PEATLANDS OF CANADA DATABASE
Version 2 (March 2005)

Table of Contents:

1. INTRODUCTION

Peatlands, which are dominant features of the Canadian landscape, cover approximately 1136 x 10^3 km^2, or 13% of the land area. These peatlands are essential to the global environment because they retain, purify and deliver fresh water, store carbon, absorb pollutants and support numerous species of plants and wildlife, many of them identified as endangered. Under current scenarios of increasing greenhouse gases, the expected increases in global temperatures have the potential to affect peatlands in many areas. Most of the peatlands (97%) occur in the Boreal Peatland Region (64%) and Subarctic Peatland Region (33%). Because of the large area they cover and their high organic carbon content, these peatlands contain approximately 147 Gt soil carbon, which is about 59% of the organic carbon stored in all Canadian soils.

2. CONTENTS OF CD

This CD is broken down into 5 folders:
1. a DATA folder containing the digital GIS peatland database in ARCVIEW shape files (found in a shp subdirectory) and in ARC/INFO export format (PEAT032005.E00). Please note, shape files do not contain the peatlands layer table. The file peat032005lyr.dbf, found in the SHP folder, is the layer table in dbase format.
2. a PUBMAP folder with published maps in JPEG format, Adobe PDF format and rasterized ESRI plot files
3. a DOC folder with readme documentation in word format
4. an application software folder called APP with software to read shape files
5. a STATS folder with statistics related to area of peatland by peatland type, SOC masses and SOC contents by peatland type and administrative provinces and ecoclimatic regions. Statistics were calculated after projecting the data in a Lambert Azimuthal equal area projection with the specifications below.

Radius of sphere of reference is 6370997.
Longitude of center of projection is -91 degrees, 52 minutes, 0 seconds.
Latitude of center of projection is 63 degrees, 0 minutes, 0 seconds.
False easting is 0 meters.
False northing is 0 meters.

3. PROJECTION PARAMETERS OF DATA ON CD

Lambert Conformal Projection
Datum is Nad27
Spheroid is Clarke 1866
Units METERS
1st standard parallel is 49 degrees, 0 minutes, 0 seconds
2nd standard parallel is 77 degreees, 0 minutes, 0 seconds

Central Meridian is -91 degrees, 52 minutes, 0 seconds
Latitude of Projection's Origin is 0 degrees, 0 minutes, 0 seconds
False Easting is 0 meters
False Northing is 0 meters

4. PEAT DEFINITIONS

Peat is material consisting largely of organic residues originating under more or less water-saturated conditions through the incomplete decomposition of plant and animal constituents. It forms as a result of anaerobic conditions, low temperatures, and other complex causes.

Peatlands (formerly referred to as organic terrain or muskeg) are wetlands with massive deposits of peat that are at least 40 cm thick (National Wetlands Working Group, 1988). Each of the four classes of peat - bog, fen, swamp or marsh - may take several to numerous forms depending on the climate, hydrology, presence or absence of permafrost, form and composition of underlying surficial materials.

Bogs are peatlands having the water table at or near the surface (National Wetlands Working Group, 1988). Since the bog surface, which may be either raised or level with the surrounding terrain, is virtually unaffected by nutrient rich groundwater from the surrounding mineral soils, it is generally acid and low in nutrients. The dominant materials are weakly to moderately decomposed sphagnum and woody peat, underlain at times by sedge peat. Bogs, which may be treed or treeless, are usually covered with Sphagnum spp. and ericaceous shrubs.

Fens are peatlands usually having the water table at or just above the surface (National Wetlands Working Group, 1988). The waters are nutrient-rich and originate from mineral soils. The dominant materials are moderately to well-decomposed sedge and/or brown moss peat of variable thickness. The vegetation consists predominately of sedges, grasses, reeds, brown mosses, with some shrubs, and, at times, a sparse tree layer.

Marshes are mineral lands or peatlands periodically inundated by standing or slowly moving water (National Wetlands Working Group, 1988). Surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mudflats. The nutrient-rich waters vary from fresh to highly saline. The substratum usually consists of mineral material, although occasionally it consists of well-decomposed peat. Marshes characteristically show zonal or mosaic surface patterns composed of pools or channels interspersed with clumps of emergent sedges, grasses, rushes and reeds that border grassy meadows and peripheral bands of shrubs or trees. Submerged and floating aquatics flourish in areas of open water.

Swamps are mineral wetlands or peatlands with standing water or water gently flowing through pools or channels (National Wetlands Working Group, 1988). The water table is usually at or near the surface. Pronounced internal water movement from the margin or other mineral sources

results in nutrient rich waters. Peat, when present, is primarily well decomposed wood underlain, at times, by sedge peat. Vegetation is characterized by a dense cover of deciduous or coniferous trees or shrubs, herbs and mosses.

5. CARBON VARIABLE DEFINITIONS

Total carbon content of the polygon (kg/m^2), 'TOCC', is a measure of the average amount of soil organic carbon of the total depth of the soil (all three layers of data recorded in the Peatlands Layer Table, see section 8) found in the land area of a soil landscape polygon.

Surface carbon content of the polygon (kg/m^2), 'SOCC', is a measure of the average amount of soil organic carbon of the active layer (0-30 cm) found in the land area of a soil landscape Polygon.

From 0-100 cm depth, carbon content of the polygon (kg/m^2), 'MOCC', is a measure of the average amount of soil organic carbon of the top 100 cm of soil found in the land area of a soil landscape polygon.

6. PEATLAND DEVELOPMENT

The distribution of peatlands is determined by the climate and by the morphology of the land surface (National Wetlands Working Group, 1988). Climate determines the amount of water received and retained while the morphology of the land influences the distribution of the water and, thus, the location of peatlands. Peatlands develop initially when areas of high water table are infilled with peat-forming vegetation such as that found in fens and bogs. Bogs are dependant upon rainfall for water (ombrotrophic), while fens can also obtain water that originates from the surrounding (adjacent) mineral terrain (minerotrophic).

Canadian peatlands, developed during the Holocene epoch, are most extensive in poorly-drained areas of glaciomarine and glaciolacustrine silt and clay and of fine-grained tills in the Hudson Bay Lowlands, in the Mackenzie River valley region, and in northern Alberta and northern Manitoba. They are also common in topographic depressions in the rugged Precambrian Shield terrain in central Canada.

7. DATABASE COMPILATION

The current Peatlands of Canada Database (Tarnocai et al. 2005) was developed by updating the 2000 version of the database using new spatial and site data together with updated information from the peatland component of the Soil Organic Carbon Database (Tarnocai and Lacelle 1996). Although all these databases were developed in an ARC/INFO environment, the current version (Tarnocai et al. 2005) differs from the earlier versions in that it contains an expanded polygon

attribute table and a peat layer table. Since this peat layer table includes all the data necessary to calculate carbon content, this latest version of the database provides the means for generating peatlands maps not only to estimate peatland areas but also to determine the relationship between the amounts of organic carbon and the various peatland classes and regions.

The SLC database was the primary source of information for the Atlantic Provinces, Quebec, Ontario, the Yukon, and parts of British Columbia, the Northwest Territories and Nunavut. Information for the Prairie Provinces was obtained primarily from Vitt et al. (1995), Halsey and Vitt (1997), Halsey et al. (1997), an Vitt et al. (2000). It should be noted that, for purposes of consistency with other sources of data, some units categorized in the Prairie Provinces as non-patterned wooded fen have been designated bogs in this compilation. The Mackenzie River Valley area in the western Northwest Territories was mapped on the basis of peatland information obtained from Geological Survey of Canada surficial geology maps (Geological Survey of Canada, B-series and Open File Maps. 1973-1980). Because peatland data for the Prairie Provinces and Mackenzie River valley were generated at a larger scale than that of the SLC landscape polygons, these data sets were resampled to a comparable scale using the SLC polygon structure. Peatland areas in the southern Arctic islands, Great Slave Lake area and eastern Nunavut were delineated on the basis of new air photo interpretations and archived field data. Coastal British Columbia (Tarnocai et al., 2004a) and Southern Ontario (Tarnocai et al., 2004b) were updated using detailed survey data. Carbon layer data were assembled from the Soil Organic Carbon Database of Canada (Tarnocai and Lacelle, 1996). When data were not available from the Soil Organic Carbon Database, regional site data (Tarnocai and Lacelle, 2001) was used. When no other data were available, data were interpolated using the previous two sources by wetland region, frozen indicator and peatland type.

Calculation of Carbon Content and Masses

The soil organic carbon contents (OCC) were calculated using the information in the Peat Layer Table of the Peatlands of Canada Database (see digital database format section of this documentation). Data on peat thickness (T), bulk density (BD) and organic carbon (C%) obtained from peat cores were entered in the first layer; (0-25 cm for fens and marshes; 0-50 cm for bogs and swamps), second layer; (remaining basal peat) and third layer; (organic-rich mineral layer underlying the basal peat) portions of this database. The OCC was then calculated for each layer using the formula OCC = C% x BD x T. For the surface organic carbon content (SOCC) T = 30 cm, for 0-100 cm (MOCC) T = 100, and for the total organic carbon content (TOCC) T is the total depth of the three layers. Each of these values was aggregated for each peat polygon in the database. In respect to the statistics calculated and reported on this CD, the organic carbon mass (OCM) of each polygon was calculated by multiplying the OCC by the area of each peatland class in the polygon.

8. DIGITAL DATABASE FORMAT

The Peatlands of Canada Database consists of an ARC/INFO spatial cover and associated attribute files. The Polygon Attribute Table consists of the distribution of peatland classes within

the polygon, their percent distribution and the soil organic carbon contents (OCC) of each spatial polygon. The Peatlands Layer Table is a file which holds the peatlands layer information needed to calculate soil organic carbon. There are a maximum of three layers per soil. See Section 7, calculation of carbon content and masses for a more in depth analysis of this file.

Polygon Attribute Table

Area of polygon (m2)	AREA
Polygon number	POLYGON_ID
Peatland Region*	PEATLANDREGION
Land (%)	LAND_PCT
Fresh Water (%)	H2OFRESH_PCT
Ocean Water (%)	H2OOCEAN_PCT
Rockland (%)	ROCKLAND_PCT
Glaciers (%)	GLACIER_PCT
Total peatland (%)	PEATLAND_PCT
Bog (%)	BOG_PCT
Fen (%)	FEN_PCT
Swamp (%)	SWAMP_PCT
Marsh (%)	MARCH_PCT
Perennially frozen peatland (%)	PEATLANDFRZN_PCT
Unfrozen peatland (%)	PEATLANDUNF_PCT
Total organic carbon content (kg m^{-2})	TOCC
One metre organic carbon content (kg m^{-2})	MOCC
Surface organic carbon content (kg m^{-2})	SOCC

*National Wetland Working Group, 1986

Peat Layer Table

Polygon number	POLYGON_ID
Peatland Class	PEATCLASS
Layer number	LAYERNO
Layer Designation	LAYER
Layer Thickness (cm)	THICK
Layer Thickness Data Indicator*	THICK-ME
Bulk Density (gm/cm^3)	BDENS
Bulk Density Data Indicator*	BDENS-ME
Organic Carbon (%)	OCARB
Organic Carbon Data Indicator*	OCARB-ME

* Measured or estimated indicator

9. ACKNOWLEDGEMENTS

The Biological Sources and Sinks (AP 2000) Fund of the Government of Canada provided the financial support for this project. Agriculture and Agri-Food Canada's computer facilities were used to develop and store the Peatlands of Canada Database and to generate the various statistics and peatland maps.

RECOMMENDED CITATION:

For Database:

Tarnocai, C., I.M. Kettles and B. Lacelle. 2005. Peatlands of Canada. Agriculture and Agri-Food Canada, Research Branch, Ottawa, (digital database)

For maps:

Tarnocai, C., I.M. Kettles and B. Lacelle. 2005. Peatlands of Canada. Agriculture and Agri-Food Canada, Research Branch, Ottawa, scale 1:6 500 000.

Tarnocai, C., Kettles, I. M. and Lacelle, B. 2005. Soil Organic Carbon Content of Canadian Peatlands. Agriculture and Agri-Food Canada, Research Branch, Ottawa, ON. (1:7 500 000 scale map)

Tarnocai, C., Kettles, I. M. and Lacelle, B. 2005. Soil Organic Carbon Mass of Canadian Peatlands. Agriculture and Agri-Food Canada, Research Branch, Ottawa, ON. (1:7 500 000 scale map)

REFERENCES:

Fulton, R.J (Comp.). 1995. Surficial Materials of Canada. Geological Survey of Canada. Map 1880A.

Geological Survey of Canada, B-series and Open File Maps. 1973-1980. NTS numbers 85D,E; 95A,B,G,I,J,K,N,O; 96C,D,E; 106E,F,G,H,I,J,K,L,M,N,O; 107B; 116H,I,O,P; 117A,B,C,D. Geological Survey of Canada, Ottawa. 1:125 000 scale maps.

Halsey, L.A. and D.H. Vitt. 1997. Peatland inventory data for Saskatchewan (unpublished data).

Halsey, L.A., D.H. Vitt, H. Stephens and S. Zoltai. 1997. Wetlands of Manitoba. 1:1,000,000 scale map.

Kettles, I.M. and C. Tarnocai. 1999. Development of a model for estimating the sensitivity of Canadian peatlands to climate warming. Geographie Physique and Quaternaire.

Centre for Land and Biological Research. 1996. Soil Landscapes of Canada, v.2.2. Research Branch, Agriculture and Agri-Food Canada, Ottawa (digital database).

National Soil Database. 1996. Soil Landscapes of Canada, v.2.2. Research Branch, Agriculture and Agri-Food Canada, Ottawa. (digital database).

National Wetlands Working Group. 1986. Distribution of Wetlands. Canada's Wetlands Map folio. Energy, Mines and Resources Canada and Environment Canada. Ottawa, Ontario.

National Wetlands Working Group. 1988. Wetlands of Canada. Canada Committee on

Ecological Land Classification, Environment Canada, Ecological Land Classification Series, No. 24, 454 p.

Soil Carbon Data Base Working Group. 1993. Soil Carbon Data for Canadian Soils. Centre for Land and Biological Resources Research , Research Branch, Agriculture Canada, Ottawa, 137 p.

Tarnocai, C. 1989. Peat resources in Canada. in: R.J. Fulton (ed.), Quaternary Geology of Canada and Greenland, Geological Survey of Canada, Geology of Canada, No. 1 Chapter 11, p.676-684.

Tarnocai, C., and B. Lacelle. 1996. The Soil Organic Carbon Digital Database of Canada. Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Tarnocai, C., and I.M. Kettles and B. Lacelle. 2000. Peatlands of Canada. Geological Survey of Canada, Open File 3834.

Tarnocai, C., and B. Lacelle. 2001. Wetlands of Canada Database. Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario (digital database).

Tarnocai, C., I.M. Kettles and B. Lacelle. 2005. Peatlands of Canada Database. Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario (digital database).

Tarnocai, C., and L. Hohban and B. Lacelle. 2004a. Peatlands of Coastal British Columbia. Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Tarnocai, C., and L. Hohban and B. Lacelle. 2004b. Peatlands of Southern Ontario. Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Tarnocai, C., I. M. Kettles and B. Lacelle. 2005. Soil Organic Carbon Content of Canadian Peatlands. Agriculture and Agri-Food Canada, Research Branch, Ottawa, ON. (1:7 500 000 scale map)

Tarnocai, C., I. M. Kettles and B. Lacelle. 2005. Soil Organic Carbon Mass of Canadian Peatlands. Agriculture and Agri-Food Canada, Research Branch, Ottawa, ON. (1:7 500 000 scale map)

Vitt, D.H., L.A. Halsey, M.N. Thormann and T. Martin. 1995. Peatland inventory of Alberta. Prepared for the Alberta Task Force and Alberta Environmental Protection Agency.

Vitt, D.H., L.A. Halsey, I.E. Bauer, and C. Campbell. 2000. Spatial and temporal trends in carbon storage of peatlands of continental western Canada through the Holocene. Canadian Journal of Earth Sciences 37(5): 683-693.