Service:****Native_Data_Set_Environment:**

ArcView version 3.2 shapefile format

v:\canada\hydro\cawshed.shp

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DATA_QUALITY_INFORMATION**Attribute_Accuracy:****Attribute_Accuracy_Report:****Logical_Consistency_Report:****Completeness_Report:****Positional_Accuracy:****Horizontal_Positional_Accuracy:****Horizontal_Positional_Accuracy_Report:****Vertical_Positional_Accuracy:****Vertical_Positional_Accuracy_Report:****Lineage:****Source_Information:****Source_Citation:****Citation_Information:****Originator:****Publication_Date:****Title:****Edition:****Geospatial_Data_Presentation_Form:** map**Publication_Information:****Publication_Place:**

Publisher:**Other_Citation_Details:**

Accessed / Unaccessed Forests

A. LABEL / CATEGORY DEFINITIONS

1. **ACCESSED LANDS:** Lands that are within one kilometer of a known access corridor. Access corridors include roads, trails, railways, pipelines (oil/gas), hydroelectric and telephone transmission lines, seismic lines, and known motorized backcountry routes (e.g. ski-doo trails).

2. **LAND COVER OF CANADA (Unaccessed):** Lands that are further than one kilometer from a known access corridor. Subclasses are defined according to the Canadian Center for Remote Sensing 1995 Land Cover of Canada (LC95) classes as **follows:**

- **Southern Boreal and Other Forests:** All forest classes, excluding "Northern Forest" (boreal) medium and low-density evergreen needleleaf forest, plus "Burns" classes. (LC95 classes 1-2,4,6-12)

- **Northern Boreal Forest:** "Northern Forest" (boreal) medium and low-density evergreen needleleaf forest classes. (LC95 classes 3,5)

- **Open Land (Wetland/Shrubland):** All "Open Land" (tree crown density of less than 10%) classes. (LC95 classes 13,14,15)

- **Grassland:** LC95 class 16.

- **Barren Land:** All "Barren Land" classes. (LC95 classes 17-22)

- **Snow/Ice:** LC95 class 31.

- **Freshwater:** LC95 class 30.

B. METHODOLOGY / TECHNICAL NOTES**GENERAL METHODOLOGY**

1. Access corridors include linear vector or raster data for transportation (roads, trails, railways, abandoned railways), utilities (oil/gas, hydro, telephone), and exploration (seismic lines) themes.

2. Access data (transportation and utility corridors) was obtained by province/territory from federal, provincial and territorial governments at the highest obtainable quality (resolution, currency and completeness) within the SOF project budget. These factors (content, quality and cost) vary considerably between provincial/federal agencies themselves, such that input datasets differ in their scale, currency, coverage, features and feature attributes. (See Data Sources for more details).

3. The analysis resolution was set to 1 km² to match the CCRS 1995 Land Cover of Canada (LC95) data that is used as a base layer for land and forest cover in Canada. This resolution also corresponds to the lowest resolution found in the input access datasets.

4. Lambert Conformal Conic, NAD27, was used as the standard SOF projection for analysis and presentation. This was found to be the most common data projection for federal agency national datasets, although no official standard exists.

5. Due to the variability of data features and feature attributes across Canada (e.g. seismic line data obtained only for Alberta and Northeast BC; winter roads found only in certain datasets, etc.), no attempt was made to differentiate between the different types of access corridors. The impact extent for all linear corridors was modeled as 1 km in width.

6. Input vector data was rasterized using a 1 km resolution grid relative to the origin of the LC95 data. Grid output cells (1 km²) were classified as accessed if any input corridor feature was present within a cell.

7. Input raster data was first buffered at its original resolution to a width of 1 km before resampling (nearest neighbour) to 1km resolution. This resulted in minimal loss of combined access features (foreground cells) by area during the resample procedure. This method was verified against the vector rasterization process using Yukon vector data (250m resolution). The two methods differed in total access area by less than 0.1%.

8. A resulting access corridor grid was produced for each province/territory. Provincial data was trimmed to exclude any data that was not under its respective jurisdiction, and then merged to produce a national access corridor grid.

9. The national access corridor grid was merged with the LC95 land cover data. Any LC95 cell (excluding water) that corresponded to an access grid cell was reclassified as accessed. In addition, all LC95 Developed classes (cropland, cropland/woodland, woodland/cropland, cropland/other, and urban classes - 23 to 29) were reclassified as accessed. This assumes that these classes would be accessible by nature of being developed in whole or in part.

10. Finally, the resulting accessed/unaccessed land cover grid was merged with a national 1:1,000,000 populated places dataset to ensure that small northern communities that are fly-in only were considered within the analysis. DISCUSSION present analysis likely underestimates accessed land (define as within 1 km of an access corridor) in

Canada due to:

- relatively old provincial inventories for transportation themes (estimated average age of data of 10 - 20 years);
- missing data (e.g. seismic line data for the Northwest Territories and Saskatchewan);
- coarse scale of certain input datasets (e.g. Newfoundland 1:1,000,000 scale).

Certain provinces were analyzed using different methods than described above due to the nature of available data.

This includes:

- British Columbia (BC): Due to the exorbitant cost of provincial access data (approx. \$4,000,000 for 1:20,000 TRIM roads data), and the availability of an existing 1989 BC Ministry of Forests Recreation Opportunity Spectrum (ROS) roadless area analysis, accessed land was determined using ROS roaded class. The ROS roaded class corresponds to lands within 1 kilometer of transportation features.
- Quebec (QC): Recent high-resolution digital data was either not available, or cost-prohibitive, for use in this analysis. However, 1994 satellite imagery (125m resolution) was obtained and used as a proxy indicator for access in Quebec. The image data (.tiff format) was imported into ERDAS IMAGINE software as a RGB file. 50 initial classes were reduced to water, forest, burns, and non-forest areas using an unsupervised classification. Non-forest areas include urban, rural, recently cut, and regenerating forest land. Non-forest land within tenured forest management areas were reclassified as accessed land. This assumes that such lands, including harvested forests, are within 1 km of an access corridor used to develop or log these areas.
- Alberta (AB) and Northeast BC: These areas were analyzed for linear disturbance density using 1:20,000 to 1:50,000 input data (See Alberta case study). Lands with densities greater than zero were reclassified as accessed. As the original road density analysis was conducted using an approximate buffer of 600 meters, the AB/NEBC access data includes some lands that are up to 1.2 km from an access corridor. Therefore, the extent of accessed lands is

slightly overestimated in AB and NEBC. The high proportion of accessed lands in AB and NEBC is related to the extremely high density of oil and gas seismic lines within these areas. (See Alberta case study).

The sharp distinction between accessed land in Alberta and certain unaccessed land along the AB/Saskatchewan (SK) and AB/NEBC/North West Territories (NWT) borders reflects the lack of seismic line data for both SK and NWT.

Accessed lands within Newfoundland are likely greatly underestimated due to limited input data (1:1,000,000 scale).

C. SOURCE DATA

THEME 1: ACCESSED LANDS

Unless otherwise stated, data processing followed the general methodology described above.

Newfoundland VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

PROVIDER: Geogratis,
Geomatics Canada

Canadian Center for Remote Sensing, NRCAN

http: [HTTP: Approximate](http://www.geogratis.gc.ca/)

Average 1990.

SCALE: 1:1,000,000.

PROCESSING: See general methodology

Nova Scotia

DATA: 1:50,000 roads, railways and utilities database.

PROVIDER: Scotia Geomatics Center

http: [HTTP: Estimated Average mid-80s](http://www.scotiageomatics.com/)

to early 90s. Highways more recently updated than secondary roads.

SCALE: 1:50,000

PROCESSING: See general methodology

New Brunswick

DATA: Digital Topographic Database of New Brunswick.

PROVIDER: New Brunswick

http: [HTTP: 1996.](http://www.gnb.ca/)

SCALE: 1:10,000

PROCESSING: See general methodology

Quebec "Le Quebec forestier meridional" (LANDSAT satellite image composite of Quebec commercial forest zone).

PROVIDER: Direction de la gestion des stocks forestiers

Ministere des Ressources naturelles du Quebec

http: [HTTP: 1993/1994](http://www.mnrn.gouv.qc.ca/)

SCALE: 125 meter resolution

PROCESSING: See Discussion notes.

- Non-forest lands may be overestimated in northern portions of the Quebec commercial forest zone due to higher level of bog land cover during classification.

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

PROVIDER: See
above.

Ontario Raster summary grid file of access corridors.

Original source data includes:

- Ontario Base Map 1:20,000 roads, railway, and transmission line data;
- Ontario logging roads from Landsat imagery;
- Ontario roads from the Digital Topographic Database 1:600,000 scale;
- Ontario Provincial Snowmobile Trails.

PROVIDER: Ministry of Natural Resources.

SOURCE DATE: Variable - estimated between mid-80s to mid-90s.

SCALE: 200m resolution raster grid

PROCESSING: Projected to SOF LCC

- 200m data buffered to 1km access corridor.
- Resampled to 1km resolution.
- Reclassed to single access class.

Manitoba Manitoba Road Network (from Forest Resources Inventory data) roads data.

PROVIDER: Natural Resources, Forestry Branch

SOURCE DATE: Quoted average age "10-20 years old".

SCALE: 1:20,000

PROCESSING: See general methodology

Notes: Limited metadata provided, therefore there was no ability to verify data content.

- The Manitoba road network consists of the provincial trunk highways and municipalities roads. This network does not include all roads constructed by the forestry and mining sectors or all the winter roads used to access some of the northern communities.

NAME: VMAP0_R4 (Digital Chart of the World) railway and utility vector data

See above.

Saskatchewan Saskatchewan Road Network road and railway data (forested region only)

PROVIDER: Saskatchewan Property Management Corporation

http: [HTTP: 1996-1998](http://1996-1998).

SCALE: 1:20,000

PROCESSING: See general methodology

Notes: No oil/gas seismic data.

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data (grassland region)

See above.

Alberta Alberta Case Study (forested region only)

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data (Alberta grassland region)

See above.

British Columbia

DATA: Recreation Opportunity Spectrum

PROVIDER: data from BC Ministry of Forests, Recreation Branch.

ARC/INFO data obtained from Earthlife Canada Foundation Vancouver, BC

CREATION DATE: 1989

SCALE: 1:2,000,000

PROCESSING: Roaded land reselected from ROS data.

Rasterized at 1km², reclassified, and projected to SOF LCC.

Notes: Original data rubber-sheeted to BC coastline, with resulting inaccuracies.

Northeast BC was analyzed using Alberta methodology. See Alberta case study.

DATA: 1:1m VMAP transportation (Northwest BC only) and utility data.

See above.

Yukon Territory

DATA: 1:250,000 topographic data (includes roads, trails, seismic lines and utility lines).

PROVIDER: Government, Department of Renewable Resources

SOURCE DATE: Variable. Original data 1970-1990. Partially updated 1995.

SCALE: 1:250,000

PROCESSING: See general methodology

Notes: Data extends into portions of Northwest Territories.

Northwest Territories

DATA: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

See above.

Notes: Missing oil/gas data.

- VMAP0_R4 data confirmed with Ministry of Tourism road

map.

Nunavut VMAP0_R4 (Digital Chart of the World)

transportation and utility vector data

See above.

National Data

DATA: VMAP0_R4 (Digital Chart of the World) populated places point data.

See above.

THEME 2: LAND COVER OF CANADA (Unaccessed)

DATA: Land Cover of Canada Version 1.1 raster data

PROVIDER: Center for Remote Sensing (CCRS), EMS Section.

http: [HTTP: 1995](http://1995)

SCALE: 1 km raster grid

PROCESSING: Projected to SOF Lambers Conformal Conic standard projection, NAD 27.

Online Linkage:

Larger Work Citation:

Citation Information:

Originator:

Publication Date:

Title:

Publication Information:

Publication Place:

Publisher:

Online Linkage:

Source Scale Denominator:

Type of Source Media:

Source Time Period of Content:

Time Period Information:

Range of Dates/Times:

Beginning Date:

Ending Date:

Source Currentness Reference:

Source Citation Abbreviation:

Source Contribution:

Source Information:

Source Citation:

Citation Information:

Originator:

Publication Date:

Title:

Edition:

Geospatial Data Presentation Form: map

Publication Information:

Publication Place:

Publisher:

Other Citation Details:

Accessed / Unaccessed Forests

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excluding "Northern Forest" (boreal) medium and low-density evergreen needleleaf forest, plus "Burns" classes. (LC95 classes 1-2, 4, 6-12)

- Northern Boreal Forest: "Northern Forest" (boreal) medium and low-density evergreen needleleaf forest classes. (LC95

classes 3,5)

- Open Land (Wetland/Shrubland): All "Open Land" (tree crown density of less than 10%) classes. (LC95 classes 13,14,15) Grassland: LC95 class 16.
- Barren Land: All "Barren Land" classes. (LC95 classes 17-22) Snow/Ice: LC95 class 31.
- Freshwater: LC95 class 30.

B. METHODOLOGY / TECHNICAL NOTES

GENERAL METHODOLOGY

1. Access corridors include linear vector or raster data for transportation (roads, trails, railways, abandoned railways), utilities (oil/gas, hydro, telephone), and exploration (seismic lines) themes.
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3. The analysis resolution was set to 1 km² to match the CCRS 1995 Land Cover of Canada (LC95) data that is used as a base layer for land and forest cover in Canada. This resolution also corresponds to the lowest resolution found in the input access datasets.
4. Lambert Conformal Conic, NAD27, was used as the standard SOF projection for analysis and presentation. This was found to be the most common data projection for federal agency national datasets, although no official standard exists. Due to the variability of data features and feature attributes across Canada (e.g. seismic line data obtained only for Alberta and Northeast BC; winter roads found only in certain datasets, etc.), no attempt was made to differentiate between the different types of access corridors. The impact extent for all linear corridors was modeled as 1 km in width.
6. Input vector data was rasterized using a 1 km resolution grid relative to the origin of the LC95 data. Grid output cells (1 km²) were classified as accessed if any input corridor feature was present within a cell.
7. Input raster data was first buffered at its original resolution to a width of 1 km before resampling (nearest neighbour) to 1km resolution. This resulted in minimal loss of combined access features (foreground cells) by area during the resample procedure. This method was verified against the vector rasterization process using Yukon vector data (250m resolution). The two methods differed in total access area by less than 0.1%.
8. A resulting access corridor grid was produced for each province/territory. Provincial data was trimmed to exclude any data that was not under its respective jurisdiction, and then merged to produce a national access corridor grid.
9. The national access corridor grid was merged with the LC95 land cover data. Any LC95 cell (excluding water) that corresponded to an access grid cell was reclassified as accessed. In addition, all LC95 Developed classes (cropland, cropland/woodland, woodland/cropland, cropland/other, and urban classes - 23 to 29) were reclassified as accessed. This assumes that these classes would be accessible by nature of being developed in whole or in part.
10. Finally, the resulting accessed/unaccessed land cover grid was merged with a national 1:1,000,000 populated

places dataset to ensure that small northern communities that are fly-in only were considered within the analysis. DISCUSSION present analysis likely underestimates accessed land (define as within 1 km of an access corridor) in

Canada due to:

- relatively old provincial inventories for transportation themes (estimated average age of data of 10 - 20 years);
- missing data (e.g. seismic line data for the Northwest Territories and Saskatchewan);
- coarse scale of certain input datasets (e.g. Newfoundland 1:1,000,000 scale).

Certain provinces were analyzed using different methods than described above due to the nature of available data.

This includes:

- British Columbia (BC): Due to the exorbitant cost of provincial access data (approx. \$4,000,000 for 1:20,000 TRIM roads data), and the availability of an existing 1989 BC Ministry of Forests Recreation Opportunity Spectrum (ROS) roadless area analysis, accessed land was determined using ROS roaded class. The ROS roaded class corresponds to lands within 1 kilometer of transportation features.
- Quebec (QC): Recent high-resolution digital data was either not available, or cost-prohibitive, for use in this analysis. However, 1994 satellite imagery (125m resolution) was obtained and used as a proxy indicator for access in Quebec. The image data (.tiff format) was imported into ERDAS IMAGINE software as a RGB file. 50 initial classes were reduced to water, forest, burns, and non-forest areas using an unsupervised classification. Non-forest areas include urban, rural, recently cut, and regenerating forest land. Non-forest land within tenured forest management areas were reclassified as accessed land. This assumes that such lands, including harvested forests, are within 1 km of an access corridor used to develop or log these areas.
- Alberta (AB) and Northeast BC: These areas were analyzed for linear disturbance density using 1:20,000 to 1:50,000 input data (See Alberta case study). Lands with densities greater than zero were reclassified as accessed. As the original road density analysis was conducted using an approximate buffer of 600 meters, the AB/NEBC access data includes some lands that are up to 1.2 km from an access corridor. Therefore, the extent of accessed lands is slightly overestimated in AB and NEBC. The high proportion of accessed lands in AB and NEBC is related to the extremely high density of oil and gas seismic lines within these areas. (See Alberta case study).

The sharp distinction between accessed land in Alberta and certain unaccessed land along the AB/Saskatchewan (SK) and AB/NEBC/North West Territories (NWT) borders reflects the lack of seismic line data for both SK and NWT.

Accessed lands within Newfoundland are likely greatly underestimated due to limited input data (1:1,000,000 scale). SOURCE DATA

THEME 1: ACCESSED LANDS

Unless otherwise stated, data processing followed the general methodology described above.

Newfoundland VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

PROVIDER: Geogratis,
Geomatics Canada

Canadian Center for Remote Sensing, NRCAN

http: [HTTP: Approximate](http://www.geogratis.gc.ca/)

Average 1990.

SCALE: 1:1,000,000.

PROCESSING: See general methodology

Nova Scotia

DATA: 1:50,000 roads, railways and utilities database.

PROVIDER: Scotia Geomatics Center

http: [HTTP: Estimated Average mid-80s](http://Estimated Average mid-80s)

to early 90s. Highways more recently updated than secondary roads. 1:50,000

PROCESSING: See general methodology

New Brunswick

DATA: Digital Topographic Database of New Brunswick.

PROVIDER: New Brunswick

http: [HTTP: 1996.](http://1996)

SCALE: 1:10,000

PROCESSING: See general methodology

Quebec "Le Quebec forestier meridional" (LANDSAT satellite image composite of Quebec commercial forest zone).

PROVIDER: Direction de la gestion des stocks forestiers
Ministere des Ressources naturelles du Quebec

http: [HTTP: 1993/1994](http://1993/1994)

SCALE: 125 meter resolution

PROCESSING: See Discussion notes.

- Non-forest lands may be overestimated in northern portions of the Quebec commercial forest zone due to higher level of bog land cover during classification.

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

PROVIDER: See

above. Raster summary grid file of access corridors.

Original source data includes:

- Ontario Base Map 1:20,000 roads, railway, and transmission line data;
- Ontario logging roads from Landsat imagery;
- Ontario roads from the Digital Topographic Database 1:600,000 scale;
- Ontario Provincial Snowmobile Trails.

PROVIDER: Ministry of Natural Resources.

SOURCE DATE: Variable - estimated between mid-80s to mid-90s. 200m resolution raster grid

PROCESSING: Projected to SOF LCC

- 200m data buffered to 1km access corridor.

- Resampled to 1km resolution.

- Reclassed to single access class.

Manitoba Manitoba Road Network (from Forest Resources Inventory data) roads data.

PROVIDER: Natural Resources, Forestry Branch

SOURCE DATE: Quoted average age "10-20 years old".

SCALE: 1:20,000

PROCESSING: See general methodology

Notes: Limited metadata provided, therefore there was no ability to verify data content.

- The Manitoba road network consists of the provincial trunk highways and municipalities roads. This network does not include all roads constructed by the forestry and mining sectors or all the winter roads used to access some of the northern communities.

NAME: VMAP0_R4 (Digital Chart of the World) railway and utility vector data

See above.

Saskatchewan Saskatchewan Road Network road and railway data (forested region only)

PROVIDER: Saskatchewan Property Management Corporation

http: [HTTP: 1996-1998.](http://1996-1998)

SCALE: 1:20,000

PROCESSING: See general methodology

Notes: No oil/gas seismic data.

NAME: VMAP0_R4 (Digital Chart of the World) transportation

and utility vector data (grassland region)

See above.

Alberta Alberta Case Study (forested region only)

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data (Alberta grassland region)

See above.

British Columbia

DATA: Recreation Opportunity Spectrum

PROVIDER: data from BC Ministry of Forests, Recreation Branch. data obtained from Earthlife Canada Foundation Vancouver, BC

CREATION DATE: 1989

SCALE: 1:2,000,000

PROCESSING: Roaded land reselected from ROS data.

Rasterized at 1km2, reclassified, and projected to SOF LCC.

Notes: Original data rubber-sheeted to BC coastline, with resulting inaccuracies.

Northeast BC was analyzed using Alberta methodology. See Alberta case study.

DATA: 1:1m VMAP transportation (Northwest BC only) and utility data.

See above.

Yukon Territory

DATA: 1:250,000 topographic data (includes roads, trails, seismic lines and utility lines).

PROVIDER: Government, Department of Renewable Resources

SOURCE DATE: Variable. Original data 1970-1990. Partially updated 1995.

SCALE: 1:250,000

PROCESSING: See general methodology

Notes: Data extends into portions of Northwest Territories.

Northwest Territories

DATA: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

See above.

Notes: Missing oil/gas data.

- VMAP0_R4 data confirmed with Ministry of Tourism road map. VMAP0_R4 (Digital Chart of the World)

transportation and utility vector data

See above.

National Data

DATA: VMAP0_R4 (Digital Chart of the World) populated places point data.

See above.

THEME 2: LAND COVER OF CANADA (Unaccessed)

DATA: Land Cover of Canada Version 1.1 raster data

PROVIDER: Center for Remote Sensing (CCRS), EMS Section.

http: [HTTP: 1995](http://1995)

SCALE: 1 km raster grid

PROCESSING: Projected to SOF Lambers Conformal Conic standard projection, NAD 27.

Online Linkage:

Larger Work Citation:

Citation Information:

Originator:

Publication Date:

Title:

Publication Information:

Publication Place:

Publisher:

Online Linkage:

Source Scale Denominator:

Type of Source Media:

Source Time Period of Content:

Time Period Information:

Range_of_Dates/Times:**Beginning Date:****Ending Date:****Source_Currentness_Reference:****Source_Citation_Abbreviation:****Source_Contribution:****Source_Information:****Source_Citation:****Citation_Information:****Originator:****Publication_Date:****Title:****Edition:****Geospatial_Data_Presentation_Form:** map**Publication_Information:****Publication_Place:****Publisher:****Other_Citation_Details:**

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B. METHODOLOGY / TECHNICAL NOTES

GENERAL METHODOLOGY

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3. The analysis resolution was set to 1 km² to match the CCRS 1995 Land Cover of Canada (LC95) data that is used as a base layer for land and forest cover in Canada. This resolution also corresponds to the lowest resolution found in the input access datasets.

4. Lambert Conformal Conic, NAD27, was used as the standard SOF projection for analysis and presentation. This was found to be the most common data projection for federal

agency national datasets, although no official standard exists. Due to the variability of data features and feature attributes across Canada (e.g. seismic line data obtained only for Alberta and Northeast BC; winter roads found only in certain datasets, etc.), no attempt was made to differentiate between the different types of access corridors. The impact extent for all linear corridors was modeled as 1 km in width.

6. Input vector data was rasterized using a 1 km resolution grid relative to the origin of the LC95 data. Grid output cells (1 km²) were classified as accessed if any input corridor feature was present within a cell.

7. Input raster data was first buffered at its original resolution to a width of 1 km before resampling (nearest neighbour) to 1km resolution. This resulted in minimal loss of combined access features (foreground cells) by area during the resample procedure. This method was verified against the vector rasterization process using Yukon vector data (250m resolution). The two methods differed in total access area by less than 0.1%.

8. A resulting access corridor grid was produced for each province/territory. Provincial data was trimmed to exclude any data that was not under its respective jurisdiction, and then merged to produce a national access corridor grid.

9. The national access corridor grid was merged with the LC95 land cover data. Any LC95 cell (excluding water) that corresponded to an access grid cell was reclassified as accessed. In addition, all LC95 Developed classes (cropland, cropland/woodland, woodland/cropland, cropland/other, and urban classes - 23 to 29) were reclassified as accessed. This assumes that these classes would be accessible by nature of being developed in whole or in part.

10. Finally, the resulting accessed/unaccessed land cover grid was merged with a national 1:1,000,000 populated places dataset to ensure that small northern communities that are fly-in only were considered within the analysis. DISCUSSION present analysis likely underestimates accessed land (define as within 1 km of an access corridor) in

Canada due to:

- relatively old provincial inventories for transportation themes (estimated average age of data of 10 - 20 years);
- missing data (e.g. seismic line data for the Northwest Territories and Saskatchewan);
- coarse scale of certain input datasets (e.g. Newfoundland 1:1,000,000 scale).

Certain provinces were analyzed using different methods than described above due to the nature of available data.

This includes:

- British Columbia (BC): Due to the exorbitant cost of provincial access data (approx. \$4,000,000 for 1:20,000 TRIM roads data), and the availability of an existing 1989 BC Ministry of Forests Recreation Opportunity Spectrum (ROS) roadless area analysis, accessed land was determined using ROS roaded class. The ROS roaded class corresponds to lands within 1 kilometer of transportation features.
- Quebec (QC): Recent high-resolution digital data was either not available, or cost-prohibitive, for use in this analysis. However, 1994 satellite imagery (125m resolution) was obtained and used as a proxy indicator for access in Quebec. The image data (.tiff format) was imported into ERDAS IMAGINE software as a RGB file. 50 initial classes were reduced to water, forest, burns, and non-forest areas using an unsupervised classification. Non-forest areas include urban, rural, recently cut, and regenerating forest

land. Non-forest land within tenured forest management areas were reclassified as accessed land. This assumes that such lands, including harvested forests, are within 1 km of an access corridor used to develop or log these areas.

- Alberta (AB) and Northeast BC: These areas were analyzed for linear disturbance density using 1:20,000 to 1:50,000 input data (See Alberta case study). Lands with densities greater than zero were reclassified as accessed. As the original road density analysis was conducted using an approximate buffer of 600 meters, the AB/NEBC access data includes some lands that are up to 1.2 km from an access corridor. Therefore, the extent of accessed lands is slightly overestimated in AB and NEBC. The high proportion of accessed lands in AB and NEBC is related to the extremely high density of oil and gas seismic lines within these areas. (See Alberta case study).

The sharp distinction between accessed land in Alberta and certain unaccessed land along the AB/Saskatchewan (SK) and AB/NEBC/North West Territories (NWT) borders reflects the lack of seismic line data for both SK and NWT.

Accessed lands within Newfoundland are likely greatly underestimated due to limited input data (1:1,000,000 scale). SOURCE DATA

THEME 1: ACCESSED LANDS

Unless otherwise stated, data processing followed the general methodology described above.

Newfoundland VMAP0_R4 (Digital Chart of the World)

transportation and utility vector data

PROVIDER: Geogratias,

Geomatics Canada

Canadian Center for Remote Sensing, NRCAN

[http: HTTP: Approximate](http://HTTP: Approximate)

Average 1990.

SCALE: 1:1,000,000.

PROCESSING: See general methodology

Nova Scotia

DATA: 1:50,000 roads, railways and utilities database.

PROVIDER: Scotia Geomatics Center

[http: HTTP: Estimated Average mid-80s](http://HTTP: Estimated Average mid-80s)

to early 90s. Highways more recently updated than secondary roads. 1:50,000

PROCESSING: See general methodology

New Brunswick

DATA: Digital Topographic Database of New Brunswick.

PROVIDER: New Brunswick

[http: HTTP: 1996.](http://HTTP: 1996.)

SCALE: 1:10,000

PROCESSING: See general methodology

Quebec "Le Quebec forestier meridional" (LANDSAT satellite image composite of Quebec commercial forest zone).

PROVIDER: Direction de la gestion des stocks forestiers

Ministere des Ressources naturelles du Quebec

[http: HTTP: 1993/1994](http://HTTP: 1993/1994)

SCALE: 125 meter resolution

PROCESSING: See Discussion notes.

- Non-forest lands may be overestimated in northern portions of the Quebec commercial forest zone due to higher level of bog land cover during classification.

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data

PROVIDER: See

above. Raster summary grid file of access corridors.

Original source data includes:

- Ontario Base Map 1:20,000 roads, railway, and transmission line data;

- Ontario logging roads from Landsat imagery;
- Ontario roads from the Digital Topographic Database 1:600,000 scale;
- Ontario Provincial Snowmobile Trails.

PROVIDER: Ministry of Natural Resources.

SOURCE DATE: Variable - estimated between mid-80s to mid-90s. 200m resolution raster grid

PROCESSING: Projected to SOF LCC

- 200m data buffered to 1km access corridor.
- Resampled to 1km resolution.
- Reclassed to single access class.

Manitoba Manitoba Road Network (from Forest Resources Inventory data) roads data.

PROVIDER: Natural Resources, Forestry Branch

SOURCE DATE: Quoted average age "10-20 years old".

SCALE: 1:20,000

PROCESSING: See general methodology

Notes: Limited metadata provided, therefore there was no ability to verify data content.

- The Manitoba road network consists of the provincial trunk highways and municipalities roads. This network does not include all roads constructed by the forestry and mining sectors or all the winter roads used to access some of the northern communities.

NAME: VMAP0_R4 (Digital Chart of the World) railway and utility vector data

See above.

Saskatchewan Saskatchewan Road Network road and railway data (forested region only)

PROVIDER: Saskatchewan Property Management Corporation

[http: HTTP: 1996-1998.](http://1996-1998)

SCALE: 1:20,000

PROCESSING: See general methodology

Notes: No oil/gas seismic data.

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data (grassland region)

See above.

Alberta Alberta Case Study (forested region only)

NAME: VMAP0_R4 (Digital Chart of the World) transportation and utility vector data (Alberta grassland region)

See above.

British Columbia

DATA: Recreation Opportunity Spectrum

PROVIDER: data from BC Ministry of Forests, Recreation Branch. data obtained from Earthlife Canada Foundation Vancouver, BC

CREATION DATE: 1989

SCALE: 1:2,000,000

PROCESSING: Roaded land reselected from ROS data.

Rasterized at 1km², reclassified, and projected to SOF LCC.

Notes: Original data rubber-sheeted to BC coastline, with resulting inaccuracies.

Northeast BC was analyzed using Alberta methodology. See Alberta case study.

DATA: 1:1m VMAP transportation (Northwest BC only) and utility data.

See above.

Yukon Territory

DATA: 1:250,000 topographic data (includes roads, trails, seismic lines and utility lines).

PROVIDER: Government, Department of Renewable Resources

SOURCE DATE: Variable. Original data 1970-1990. Partially updated 1995.

SCALE: 1:250,000

PROCESSING: See general methodology

Notes: Data extends into portions of Northwest Territories.
Northwest Territories

DATA: VMAP0_R4 (Digital Chart of the World) transportation
and utility vector data

See above.

Notes: Missing oil/gas data.

- VMAP0_R4 data confirmed with Ministry of Tourism road
map. VMAP0_R4 (Digital Chart of the World)
transportation and utility vector data

See above.

National Data

DATA: VMAP0_R4 (Digital Chart of the World) populated
places point data.

See above.

THEME 2: LAND COVER OF CANADA (Unaccessed)

DATA: Land Cover of Canada Version 1.1 raster data

PROVIDER: Center for Remote Sensing (CCRS), EMS Section.

http: [HTTP: 1995](http://1995)

SCALE: 1 km raster grid

PROCESSING: Projected to SOF Lambers Conformal Conic
standard projection, NAD 27.

Online Linkage:

Larger Work Citation:

Citation Information:

Originator:

Publication Date:

Title:

Publication Information:

Publication Place:

Publisher:

Online Linkage:

Source Scale Denominator:

Type of Source Media:

Source Time Period of Content:

Time Period Information:

Range of Dates/Times:

Beginning Date:

Ending Date:

Source Currentness Reference:

Source Citation Abbreviation:

Source Contribution:

Source Information:

Source Citation:

Citation Information:

Originator:

Publication Date:

Title:

Edition:

Geospatial Data Presentation Form: map

Publication Information:

Publication Place:

Publisher:

Other Citation Details:

Accessed / Unaccessed Forests

A. LABEL / CATEGORY DEFINITIONS

1. ACCESSED LANDS: Lands which are within one kilometer of
a known access corridor. Access corridors include roads,
railways, pipelines (oil/gas), hydroelectric and telephone
transmission lines.

2. LAND COVER OF CANADA (Unaccessed): Used to define

forest, nonforest, and converted lands. Input dataset:

Canadian Center for Remote Sensing 1995 Land Cover of

Canada (LC95). Classes as follows:

The following classes were grouped as 'forest:'

· Southern Boreal and Other Forests: All forest classes,

excluding "Northern Forest" (boreal) medium and low density evergreen needleleaf forest, and 2 "Burns" classes. (LC95 classes 1-2,4,6-12)

- Northern Boreal Forest: "Northern Forest" (boreal) medium and low-density evergreen needleleaf forest classes. (LC95 classes 3,5)

The following classes were considered 'nonforest':

- Open Land (Wetland/Shrubland): All "Open Land" (tree crown density of less than 10%) classes. (LC95 classes 13,14,15)

- Grassland: LC95 class 16.

- Barren Land: All "Barren Land" classes. (LC95 classes 17-22)

- Snow/Ice: LC95 class 31.

- Freshwater: LC95 class 30.

The following classes were considered 'converted forest land':

Lands that have been converted from a historic forest/forest ecosystem condition to non-forest land.

Grassland conversion is not shown or considered. Subclasses

include:

- Urban: Lands classified as "Developed - Urban/Built Up Area" from 1995 Land Cover of Canada (LC95) data.

- Rural: Lands classified as "Developed - Cropland", and "Developed - Cropland/Other" from LC95 data.

MIXED FOREST LAND: Lands defined as "Developed - Cropland/Woodland" and "Developed - Woodland/Cropland" from LC95 data.

FOREST REGIONS OF CANADA: Based on Rowe's Forest Regions of Canada.

B. METHODOLOGY / TECHNICAL NOTES

GENERAL METHODOLOGY

1. Access corridors include linear vector or raster data for transportation (roads, trails, railways, and abandoned railways), and utilities (oil/gas, hydro, and telephone).

2. The analysis resolution was set to 1 km² to match the CCRS 1995 Land Cover of Canada (LC95) data that is used as a base layer for land and forest cover in Canada. This resolution also corresponds to the lowest resolution found in the set of input access data.

3. No attempt was made to differentiate between the different types of access corridors (no weighting). The impact extent for all linear corridors was modeled as 1 km in width.

4. Input vector data was rasterized using a 1-km² grid relative to the origin of the LC95 data. Grid output cells (1-km²) were classified as accessed if any input corridor vector was present within the cell.

5. The national access corridor grid was merged with the LC95 land cover data. Any LC95 cell (excluding water) that corresponded to an access grid cell was reclassified as accessed. In addition, all LC95 Developed classes (cropland, cropland/woodland, woodland/cropland, cropland/other, and urban classes - 23 to 29) were reclassified as accessed.. This assumes that these classes would be accessible by nature of being developed in whole or in part.

Finally, the resulting accessed/unaccessed land cover grid was merged with a national 1:1,000,000 populated places dataset to ensure that small northern communities that are fly-in only were considered within the analysis.

C. SOURCE DATA

THEME 1: ACCESSED LANDS

Unless otherwise stated, data processing followed the general methodology described above.

NAME: DMTI CanMap Streetfiles V2.0
 PROVIDER: DMTI Spatial
 SOURCE DATE: based on 1996 CMA boundary extents
 SCALE: 1:50,000
 PROCESSING: Following layers included in analysis: Roads
 (including Expressways, Principal highways, Major Roads,
 Local Roads
 National Data
 DATA: VMAP0_R4 (Digital Chart of the World) populated
 places point data.
 see above.
 THEME 2: LAND COVER OF CANADA (Unaccessed)
 DATA: Land Cover of Canada Version 1.1 raster data
 PROVIDER: Canadian Center for Remote Sensing (CCRS) and the
 Canadian Forest Service.
 SOURCE DATE: 1995
 SCALE: 1 km² resolution1:1,000,000
 PROCESSING: to SOF Lambers Conformal Conic standard
 projection, NAD 27.

Online Linkage:**Larger Work Citation:****Citation Information:****Originator:****Publication Date:****Title:****Publication Information:****Publication Place:****Publisher:****Online Linkage:****Source Scale Denominator:****Type of Source Media:****Source Time Period of Content:****Time Period Information:****Range of Dates/Times:****Beginning Date:****Ending Date:****Source Currentness Reference:****Source Citation Abbreviation:****Source Contribution:****Source Information:****Source Citation:****Citation Information:****Originator:****Publication Date:****Title:****Edition:****Geospatial Data Presentation Form:** map**Publication Information:****Publication Place:****Publisher:****Other Citation Details:****Online Linkage:****Larger Work Citation:****Citation Information:****Originator:****Publication Date:****Title:****Publication Information:****Publication Place:****Publisher:****Online Linkage:****Source Scale Denominator:****Type of Source Media:****Source Time Period of Content:****Time Period Information:**

Range_of_Dates/Times:
Beginning_Date:
Ending_Date:
Source_Currentness_Reference:
Source_Citation_Abbreviation:
Source_Contribution:
Source_Information:
Source_Citation:
Citation_Information:
Originator:
Publication_Date:
Title:
Edition:
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place:
Publisher:
Other_Citation_Details:
SOURCE INFORMATION:
NAME: Canada Watersheds (Sub-Sub Drainage Basins)
PROVIDER: Canadian Federal Geogratis website,
[http: HTTP://geogratis.cgdi.gc.ca](http://geogratis.cgdi.gc.ca)
SCALE: 1:2,000,000
SOURCE DATE: Original source 1972 to 1977, revised mid-80s.
This coverage was digitized from a published Environment
Canada Map depicting active and discontinued hydrometric
stations operated by Water Resources Branch from 1972 to
1977. The coverage depicts primary, secondary, and tertiary
drainage basins across Canada.
Online_Linkage:
Larger_Work_Citation:
Citation_Information:
Originator:
Publication_Date:
Title:
Publication_Information:
Publication_Place:
Publisher:
Online_Linkage:
Source_Scale_Denominator:
Type_of_Source_Media:
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date:
Ending_Date:
Source_Currentness_Reference:
Source_Citation_Abbreviation:
Source_Contribution:
Source_Information:
Source_Citation:
Citation_Information:
Originator:
Publication_Date:
Title:
Edition:
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place:
Publisher:
Other_Citation_Details:
SOURCE INFORMATION:
NAME: Canada Watersheds (Sub-Sub Drainage Basins)
PROVIDER: Canadian Federal Geogratis website,
[http: HTTP:2,000,000](http://2,000,000)

SOURCE DATE: Original source 1972 to 1977, revised mid-80s. This coverage was digitized from a published Environment Canada Map depicting active and discontinued hydrometric stations operated by Water Resources Branch from 1972 to 1977. The coverage depicts primary, secondary, and tertiary drainage basins across Canada.

Online_Linkage:**Larger_Work_Citation:****Citation_Information:****Originator:****Publication_Date:****Title:****Publication_Information:****Publication_Place:****Publisher:****Online_Linkage:****Source_Scale_Denominator:****Type_of_Source_Media:****Source_Time_Period_of_Content:****Time_Period_Information:****Range_of_Dates/Times:****Beginning_Date:****Ending_Date:****Source_Currentness_Reference:****Source_Citation_Abbreviation:****Source_Contribution:****Process_Step:****Process_Description:****Source_Used_Citation_Abbreviation:****Process_Date:****Source_Produced_Citation_Abbreviation:****Process_Contact:****Contact_Information:****Contact_Person_Primary:****Contact_Organization:****Contact_Person:****Contact_Position:****Contact_Address:****Address_Type:** mailing and physical address**Address:****City:****State_or_Province:****Postal_Code:****Country:****Contact_Voice_Telephone:****Contact_Facsimile_Telephone:****Contact_Electronic_Mail_Address:****Hours_of_Service:**[Top](#)**SPATIAL_DATA_ORGANIZATION_INFORMATION****Direct_Spatial_Reference_Method:** Vector**Point_and_Vector_Object_Information:****SDTS_Terms_Description:****SDTS_Point_and_Vector_Object_Type:** GT-polygon composed of chains**Point_and_Vector_Object_Count:** 845[Top](#)

SPATIAL_REFERENCE_INFORMATION

Horizontal_Coordinate_System_Definition:

Planar:

Map_Projection:

Map_Projection_Name: Lambert Conformal Conic

Lambert_Conformal_Conic:

Standard_Parallel: -95.000000

Standard_Parallel: 49.000000

Longitude_of_Central_Meridian: 49.000000

Latitude_of_Projection_Origin: 77.000000

False_Easting: 0.000000

False_Northing: 0.000000

Standard_Parallel: -95.000000

Standard_Parallel: 49.000000

Longitude_of_Central_Meridian: 49.000000

Latitude_of_Projection_Origin: 77.000000

False_Easting: 0.000000

False_Northing: 0.000000

Planar_Coordinate_Information:

Planar_Coordinate_Encoding_Method: Coordinate pair

Coordinate_Representation:

Abscissa_Resolution:

Ordinate_Resolution:

Planar_Distance_Units: Meters

Geodetic_Model:

Horizontal_Datum_Name: North American Datum of 1927

Ellipsoid_Name: Clarke 1866

Semi-major_Axis: 6378206.4000000

Denominator_of_Flattening_Ratio: 294.98

[Top](#)

ENTITY_AND_ATTRIBUTE_INFORMATION

Overview_Description:

Entity_and_Attribute_Overview:

SUBDIV is a 3-character code for the drainage sub-division:

The first two characters are always numeric and represent the primary drainage division; the last character is always alphabetic and represents the first order drainage sub-division. Drainage sub-divisions are named (see below).

SUBSUBDIV is a 4-character code for the drainage

sub-sub-division:

The first three characters are the same as the sub-division code above; the last alphabetic code further breaks down the drainage basins by principal river. Drainage sub-sub-divisions are not named.

Entity_and_Attribute_Detail_Citation:

[Top](#)

DISTRIBUTION_INFORMATION

Distributor:**Contact_Information:****Contact_Organization_Primary:****Contact_Organization:****Contact_Person:****Contact_Position:****Contact_Address:****Address_Type:** mailing and physical address**Address:****City:****State_or_Province:****Postal_Code:****Country:****Contact_Voice_Telephone:****Contact_Facsimile_Telephone:****Contact_Electronic_Mail_Address:****Hours_of_Service:****Resource_Description:****Distribution_Liability:**[Top](#)

METADATA_REFERENCE_INFORMATION**Metadata_Date:****Metadata_Review_Date:****Metadata_Contact:****Contact_Information:****Contact_Organization_Primary:****Contact_Organization:****Contact_Person:****Contact_Position:****Contact_Address:****Address_Type:** Mailing and physical address**Address:****City:****State_or_Province:****Postal_Code:****Country:****Contact_Voice_Telephone:****Contact_Facsimile_Telephone:****Contact_Electronic_Mail_Address:****Hours_of_Service:****Metadata_Standard_Name:** FGDC CSDGM**Metadata_Standard_Version:** FGDC-STD-001-1998[Top](#)