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Forrest G. Hall, Editor

Volume 115

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

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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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.

Table of Contents

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
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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:

Point	BOREAS X (km)	BOREAS Y (km)	Longitude	Latitude
Northwest	303.000	399.990	106.31380W	54.50245N
Northeast	464.610	399.990	103.82894W	54.37908N
Southeast	464.610	282.000	104.01113W	53.32543N
Southwest	303.000	282.000	106.43333W	53.44574N

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
```

MOD_NUM	The number of the soil modifier, which is directly related to the MODIFIER
SOILNAME	Name of soil
SOIL_CODE	A 3-character code identifying a soil
MODIFIER	Soil type modifier
LU	Land use
KIND	Kind of soil
WATERTBL	Water table characteristics
ROOTRESTRI	Soil layer that restricts root growth
RESTR_TYPE	Type of root-restricting layer
DRAINAGE	Soil drainage class
MDEP1	Mode of deposition for primary soil
MDEP2	Mode of deposition for secondary soil
MDEP3	Mode of deposition for tertiary soil
ORDER	Soil order
S_GROUP	Soil subgroup
G_GROUP	Great group
PROFILE	Header from Detail II file
DATE	Date of last revision
A-THICK	A horizon thickness
SOL-THICK	Soil thickness
SOL-CHEM	Soil chemistry
PM-MODIFY	Parent material modification
PM-COMPLEX	Parent material complex
PMDEP2	Mode of deposition of second parent material deposition where a soil name is a complex of materials
PM-CHEM	Parent material chemistry
PMTEXCLASS	Parent material textural class
TEXMODIFY	Texture modification
FAMPARTSIZ	Soil family particle size
PHYSIOG	Physiography

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:

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

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

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

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.

-.-	Not Applicable
O.MB	Orthic Melanic Brunisolic
E.MB	Eluviated Melanic Brunisol
GL.MB	Gleyed Melanic Brunisol
GLE.MB	Gleyed Eluviated Melanic Brunisol
O.EB	Orthic Eutric Brunisol
E.EB	Eluviated Eutric Brunisol
GL.EB	Gleyed Eutric Brunisol
GLE.EB	Gleyed Eluviated Eutric Brunisol
O.SB	Orthic Sombric Brunisol
E.SB	Eluviated Sombric Brunisol
DU.SB	Duric Sombric Brunisol
GL.SB	Gleyed Sombric Brunisol
GLE.SB	Gleyed Eluviated Sombric Brunisol
O.DYB	Orthic Dystric Brunisol
E.DYB	Eluviated Dystric Brunisol
DU.DYB	Duric Dystric Brunisol
GL.DYB	Gleyed Dystric Brunisol
GLE.DYB	Gleyed Eluviated Dystric Brunisol
O.B	Orthic Brown
R.B	Rego Brown
CA.B	Calcareous Brown
E.B	Eluviated Brown
SZ.B	Solonetzic Brown
GL.B	Gleyed Brown
GLR.B	Gleyed Rego Brown
GLCA.B	Gleyed Calcareous Brown
GLE.B	Gleyed Eluviated Brown
GLSZ.B	Gleyed Solonetzic Brown
O.DB	Orthic Dark Brown
R.DB	Rego Dark Brown
CA.DB	Calcareous Dark Brown
E.DB	Eluviated Dark Brown
SZ.DB	Solonetzic Dark Brown
GL.DB	Gleyed Dark Brown
GLR.DB	Gleyed Rego Dark Brown
GLCA.DB	Gleyed Calcareous Dark Brown

GLE.DB	Gleyed Eluviated Dark Brown
GLSZ.DB	Gleyed Solonetzic Dark Brown
O.BL	Orthic Black
R.BL	Rego Black
CA.BL	Calcareous Black
E.BL	Eluviated Black
SZ.BL	Solonetzic Black
GL.BL	Gleyed Black
GLR.BL	Gleyed Rego Black
GLCA.BL	Gleyed Calcareous Black
GLE.BL	Gleyed Eluviated Black
GLSZ.BL	Gleyed Solonetzic Black
O.DG	Orthic Dark Gray
R.DG	Rego Dark Gray
CA.DG	Calcareous Dark
SZ.DG	Solonetzic Dark Gray
GL.DG	Gleyed Dark Gray
GLR.DG	Gleyed Rego Dark Gray
GLCA.DG	Gleyed Calcareous Dark Gray
GLSZ.DG	Gleyed Solonetzic Dark Gray
O.TC	Orthic Turbic Cryosol
BR.TC	Brunisolic Turbic Cryosol
R.TC	Rego Turbic Cryosol
GL.TC	Gleysolic Turbic Cryosol
O.SC	Orthic Static Cryosol
BR.SC	Brunisolic Static Cryosol
R.SC	Regosolic Static Cryosol
GL.SC	Gleysolic Static Cryosol
FI.OC	Fibric Organic Cryosol
ME.OC	Mesic Organic Cryosol
HU.OC	Humic Organic Cryosol
TFI.OC	Terric Fibric Organic Cryosol
TME.OC	Terric Mesic Organic Cryosol
THU.OC	Terric Humic Organic Cryosol
GC.OC	Glacic Organic Cryosol
O.HG	Orthic Humic Gleysol
R.HG	Rego Humic Gleysol
FE.HG	Fera Humic Gleysol
SZ.HG	Solonetzic Humic Gleysol
O.G	Orthic Gleysol
R.G	Rego Gleysol
FE.G	Fera Gleysol
SZ.G	Solonetzic Gleysol
O.LG	Orthic Luvic Gleysol
HU.LG	Humic Luvic Gleysol
FE.LG	Fera Luvic Gleysol
FR.LG	Fragic Luvic Gleysol
SZ.LG	Solonetzic Luvic Gleysol
O.GBL	Orthic Gray Brown Luvisol
BR.GBL	Brunisolic Gray Brown Luvisol
PZ.GBL	Podzolic Gray Brown Luvisol
GL.GBL	Gleyed Gray Brown Luvisol
GLBR.GBL	Gleyed Brunisolic Gray Brown Luvisol
GLPZ.GBL	Gleyed Podzolic Gray Brown Luvisol

O.GL	Orthic Gray Luvisol
D.GL	Dark Gray Luvisol
BR.GL	Brunisolic Gray Luvisol
PZ.GL	Podzolic Gray Luvisol
SZ.GL	Solonetzic Gray Luvisol
FR.GL	Fragic Gray Luvisol
GL.GL	Gleyed Gray Luvisol
GLD.GL	Gleyed Dark Gray Luvisol
GLBR.GL	Gleyed Brunisolic Gray Luvisol
GLPZ.GL	Gleyed Podzolic Gray Luvisol
GLSZ.GL	Gleyed Solonetzic Gray Luvisol
GLFR.GL	Gleyed Fragic Gray Luvisol
TY.F	Typic Fibrisol
ME.F	Mesic Fibrisol
HU.F	Humic Fibrisol
LM.F	Limno Fibrisol
CU.F	Cumulo Fibrisol
T.F	Terric Fibrisol
TME.F	Terric Mesic Fibrisol
THU.F	Terric Humic Fibrisol
HY.F	Hydric Fibrisol
TY.M	Typic Mesisol
FI.M	Fibric Mesisol
HU.M	Humic Mesisol
LM.M	Limno Mesisol
CU.M	Cumulo Mesisol
T.M	Terric Mesisol
TFI.M	Terric Fibric Mesisol
THU.M	Terric Humic Mesisol
HY.M	Hydric Mesisol
TY.H	Typic Humisol
FI.H	Fibric Humisol
ME.H	Mesic Humisol
LM.H	Limno Humisol
CU.H	Cumulo Humisol
T.H	Terric Humisol
TFI.H	Terric Fibric Humisol
TME.H	Terric Mesic Humisol
HY.H	Hydric Humisol
HE.FO	Hemic Folisol
HI.FO	Histic Folisol
HU.FO	Humic Folisol
LI.FO	Lignic Folisol
O.HP	Orthic Humic Podzol
OT.HP	Ortstein Humic Podzol
P.HP	Placic Humic Podzol
DU.HP	Duric Humic Podzol
FR.HP	Fragic Humic Podzol
O.FHP	Orthic Ferro-Humic Podzol
OT.FHP	Ortstein Ferro-Humic Podzol
P.FHP	Placic Ferro-Humic Podzol
DU.FHP	Duric Ferro-Humic Podzol
FR.FHP	Fragic Ferro-Humic Podzol
LU.FHP	Luvisolic Ferro-Humic Podzol

SM.FHP	Sombric Ferro-Humic Podzol
GL.FHP	Gleyed Ferro-Humic Podzol
GLSM.FHP	Gleyed Sombric Ferro-Humic Podzol
GLOT.FHP	Gleyed Ortstein Ferro-Humic Podzol
O.HFP	Orthic Humo-Ferric Podzol
OT.HFP	Ortstein Humo-Ferric Podzol
P.HFP	Placic Humo-Ferric Podzol
DU.HFP	Duric Humo-Ferric Podzol
FR.HFP	Fragic Humo-Ferric Podzol
LU.HFP	Luvisolic Humo-Ferric Podzol
GL.HFP	Gleyed Humo-Ferric Podzol
GLSM.HFP	Gleyed Sombric Humo-Ferric Podzol
SM.HFP	Sombric Humo-Ferric Podzol
GLOT.HFP	Gleyed Ortstein Humo-Ferric Podzol
O.R	Orthic Regosol
CU.R	Cumulic Regosol
GL.R	Gleyed Regosol
GLCU.R	Gleyed Cumulic Regosol
O.HR	Orthic Humic Regosol
CU.HR	Cumulic Humic Regosol
GL.HR	Gleyed Humic Regosol
GLCU.HR	Gleyed Cumulic Humic Regosol
B.SZ	Brown Solonetz
DB.SZ	Dark Brown Solonetz
BL.SZ	Black Solonetz
A.SZ	Alkaline Solonetz
GLB.SZ	Gleyed Brown Solonetz
GLDB.SZ	Gleyed Dark Brown Solonetz
GLBL.SZ	Gleyed Black Solonetz
B.SS	Brown Solodized Solonetz
DB.SS	Dark Brown Solodized Solonetz
BL.SS	Black Solodized Solonetz
DG.SS	Dark Gray Solodized Solonetz
G.SS	Gray Solodized Solonetz
GLB.SS	Gleyed Brown Solodized Solonetz
GLDB.SS	Gleyed Dark Brown Solodized Solonetz
GLBL.SS	Gleyed Black Solodized Solonetz
GLDG.SS	Gleyed Dark Gray Solodized Solonetz
GLG.SS	Gleyed Gray Solodized Solonetz
B.SO	Brown Solod
DB.SO	Dark Brown Solod
BL.SO	Black Solod
DG.SO	Dark Gray Solod
G.SO	Gray Solod
GLB.SO	Gleyed Brown Solod
GLDB.SO	Gleyed Dark Brown Solod
GLBL.SO	Gleyed Black Solod
GLDG.SO	Gleyed Dark Gray Solod
GLG.SO	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

	G20	greater 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	Saprolite
	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

	SA	Saline
	-	Not applicable
PMTEXCLASS	Parent Material Textural Class	
	VCS	very coarse sand
	CS	coarse sand
	LCS	loamy coarse sand
	S	sand
	FS	fine sand
	LS	loamy sand
	LFS	loamy fine sand
	VFS	very fine sand
	LVFS	loamy very fine sand
	CSL	coarse sandy loam
	SL	sandy loam
	FSL	fine sandy loam
	VFSL	very fine sandy loam
	L	loam
	SIL	silt loam
	SCL	sandy clay loam
	SICL	silty clay loam
	CL	clay loam
	C	clay
	HC	heavy clay
	O	organic
	F	fibric
	M	mesic
	H	humic
	NA	not applicable
TEXMODIFY	Texture Modifier	
	GR	gravelly
	VG	very gravelly
	WY	woody
	NA	not applicable
FAMPARTSIZ	Family Particle Size	
	UD	undifferentiated
	FR	fragmental
	SK	skeletal
	SY	sandy
	CL	coarse loamy
	FL	fine loamy
	LY	loamy
	CY	clayey
	SM	stratified mineral
	SU	stratified mineral and organic
	SO	stratified organic
	OG	organic
	WY	woody
	FI	fibric
	ME	mesic
	HU	humic
	RU	bedrock undifferentiated
	RA	bedrock acid
	RB	bedrock basic
	RS	bedrock soft

```
              NA    not applicable
PHYSIOG       Physiography
              PHY   physiographic
              NA    not applicable
```

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

Welch, T.A. 1984. A Technique for High Performance Data Compression. IEEE Computer, Vol. 17, No. 6, pp. 8-19.

17.2 Journal Articles and Study Reports

Acton, D.F., G.A. Padbury, and J.A. Shields. 1991. Soil Landscapes of Canada-Saskatchewan Digital Map Data; Scale 1:1000000; CanSIS No. SK018200, Version 90.11.30; CLBRR Archive, Agriculture Canada, Research Branch, Ottawa, Canada (CLBRR Contribution No. 91-107D).

Newcomer, J., D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers, eds. 2000. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM.

Padbury, G.A., and J.A. Shields. 1991. Soil Landscapes of Canada-Saskatchewan Soil Landscapes Polygon Attribute Digital Data. CanSIS No. SK018200, version 90.11.30; CLBRR Archive, Agriculture Canada, Research Branch, Ottawa, Canada. (CLBRR Contribution No. 91-108D).

Sellers, P. and F. Hall. 1994. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1994-3.0, NASA BOREAS Report (EXPLAN 94).

Sellers, P. and F. Hall. 1996. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1996-2.0, NASA BOREAS Report (EXPLAN 96).

Sellers, P., F. Hall, and K.F. Huemmrich. 1996. Boreal Ecosystem-Atmosphere Study: 1994 Operations. NASA BOREAS Report (OPS DOC 94).

Sellers, P., F. Hall, and K.F. Huemmrich. 1997. Boreal Ecosystem-Atmosphere Study: 1996 Operations. NASA BOREAS Report (OPS DOC 96).

Sellers, P., F. Hall, H. Margolis, B. Kelly, D. Baldocchi, G. den Hartog, J. Cihlar, M.G. Ryan, B. Goodison, P. Crill, K.J. Ranson, D. Lettenmaier, and D.E. Wickland. 1995. The boreal ecosystem-atmosphere study (BOREAS): an overview and early results from the 1994 field year. Bulletin of the American Meteorological Society. 76(9):1549-1577.

Sellers, P.J., F.G. Hall, R.D. Kelly, A. Black, D. Baldocchi, J. Berry, M. Ryan, K.J. Ranson, P.M. Crill, D.P. Lettenmaier, H. Margolis, J. Cihlar, J. Newcomer, D. Fitzjarrald, P.G. Jarvis, S.T. Gower, D. Halliwell, D. Williams, B. Goodison, D.E. Wickland, and F.E. Guertin. 1997. BOREAS in 1997: Experiment Overview, Scientific Results and Future Directions. Journal of Geophysical Research 102 (D24): 28,731-28,770.

17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

```
AEAC    - Albers Equal-Area Conic
ASCII   - American Standard Code for Information Interchange
BOREAS  - BOReal Ecosystem-Atmosphere Study
BORIS   - BOREAS Information System
BPI     - Bytes Per Inch
CANSIS  - Canadian Soil Information System
DAAC    - Distributed Active Archive Center
DN      - Digital Number
EOS     - Earth Observing System
EOSDIS  - EOS Data and Information System
GIS     - Geographic Information System
GSFC    - Goddard Space Flight Center
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NAD83   - North American Datum of 1983
NASA    - National Aeronautics and Space Administration
NSA     - Northern Study Area
ORNL    - Oak Ridge National Laboratory
PANP    - Prince Albert National Park
SSA     - Southern Study Area
URL     - Uniform Resource Locator
```

20. Document Information

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

BOREAS Staff Science, "BOREAS Staff Science GIS Data Collection Program." In Collected Data of The Boreal Ecosystem-Atmosphere Study. Eds. J. Newcomer, D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers. CD-ROM. NASA, 2000.

Also, cite the BOREAS CD-ROM set as:

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13. ABSTRACT *(Maximum 200 words)*

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.

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