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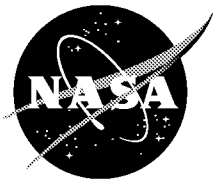

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall, Editor

Volume 107

Prince Albert National Park Forest Cover Data in Vector Format

Michael Fitzsimmons and Jaime Nickeson
Raytheon ITSS, NASA Goddard Space Flight Center,
Greenbelt, Maryland

National Aeronautics and
Space Administration

Goddard Space Flight Center
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September 2000

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Prince Albert National Park Forest Cover Data in Vector Format

Michael Fitzsimmons, Jaime Nickeson

Summary

This data set provides detailed canopy, understory, and ground cover height, density, and condition information for PANP in the western portion of the BOREAS SSA in vector form. The original biophysical resource data set was produced in 1978 based on aerial photographs taken in 1968 and field work conducted in the mid-1970s, and PANP's update/revision of the data set was completed in 1994. The data are stored in an ARC/INFO export file.

Note that the data file on the BOREAS CD-ROMs has been compressed using the Gzip program. See Section 8.2 for details.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

Prince Albert National Park Forest Cover Data in Vector Format

1.2 Data Set Introduction

The original biophysical inventory data set for the Prince Albert National Park (PANP) was stored as four quadrant maps and was obtained in digital form from the Canadian Soil and Information Service (CANSIS). There were problems with this data set in that the polygons in the four maps of the park, which were created separately, did not necessarily match at the map edges. This current version, which contains only vegetation cover information as opposed to the original biophysical data set, which also included soils and wildlife information, has been error-checked, updated, and combined into one digital map for the whole park by PANP staff.

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 is an error-checked revision of the biophysical inventory data for PANP.

1.4 Summary of Parameters

Each polygon in this data set contains information (height, density, species, percent cover, and condition) for overstory, understory, and ground vegetation components.

1.5 Discussion

This data set is a digital version of the forest cover map produced by Padbury et al. (1978). It is a revision of the data provided to the BOREAS project previously from CANSIS. The attributes for each polygon have been checked against the attributes shown on the original maps. The information in this data set was compiled from hardcopy maps at a scale of 1:50,000.

1.6 Related Data Sets

SERM Forest Cover Data Layers of the SSA in Vector Format
BOREAS Forest Cover Data Layers over the SSA-MSA in Raster Format
SERM Forest Cover Data of Saskatchewan in Vector Format
SERM Forest Fire Chronology of Saskatchewan in Vector Format

2. Investigator(s)

2.1 Investigator(s) Name and Title

Michael Fitzsimmons
Senior Park Warden

2.2 Title of Investigation

Prince Albert National Park Forest Cover Map

2.3 Contact Information

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Jaime.Nickeson@gsfc.nasa.gov

3. Theory of Measurements

This data set is a digital vector version of the forest cover map produced by Padbury et al. (1978) as part of the biophysical resource inventory of the PANP. PANP maintains its own soil and forest resource inventory information independent of provincial maps. The data set provided here is a revision of the original digital biophysical resource inventory data and has been updated and modified. The information in this data set was compiled from hardcopy maps at a scale of 1:50,000.

4. Equipment

4.1 Sensor/Instrument Description

The original map data were digitized from 1:50,000-scale maps. The data are based on 1968 aerial photographs at a scale of 1:15,840 and field work conducted in the mid-1970s. Information regarding the original mapping effort can be found in the Padbury et al. (1978) reference in Section 17.

4.1.1 Collection Environment

The data are based on 1968 aerial photographs and field work conducted in the mid-1970s.

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 are polygon coverage items described in Sections 1.4 and 7.3.

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

None.

5. Data Acquisition Methods

The data are based on 1968 aerial photographs and field work conducted in the mid-1970s.

6. Observations

6.1 Data Notes

Not available.

6.2 Field Notes

Not available.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

This data set covers all of PANP in central Saskatchewan.

7.1.2 Spatial Coverage Map

The North American Datum of 1927 (NAD27) minimum bounding rectangular coordinates for these data are Universal Transverse Mercator (UTM) zone 13:

	Easting	Northing	Longitude	Latitude
NW	382874.0	6020921.5	106.80090W	54.32464N
NE	434730.5	6020921.5	106.00376W	54.33390N
SW	382874.0	5935702.0	106.76822W	53.55906N
SE	434730.5	5935702.0	105.98553W	53.56808N

7.1.3 Spatial Resolution

Not applicable.

7.1.4 Projection

The data are in their original UTM projection. PANP, Saskatchewan, is in UTM zone 13.

7.1.5 Grid Description

None.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

The data are based on 1968 aerial photographs and field work conducted in the mid-1970s. The biophysical resource survey by Padbury et al. was performed in 1978. PANP's update/revision of the data set was completed in 1994.

7.2.2 Temporal Coverage Map

Not available.

7.2.3 Temporal Resolution

See Section 7.2.1.

7.3 Data Characteristics

7.3.1 Parameter/Variable

Each polygon has the following attributes in the Polygon Attribute Table (PAT):

Col.	Item	Wid.	Out.	Type	N.Dec.	Description
1	AREA	8	18	F	5	Area of polygon
9	PERIMETER	8	18	F	5	Perimeter of polygon
17	PANP#	4	5	B	-	ARC/INFO Parameter
21	PANP-ID	4	5	B	-	ARC/INFO Polygon No.
25	C1HT	1	1	C	-	Canopy 1 Height Code
26	C1SPEC	7	7	C	-	Canopy 1 Species Code
33	C1DENS	1	1	C	-	Canopy 1 Density Code
34	C1COND	2	2	C	-	Canopy 1 Condition Code
36	C1PERCA	2	2	I	-	Canopy 1 Percent Code
38	C2HT	1	1	C	-	Canopy 2 Height Code
39	C2SPEC	7	7	C	-	Canopy 2 Species Code
46	C2DENS	1	1	C	-	Canopy 2 Density Code
47	C2COND	2	2	C	-	Canopy 2 Condition Code
49	C2PERC	1	1	I	-	Canopy 2 Percent Code
50	C3HT	1	1	C	-	Canopy 3 Height Code
51	C3SPEC	7	7	C	-	Canopy 3 Species Code
58	C3DENS	1	1	C	-	Canopy 3 Density Code
59	C3COND	2	2	C	-	Canopy 3 Condition Code
61	C3PERC	1	1	I	-	Canopy 3 Percent Code
62	U1HT	1	1	C	-	Understory 1 Height Code
63	U1SPEC	7	7	C	-	Understory 1 Species Code
70	U1DENS	1	1	C	-	Understory 1 Density Code
71	U1COND	2	2	C	-	Understory 1 Condition Code
73	U2HT	1	1	C	-	Understory 2 Height Code
74	U2SPEC	7	7	C	-	Understory 2 Species Code
81	U2DENS	1	1	C	-	Understory 2 Density Code
82	U2COND	2	2	C	-	Understory 2 Condition Code
84	U3HT	1	1	C	-	Understory 3 Height Code
85	U3SPEC	7	7	C	-	Understory 3 Species Code
92	U3DENS	1	1	C	-	Understory 3 Density Code
93	U3COND	2	2	C	-	Understory 3 Condition Code
95	G1SPEC	7	7	C	-	Ground 1 Species Code
102	G1PERCA	2	2	I	-	Ground 1 Percent Code
104	G2SPEC	7	7	C	-	Ground 2 Species Code
111	G2PERC	1	1	I	-	Ground 2 Percent Code
112	G3SPEC	7	7	C	-	Ground 3 Species Code
119	G3PERC	1	1	I	-	Ground 3 Percent Code

The mapping system recognizes that each polygon is not homogeneous in terms of cover type. Each polygon can contain up to three different canopy types (with or without understory data) and/or ground cover types. The percent fields provide the areal extent of each cover type within the polygon. A canopy or ground cover type had to have an areal extent of at least 20% of the polygon to be included. In the majority of the polygons there will be data in only one or two groups of fields (e.g., Canopy 1 and Canopy 2 fields). Data in the first group of understory fields (U1HT, U1SPEC, U1DENS, U1COND) are associated with the first group of canopy fields (C1HT, C1SPEC, C1DENS, C1COND) and have the same areal extent as the value in the field C1PERCA. The same is true for the second and third groups of understory and canopy fields. However, the first group of ground fields

(G1SPEC, G1PERC) represents nonforested areas and is independent of any data in the first group of canopy and understory fields. The same is true for the second and third groups of ground fields. C1PERCA + C2PERC + C3PERC + G1PERCA + G2PERC + G3PERC should equal 10 deciles (100%).

7.3.2 Variable Description/Definition

AREA - The spatial area of polygon.
PERIMETER - The linear distance of the boundary around the edge of the polygon.
PANP# - PANP polygon number.
PANP-ID - ARC/INFO Polygon ID.

Canopy and Understory Height Classes

C1HT - The height code of the first canopy species.
C2HT - The height code of the second canopy species.
C3HT - The height code of the third canopy species.
U1HT - The height code of the first understory species.
U2HT - The height code of the second understory species.
U3HT - The height code of the third understory species.

Height:

Code	Height range
1	0 - 6 m
3	7 - 12 m
5	13 - 18 m
7	> 19 m

Canopy and Understory Species Associations

C1SPEC - The first canopy species or species association designation.
C2SPEC - The second canopy species or species association designation.
C3SPEC - The third canopy species or species association designation.
U1SPEC - The first understory species or species association designation.
U2SPEC - The second understory species or species association designation.
U3SPEC - The third understory species or species association designation.

The following codes may be found singly or in combinations (e.g., ABPT) in the data file:

Code	Description
0	Nonforest or no data available
WATER	Water body
ISLAND	Island with no vegetation data available
AB	Abies balsamea
BP	Betula papyrifera
LL	Larix laracina
PB	Pinus banksiana
PG	Picea glauca
PM	Picaa mariana
PT	Populus tremuloides (including some P. Balsamifera)

Canopy and Understory Density Classes

C1DENS - The density code of the first canopy species.
C2DENS - The density code of the second canopy species.
C3DENS - The density code of the third canopy species.
U1DENS - The density code of the first understory species.
U2DENS - The density code of the second understory species.
U3DENS - The density code of the third understory species.

Code	Description
1	Open (0-30%)
2	Moderate (30-60%)
3	Dense (60-100%)

Canopy and Understory Condition Classes (ages as of 1968)

C1COND - The condition code for the first canopy species.
C2COND - The condition code for the second canopy species.
C3COND - The condition code for the third canopy species.
U1COND - The condition code for the first understory species.
U2COND - The condition code for the second understory species.
U3COND - The condition code for the third understory species.

Code	Description
1	Forest land restocked following disturbance (10 years)
2	Young stands (10-30 years)
3	Semimature stands (30-60 years)
4	Mature stands (60-80 years)
5	Mature stands (80+ years)
1A	Forest land not restocked following disturbance
2A	Stands similar to class 2 with retarded growth due to site or overstocking
3A	Stands similar to class 3 with retarded growth due to site or overstocking
5A	Overmature stands showing signs of decadence

Canopy and Ground Percent Coverage Codes

C1PERCA - The percent coverage code of the first canopy species.
C2PERC - The percent coverage code of the second canopy species.
C3PERC - The percent coverage code of the third canopy species.
G1PERCA - The percent coverage code of the first ground cover class.
G2PERC - The percent coverage code of the second ground cover class.
G3PERC - The percent coverage code of the third ground cover class.

Code	Description
0	0%
2	20%
3	30%
4	40%
5	50%
6	60%
7	70%
8	80%
10	100% (C1PERCA and G1PERCA only)

Nonforest Cover Classes

G1SPEC - The code for the first nonforest ground cover class.
G2SPEC - The code for the second nonforest ground cover class.
G3SPEC - The code for the third nonforest ground cover class.

Code	Description
C	cleared land
FL	flooded land
M1	lowland (wet site) herb and sedge cover
M2	lowland (wet site) shrub cover
U1	upland (dry site)herb and grass cover
U2	upland (dry site) shrub cover

7.3.3 Unit of Measurement
Defined above (Section 7.3.2) where applicable.

7.3.4 Data Source
The data were acquired from Michael Fitzsimmons, Senior Park Warden, PANP, in ARC/INFO export format.

7.3.5 Data Range
See Section 7.3.2 for the possible values.

7.4 Sample Data Record
Not applicable.

8. Data Organization

8.1 Data Granularity
The smallest amount of obtainable data is the whole data set.

8.2 Data Format(s)

8.2.1 Uncompressed Data Files
The PANPFORC_E00.GZ file is an ARC/INFO export file. ARC/INFO export files are ASCII files with 80-byte records. After using ungzip, the file should be renamed to have a .e00 extension before using the IMPORT command within ARC/INFO.

8.2.2 Compressed CD-ROM Files
On the BOREAS CD-ROMs, the data file listed above has 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
None.

9.1.1 Derivation Techniques and Algorithms
None.

9.2 Data Processing Sequence

9.2.1 Processing Steps
BOREAS Information System (BORIS) staff compressed the files for release on CD-ROM.

9.2.2 Processing Changes
None.

9.3 Calculations

9.3.1 Special Corrections/Adjustments
Not available.

9.3.2 Calculated Variables
None.

9.4 Graphs and Plots
Not available.

10. Errors

10.1 Sources of Error
Natural disturbances and stand development have occurred since the maps were originally produced. Also, there is the possibility of coding errors in the attributes, transcription errors from original sample data, and photo-interpretation errors.

10.2 Quality Assessment

10.2.1 Data Validation by Source
Unknown.

10.2.2 Confidence Level/Accuracy Judgment
Positional accuracy of polygon lines is approximately +/- 100 m.

10.2.3 Measurement Error for Parameters
None given.

10.2.4 Additional Quality Assessments
None.

10.2.5 Data Verification by Data Center
BORIS staff has looked at the coverage but has not made any assessment of the data.

11. Notes

11.1 Limitations of the Data

There has been no update of this data set since the acquisition of the data by BORIS. Stand development and disturbances have occurred in the period since the maps were produced.

11.2 Known Problems with the Data

Boundaries of the vegetation polygons were used as water body boundaries. Many islands were added to the original coverage. They have no vegetation attributes on the original analog map, and attribute fields are left blank in the file.

11.3 Usage Guidance

Ages in condition class data refers to age of stands as of 1968 when the aerial photographs were taken.

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 given.

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 serve as an initial baseline data set for analyzing at land cover and vegetation change.

13. Future Modifications and Plans

Unknown.

14. Software

14.1 Software Description

The Environmental Systems Research Institute, Inc. (ESRI) ARC/INFO package was used to create this data set. 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 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 decompression software for various systems are included on the CD-ROMs.

15. Data Access

The PANP forest cover 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 can be made available on Digital Archive Tape (DAT) or 8-mm tape.

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

Padbury, G.E., W.K. Head, and W.E. Souster. 1978. Biophysical Resource Inventory of the Prince Albert National Park, Saskatchewan. Saskatchewan Institute of Pedology Publication S185, Saskatoon. 517 pp + appendices.

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

```
ASCII   - American Standard Code for Information Interchange
BOREAS  - BOReal Ecosystem-Atmosphere Study
BORIS   - BOREAS Information System
CANSIS  - Canadian Soil and Information Service
CD-ROM  - Compact Disk-Read-Only Memory
DAAC    - Distributed Active Archive Center
DAT     - Digital Archive Tape
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
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NAD27    - North American Datum of 1927
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
PAT      - Polygon Attribute Table
SSA      - Southern Study Area
URL      - Uniform Resource Locator
UTM      - Universal Transverse Mercator
```

20. Document Information

20.1 Document Revision Dates

Written: 28-Apr-1994
Last Updated: 05-Feb-1999

20.2 Document Review Dates

BORIS Review: 15-May-1997
Science Review:

20.3 Document ID

20.4 Citation

If using data from the BOREAS CD-ROM series, also reference the data as:
Michael Fitzsimmons, Parks Canada. "Prince Albert National Park Forest Cover Map." 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. CD-ROM. NASA, 2000.

The authors and contributors of the original biophysical resource inventory upon which these data are based are:

G.A. Padbury: Saskatchewan Institute of Pedology
W.K Head: Saskatchewan Institute of Pedology
W.E. Souste: Saskatchewan Institute of Pedology
D. Burles: Environment Canada, Canadian Parks Service
D. West: Environment Canada, Canadian Parks Service
E.A. Christiansen: Consulting LTD, Saskatchewan

20.5 Document Curator

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This data set provides detailed canopy, understory, and ground cover height, density, and condition information for PANP in the western portion of the BOREAS SSA in vector form. The original biophysical resource data set was produced in 1978 based on aerial photographs taken in 1968 and field work conducted in the mid-1970s, and PANP's update/revision of the data set was completed in 1994. The data are stored in an ARC/INFO export file.

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