Title: Report Soils on the Baseline Ecosystem-Atmosphere Study (BOREAS)

Author: H. Rostad

Institute: NASA


NASA Soils Data over the SSA in the AEAC Projection

September 2000
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Volume 115

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

David Knapp, Raytheon ITSS, NASA Goddard Space Flight Center, Greenbelt, Maryland
Harold Rostad, Agriculture Canada, Ottawa, Ontario, Canada

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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.

Page 1
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 in "Map Projections - A Working Manual," USGS Professional Paper 1395, John P. Snyder, 1987. All of 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, CRE, 
-,-, 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, CRE, -,-, 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</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
### Soil Subgroup and Great Group

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.

<table>
<thead>
<tr>
<th>Soil Subgroup and Great Group</th>
<th>S_GROUP</th>
<th>G_GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthic Melanic Brunisolic</td>
<td>O.MB</td>
<td>E.MB</td>
</tr>
<tr>
<td>Eluviated Melanic Brunisol</td>
<td>GL.MB</td>
<td>GLEY.MB</td>
</tr>
<tr>
<td>Gleyed Melanic Brunisol</td>
<td>O.EB</td>
<td>E.EB</td>
</tr>
<tr>
<td>Gleyed Eluviated Melanic Brunisol</td>
<td>GL.GLEY.EB</td>
<td></td>
</tr>
<tr>
<td>Orthic Eutric Brunisol</td>
<td>O.SB</td>
<td>E.SB</td>
</tr>
<tr>
<td>Duric Sombric Brunisol</td>
<td>DU.SB</td>
<td>GLEY.SB</td>
</tr>
<tr>
<td>Gleyed Sombric Brunisol</td>
<td>O.DYB</td>
<td>E.DYB</td>
</tr>
<tr>
<td>Orthic Dystric Brunisol</td>
<td>DU.DYB</td>
<td>GLEY.DYB</td>
</tr>
<tr>
<td>Gleyed Dystric Brunisol</td>
<td>GLEY.DYB</td>
<td>GLEY.DYB</td>
</tr>
<tr>
<td>Orthic Brown</td>
<td>O.B</td>
<td>R.B</td>
</tr>
<tr>
<td>Rego Brown</td>
<td>CA.B</td>
<td>E.B</td>
</tr>
<tr>
<td>Calcareous Brown</td>
<td>CA.B</td>
<td>E.B</td>
</tr>
<tr>
<td>Eluviated Brown</td>
<td>CA.B</td>
<td>E.B</td>
</tr>
<tr>
<td>Solonetizic Brown</td>
<td>CA.B</td>
<td>E.B</td>
</tr>
<tr>
<td>Gleyed Brown</td>
<td>CA.B</td>
<td>E.B</td>
</tr>
<tr>
<td>Gleyed Rego Brown</td>
<td>GLR.B</td>
<td>GLEY.R.B</td>
</tr>
<tr>
<td>Gleyed Calcareous Brown</td>
<td>GLEY.CA.B</td>
<td></td>
</tr>
<tr>
<td>Gleyed Eluviated Brown</td>
<td>GLEY.B</td>
<td>GLEY.EB</td>
</tr>
<tr>
<td>Gleyed Solonetizic Brown</td>
<td>GLEY.B</td>
<td>GLEY.SB</td>
</tr>
<tr>
<td>Orthic Dark Brown</td>
<td>O.DB</td>
<td>R.DB</td>
</tr>
<tr>
<td>Rego Dark Brown</td>
<td>CA.DB</td>
<td>E.DB</td>
</tr>
<tr>
<td>Calcareous Dark Brown</td>
<td>CA.DB</td>
<td>E.DB</td>
</tr>
<tr>
<td>Eluviated Dark Brown</td>
<td>CA.DB</td>
<td>E.DB</td>
</tr>
<tr>
<td>Solonetizic Dark Brown</td>
<td>CA.DB</td>
<td>E.DB</td>
</tr>
<tr>
<td>Gleyed Dark Brown</td>
<td>GL.DB</td>
<td>GLEY.DB</td>
</tr>
<tr>
<td>Gleyed Rego Dark Brown</td>
<td>GLR.DB</td>
<td>GLEY.R.DB</td>
</tr>
<tr>
<td>Gleyed Calcareous Dark Brown</td>
<td>GLCA.DB</td>
<td>GLEY.CA.DB</td>
</tr>
<tr>
<td>Gleyed Eluviated Dark Brown</td>
<td>GLCA.DB</td>
<td>GLEY.EB</td>
</tr>
<tr>
<td>Gleyed Solonetizic Dark Brown</td>
<td>GLCA.DB</td>
<td>GLEY.SB</td>
</tr>
</tbody>
</table>

---

**Notes:**

- **VOLC Volcanic**
- **ORDER Soil Order**
  - **--** Not Applicable
  - **BR** Brunisolic
  - **CH** Chernozemic
  - **CY** Cryosolic
  - **GL** Gleysolic
  - **LU** Luvisolic
  - **OR** Organic
  - **PZ** Podzolic
  - **RG** Regosolic
  - **SZ** Solonetzic

---

Page 10
GLEYED ELUVIATED DARK BROWN
GLEYED SOلونETZIC DARK BROWN
ORTHIC BLACK
REGO BLACK
CALCAREOUS BLACK
ELUVIATED BLACK
SOلونETZIC BLACK
LEYED BLACK
LEYED REGO BLACK
LEYED CALCAREOUS BLACK
LEYED ELUVIATED BLACK
LEYED SOлонETZIC BLACK
LEYED GLEYED BLACK
LEYED GLEYED SOلونETZIC BLACK
LEYED ORTHIC DARK GRAY
LEYED REGO DARK GRAY
LEYED CALCAREOUS DARK GRAY
LEYED SOлонETZIC DARK GRAY
LEYED GLEYED DARK GRAY
LEYED GLEYED REGO DARK GRAY
LEYED GLEYED CALCAREOUS DARK GRAY
LEYED GLEYED SOлонETZIC DARK GRAY
LEYED ORTHIC TURBIC CRYOSOL
LEYED BRUNISOLIC TURBIC CRYOSOL
LEYED REGO TURBIC CRYOSOL
LEYED GLEYED TURBIC CRYOSOL
LEYED ORTHIC STATIC CRYOSOL
LEYED BRUNISOLIC STATIC CRYOSOL
LEYED REGOSOLIC STATIC CRYOSOL
LEYED GLEYED STATIC CRYOSOL
LEYED FIBRIC ORGANIC CRYOSOL
LEYED MESIC ORGANIC CRYOSOL
LEYED HUMIC ORGANIC CRYOSOL
LEYED TERRIC FIBRIC ORGANIC CRYOSOL
LEYED TERRIC MESIC ORGANIC CRYOSOL
LEYED TERRIC HUMIC ORGANIC CRYOSOL
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LEYED ORTHIC HUMIC GLEYSOl
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**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**  
Soil thickness in centimeters  
99 Not applicable

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

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

**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 Saproite  
SEPT Sedimentary Peat  
SPPT Sphagnum Moss  
TILL Till (Morainal)  
UNDM Undifferentiated mineral  
UNDO Undifferentiated organic  
VOLC Volcanic

**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>
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<td>FR fragmental</td>
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<td>VCS very coarse sand</td>
<td>WY woody</td>
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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
http://www-eosdis.ornl.gov/

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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<td>GSFC</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.