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

Forrest G. Hall, Editor

Volume 104

BOREAS Forest Cover Data Layers of the NSA in Raster Format

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

September 2000

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BOREAS Forest Cover Data Layers of the NSA in Raster Format

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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BOREAS Forest Cover Data Layers of the NSA in Raster Format

David Knapp, Manning Tuinhoff

Summary

This data set was processed by BORIS staff from the original vector data of species, crown closure, cutting class, and site classification/subtype into raster files. The original polygon data were received from Linnet Graphics, the distributor of data for MNR. In the case of the species layer, the percentages of species composition were removed. This reduced the amount of information contained in the species layer of the gridded product, but it was necessary in order to make the gridded product easier to use. The original maps were produced from 1:15,840-scale aerial photography collected in 1988 over an area of the BOREAS NSA MSA. The data are stored in binary, image format files.

Note that the binary 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 Forest Cover Data Layers of the NSA in Raster Format

1.2 Data Set Introduction

This data set was gridded to a 30-meter pixel size from vector polygons of forest cover information. The four separate layers include species, crown closure category, cutting class, and site classification/subtype.

1.3 Objective/Purpose

These data are provided as part of the BOReal Ecosystem-Atmosphere Study (BOREAS) Staff Science Geographic Information System (GIS) Data Collection Program, which included the collection of pertinent map data in both hardcopy and digital form. This data set, originally provided as vector polygons with attributes, has been processed to provide raster files that can be used for modeling or for comparison purposes. It has been used by foresters and others interested in the forest resources of Manitoba.

1.4 Summary of Parameters

The parameters in this raster data set include species, crown closure category, cutting class, and site classification/subtype.

1.5 Discussion

As mentioned in the Summary and Section 1.2, these data were gridded from vector polygons produced by Manitoba Natural Resources (MNR) and distributed by Linnet Graphics. A full description of the data layer derivations is given in Section 9.

1.6 Related Data Sets

The original vector data are available for a larger area, but are not distributable by BOREAS. Individuals interested in the original data should contact Linnet Graphics as indicated in Section 7.3.

BOREAS SERM Forest Cover Data for the Southern Study Area in Vector Form
BOREAS Forest Cover Data for the Southern Study Area in Raster Form

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:
Manning Tuinhoff
Manitoba Natural Resources
Forestry Branch
300-530 Kenston Blvd.
Winnipeg, Manitoba
Canada R3N 1Z4
(204) 945-7952

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

MNR personnel collect and maintain GIS types of information for use by natural resource managers. The data from which these were derived are a part of the MNR data holdings.

4. Equipment

4.1 Sensor/Instrument Description

Linnet Graphics is the distributor of the vector data for MNR. The original data were digitized from maps at a scale of 1:15,840. These maps were produced from aerial photography collected in 1988. The original vector data were acquired as ARC/INFO vector coverages in ARC/INFO export format. No specific information other than the scale of the resulting photography is known about the aircraft flights or the equipment that was used to collect the aerial photography.

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

The key variables in this raster data set include species, crown closure category, cutting class, and site classification/subtype.

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

The original data were digitized from 1:15,840-scale maps that were produced from aerial photography collected in 1988.

6. Observations

6.1 Data Notes

None.

6.2 Field Notes

Field survey or data verification notes may be available through MNR but are not known in detail by BOREAS Information System (BORIS) personnel.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

These data cover an area of the Northern Study Area (NSA) Modeling Sub-Area (MSA) that in turn covers most of the tower sites. The outside corners of the corner image pixels are as follows:

Corner	BOREAS X (km)	BOREAS Y (km)	NAD83 Longitude	NAD83 Latitude
Northwest	759.000	632.010	98.732W	56.074N
Northeast	816.000	632.010	97.832W	55.981N
Southwest	759.000	602.010	98.816W	55.809N
Southeast	816.000	602.010	97.922W	55.717N

7.1.2 Spatial Coverage Map

Not available.

7.1.3 Spatial Resolution

These data were gridded to a cell size of 30 meters.

7.1.4 Projection

The area mapped is projected in the ellipsoidal version of the Albers Equal-Area Conic (AEAC) projection. The projection has the following parameters:

```
Datum:  North American Datum of 1983 (NAD83)
Ellipsoid:  GRS80 or WGS84
Origin:    111.000°W   degrees   51.000°N
Standard Parallels:   52°  30' 00"N
                      58°  30' 00"N
Units of Measure:  kilometers
```

7.1.5 Grid Description

The data are gridded in 30-meter intervals based on the ellipsoidal version of the AEAC projection with standard parallels of 52° 30' N, 58° 30' N and a southwest origin of 51° N, 111° W.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

The publication dates of the hardcopy version of the maps from which these data were derived range from 1991 to 1992. BORIS acquired the data in 1994; the forest cover layers have not yet had any inventory updates.

7.2.2 Temporal Coverage Map

Not available.

7.2.3 Temporal Resolution

As noted, the original maps were produced from 1:15,840-scale aerial photography collected in 1988. Although hardcopy versions of these maps were published in 1990 and 1991, BORIS staff is not aware of any updates since 1988.

7.3 Data Characteristics

7.3.1 Parameter/Variable

Species Category
Cutting Class
Crown Closure
Site Class

7.3.2 Variable Description/Definition

Species Category

The category of vegetative species covering the given area as derived by BORIS personnel.

Pixel Value	Cover Type
11	Jack Pine (JP)
12	Black Spruce (BS)
13	Tamarack Larch (TL)
14	White Spruce (WS)
15	JP/BS
16	BS/JP
17	BS/TL
18	TL/BS
19	BS/WS
20	JP/WS
21	WS/BS
22	WS/JP
23	BS/JP/TL
24	JP/BS/TL
25	BS/WS/JP
26	BS/TL/JP
31	Trembling Aspen (TA)
33	White Birch (WB)
41	JP/TA
42	BS/TA
43	WS/TA
44	BS/WB
45	BS/JP/TA
46	JP/BS/TA

47	BS/WS/TA
48	BS/TL/TA
49	JP/BS/WB
50	BS/JP/WB
51	WS/JP/TA
52	WS/BS/TA
53	JP/WS/TA
54	BS/JP/TL/TA
55	BS/BA
61	TA/JP
62	TA/BS
63	TA/WS
64	WB/BS
65	TA/JP/BS
66	TA/BS/JP
67	TA/JP/WS
68	TA/WS/JP
69	TA/BS/TL
70	TA/WS/BS
71	TA/WB/JP/BS
72	BA/BS
73	Willow
101	treed muskeg
102	treed rock
103	clear muskeg
105	brushland
107	clearing
109	nonproductive burn-over
121	flooded land
122	water
133	disturbance - cut-over
134	disturbance - burn-over
135	experimental area
136	gravel pits/mines
137	marsh
138	town
139	roads
140	hayland
141	drainage ditch
142	precipitous slopes/fragile
143	small islands
144	transmission/pipelines

Species	Symbol
Ash	AS
Basswood	B
Balsam Poplar	BA
Balsam Fir	BF
Bur Oak	BO
Black Spruce	BS
Eastern Cottonwood	CO
White Elm	E
Eastern Cedar	EC
Hackberry	HB
Hop Hornbeam	HH
Jack Pine	JP
Large Tooth Aspen	LA
Manitoba Maple	MM
Red Pine	RP
Scots Pine	SP
Trembling Aspen	TA
Tamarack Larch	TL
Willow	W
White Birch	WB
White Pine	WP
White Spruce	WS

Cutting Class

Cutting class is based on size, vigor, state of development, and maturity of a stand for harvesting purposes with designations such as 'Unproductive,' 'Not restocked,' 'Immature,' and 'Mature.'

PIXEL VALUE	DESCRIPTION
0	No original data over the area.
1	Unproductive stands. No cutting class given.
2	Forest land not restocked following fire, cutting, windfall, or other major disturbances (hence, potentially productive land). Some reproduction or scattered residual trees (with net merchantable volume less than 20 cubic meters per hectare) may be present.
3	Stands that have been restocked either naturally or artificially. Scattered residual trees may be present as in cutting class 0. To be in cutting class 3 the average height of the stand must be less than 3 meters (3 m).
4	Advanced young growth of post size, with some merchantable volume. The average height of the stand must be over 3 meters in order to be in this cutting class.
5	Immature stands with merchantable volume growing at or near their maximum rate, which definitely should not be cut. The average height of the stand should be over 10 meters and the average diameter should be over 9.0 centimeters (9.0 cm) at Diameter at Breast Height (Dbh) (1.3 m).
6	Mature stands that may be cut because they have reached rotation age (+/- 10 years on site 1 or +/- 20 years on site 2.
7	Overmature stands, which should be given priority in cutting.

Crown Closure Category

The category of crown closure specified in the original data set. Crown closure was estimated from the photography by the photointerpreter. Five classes were recognized and entered onto the stand description sheet for each township as part of the photointerpreted type aggregate. Changes of this estimate can be made only under exceptional circumstances.

PIXEL VALUE	DESCRIPTION
0	No original data over the area.
1	Unproductive stand. No Crown Closure given.
2	Applies to Cutting Class 0 stands only.
3	15%-30% crown closure.
4	31%-50% crown closure.
5	51%-70% crown closure.
6	71% and over.

Site Class

The type of site on which the forest is growing. Note that the site class descriptions that follow were taken from page 16 of "Natural Resources Manitoba - Forest Instruction Manual," Feb. 1996, which was supplied to BORIS staff with the original vector data. However, the manual indicates that the site classification is applicable only to the Interlake Section of Manitoba, and the BOREAS NSA near Thompson is not included geographically in the Interlake Section. Therefore, it is not clear if the provided descriptions are totally applicable.

The land types and associated indicator plants are described for each moisture regime described in a table on page 16 of "Natural Resources Manitoba - Forest Instruction Manual," Feb. 1996. The moisture regime in return denotes the site class for each tree species. Because height, growth, and stand density are reflections of site, these factors should be considered when evaluating the growth of timber types. A site class was assigned to each subtype on the basis of its major species.

In general terms, site class 1 is associated with moist, very moist, and wet moisture regimes, regardless of the dominant tree species. Site class 2 is associated with the saturated moisture regime when black spruce or tamarack is the dominant species. Site class 2 is also associated with the dry moisture regime when jack pine or trembling aspen is the dominant species. Site class 3 is generally associated with various tree species in the arid or dry moisture regime. Refer to the table on page 16 of "Natural Resources Manitoba - Forest Instruction Manual," Feb. 1996, for more information on this layer.

Although the plants generally reflect the moisture regime of the area, they become important site indicators only when they occur in abundance throughout the entire type. Localized elevations and depressions in the timber stand can reflect entirely different plant indicators than those throughout most of the type. Mineral and nutrients strongly influence tree growth but may not affect the presence of minor vegetation. Most of the soil in the Interlake area of Manitoba consists of strongly calcareous till. Although this high calcareous content does not affect the growth of indicators of class 1 jack pine sites, it seriously inhibits the growth of jack pine. On the other hand, Sphagnum ssp. do not tolerate high lime conditions. For this reason, feather moss rather than sphagnum is found on much of the deep organic terrain in the Interlake section.

Because most of the indicator plants grow over a range of moisture regimes, they generally become important only when they occur in abundance and when a variety of plants are present. In isolated cases, however, the mere presence of a certain indicator plant throughout the type can denote site class. A good example of this is when bunchberry or twinflower occurs in association with jack pine. These plants do not occur on dry moisture regimes and therefore denote site class 1.

7.3.3 Unit of Measurement
Species Category - Coded but unitless value.
Cutting Class - Coded but unitless value.
Crown Closure - Coded but unitless value.
Site Class - Coded but unitless value.

7.3.4 Data Source
The original data were acquired in ARC/INFO format from:
Linnet Graphics International, Inc.
600-191 Broadway Avenue
Winnipeg, Manitoba, Canada R3C 3T8

7.3.5 Data Range
```
Species Category -  11 to 144
Cutting Class    -   0 to 7
Crown Closure    -   0 to 6
Site Class       -   1 to 9
```

7.4 Sample Data Record
Not applicable.

8. Data Organization

8.1 Data Granularity
The smallest amount of obtainable data is the entire data set containing the four raster layers and other supporting files.

8.2 Data Format(s)

8.2.1 Uncompressed Data Files
The data product consists of five total files. The first file is an American Standard Code for Information Interchange (ASCII) header file that describes the product. Files 2 through 5 contain the binary raster data layers. Each file (raster layer) contains 1,900 8-bit (1-byte) values in each of 1,000 lines. The following is a list of the data set files:

File	Description	Record Size (Bytes)	Number of Records	Bytes/Pixel
1	Header File	80		N/A
2	SPECIES COVER	1900	1000	1
3	CUTTING CLASS	1900	1000	1
4	CROWN CLOSURE	1900	1000	1
5	SITE CLASS	1900	1000	1

8.2.2 Compressed CD-ROM Files
On the BOREAS CD-ROMs, file 1 listed above is stored as ASCII text; however, files 2 through 5 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

The original polygon data were digitized from 1:15,840-scale forest cover maps by MNR or by an organization appointed by MNR. The important attributes that were associated with each polygon are as follows:

```
COVERTYPE
SPECIES
LAND-ID
```

The following data layers were extracted and gridded from the above attributes:

```
SPECIES COVER
CROWN CLOSURE
CUTTING CLASS
SITE CLASS/SUBTYPE
```

The SPECIES COVER layer was produced based on information from the SPECIES attribute. CROWN CLOSURE, CUTTING CLASS, and SITE CLASS were extracted from the original COVERTYPE attribute. The original COVERTYPE attribute consists of a 5 digit code. The third, fourth, and fifth digits of this code indicate the site class, cutting class, and crown closure, respectively.

9.1.1 Derivation Techniques and Algorithms

For the SPECIES layer, the species attribute string had to be modified for each polygon. In general, the species attributes were labeled as dominant species and percent followed by codominant species and percent. For example, a polygon with a species attribute of BS6JP4 indicated 60% black spruce, 40% jack pine. Similarly, BS7JP3 indicated 70% black spruce, 30% jack pine. In creating the raster species cover layer, the percentages were removed to change initial polygons listed with black spruce first followed by jack pine to BS/JP. Polygons labeled as BS5JP5 or JP5BS5 retained their original species label order. Any resultant polygons that were labeled as BS/JP were assigned a value of 16. In this same manner, all polygons were assigned numeric values that were used as pixel values in the gridded product. The crown closure, cutting class, and site class parameters were only renumbered from their original values.

9.2 Data Processing Sequence

9.2.1 Processing Steps

The following processing sequence was used to grid each of the four layers:

- Edit vectors as needed to create gridded layers.
- Reproject vectors from Universal Transverse Mercator (UTM) to AEAC projection.
- Grid vector coverages.
- Combine gridded townships to make one large gridded layer.
- Write gridded layers to tape.
- Copy the ASCII and compress the binary files for release on CD-ROM.

9.2.2 Processing Changes

None.

9.3 Calculations

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

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 accuracy of the original data. Therefore, caution should be used when inferring information from this data set.

10.2.3 Measurement Error for Parameters
Unknown.

10.2.4 Additional Quality Assessments
Not applicable.

10.2.5 Data Verification by Data Center
Each gridded image was visually checked by BORIS personnel to ensure the gridding procedure assigned a digital number (DN) to each attribute value and that the resultant images seemed reasonable.

11. Notes

11.1 Limitations of the Data
BORIS staff acquired these data in 1994; areas subjected to logging activity or other disturbance, such as fire, would appear much different today as compared to the forest cover data.

11.2 Known Problems with the Data
At least one polygon in the original data was incorrectly coded. The SPECIES was indicated as 80% Balsam Poplar and 20% Balsam Poplar (coded BA8BA2). This was an obvious coding error in the original data. There were also a few polygons that did not have any code at all. In these cases, a code was added if it existed in the hardcopy version of the product; otherwise, it was left as a "no data" area.

11.3 Usage Guidance
The SPECIES layer can be used to determine the dominant species or the presence of a species in an area. The CROWN CLOSURE layer can be used to estimate tree density. The CUTTING CLASS layer can be used to estimate stand age.

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

MNR personnel are constantly updating their data. Contact Linnet Graphics International, Inc., for more recent data.

12. Application of the Data Set

This data set would provide good reference information for assessing spectral image data classification techniques over the area and as an initial baseline data set for analyzing land cover and vegetation change.

13. Future Modifications and Plans

None.

14. Software

14.1 Software Description

The data manipulation capabilities in the ARC/INFO software package (Version 7) were used to reproject the vector data prior to gridding. Questions about the software should be directed to:

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

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 commercial package; contact Environmental Systems Research Institute, Inc. (ESRI) for details.

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 software for various systems are included on the CD-ROMs.

15. Data Access

The forest cover data layers of the NSA in raster format 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 1600 or 6250 Bytes Per Inch (BPI) 9-track, 8-mm, or Digital Archive Tape (DAT) 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.

Natural Resources Manitoba - Forest Instruction Manual. Feb. 1996.

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).

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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
CCRS    - Canadian Centre for Remote Sensing
CCT     - Computer Compatible Tape
CD-ROM  - Compact Disk-Read-Only Memory
DAAC    - Distributed Active Archive Center
DAT     - Digital Archive Tape
DN      - Digital Number
EOS     - Earth Observing System
EOSDIS  - EOS Data and Information System
ESRI    - Environmental Systems Research Institute, Inc.
GIS     - Geographic Information System
GSFC    - Goddard Space Flight Center
MSA     - Modeling Sub-Area
NAD83   - North American Datum of 1983
MNR     - Manitoba Natural Resources
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
UTM     - Universal Transverse Mercator
URL     - Uniform Resource Locator
YJP     - Young Jack Pine
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This data set was processed by BORIS staff from the original vector data of species, crown closure, cutting class, and site classification/subtype into raster files. The original polygon data were received from Linnet Graphics, the distributor of data for MNR. In the case of the species layer, the percentages of species composition were removed. This reduced the amount of information contained in the species layer of the gridded product, but it was necessary in order to make the gridded product easier to use. The original maps were produced from 1:15,840-scale aerial photography collected in 1988 over an area of the BOREAS NSA MSA. The data are stored in binary, image format files.

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