Technical Report on the 
Boreal Ecosystem-Atmosphere Study (BOREAS)

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Soils Data over the SSA in 
the AEAC Projection

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September 1997
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Volume 115

BOREAS Soils Data over the SSA in
Raster Format and AEAC Projection

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September 2000
BOREAS Soils Data over the SSA in Raster Format and AEAC Projection

David Knapp, Harold Rostad

Summary

This data set consists of GIS layers that describe the soils of the BOREAS SSA. The original data were submitted as vector layers that were gridded by BOREAS staff to a 30-meter pixel size in the AEAC projection. These data layers include the soil code (which relates to the soil name), modifier (which also relates to the soil name), and extent (indicating the extent that this soil exists within the polygon). There are three sets of these layers representing the primary, secondary, and tertiary soil characteristics. Thus, there is a total of nine layers in this data set along with supporting files. The data are stored in binary, image format files.

Note that several files of this data set on the BOREAS CD-ROMs have been compressed using the Gzip program. See Section 8.2 for details.

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1. Data Set Overview

1.1 Data Set Identification

BOREAS Soils Data over the SSA in Raster Format and AEAC Projection

1.2 Data Set Introduction

This data set consists of Geographic Information System (GIS) layers that describe the soils of the BOReal Ecosystem-Atmosphere Study (BOREAS) Southern Study Area (SSA). The original data were submitted as vector layers that were gridded by BOREAS staff to a 30-meter pixel size. The pixels contain integer values that link to data tables that indicate the soil name.
1.3 Objective/Purpose
These data are provided as part of the BOREAS Staff Science GIS Data Collection Program, which included the collection of pertinent map data, in both hardcopy and digital form. The objective of this data set is to provide BOREAS investigators with a map of soil types and other soil properties. Although this data set was received from Agriculture Canada, it does not cover agricultural areas of the BOREAS SSA, only forested areas.

1.4 Summary of Parameters
The parameters contained include:

SOIL CODE, MODIFIERS, EXTENT, and soil names for primary, secondary, and tertiary soil units.

1.5 Discussion
These data layers include the soil code (which relates to the soil name), modifier (which also relates to the soil name), and extent (indicating the extent that this soil exists within the polygon). There are three sets of these layers representing the primary, secondary, and tertiary soil characteristics. Thus, there is a total of nine layers in this data set along with supporting files. The data are stored in binary, image format files.

1.6 Related Data Sets
Agriculture Canada Central Saskatchewan Vector Soils Data
CanSIS Regional Soils Data in Vector Format
BOREAS Regional Soils Data in Raster Format and AEAC Projection

2. Investigator(s)

2.1 Investigator(s) Name and Title
BOREAS Staff Science

2.2 Title of Investigation
BOREAS Staff Science GIS Data Collection Program

2.3 Contact Information

Contact 1:
Dr. Harold Rostad
Agriculture Canada
Saskatoon, SK
CANADA S7N 0W0
(306) 975-6305
rostad@digger.usask.ca

Contact 2:
David Knapp
Raytheon ITSS
NASA GSFC
Code 923
Greenbelt, MD 20771
(301) 286-1424
David.Knapp@gsfc.nasa.gov
3. Theory of Measurements

Unknown.

4. Equipment

4.1 Sensor/Instrument Description
Unknown.

4.1.1 Collection Environment
Unknown.

4.1.2 Source/Platform
Unknown.

4.1.3 Source/Platform Mission Objectives
Unknown.

4.1.4 Key Variables
Unknown.

4.1.5 Principles of Operation
Unknown.

4.1.6 Sensor/Instrument Measurement Geometry
Unknown.

4.1.7 Manufacturer of Sensor/Instrument
Unknown.

4.2 Calibration
Unknown.

4.2.1 Specifications
Unknown.

4.2.1.1 Tolerance
Unknown.

4.2.2 Frequency of Calibration
Unknown.

4.2.3 Other Calibration Information
Unknown.

5. Data Acquisition Methods

These data were acquired in ARC/INFO EXPORT format as vector coverages. The Soil Names file and Soil Layer file are standard files that provide soil attributes for the province of Saskatchewan. The soil code for each polygon can be linked to the corresponding soil number attribute in the Soil Names file.
6. Observations

6.1 Data Notes
Unknown.

6.2 Field Notes
Unknown.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage
These data cover the Southern Study Area (SSA) and a buffer area around it. The locations of the
outside corners of the corner pixels are:

<table>
<thead>
<tr>
<th>Point</th>
<th>BOREAS X (km)</th>
<th>BOREAS Y (km)</th>
<th>Longitude</th>
<th>Latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest</td>
<td>303.000</td>
<td>399.990</td>
<td>106.31380W</td>
<td>54.50245N</td>
</tr>
<tr>
<td>Northeast</td>
<td>464.610</td>
<td>399.990</td>
<td>103.82894W</td>
<td>54.37908N</td>
</tr>
<tr>
<td>Southeast</td>
<td>464.610</td>
<td>282.000</td>
<td>104.01113W</td>
<td>53.32543N</td>
</tr>
<tr>
<td>Southwest</td>
<td>303.000</td>
<td>282.000</td>
<td>106.43333W</td>
<td>53.44574N</td>
</tr>
</tbody>
</table>

7.1.2 Spatial Coverage Map
Not available.

7.1.3 Spatial Resolution
These data were gridded to a cell size of 30 meters in the X and Y directions.

7.1.4 Projection
The established BOREAS grid system is based on the ellipsoidal version of the Albers Equal-Area
Conic (AEAC) projection as defined within the North American Datum of 1983 (NAD83). The origin
of the grid is at 111° W, 51° N, and the standard parallels are set to 52.5° N and 58.5° N as prescribed
the projection equations used to calculate the BOREAS grid coordinates were taken from this
manual.

7.1.5 Grid Description
The gridded layers are projected into the AEAC projection described in Section 7.1.4 at a
resolution of 30 meters per pixel (grid cell) in both the X and Y directions.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage
The time at which these soils were mapped could not be determined. They may have originally
been mapped in the early 1980s, but the data have been updated and edited by Agriculture Canada
based on new information since that time.

7.2.2 Temporal Coverage Map
Not available.
7.2.3 Temporal Resolution
Unknown.

7.3 Data Characteristics

7.3.1 Parameter/Variable
SOIL CODE 1
SOIL CODE 2
SOIL CODE 3
MODIFIER SOIL 1
MODIFIER SOIL 2
MODIFIER SOIL 3
EXTENT OF SOIL 1
EXTENT OF SOIL 2
EXTENT OF SOIL 3

7.3.2 Variable Description/Definition

SOIL_CODE1 3-character code for the primary soil name. In this layer, the numerical value of each pixel corresponds to the SOIL_NUM attribute in the soil name and soil layer files. There is a unique SOIL_NUM for each SOIL_CODE.

SOIL_CODE2 3-character code for the secondary soil name. This layer is coded and can be used in the same way as the SOIL_CODE1 layer.

SOIL_CODE3 3-character code for the tertiary soil name. This layer is coded and can be used in the same way as the SOIL_CODE1 layer.

MODIFIER1 3-character code to show soil variations of the primary soil. The modifier applies to the soil name and the soil code. The numerical value of each pixel in this layer corresponds to the MOD_NUM attribute in the soil name and soil layer files. There is a unique MOD_NUM for each MODIFIER. Together with the SOIL_NUM, a unique record can be identified in the soil name and soil layer file that matches both the SOIL_NUM and MOD_NUM of the pixel.

MODIFIER2 3-character code to show soil variations. The modifier applies to the soil name and the soil code.

MODIFIER3 3-character code to show soil variations. The modifier applies to the soil name and the soil code.

EXTENT1 Percent of the map occupied by a specific soil. The numeric value of each pixel represents the percentage. 
Range = 34 to 100

EXTENT2 Percent of the map occupied by a specific soil. The numeric value of each pixel represents the percentage. 
Range = 0 to 50

EXTENT3 Percent of the map occupied by a specific soil. The numeric value of each pixel represents the percentage. 
Range = 0 to 33

The three SOIL_CODE and three MODIFIER layer attributes are associated with soil names. As explained above, they can be linked to the SOIL_NUM and MOD_NUM values in the soil name and soil layer files. Please refer to section 8.2.1 to decode this information in the soil names file. The items in the soil names file are listed in the following order:

UNKNOWN An unknown and undocumented attribute
PROVINCE Province name (here they will all be SK for Saskatchewan)
SOIL_NUM The number of the soil, which is directly related to the SOIL_CODE
A subset of the Soil Layer file is also included with this data set. This subset includes the layer information for the soils that occur in the SSA. The information in the Soil Names file can be linked to the Soil Layer file with the SOIL_NUM and/or SOIL_CODE. The Soil Layer file provides information about the soil strata for a particular soil name. The attributes in the Soil Layer file include:

PROVINCE Province name (here they will all be SK for Saskatchewan)
SOIL_NUM The number of the soil, which is directly related to the SOIL_CODE
MOD_NUM The number of the soil modifier, which is directly related to the MODIFIER
SOIL_CODE A 3-character code identifying a soil
MODIFIER Soil type modifier
LU Land use
LAYER_NO Horizon number
HZN_LIT Horizon lithological discontinuity
HZN_MAS Master horizon (upper case)
HZN_SUF Master suffix (lower case)
HZN_MOD Horizon modifier
UDEPTH Upper horizon depth (cm)
LDEPTH Lower horizon depth (cm)
COFRAG Coarse fragments (% by volume)
DOMSAND Dominant sand fraction
VFSAND Very fine sand (% by weight)
TSAND  Total sand  (% by weight)
TSILT  Total silt  (% by weight)
TCLAY  Total clay  (% by weight)
ORGCARB  Organic carbon  (% by weight)
PHCA  pH in calcium chloride
PH2  pH as specified in project report
BASES  Base saturation
CEC  Cation exchange capacity  (meq/100g)
KSAT  Saturated hydraulic conductivity  (cm/h)
KP0  Water retention at  0 kilopascals
KP10  Water retention at  10 kilopascals
KP33  Water retention at  33 kilopascals
KP1500  Water retention at  1,500 kilopascals

(Water retention units are % by volume corrected for coarse fragment content.)

BD  Bulk density  (g/cm³)
EC  Electrical conductivity  (dS/m)
CACO₃  Calcium carbonate equivalent  (%)
VONPOST  Von Post estimate of decomposition
WOOD  Volume  (%) of woody material
DATE  Date of last revision

7.3.3 Unit of Measurement
SOIL_CODE1  - Coded but unitless value
SOIL_CODE2  - Coded but unitless value
SOIL_CODE3  - Coded but unitless value
MODIFIER1  - Coded but unitless value
MODIFIER2  - Coded but unitless value
MODIFIER3  - Coded but unitless value
EXTENT1  - Percent
EXTENT2  - Percent
EXTENT3  - Percent

7.3.4 Data Source
The data from which this data set was derived were acquired in ARC/INFO format from:

Dr. Harold P.W. Rostad, Unit Head
Agriculture Canada-Research-CLBRR/LRD
Saskatchewan Land Resource Unit
Room 5C26 Agriculture Building
c/o The Soil Science Department
University of Saskatchewan Campus
Saskatoon, SK CANADA S7N 0W0

7.3.5 Data Range
See Section 7.3.2.

7.4 Sample Data Record
The following are sample data records of the Saskatchewan Soil Names File:

T,SK,2,1,ARDILL O.B,ADA,,A,M,NO,0,,-,W,TILL,,-,-,CH,O,B,,19901213,L20,40,AN,CRET,
,-,-,VC,CL,-,FL,-T,SK,2,41,ARDILL O.B,ADA,R,A,M,NO,4,LI,W,TILL,RESD,,-,CH,O,B,,
19901213,L20,40,AN,CRET,-,-,VC,CL,-,FL,
The following are sample data records of the Saskatchewan Soil Layer File:

SK,2,1,ADA,,A,1,,A,p,,0,13,0,VF,12,38,36,26,1.7,6.8,7.0,100,22,3.290,47,-9,34,
20,1.40,1,0,-9,-9,19910111SK,2,1,ADA,,A,2,,B,m,,13,40,0,VF,13,35,32,33,1.0,7.2,
7.4,100,24,2.350,47,-9,35,21,1.40,1,0,-9,-9,19910111

**8. Data Organization**

**8.1 Data Granularity**
The smallest unit of data for this data set is the entire data set on tape.

**8.2 Data Format(s)**

**8.2.1 Uncompressed Data Files**
This data set consists of the following files:

<table>
<thead>
<tr>
<th>File</th>
<th>Attribute Name</th>
<th>NP</th>
<th>NL</th>
<th>BYTES/PIXEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ASCII Header File (80-byte records)</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>2</td>
<td>SOIL CODE 1</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>3</td>
<td>SOIL CODE 2</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>4</td>
<td>SOIL CODE 3</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>5</td>
<td>MODIFIER SOIL 1</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>6</td>
<td>MODIFIER SOIL 2</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>7</td>
<td>MODIFIER SOIL 3</td>
<td>5387</td>
<td>3933</td>
<td>2 (low-order byte first)</td>
</tr>
<tr>
<td>8</td>
<td>EXTENT OF SOIL 1</td>
<td>5387</td>
<td>3933</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>EXTENT OF SOIL 2</td>
<td>5387</td>
<td>3933</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>EXTENT OF SOIL 3</td>
<td>5387</td>
<td>3933</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Tabular Data of Soil Names File for Saskatchewan (ASCII, 144-byte records)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Tabular Data of Soil Layer File for Saskatchewan (ASCII, 144-byte records)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following information, which is needed to decode the Soil Names file, was extracted (with modifications) from an information sheet from the Canadian Soil Information System (CanSIS):

**LU** Land Use
- N Native Conditions
- A Agriculture

**KIND** Kind of Soil
- M Mineral
- O Organic
- N Nonsoil
- U Unclassified

**WATERTBL** Water table characteristics
- NO Not present any time
- YU Present during unspecified time
- YG Present during the growing season
- YN Present during nongrowing season
- YB Present during both seasons
**ROOTRESTR**  Soil Layer that restricts root growth
- -- Not applicable
- 0 Not present
- 1-9 Restricting layer number

**RESTR_TYPE**  Type of Root Restricting Layer
- -- Not applicable
- UN Undifferentiated
- BN Solonetzic B
- SA EC>4dS/m
- CT Compact (Basal) Till
- OR Ortstein
- FP Fragipan
- LI Lithic
- CR Cryic
- DU Duric
- PL Placic

**DRAINAGE**  Soil Drainage Class
- -- Not applicable
- VR Very Rapidly
- R Rapidly
- W Well
- MW Moderately Well
- I Imperfectly
- P Poorly
- VP Very Poorly

**MDEP1**  Mode of Deposition for primary soil
**MDEP2**  Mode of Deposition for secondary soil
**MDEP3**  Mode of Deposition for tertiary soil
- -- Not Applicable
- ANTH Anthropogenic
- COLL Colluvial
- EOLI Eolian
- FLEO Fluvioeolian
- FLLC Fluviolacustrine
- FLUV Fluvial
- FNPT Fen Peat
- FOPT Forest Peat
- GLFL Glaciofluvial
- GLLC Glaciolacustrine
- GLMA Glaciomarine
- LACU Lacustrine
- LATL Lacustro-Till
- MARI Marine
- RESD Residual
- SAPR Saprolite
- SEPT Sedimentary Peat
- SPPT Sphagnum Moss
- TILL Till (Morainal)
- UNDM Undifferentiated mineral
- UNDO Undifferentiated organic
<table>
<thead>
<tr>
<th>Soil Subgroup and Great Group</th>
<th>Characters before the dot (.) go into the S_GROUP (soil subgroup) field. Characters after the dot go into the G_GROUP (soil great group) field.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O. MB</td>
<td>Orthic Melanic Brunisolic</td>
</tr>
<tr>
<td>E. MB</td>
<td>Eluviated Melanic Brunisol</td>
</tr>
<tr>
<td>GL. MB</td>
<td>Gleyed Melanic Brunisol</td>
</tr>
<tr>
<td>GLE. MB</td>
<td>Gleyed Eluviated Melanic Brunisol</td>
</tr>
<tr>
<td>O. EB</td>
<td>Orthic Eutric Brunisol</td>
</tr>
<tr>
<td>E. EB</td>
<td>Eluviated Eutric Brunisol</td>
</tr>
<tr>
<td>GL. EB</td>
<td>Gleyed Eutric Brunisol</td>
</tr>
<tr>
<td>GLE. EB</td>
<td>Gleyed Eluviated Eutric Brunisol</td>
</tr>
<tr>
<td>O. SB</td>
<td>Orthic Sombric Brunisol</td>
</tr>
<tr>
<td>E. SB</td>
<td>Eluviated Sombric Brunisol</td>
</tr>
<tr>
<td>DU. SB</td>
<td>Duric Sombric Brunisol</td>
</tr>
<tr>
<td>GL. SB</td>
<td>Gleyed Sombric Brunisol</td>
</tr>
<tr>
<td>GLE. SB</td>
<td>Gleyed Eluviated Sombric Brunisol</td>
</tr>
<tr>
<td>O. DYB</td>
<td>Orthic Dystric Brunisol</td>
</tr>
<tr>
<td>E. DYB</td>
<td>Eluviated Dystric Brunisol</td>
</tr>
<tr>
<td>DU. DYB</td>
<td>Duric Dystric Brunisol</td>
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<tr>
<td>GL. DYB</td>
<td>Gleyed Dystric Brunisol</td>
</tr>
<tr>
<td>GLE. DYB</td>
<td>Gleyed Eluviated Dystric Brunisol</td>
</tr>
<tr>
<td>O. B</td>
<td>Orthic Brown</td>
</tr>
<tr>
<td>R. B</td>
<td>Rego Brown</td>
</tr>
<tr>
<td>CA. B</td>
<td>Calcareous Brown</td>
</tr>
<tr>
<td>E. B</td>
<td>Eluviated Brown</td>
</tr>
<tr>
<td>S  .B</td>
<td>Solonetzic Brown</td>
</tr>
<tr>
<td>GL. B</td>
<td>Gleyed Brown</td>
</tr>
<tr>
<td>GLR. B</td>
<td>Gleyed Rego Brown</td>
</tr>
<tr>
<td>GLCA. B</td>
<td>Gleyed Calcareous Brown</td>
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<tr>
<td>GLE. B</td>
<td>Gleyed Eluviated Brown</td>
</tr>
<tr>
<td>GLS  .B</td>
<td>Gleyed Solonetzic Brown</td>
</tr>
<tr>
<td>O. DB</td>
<td>Orthic Dark Brown</td>
</tr>
<tr>
<td>R. DB</td>
<td>Rego Dark Brown</td>
</tr>
<tr>
<td>CA. DB</td>
<td>Calcareous Dark Brown</td>
</tr>
<tr>
<td>E. DB</td>
<td>Eluviated Dark Brown</td>
</tr>
<tr>
<td>S  . DB</td>
<td>Solonetzic Dark Brown</td>
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<td>Gleyed Dark Brown</td>
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<td>Gleyed Rego Dark Brown</td>
</tr>
<tr>
<td>GLCA. DB</td>
<td>Gleyed Calcareous Dark Brown</td>
</tr>
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<tr>
<td>Code</td>
<td>Description</td>
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<td>GLE.DB</td>
<td>Gleyed Eluviated Dark Brown</td>
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</tr>
<tr>
<td>O.BL</td>
<td>Orthic Black</td>
</tr>
<tr>
<td>R.BL</td>
<td>Rego Black</td>
</tr>
<tr>
<td>CA.BL</td>
<td>Calcareous Black</td>
</tr>
<tr>
<td>E.BL</td>
<td>Eluviated Black</td>
</tr>
<tr>
<td>SZ.BL</td>
<td>Solonetzic Black</td>
</tr>
<tr>
<td>GL.BL</td>
<td>Gleyed Black</td>
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<tr>
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<td>Gleyed Rego Black</td>
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<td>GLCA.BL</td>
<td>Gleyed Calcareous Black</td>
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<td>GLE.BL</td>
<td>Gleyed Eluviated Black</td>
</tr>
<tr>
<td>GLSZ.BL</td>
<td>Gleyed Solonetzic Black</td>
</tr>
<tr>
<td>O.DG</td>
<td>Orthic Dark Gray</td>
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<tr>
<td>R.DG</td>
<td>Rego Dark Gray</td>
</tr>
<tr>
<td>CA.DG</td>
<td>Calcareous Dark</td>
</tr>
<tr>
<td>SZ.DG</td>
<td>Solonetzic Dark Gray</td>
</tr>
<tr>
<td>GL.DG</td>
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Dark Gray Luvisol

Brunisolic Gray Luvisol

Podzolic Gray Luvisol

Solonetzic Gray Luvisol

Fragic Gray Luvisol

Gleyed Gray Luvisol

Gleyed Dark Gray Luvisol

Gleyed Brunisolic Gray Luvisol

Gleyed Podzolic Gray Luvisol

Gleyed Solonetzic Gray Luvisol

Gleyed Fragic Gray Luvisol

Typic Fibrisol

Mesic Fibrisol

Humic Fibrisol

Limno Fibrisol

Cumulo Fibrisol

Terric Fibrisol

Terric Mesic Fibrisol

Terric Humic Fibrisol

Hydric Fibrisol

Typic Mesisol

Fibric Mesisol

Humic Mesisol

Limno Mesisol

Cumulo Mesisol

Terric Mesisol

Terric Fibric Mesisol

Terric Humic Mesisol

Hydric Mesisol

Typic Humisol

Fibric Humisol

Humic Humisol

Limno Humisol

Cumulo Humisol

Terric Humisol

Terric Fibric Humisol

Terric Mesic Humisol

Hydric Humisol

Hemic Folisol

Histic Folisol

Humic Folisol

Lignic Folisol

Orthic Humic Podzol

Ortstein Humic Podzol

Placic Humic Podzol

Duric Humic Podzol

Fragic Humic Podzol

Orthic Ferro-Humic Podzol

Ortstein Ferro-Humic Podzol

Placic Ferro-Humic Podzol

Duric Ferro-Humic Podzol

Fragic Ferro-Humic Podzol

Luvisolic Ferro-Humic Podzol
Sombric Ferro-Humic Podzol
Gleyed Ferro-Humic Podzol
Gleyed Sombric Ferro-Humic Podzol
Gleyed Ortstein Ferro-Humic Podzol
Orthic Humo-Ferric Podzol
Ortstein Humo-Ferric Podzol
Placic Humo-Ferric Podzol
Duric Humo-Ferric Podzol
Fragic Humo-Ferric Podzol
Luvisolic Humo-Ferric Podzol
Gleyed Humo-Ferric Podzol
Gleyed Sombric Humo-Ferric Podzol
Sombric Humo-Ferric Podzol
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Gleyed Regosol
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Cumulic Humic Regosol
Gleyed Humic Regosol
Gleyed Cumulic Humic Regosol
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Alkaline Solonetz
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Black Solodized Solonetz
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Gray Solodized Solonetz
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Black Solod
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Gray Solod
Gleyed Brown Solod
Gleyed Dark Brown Solod
Gleyed Black Solod
Gleyed Dark Gray Solod
Gleyed Gray Solod

PROFILE  
Header from Detail II file (Unknown)
DATE  
YY.MM.DD  Date of last revision
A-THICK  
Thickness of A horizon
L20  less than 20
### SOL-THICK

- **G20** greater than 20
- **SOL-THICK** Soil thickness in centimeters
- **99** Not applicable

### SOL-CHEM

- **SOL-CHEM** Soil Chemistry
- **UD** Undifferentiated
- **EA** Extremely Acid
- **AN** Medium Acid to Neutral
- **WC** Weakly Calcareous
- **VC** Very Calcareous
- **EC** Extremely Calcareous
- **SA** Saline
- **-** Not applicable

### PM-MODIFY

- **PM-MODIFY** Parent Material Modification
- **SHAL** Shale
- **CRET** Cretaceous
- **TERT** Tertiary
- **STON** Stony contact
- **LIME** Limestone
- **TECR** Tertiary-Cretaceous
- **NA** Not applicable

### PM-COMPLEX

- **PM-COMPLEX** Parent Material Complex
- **COM** Complex
- **NA** Not applicable

### PMDEP2

- **PMDEP2** Parent Material Deposition for secondary soil
  - **-** Not Applicable
  - **ANTH** Anthropogenic
  - **COLL** Colluvial
  - **EOLI** Eolian
  - **FLEO** Fluvioeolian
  - **FLLC** Fluviolacustrine
  - **FLUV** Fluvial
  - **FNPT** Fen Peat
  - **FOPT** Forest Peat
  - **GLFL** Glaciofluvial
  - **GLLC** Glaciolacustrine
  - **GLMA** Glaciomarine
  - **LACU** Lacustrine
  - **LATL** Lacustro-Till
  - **MARI** Marine
  - **RESD** Residual
  - **SAPR** Saprolite
  - **SEPT** Sedimentary Peat
  - **SPPT** Sphagnum Moss
  - **TILL** Till (Morainal)
  - **UNDM** Undifferentiated mineral
  - **UNDO** Undifferentiated organic
  - **VOLC** Volcanic

### PM-CHEM

- **PM-CHEM** Parent Material Chemistry
- **UD** Undifferentiated
- **EA** Extremely Acid
- **AN** Medium Acid to Neutral
- **WC** Weakly Calcareous
- **VC** Very Calcareous
- **EC** Extremely Calcareous
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<tr>
<td>WY</td>
<td>woody</td>
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<tr>
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<tr>
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8.2.2 Compressed CD-ROM Files

On the BOREAS CD-ROMs, files 1, 11, and 12 listed above are stored as ASCII text files; however, files 2 - 10 have been compressed with the Gzip compression program (file name *.gz). These data have been compressed using gzip version 1.2.4 and the high compression (-9) option (Copyright (C) 1992-1993 Jean-loup Gailly). Gzip (GNU zip) uses the Lempel-Ziv algorithm (Welch, 1994) used in the zip and PKZIP programs. The compressed files may be uncompressed using gzip (-d option) or gunzip. Gzip is available from many Web sites (for example, ftp site prep.ai.mit.edu/pub/gnu/gzip-*.* for a variety of operating systems in both executable and source code form. Versions of the decompression software for various systems are included on the CD-ROMs.

9. Data Manipulations

9.1 Formulae

9.1.1 Derivation Techniques and Algorithms

The GIS software package ARC/INFO (Version 6 and 7) was used to grid these data.

9.2 Data Processing Sequence

9.2.1 Processing Steps

- Seven separate vector ARC/INFO coverages were edgematched to make the edges of the various coverages match up as much as possible.
- The soil code or modifier (depending on what was being gridded) was linked to a table of numeric values to assign a number to each polygon based on the soil code or modifier of the polygon.
- These edgematched vector data were then gridded by assigning a numeric value to each pixel.
- BOREAS Information System (BORIS) staff copied the ASCII and compressed the binary files for release on CD-ROM.

9.2.2 Processing Changes

None.

9.3 Calculations

None.

9.3.1 Special Corrections/Adjustments

None.

9.3.2 Calculated Variables

None.

9.4 Graphs and Plots

None.
10. Errors

10.1 Sources of Error

A major source of error in the original data set could be digitizing error. There is also the possibility of coding errors in the attributes. The value of an attribute could have been keyed in incorrectly.

There is some question about the positional accuracy of the data. Although the data are mapped at a scale of 1:125,000, the source of the mapping is aerial photography that was not orthocorrected. Therefore, the soils mapping may contain distortions that exist in the air photos. This problem can be mitigated by "rubber sheeting" the data to an accurate map base, or acquiring the original air photos and compensating for their distortions. However, the minor benefits of improved positional accuracy would not be worth the time and effort of correcting all of these data.

The data that were gridded comprised seven vector layers that were edgematched. Although most of the attributes of polygons along the seams are the same, in some cases the soil attributes are different. This can cause some discontinuities in these layers.

10.2 Quality Assessment

10.2.1 Data Validation by Source

Unknown.

10.2.2 Confidence Level/Accuracy Judgment

Although the gridding procedure itself is highly accurate, there is some question as to the positional accuracy of the original data. Therefore, caution should be used when inferring information from this data set.

The source in Canada from whom these data were received has strong caveats about the use of the data. These data are constantly being updated as new data are collected and become available. These data represent broad generalizations about the soil characteristics of this area. Caution is to be used when inferring information from the data.

10.2.3 Measurement Error for Parameters

Unknown.

10.2.4 Additional Quality Assessments

Unknown.

10.2.5 Data Verification by Data Center

Each gridded image was spot-checked to ensure that the gridding procedure assigned a digital number (DN) to each attribute value.

11. Notes

11.1 Limitations of the Data

The original data were received in seven parts. These seven parts were edgematched so that the polygon boundaries were aligned with each other. The gridded data represent a merging of these two data sets. Unfortunately, some of the attributes of polygons along the border have different values. Therefore, a sharp discontinuity may exist along a map edge in the images.

11.2 Known Problems with the Data

The original vector data apparently were digitized from aerial photography that was not orthometrically corrected. Therefore, the locational accuracy of the soil polygons may not be very accurate.
11.3 Usage Guidance

Users of these data should be cautious about inferring information from this data set and extending those inferences over a larger area. The polygons from the original data set are large and may have small inclusions of various soil types that are not mapped in these data layers.

Before uncompressing the Gzip files on CD-ROM, be sure that you have enough disk space to hold the uncompressed data files. Then use the appropriate decompression program provided on the CD-ROM for your specific system.

11.4 Other Relevant Information

None.

12. Application of the Data Set

The original intended use of these data is unknown. Users from the BOREAS project might use these data for hydrological modeling or some other ecosystem modeling activity.

13. Future Modifications and Plans

None.

14. Software

14.1 Software Description

The GIS software package ARC/INFO (Version 6 and 7) was used to grid these data. Gzip (GNU zip) uses the Lempel-Ziv algorithm (Welch, 1994) used in the zip and PKZIP commands.

14.2 Software Access

ARC/INFO is a proprietary software package produced by Environmental Systems Research Institute, Inc. (ESRI), Redlands, CA.

Gzip is available from many Web sites across the Internet (for example) ftp site prep.ai.mit.edu/pub/gnu/gzip-*.*) for a variety of operating systems in both executable and source code form. Versions of the decompression software for various systems are included on the CD-ROMs.

15. Data Access

The BOREAS soils data over the SSA in raster format and AEAC projection are available from the Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).
15.1 Contact Information
For BOREAS data and documentation please contact:

ORNL DAAC User Services
Oak Ridge National Laboratory
P.O. Box 2008 MS-6407
Oak Ridge, TN 37831-6407
Phone: (423) 241-3952
Fax: (423) 574-4665
E-mail: ornldaac@ornl.gov or ornl@eos.nasa.gov

15.2 Data Center Identification
Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics

15.3 Procedures for Obtaining Data
Users may obtain data directly through the ORNL DAAC online search and order system [http://www-eosdis.ornl.gov/] and the anonymous FTP site [ftp://www-eosdis.ornl.gov/data/] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

15.4 Data Center Status/Plans
The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

16. Output Products and Availability

16.1 Tape Products
These data can be made available on 8-mm, Digital Archive Tape (DAT), or 9-track tapes at 1600 or 6250 Bytes Per Inch (BPI).

16.2 Film Products
None.

16.3 Other Products
These data are available on the BOREAS CD-ROM series.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

17.2 Journal Articles and Study Reports


17.3 Archive/DBMS Usage Documentation
None.

18. Glossary of Terms
None.

19. List of Acronyms

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<tr>
<th>Acronym</th>
<th>Definition</th>
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<td>AEAC</td>
<td>Albers Equal-Area Conic</td>
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<tr>
<td>ASCII</td>
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20. Document Information

20.1 Document Revision Dates
Written: 02-Dec-1994
Last Updated: 29-Nov-1999

20.2 Document Review Dates
Science Review:

20.3 Document ID

20.4 Citation
When using these data, please include the following acknowledgment as well as citations of relevant papers in Section 17.2:

The author(s) express their thanks to Dr. Harold Rostad (Agriculture Canada) for providing the original vector data to the BOREAS Information System (BORIS) and to the BORIS staff for creating and documenting the raster product.

If using data from the BOREAS CD-ROM series, also reference the data as:


Also, cite the BOREAS CD-ROM set as:

20.5 Document Curator

20.6 Document URL
This data set consists of GIS layers that describe the soils of the BOREAS SSA. The original data were submitted as vector layers that were gridded by BOREAS staff to a 30-meter pixel size in the AEAC projection. These data layers include the soil code (which relates to the soil name), modifier (which also relates to the soil name), and extent (indicating the extent that this soil exists within the polygon). There are three sets of these layers representing the primary, secondary, and tertiary soil characteristics. Thus, there is a total of nine layers in this data set along with supporting files. The data are stored in binary, image format files.