NASA/TM—2000–209891, Vol. 181

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

Forrest G. Hall, Editor

Volume 181
BOREAS TE-20 Soils Data over the NSA-MSA and Tower Sites in Raster Format

H. Veldhuis and D. Knapp

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

October 2000

The NASA STI Program Office ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program Office plays a key part in helping NASA maintain this important role.

The NASA STI Program Office is operated by Langley Research Center, the lead center for NASA's scientific and technical information. The NASA STI Program Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program Office is also NASA's institutional mechanism for disseminating the results of its research and development activities. These results are published by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA's counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or cosponsored by NASA.
- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and mission, often concerned with subjects having substantial public interest.
- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services that complement the STI Program Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results . . . even providing videos.

For more information about the NASA STI Program Office, see the following:

- Access the NASA STI Program Home Page at http://www.sti.nasa.gov/STI-homepage.html
- E-mail your question via the Internet to help@sti.nasa.gov
- Fax your question to the NASA Access Help Desk at (301) 621-0134
- Telephone the NASA Access Help Desk at (301) 621-0390
- Write to:
  NASA Access Help Desk
  NASA Center for AeroSpace Information
  7121 Standard Drive
  Hanover, MD 21076-1320

NASA/TM—2000-209891, Vol. 181

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

Forrest G. Hall, Editor

Volume 181

BOREAS TE-20 Soils Data over the NSA-MSA and Tower Sites in Raster Format

Hugo Veldhuis, Agriculture and Agri-food Canada
Winnipeg, Manitoba
David Knapp, Raytheon ITSS, NASA Goddard Space Flight Center
Greenbelt, Maryland

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

October 2000

Available from:

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320
Price Code: A17

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Price Code: A10

BOREAS TE-20 Soils Data over the NSA-MSA and Tower Sites in Raster Format

Hugo Veldhuis, David Knapp

Summary

The BOREAS TE-20 team collected several data sets for use in developing and testing models of forest ecosystem dynamics. This data set was gridded from vector layers of soil maps that were received from Dr. Hugo Veldhuis, who did the original mapping in the field during 1994. The vector layers were gridded into raster files that cover the NSA-MSA and tower sites. The data are stored in binary, image format files.

Note that some of the data set files 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 TE-20 Soils Data over the NSA-MSA and Tower Sites in Raster Format

1.2 Data Set Introduction

This data set contains soil properties and classification information over the BOReal Ecosystem-Atmosphere Study (BOREAS) Northern Study Area (NSA)-Modeling Sub-Area (MSA) and the tower sites. It was gridded to a 30-meter pixel resolution for the NSA-MSA area and a 10-meter pixel resolution for the tower sites. The data were reprojected into the BOREAS Grid system from the original map made by Dr. Hugo Veldhuis (University of Manitoba).

1.3 Objective/Purpose

The BOREAS Terrestrial Ecology team #20 (TE-20) collected, processed, and delivered the original data to BOREAS Information System (BORIS) personnel. BORIS personnel processed the data into raster files that can be used for modeling or for comparison purposes. The purpose of this data set is to provide information about the spatial distribution of soils and their characteristics over the NSA-MSA and tower sites.

1.4 Summary of Parameters

This data set contains information about the spatial distribution of soil classes around the NSA-MSA and tower sites along with soil class properties such as parent material, texture, slope class, and water table depth. A detailed list of parameters is given in Section 7. The polygon numbers in the American Standard Code for Information Interchange (ASCII) table files correspond to pixel values in the binary raster files. The value of each pixel can be linked to the table described in Section 7 in order to extract these parameters.

1.5 Discussion

This data set was produced as vector layers by Dr. Veldhuis. Using aerial photography and field methods, he identified various soil polygons at a scale of 1:50,000 for the NSA-MSA (what Dr. Veldhuis calls the "super site") and at 1:5,000 for the tower sites (Old Black Spruce (OBS), Old Jack Pine (OJP), Young Jack Pine (YJP), Fen, and Old Aspen (OA)).

1.6 Related Data Sets

BOREAS TE-20 Lab Analysis of NSA Soils Data
BOREAS TE-20 Soils Data of the NSA-MSA Tower Sites in Vector Format

2. Investigators

2.1 Investigator Name and Title

Dr. Hugo Veldhuis

2.2 Title of Investigation

Multidiscipline Integrative Models of Forest Ecosystem Dynamics for the Boreal Forest Biome: Modeling Gas and Energy Fluxes from Landscapes

2.3 Contact Information

Contact 1:
Dr. Hugo Veldhuis
Agriculture & Agri-food Can.
CLBRR, Manitoba Land Res.
Rm. 362A, ELLIS Building
Univ. of Manitoba
Winnipeg, Manitoba CANADA
R3T 2N2
(204)474-6124
(204) 275-5817 (fax)

Contact 2:
David Knapp
Raytheon ITSS
NASA GSFC
Code 923
Greenbelt, MD 20771
(301) 286-1424
(301) 286-0239 (fax)
David.Knapp@gsfc.nasa.gov

3. Theory of Measurements

The original soils mapping was performed by using a combination of field samples of the soil and aerial photographs. These digital map data provide investigators with a continuous surface of soil parameters that can be used for modeling purposes.

4. Equipment

4.1 Sensor/Instrument Description

In addition to field techniques, aerial photography from 1971-73 at a scale of 1:15,840 was used to map the soils at the tower sites. Aerial photography taken in 1978 at a scale of 1:50,000 was used to map the soils of the NSA-MSA. No additional information is available about this photography. Please refer to the report submitted by Dr. Veldhuis regarding what equipment was used to perform the soils mapping.

4.1.1 Collection Environment

The original vector files were received in digital line graph (DLG) format from Dr. Veldhuis.

4.1.2 Source/Platform

Unknown.

4.1.3 Source/Platform Mission Objectives

Unknown.

4.1.4 Key Variables

The key variables of this data set include:

```
POLYNUM = Polygon number
GRIDLOC = Grid location
COMPONT = Polygon component (landscape element)
NUMBER  = Component rank number
PERCENT = Percentage distribution of components
KINDMAT = Kind of rock outcrop or other material at the surface
LANDFRM = Local surface form
PMDEPO1 = Mode of deposition or origin of first (upper) parent material
TXTURE1 = Texture of first (upper) parent material
TXTMOD1 = Texture modifier of first (upper) parent material
PMDEPO2 = Mode of deposition or origin of second (middle) parent material
TXTURE2 = Texture of second (middle) parent material
TXTMOD2 = Texture modifier of second (middle) parent material
PMDEPO3 = Mode of deposition or origin of third (lower) parent material
TXTURE3 = Texture of third (lower) parent material
```

```
TXTMOD3 = Texture modifier of third (lower) parent material
COFRAGS = Coarse fragment content in control section of mineral soils
SLOPE   = Slope gradient class
DRAINGE = Drainage class
DEPTHWT = Depth to water table, average
PFDISTR = Permafrost distribution or occurrence
DPTHACT = Depth of active layer (average)
ICECTNT = Ice content of permanently frozen layer
DPTHLFH = Thickness of humus layer (L,F,H)
DPTHORG = Average thickness of peat deposit
SOILDEV = Soil development (soil classification)
VARIANT = Classification variant or phase
SOILTP1 = Dominant soil type associated with polygon component
SOILPH1 = Soil phase or variant associated with dominant soil type
SOILTP2 = Subdominant soil type associated with polygon component
SOILPH2 = Soil phase or variant associated with subdominant soil type
```

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

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

A detailed report of the soils mapping effort was submitted by Dr. Veldhuis and is available. Part 2 of the report (Methodology) provides detailed information about data acquisition methods.

6. Observations

6.1 Data Notes

The soils report by Dr. Veldhuis provides observations and descriptions of soils. Additional notes exist in files (not included here) submitted by Dr. Veldhuis.

6.2 Field Notes

See Section 6.1.

7. Data Description

7.1 Spatial Characteristics

The soil maps in this data set vary in their resolution and coverage. The details of these are given in the following sections.

7.1.1 Spatial Coverage

The area mapped is projected in the BOREAS Grid system and is bounded by the following points. These coordinates are based on the North American Datum of 1983 (NAD83).

NSA-MSA (1,286 pixels by 989 lines, 30-meter pixel size)

Point	BOREAS_X	BOREAS_Y	Longitude	Latitude
Northwest	761.070	630.660	98.70324W	56.05867N
Northeast	799.650	630.660	98.09375W	55.99638N
Southwest	761.070	600.990	98.78647W	55.79667N
Southeast	799.650	600.990	98.18092W	55.73479N

NSA-Fen (130 pixels by 130 lines, 10-meter pixel size)

Point	BOREAS_X	BOREAS_Y	Longitude	Latitude
Northwest	780.590	618.680	98.42917W	55.92183N
Northeast	781.890	618.680	98.40869W	55.91973N
Southwest	780.590	617.380	98.43291W	55.91036N
Southeast	781.890	617.380	98.41243W	55.90826N

NSA-OBS (130 pixels by 130 lines, 10-meter pixel size)

Point	BOREAS_X	BOREAS_Y	Longitude	Latitude
Northwest	777.540	614.230	98.48997W	55.88746N
Northeast	778.840	614.230	98.46950W	55.88538N
Southwest	777.540	612.930	98.49369W	55.87599N
Southeast	778.840	612.930	98.47323W	55.87390N

NSA-OJP (130 pixels by 130 lines, 10-meter pixel size)

Point	BOREAS_X	BOREAS_Y	Longitude	Latitude
Northwest	767.860	617.990	98.63181W	55.93608N
Northeast	769.160	617.990	98.61131W	55.93402N
Southwest	767.860	616.690	98.63549W	55.92460N
Southeast	769.160	616.690	98.61499W	55.92254N

NSA-OA (130 pixels by 130 lines, 10-meter pixel size)

Point	BOREAS_X	BOREAS_Y	Longitude	Latitude
Northwest	765.510	613.090	98.68269W	55.89654N
Northeast	766.810	613.090	98.66221W	55.89448N
Southwest	765.510	611.790	98.68635W	55.88506N
Southeast	766.810	611.790	98.66588W	55.88301N

NSA-YJP (130 pixels by 130 lines, 10-meter pixel size)

Point	BOREAS_X	BOREAS_Y	Longitude	Latitude
Northwest	789.250	618.150	98.29431W	55.90313N
Northeast	790.550	618.150	98.27384W	55.90101N
Southwest	789.250	616.850	98.29808W	55.89166N
Southeast	790.550	616.850	98.27762W	55.88955N

7.1.2 Spatial Coverage Map

See Section 7.1.1.

7.1.3 Spatial Resolution

These data were gridded from their original vector form to a pixel resolution of 30 meters for the MSA and 10 meters for the tower sites.

7.1.4 Projection

The area mapped is projected in the BOREAS Grid system, which is based on the ellipsoidal version of the Albers Equal-Area Conic (AEAC) projection. The projection has the following parameters:

```
Datum:  NAD83
Ellipsoid:  GRS80 or WGS84
Origin:   111.000°W   51.000°N
Standard Parallels:   52° 30' 00"N
                      58° 30' 00"N
Units of Measure:  kilometers
```

7.1.5 Grid Description

The grid in which these images are projected is the BOREAS Grid system. The parameters for this projection are described in Section 7.1.4.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Field samples for mapping the MSA and tower sites were collected in 1994. Aerial photos taken in 1978 at a scale of 1:50,000 were used for extending the field samples to map the NSA-MSA. Aerial photos used to map the tower sites were taken in 1971 and 1972 at a scale of 1:15,840.

7.2.2 Temporal Coverage Map

Not applicable.

7.2.3 Temporal Resolution

Not applicable.

7.3 Data Characteristics

These data are in an image format in which the value of a pixel represents the polygon number from the original vector data. This number can be related to a set of records in the ASCII soils table files. This soils table file contains parameters for the various polygons. There is a separate soils table for each map. In the NSA-MSA soils map, lakes are indicated with a polygon number equal to or greater than 5,000. There is no value in the corresponding soils table for these lake polygons.

7.3.1 Parameter/Variable

```
POLYNUM
GRIDLOC
COMPONT
NUMBER
PERCENT
KINDMAT
LANDFRM
PMDEPO1
TXTURE1
TXTMOD1
PMDEPO2
TXTURE2
TXTMOD2
PMDEPO3
TXTURE3
TXTMOD3
COFRAGS
SLOPE
DRAINGE
DEPTHWT
PFDISTR
DPTHACT
ICECTNT
DPTHLFH
DPTHORG
SOILDEV
VARIANT
SOILTP1
SOILPH1
SOILTP2
SOILPH2
```

7.3.2 Variable Description/Definition

Binary Raster Image Files

1. POLYNUM = Number of the map polygon.

2. GRIDLOC = An alphanumeric grid to be used to find a particular polygon on the map.

3. COMPONT = Polygon component (landscape element).

The landscape components that make up the area delineated by the polygon. A polygon may have one or many components. They are listed in order of extent.

Code	Class	Description
D	Dominant	The D#components combined cover >50% of the land area of a polygon.
S	Subdominant	The S#components combined cover <50 % of the land area of a polygon.
I	Inclusion	Each inclusion covers <15% of the polygon, but the combined area of inclusions may be 25%.
W	Water	Surface water in the form of lakes, ponds, or streams may cover between 5 and 100% of a polygon.

4. NUMBER = Component rank number.

Landscape elements with similar parent material properties are considered to belong to the same general component. Thus, these elements together form the dominant or subdominant component in the polygon, but the individual elements will not be dominant or subdominant. To show the landscape relationship or parent material association, the elements are considered to belong to the dominant (D) or subdominant (S) group, but are ranked D1, D2, etc., according to their relative importance within the group. For example, three drainage conditions exist on a gently undulating glaciolacustrine blanket. The well-drained portion occupies 30% of the polygon area, imperfectly drained conditions exist in 15% of the polygon, and poorly drained areas with a thin peat cover occupy an additional 10% for a combined total of 55% making this grouping the dominant component in the polygon. Thus, these three elements will be labelled D1, D2, and D3, respectively.

In the cases of inclusions (I) and water (W), the rank numbers link these components either to the dominant or to the subdominant components. The convention is that an odd rank number (1,3,5.) links the inclusion or water to the dominant component(s), while an even rank number links it to the subdominant component(s).

5. PERCENT = Percentage distribution of components.

Percent area is estimated within the nearest 5%. Components <10% are not listed except for W.

6. KINDMAT = Kind of rock outcrop or other material at the surface.

Code	Class	Description
OR	Organic soil	Contains >30% organic matter by weight
R2	Hard rock, acidic	Granite
SO	Mineral soil	Dominant mineral particles, contains <30% organic matter by weight
WA	Water	Water

7. LANDFRM = Local surface form.

Mineral surface forms. Two classes may be combined; for example, "bh" is hummocky blanket and "vi" is inclined veneer.

Code	Class	Description
b	blanket	Unconsolidated surficial materials >1 m thick.
d	dissected	Gullies or valleys dissect the component.
h	hummocky	A complex sequence of slopes extending from concavities of various sizes to knolls or short, discontinuous ridges.
i	inclined	A sloping, unidirectional surface with a generally constant slope not broken by marked irregularity or gullies.
k	knoll and kettle	A very chaotic sequence of knolls, ridges, and kettles.
l	level	A flat or very gently sloping unidirectional surface with a generally constant slope not broken by marked elevations and depressions; slopes are generally <2%.
r	ridged	A long, narrow elevation of the surface, usually distinctly crested with steep sides.
s	steep	Erosional slopes on both consolidated and unconsolidated materials.
u	undulating	A regular sequence of gentle slopes that extends from rounded and, in some places, confined concavities to broad, rounded convexities; low local relief with slopes usually between 2 and 5%.
v	veneer	Unconsolidated surficial materials <1 m thick. Veneers may be continuous or patchy.
w	beach, strandline	Low ridges with a steeper slope on one side than on the other.
y	subdued hummocky	A complex sequence of slopes extending from concavities of various sizes to knolls. Local topography is <10 m.

Organic Surface Forms.

The classification of landforms is often the case of "best fit." Often the landform encountered does not quite meet all criteria of any class. Organic landforms often are intergrades of one form to another.

Code	Class	Description
Ba	Palsa bog	A bog composed of individual or coalesced palsas, occurring in an unfrozen peatland. Palsas are mounds of perennially frozen peat and mineral soil, up to 5 m high, with a maximum diameter of 100 m. The surface is highly uneven, often containing collapse scar bogs.
Bc	Collapse scar bog	A circular or oval-shaped wet depression in a perennially frozen peatland; the collapse scar bog was once part of the perennially frozen peatland, but the permafrost thawed, causing the surface to subside; the depression is poor in nutrients, as it is not connected to the minerotrophic fens in which the palsa or peat plateau occurs.
Bt	Peat plateau bog	A bog composed of perennially frozen peat, rising abruptly about 1 m from the surrounding unfrozen fen; the surface is relatively flat and even, and the bog commonly covers large areas; the peat was originally deposited in a nonpermafrost environment and is associated in many places with collapse bogs or fens.
Bv	Veneer bog	A bog occurring on gently sloping terrain underlain by generally discontinuous permafrost; although drainage is predominantly below the surface, overland flow occurs in poorly defined drainage-ways during peak runoff; peat thickness is usually less than 1.5 m.
Fb	Basin fen	A fen occupying a topographically defined basin; however, the basins do not receive drainage from upstream, and the fens are thus influenced mainly by local hydrological conditions; the depth of peat increases toward the center.
Fc	Collapse scar fen	A fen with circular or oval depressions, up to 100 m occurring in larger fens, marking the subsidence of thawed permafrost peatlands. Dead trees, remnants of the subsided vegetation of permafrost peatlands, are often evident.
Fh	Horizontal fen	A fen with a very gently sloping featureless surface; this fen occupies broad, often ill-defined depressions, and

		may be interconnected with other fens; peat accumulation is generally uniform.
Fs	Stream fen	A fen located in the main channel or along the banks of permanent or semi-permanent streams. This fen is affected by the water of the stream at normal and flood stages.

8. PMDEP01 = Mode of deposition or origin of first (upper) parent material.

Code	Class	Description
AN	Anthropogenic	Materials modified by human activity so that their physical properties have been drastically altered; they include borrow pits, gravel pits and road beds.
B	Bog	Bogs consist of unspecified organic materials associated with an ombrotrophic environment because the slightly elevated nature of the bog dissociates it from nutrient-rich groundwater or surrounding mineral soils; near the surface, materials are usually not or very little decomposed (fibric), yellowish to pale brown, and loose and spongy in consistency, with entire sphagnum plants readily identifiable; these materials are extremely acid, with low bulk density and high fiber content; at depths they become darker, compacted, and somewhat layered; bogs are associated with slopes or depressions on topography with a water table at or near the surface in the spring and slightly below it during the rest of the year; they are usually covered with sphagnum mosses, but sedges may also grow on them; bogs may be treed or treeless, and many are characterized by a layer of ericaceous shrubs.
F	Fluvial	Sediment generally consisting of silt and clay with a minor fraction of sand and gravel; gravels are typically rounded; alluvial sediments are commonly moderately to well sorted and display stratification.
FN	Fen	Fen consists of unspecified organic materials formed in a minerotrophic environment because of the close association of the material with mineral-rich waters; it is usually moderately well to well decomposed, dark brown to black, with fine- to medium-sized fibers; decomposition commonly becomes greater at lower depths; the materials are covered with a dominant component of sedges or brown mosses, but grasses, reeds, sphagnum

		mosses, shrubs, and trees may be associated.
GF	Glaciofluvial	Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers, and kame terraces.
GL	Glaciolacustrine	Sediment generally consisting of either stratified fine sand, silt, and clay deposited on the glacial lake bed or moderately well sorted and stratified sand and coarser materials that are beach and other near-shore sediments transported and deposited by wave action; these materials either have settled from suspension in bodies of standing freshwater or have accumulated at their margins through wave action.
O	Organic	A layered sequence of more than three types of organic undifferentiated material (>30% organic matter by weight).
R	Residual	Unconsolidated, weathered, or partly weathered soil mineral materials that accumulate by disintegration of bedrock in place.
T	Till (Morainal)	Sediment generally consisting of well-compacted material that is nonstratified and contains a heterogeneous mixture of sand, silt, and clay particle sizes and coarse fragments in a mixture that has been transported beneath, beside, on, within, or in front of a glacier and not modified by any intermediate agent.
RK	Rock	A consolidated bedrock layer that is too hard to break with the hands (>3 on Mohs' scale) or to dig with a spade when moist.

9. TXTURE1 = Texture of first (upper) parent material.

Soil texture indicates the relative proportions of the various soil separates in a soil. Soil separates are mineral particles, <2.0 mm in equivalent diameter, ranging between specified size limits:

Soil separate	Diameter (mm)
Very coarse sand	2.0-1.0
Coarse sand	1.0-0.50
Medium sand	0.50-0.25
Fine sand	0.25-0.10
Very fine sand	0.10-0.05
Silt	0.05-0.002
Clay	<0.002

Coarse fragments are rock or mineral fragments >2.0 mm in diameter:

Coarse fragment	Diameter (cm)
Gravel	0.2-7.5
Cobble	7.5-25.0

Sands. Sand is a soil material that contains 85% or more sand; the percentage of silt plus 1.5 times the percentage of clay does not exceed 15.

Code	Class	Description
VCS	Very Coarse Sand	25% or more very coarse sand, and less than 50% any other one grade of sand.
CS	Coarse Sand	25% or more very coarse and coarse sand, and less than 50% any other grade of sand.
S	Sand	25% or more very coarse, coarse, and medium coarse sand (but less than 25% very coarse and coarse sand), and less than 50% of either fine or very fine sand.
FS	Fine Sand	50% or more fine sand, or less than 25% very coarse, coarse, and medium sand and less than 50% very fine sand.
VFS	Very Fine Sand	50% or more very fine sand.

Loamy Sands. Loamy sand is a soil material that contains at the upper limit 85-90% sand, and the percentage of silt plus 1.5 times the percentage of clay is not less than 15; at the lower limit it contains not less than 70-85% sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Code	Class	Description
LCS	Loamy Coarse Sand	25% or more very coarse and coarse sand, and less than 50% any other one grade of sand.
LS	Loamy Sand	25% or more very coarse, coarse, and medium sand (but less than 25% very coarse and coarse sand), and less than 50% fine or very fine sand.
LFS	Loamy Fine Sand	50% or more fine sand, or less than 50% very fine sand and less than 25% very coarse, coarse, and medium sand.
LVFS	Loamy Very Fine Sand	50% or more very fine sand.

Sandy Loams. Sandy loam is a soil material that contains either 20% clay or less, with the percentage of silt plus twice the percentage of clay exceeding 30, and 52% or more sand; or less then 7% clay, less than 50% silt, and 43-52% sand.

Code	Class	Description
CSL	Coarse Sandy Loam	25% or more very coarse and coarse sand and less than 50% any other one grade of sand.
SL	Sandy Loam	30% or more very coarse, coarse, and medium sand (but less than 25% very coarse and coarse sand), and less than 30% of either very fine or fine sand.
FSL	Fine Sandy Loam	30% or more fine sand and less than 30% very fine sand; or between 15-30% very coarse, coarse, and medium sand; or more than 40% fine and very fine sand, at least half of which is fine sand, and less than 15% very coarse, coarse, and medium sand.
VFSL	Very Fine Sandy Loam	30% or more very fine sand, or more than 40% fine and very fine sand, at least half of which is very fine sand, and less than 15% very coarse, coarse, and medium sand.

Textures finer than sandy loams:

Code	Class	Description
L	Loam	7-27% clay, 28-50% silt, and less than 52% sand.
SIL	Silt Loam	50% or more silt and 12-27% clay, or 50-80% silt and less than 12% clay.
SI	Silt	80% or more silt and less than 12% clay.
SCL	Sandy Clay Loam	20-35% clay, less than 28% silt, and 45% or more sand.
CL	Clay Loam	27-40% clay and 20-45% sand.
SICL	Silty Clay Loam	27-40% clay and less than 20% sand.
SC	Sandy Clay	35% or more clay and 45% or more sand.
SIC	Silty Clay	40% or more clay and 40% or more silt.
C	Clay	40% or more clay, less than 45% sand, and less than 40% silt.
HC	Heavy Clay	More than 60% clay.
O	Organic	Fiber content undifferentiated.
F	Fibric	40% or more rubbed fiber content by volume.
M	Mesic	10% or more and less than 40% fiber content by volume.
H	Humic	<10% rubbed fiber content by volume.

10. TXTMOD1 = Texture modifier of first (upper) parent material.

Code	Class	Description
GR	Gravelly	15-35% gravel by volume
VG	Very gravelly	35-60% gravel by volume
EG	Extremely gravelly	>60% gravel by volume
MU	Mucky	9-17% organic carbon
GY	Gritty	Sharp-edged particles present
AY	Ashy	Quantities of volcanic or organic ash present
WY	Woody	Quantities of woody fragments present (organic soils).

11. PMDEPO2 = Mode of deposition or origin of second (middle) parent material.

12. TXTURE2 = Texture of second (middle) parent material.

13. TXTMOD2 = Texture modifier of second (middle) parent material.

14. PMDEPO3 = Mode of deposition or origin of third (lower) parent material.

15. TXTURE3 = Texture of third (lower) parent material.

16. TXTMOD3 = Texture modifier of third (lower) parent material.

17. COFRAGS = Coarse fragment content in control section of mineral soils.

Code	Class	Description
A	<1% by volume	Rounded, subrounded, flat, angular, or irregular rock fragment from 2 mm to 60 cm or more in size.
B	1-15%	
C	16-35%	
D	36-60%	
E	>60%	
#	Not applicable	

18. SLOPE = Slope gradient class.
The slope is generally the average or common slope of the unit, but in the case of complex topography, the steepest slope class is listed.

Code	Class
1	1-2%
4	3-5%
8	6-9%
13	10-15%
25	16-30%
45	31-60%

19. DRAINGE = Drainage class.

Code	Class	Description
VR	Very rapid	Water is removed from the soil very rapidly in relation to supply; excess water flows downward very rapidly if underlying material is pervious; subsurface flow may be very rapid during heavy rainfall provided the gradient is steep; source of water is precipitation.
R	Rapid	Water is removed from the soil rapidly in relation to supply; excess water flows downward if underlying material is pervious; subsurface flow may occur on steep gradients during heavy rainfall; source of water is precipitation.
W	Well	Water is removed from the soil readily but not rapidly; excess water flows downward readily into underlying pervious material or laterally as subsurface flow; these soils commonly retain optimum amounts of moisture for plant growth after rains or addition of irrigation water.
MW	Moderately well	Water is removed from the soil somewhat slowly in relation to supply; excess water is removed somewhat slowly because of low perviousness, shallow water table, lack of gradient, or some combination of these; precipitation is the dominant source of water in medium-to-fine textured soils; precipitation and significant additions by subsurface flow are necessary in coarse textured soils.
I	Imp[illegible]	Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season; excess water moves slowly downward if precipitation is the major supply; if subsurface water or groundwater, or both, is the main source, the flow rate may vary, but the soil remains wet for a significant part of the growing season.
P	[illegible]	Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen; excess water is evident in the soil for much of the time; subsurface flow or groundwater flow, or both, in addition to precipitation, are the main sources of water; there may also

		be a perched water table.
VP	Very poor	Water is removed from the soil so slowly that the water table remains at or near the surface for most of the time the soil is not frozen; groundwater flow and subsurface flow are the major sources of water; precipitation is less important except where there is a perched water table.
#	Not applicable	

20. DEPTHWT = Average depth to water table.

Code	Class	Description
10	0-20 cm	Most shallow water table during growing season.
50	20-75 cm	
125	75-150 cm	
200	>150 cm	
*	0-100 cm	With perennially frozen subsoil.
#	Not applicable	(Water, ice, rock.)

21. PFDISTR = Permafrost distribution or occurrence.

Code	Class	Description
V	Very sporadic	Sparse patches of permafrost are associated with the component.
S	Sporadic	Isolated patches or islands of permafrost occur within the component.
D	Discontinuous	Widespread permafrost occurs within the component.
C	Continuous	Permafrost underlies all or almost all of the component.
#	Not applicable	

22. DPTHACT = Depth of active layer (average).

Code	Class	Description
50	35-75 cm	Top layer of ground subject to annual thawing and freezing in areas underlain by permafrost
100	>75 cm.	
#		Not applicable

23. ICECTNT = Ice content of permanently frozen layer.

Code	Class	Description
L	Low	Ice content (volume) less than available pore space in nonfrozen soil.
M	Medium	No excess ice; ice content (volume) equal to pore space of nonfrozen soil.
H	High	Excess ice: ice content greater than pore space in nonfrozen soil; ice usually in the form of lenses, vein ice, or massive ground ice.

24. DPTHLFH = Thickness of humus layer (L,F,H)

The thickness of the humus layer is estimated, based on observations in the field. However, the frequency of forest fires in the area may reduce deep LFH layers to zero from one year to the next.

Code	Class
0	<5 cm
1	5-10 cm
2	11-20 cm
3	21-40 cm
4	>40 cm
#	Not applicable (e.g., borrow pit, organic deposits)

25. DPTHORG = Average thickness of peat deposit.

Peat consist of organic material that accumulated under very wet or saturated conditions.

Code	Class	Description
0	<0.2 m	Peat development has just started (paludification), or depth of peat layer has been reduced by fire.
1	0.2-0.6 m	Peat depth generally less than 40 cm if peat depth is rather uniform; or peat depth is on average about 40 cm but varies strongly over short distances because of sphagnum hummock formation.
2	0.6-1.6 m	Shallow peat (fens and bogs).
3	1.6-3.0 m	Deep peat.
4	>3.0 m	Very deep peat.

26. SOILDEV = Soil development (soil classification).

The dominant soil development associated with the polygon component. Other kinds of soil development are usually present, but only as inclusions.

Code	Class
Brunisolic	
EDYB	Eluviated Dystric Brunisol
GLEDYB	Gleyed Eluviated Dystric Brunisol
EEB	Eluviated Eutric Brunisol
GLEEB	Gleyed Eluviated Eutric Brunisol
Gleysolic	
OHG	Orthic Humic Gleysol
RHG	Rego Humic Gleysol
OG	Orthic Gleysol
FEG	Ferric Gleysol
OLG	Orthic Luvic Gleysol
HULG	Humic Luvic Gleysol
Luvisolic	
OGL	Orthic Gray Luvisol
DGL	Dark Gray Luvisol
GLGL	Gleyed Gray Luvisol
GLDGL	Gleyed Dark Gray Luvisol
Organic	
TYF	Typic Fibrisol
MEF	Mesic Fibrisol
TF	Terric Fibrisol
TMEF	Terric Mesic Fibrisol
HYF	Hydric Fibrisol
TYM	Typic Mesisol
FIM	Fibric Mesisol
TM	Terric Mesisol
TFIM	Terric Fibric Mesisol
THUM	Terric Mesic Humisol
TH	Terric Humisol
TFIH	Terric Fibric Humisol
TMEH	Terric Mesic Humisol
Cryosolic	
OSC	Orthic Static Cryosol
RSC	Regosolic Static Cryosol
OTC	Orthic Turbic Cryosol
RTC	Regosolic Turbic Cryosol
FIOC	Fibric Organic Cryosol
MEOC	Mesic Organic Cryosol
HUOC	Humic Organic Cryosol
TFIOC	Terric Fibric Organic Cryosol
TMEOC	Terric Mesic Organic Cryosol
THUOC	Terric Humic Organic Cryosol

27. VARIANT = Classification variant or phase.

Code	Class	Description
c	Cryic	This designation has been used to identify Luvisolic soils with permafrost within the control section. These soils are at present not recognized in the Canadian System of Soil Classification.
l	Lithic	A soil that has a lithic contact within the control section.
p	Peaty	A soil that has a peaty layer 15-40 cm thick.

28. SOILTP1 = Dominant soil type associated with polygon component.

The dominant soil type listed represents the soils that occupy >50% of the component. The soil type may be a soil series, which is a soil type defined within narrow limits, or a group of soils that vary to some extent in texture, depth of profile, etc. The soil type used to identify organic landscape components is the soil that best represents the group or complex of soils associated with that particular landscape component. The organic soil type usually represents related, but sometimes quite different, soils. These variations may include peat depth, presence or absence of certain peat layers, variation in peat decomposition, etc.

29. SOILPH1 = Soil phase or variant associated with dominant soil type.

The soil phase or variant is used to identify more specifically the dominant soil type. These soils vary to some degree from the model because of differences in parent material (stratification, texture), depth of the LFH layer, peaty surface, coarse fragment content, etc.

Code	Class	Description
d	Deep	A soil that is relatively deep.
h	Humus	A soil with a relatively deep duff layer.
s	Shallow	A soil that is relatively shallow.
v	Very deep	A soil that is very deep.
w	Very shallow	A soil that is very shallow.
x	Complex	A soil that varies in a number of properties from the model (series concept).
1,2,3	Variant number	A soil that varies in one or more specific properties from the series concept.

30. SOILTP2 = Subdominant soil type associated with polygon component.

The subdominant soil type listed represents the soils that occupy <50% of the component. The soil type may be a soil series, which is a soil type defined within narrow limits, or a group of soils that vary to some extent in texture, depth of profile, etc. The soil type used to identify organic landscape components is the soil that best represents the group or complex of soils associated with that particular landscape component. The organic soil type usually represents related, but sometimes quite differen,t soils. These variations may include peat depth, presence or absence of certain peat layers, variation in peat decomposition etc.

31. SOILPH2 = Soil phase or variant associated with subdominant soil type.

The soil phase or variant is used to identify more specifically the subdominant soil type component. (See no. 29 for codes).

7.3.3 Unit of Measurement

See Section 7.3.2.

7.3.4 Data Source

The original soils mapping was performed by using a combination of field samples of the soil and aerial photographs. These digital map data provide investigators with a continuous surface of soil parameters that can be used for modeling purposes.

7.3.5 Data Range

Image files:

Each pixel in the image files contains the polygon number value. This value is matched to the polygon number listed in the corresponding ASCII soils table file. The values for that polygon number apply to that polygon.

7.4 Sample Data Record

Sample data records from the binary images are not appropriate here. The following three sample records illustrate how the data are formatted in the ASCII soils table files. Each column is in a fixed-length format. The column labels are written vertically. Because the records are so long, they are presented here in two groups.

POLYNUM	GRIDLOC	COMPONT	RANKNUM	PERCENT	KINDMAT	LANDFRM	PMDEPO1	TXTURE1	TX MOD1	PMDEPO2	TXTURE2	TXMOD2	PMDEPO3	TXTURE3	TXMOD3	COFRAGS	SLOPE	DRAINGE	DEPTHWT	PFDISTR	DPTHACT
001	F1	D	1	65	R2	h	RK	#	#	#	#	#	#	#	#	#	C	#	#	#	#
001	F1	D	2	20	SO	vh	GL	HC	-	RK	-	-	-	-	-	A	B	MW	-	-	-
001	F1	I	1	15	SO	bh	GL	HC	-	-	-	-	-	-	-	A	B	I	125	-	-

ICECTNT	DPTHLFH	DPTHORG	SOILDEV	VARIANT	SOILTP1	SOILPH1	SOILTP2	SOILPH2
#	#	#	#		$AR			
-	1	#	OGL	1	WRL			
-	1	#	GLGL		ROK		LPR	p

8. Data Organization

8.1 Data Granularity

The smallest unit of data for this data set is the data set itself. The image files contain either binary 8-bit (1-byte) values or binary 16-bit (2-byte) values with the low-order byte first. The ASCII soils table files contain text records with the values on the records in a fixed format.

8.2 Data Format(s)

8.2.1 Uncompressed Data Files

The binary raster file that covers the NSA-MSA is distributed as 16-bit integers with the low order byte first. The binary raster files of the tower sites are distributed as 8-bit integers. The soils table files that indicate the soil parameters for the polygons in each map are distributed as ASCII text files. The overall content of this product is:

```
File 1     ASCII header file describing the product
File 2     NSA-MSA Binary Soil Map
File 3     NSA-OBS Tower Area Binary Soil Map
File 4     NSA-Fen Tower Area Binary Soil Map
File 5     NSA-OJP Tower Area Binary Soil Map
File 6     NSA-OA TE Tower Area Binary Soil Map
File 7     NSA-YJP Tower Area Binary Soil Map
File 8     NSA-MSA Soil Polygon Data Table (ASCII)
File 9     NSA-OBS Soil Polygon Data Table (ASCII)
File 10    NSA-Fen Soils Polygon Data Table (ASCII)
File 11    NSA-OJP Soil Polygon Data Table (ASCII)
File 12    NSA-OA Soil Polygon Data Table (ASCII)
File 13    NSA-YJP Soil Polygon Data Table (ASCII)
```

The files have the following characteristics:

File #	Record Size (Bytes)	Bytes/Pixel	# Records
File 1	80	N/A	36
File 2	2572	2	989
File 3	130	1	130
File 4	130	1	130
File 5	130	1	130
File 6	130	1	130
File 7	130	1	130
File 8	100	N/A	936
File 9	100	N/A	117
File 10	100	N/A	117
File 11	100	N/A	39
File 12	100	N/A	39
File 13	100	N/A	78

8.2.2 Compressed CD-ROM Files

On the BOREAS CD-ROMs, files 1 and 8-13 listed above are stored as ASCII text files; however, files 2-7 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 reader is referred to the detailed report submitted by Dr. Veldhuis for details on the derivation of the original maps.

9.2 Data Processing Sequence

The data were received from Dr. Veldhuis as DLG files. These files were read into ARC/INFO and gridded to 30-meter (NSA-MSA) and 10-meter (tower sites) cell sizes. These gridded data sets were then written out as binary raster files.

9.2.1 Processing Steps

BOREAS Information System (BORIS) staff processed these data by:

- Reading in DLG files to ARC/INFO.
- Gridding ARC/INFO coverages into ARC/INFO GRID format.
- Writing out gridded data from ARC/INFO GRID to flat raster files.
- Writing out raster files to tape. 5) Copying the ASCII and compressing the binary files for release on CD-ROM.

9.2.2 Processing Changes

None.

9.3 Calculations

9.3.1 Special Corrections/Adjustments

The maps that covered the tower sites had the towers indicated on them and were centered on the tower location. Because we have precise Global Positioning System (GPS) locations of the towers, the gridded maps of the towers were shifted so that the tower location from the map matched the GPS location. This should improve the locational accuracy of the tower soils maps.

9.3.2 Calculated Variables

None.

9.4 Graphs and Plots

None.

10. Errors

10.1 Sources of Error
Errors could result from the change in format from vector to raster. However, the raster images were thoroughly checked and compared to the original vector data to avoid such problems. The vector data came from an original mapping using data collected directly from the field along with aerial photos. Errors could arise from a typographical error in the field notes.

10.2 Quality Assessment

10.2.1 Data Validation by Source
Any data validation or accuracy assessment would have to have been made by the original source. Please refer to the report mentioned in Section 5.

10.2.2 Confidence Level/Accuracy Judgment
The accuracy of these data is considered very good, especially because GPS coordinates were used to locate the soils mapping at the tower locations.

10.2.3 Measurement Error for Parameters
Unknown.

10.2.4 Additional Quality Assessments
None.

10.2.5 Data Verification by Data Center
BORIS personnel viewed and compared the images with the original vector data to identify any possible discrepancies.

11. Notes

11.1 Limitations of the Data
The report by Dr. Veldhuis may indicate some limitations of the soil mapping.

11.2 Known Problems with the Data
None.

11.3 Usage Guidance
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
For more information on this data set, please consult the soils report by Dr. Veldhuis.

12. Application of the Data Set

This data set was created for BOREAS investigators who need soils data in the vicinity of the flux towers and the MSA.

13. Future Modifications and Plans

None.

14. Software

14.1 Software Description

ARC/INFO GIS software was used to grid these data from their original vector form. This software is a product of Environmental Systems Research Institute, Inc. (ESRI). Gzip (GNU zip) uses the Lempel-Ziv algorithm (Welch, 1994) used in the zip and PKZIP commands.

14.2 Software Access

ARC/INFO is proprietary software with copyright protection. Contact ESRI for details.

Environmental Systems Research Institute, Inc.
380 New York Street
Redland, CA 92373-8100

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 raster format NSA soils data 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 are available on 1600 or 6250 Bytes Per Inch (BPI) 8-mm, Digital Archive Tape (DAT), or 9-track tapes.

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

ARC/INFO User's Guide (Version 7). 1994. Redlands, CA.

See the report by Dr. Veldhuis for reference information.

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

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.

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
CD-ROM    - Compact Disk-Read-Only-Memory
DAAC      - Distributed Active Archive Center
DAT       - Digital Archive Tape
DLG       - Digital Line Graph
EOS       - Earth Observing System
EOSDIS    - EOS Data and Information System
GIS       - Geographic Information System
GMT       - Greenwich Mean Time
GPS       - Global Positioning System
GRS80     - Geodetic Reference System of 1980
GSFC      - Goddard Space Flight Center
MSA       - Modeling Sub-Area
NAD27     - North American Datum of 1927
NAD83     - North American Datum of 1983
NASA      - National Aeronautics and Space Administration
NSA       - Northern Study Area
OA        - Old Aspen
OBS       - Old Black Spruce
OJP       - Old Jack Pine
ORNL      - Oak Ridge National Laboratory
PANP      - Prince Albert National Park
SSA       - Southern Study Area
TE        - Terrestrial Ecology
URL       - Uniform Resource Locator
WGS84     - Worldwide Geodetic System of 1984
WWW       - World Wide Web
YJP       - Young Jack Pine
```

20. Document Information

20.1 Document Revision Date
Written: 31-Mar-1997
Last Updated: 29-Nov-1999

20.2 Document Review Dates
BORIS Review: 02-Mar-1997
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 raster version of these data was created by BORIS staff from the vector version supplied by Dr. Veldhuis. The efforts of Dr. Veldhuis and BORIS staff in creating these data are greatly appreciated.

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

Dr. Hugo Veldhuis, "Multidiscipline Integrative Models of Forest Ecosystem Dynamics for the Boreal Forest Biome: Modeling Gas and Energy Fluxes from Landscapes." 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:

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. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM. NASA, 2000.

20.5 Document Curator

20.6 Document URL

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
October 2000

3. REPORT TYPE AND DATES COVERED
Technical Memorandum

4. TITLE AND SUBTITLE
Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)
BOREAS TE-20 Soils Data over the NSA-MSA and Tower Sites in Raster Format

5. FUNDING NUMBERS
923
RTOP: 923-462-33-01

6. AUTHOR(S)
Hugo Veldhuis and David Knapp
Forrest G. Hall, Editor

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS (ES)
Goddard Space Flight Center
Greenbelt, Maryland 20771

8. PEFORMING ORGANIZATION REPORT NUMBER
2000-03136-0

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS (ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
TM—2000–209891
Vol. 181

11. SUPPLEMENTARY NOTES
H. Veldhuis: Agriculture and Agri-food Canada, Winnipeg, Manitoba;
D. Knapp: Raytheon ITSS, NASA Goddard Space Flight Center, Greenbelt, Maryland

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Unclassified–Unlimited
Subject Category: 43
Report available from the NASA Center for AeroSpace Information,
7121 Standard Drive, Hanover, MD 21076-1320. (301) 621-0390.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The BOREAS TE-20 team collected several data sets for use in developing and testing models of forest ecosystem dynamics. This data set was gridded from vector layers of soil maps that were received from Dr. Hugo Veldhuis, who did the original mapping in the field during 1994. The vector layers were gridded into raster files that cover the NSA-MSA and tower sites. The data are stored in binary, image format files.

14. SUBJECT TERMS
BOREAS, terrestrial ecology, forest ecosystem.

15. NUMBER OF PAGES
28

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39.18
298-102