



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

*Forrest G. Hall and Sara K. Conrad, Editors*

### **Volume 231**

## **BOREAS TGB-5 Fire History of Manitoba 1980 to 1991 in Raster Format**

*Brian J. Stocks, Canadian Forest Service-Ontario Region, Sault Ste. Marie*

*Richard Zepp, U.S. Environmental Protection Service, Athens, Georgia*

*David Knapp, Raytheon ITSS, NASA Goddard Space Flight Center, Greenbelt, Maryland*

National Aeronautics and  
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# **BOREAS TGB-5 Fire History of Manitoba 1980 to 1991 in Raster Format**

Brian J. Stocks, Richard G. Zepp, David Knapp

## **Summary**

The BOREAS TGB-5 team collected several data sets related to the effects of fire on the exchange of trace gases between the surface and the atmosphere. This raster format data set covers the province of Manitoba between 1980 and 1991. The data were gridded into the AEAC projection from the original vector data. The original vector data were produced by Forestry Canada from hand-drawn boundaries of fires on photocopies of 1:250,000-scale maps. The locational accuracy of the data is considered fair to poor. When the locations of some fire boundaries were compared to Landsat TM images, they were found to be off by as much as a few kilometers. This problem should be kept in mind when using these data. 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.

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## **1. Data Set Overview**

### **1.1 Data Set Identification**

BOREAS TGB-05 Fire History of Manitoba 1980 to 1991 in Raster Format

### **1.2 Data Set Introduction**

This data set covers the province of Manitoba and was processed from the original vector data, which were produced by Forestry Canada from hand-drawn boundaries of fires on photocopies of 1:250,000-scale maps. The data are gridded with a pixel size of 1,000 m x 1,000 m in the BOREal Ecosystem-Atmosphere Study (BOREAS) adopted Albers Equal-Area Conic (AEAC) projection. This resolution is considered reasonable for these data given the accuracy and scale of the original data

sources. Each year is represented by a separate layer because some fire boundaries can overlap among various years. The locational accuracy of these data is considered fair to poor. When the locations of some fire boundaries were compared to Landsat Thematic Mapper (TM) images, they were found to be off by as much as a few kilometers. This problem should be kept in mind when using these data.

### **1.3 Objective/Purpose**

These data are provided as part of the BOREAS Staff Science Geographic Information System (GIS) Data Collection Program, which included the collection of pertinent map data in both hardcopy and digital form. The objective of collecting these data was to give BOREAS investigators a product showing the spatial distribution of fires in the province of Manitoba.

### **1.4 Summary of Parameters**

Presence of a fire.

### **1.5 Discussion**

Some investigators who have been using Advanced Very High Resolution Radiometer (AVHRR) imagery have found these data useful because they are on a scale that is suitable for 1,000-m x 1,000-m AVHRR pixels. This product is useful as ground truth for comparing to image classifications from AVHRR imagery. However, because the location of pixels may be off by as much as a few kilometers, care should be taken when determining fire locations.

### **1.6 Related Data Sets**

SERM Forest Fire Chronology of Saskatchewan in Vector Format

BOREAS TGB-05 Fire History of Manitoba 1980 to 1991 in Vector Format

## **2. Investigator(s)**

### **2.1 Investigator(s) Name and Title**

Brian J. Stocks  
Canadian Forest Service-Ontario Region  
Great Lakes Forestry Centre  
1219 Queen St. East  
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Richard G. Zepp  
Environmental Protection Agency  
Environmental Research Laboratory  
College Station Road  
Athens, GA 30613

### **2.2 Title of Investigation**

Trace Gas Exchange in the Boreal Forest Biome: Effects of Fire and Beaver Activity

### **2.3 Contact Information**

#### **Contact 1:**

Brian J. Stocks  
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### **3. Theory of Measurements**

As stated above, this product was created for BOREAS investigators who are interested in the fire history of this area. It could be used for ground truth of satellite image classifications and to get an estimate of the amount of burned area. The uses of this product are general enough that the way in which these data were collected will have little to no impact on the theory behind the way they are being used. No information with regard to the intensity of the burn is identified in this data base. Only the presence or absence of a fire is given for each year.

### **4. Equipment**

#### **4.1 Sensor/Instrument Description**

Unknown.

##### **4.1.1 Collection Environment**

Unknown.

##### **4.1.2 Source/Platform**

Unknown.

##### **4.1.3 Source/Platform Mission Objectives**

Unknown.

##### **4.1.4 Key Variables**

Presence or absence of fire in a particular year

##### **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**

Not applicable.

##### **4.2.1 Specifications**

Unknown.

#### **4.2.1.1 Tolerance**

Not applicable.

#### **4.2.2 Frequency of Calibration**

Not applicable.

#### **4.2.3 Other Calibration Information**

Not applicable.

## **5. Data Acquisition Methods**

Forestry Canada compiled these data from maps of fires in the province of Manitoba. Apparently, the fires were mapped based on observation from the air. These fire polygons were hand traced onto photocopies of 1:250,000-scale maps. The fire data were then compiled by year and hand digitized into ARC/INFO polygon coverages. BOREAS staff gridded the polygon coverages into raster images at a pixel resolution of 1,000 m x 1,000 m. There is a separate image for each year of fire history data (1980-91).

## **6. Observations**

### **6.1 Data Notes**

These data simply contain information that indicates whether or not a fire occurred at a particular pixel location in a given year. The pixel values are the year in which the fire occurring 0 (no fire) or 82 (fire that occurred in 1982).

### **6.2 Field Notes**

There is no record of observations except for the actual data.

## **7. Data Description**

### **7.1 Spatial Characteristics**

The pixel size of this image is 1,000 m x 1,000 m.

#### **7.1.1 Spatial Coverage**

The approximate corner coordinates of the BOREAS region are:

	Longitude	Latitude	BOREAS X	BOREAS Y
	-----	-----	-----	-----
Northwest	111.000W	59.979N	0.000	1000.000
Northeast	93.502W	58.844N	1000.000	1000.000
Southeast	96.970W	50.089N	1000.000	0.000
Southwest	111.000W	51.000N	0.000	0.000

Although the corners of the image are at these locations, only areas within the province of Manitoba have the fires mapped. The area defined by the above coordinates encompasses a much larger area than the province of Manitoba.

#### **7.1.2 Spatial Coverage Map**

Not available.



### **7.1.3 Spatial Resolution**

These data were gridded to a cell size of 1,000 meters in the AEAC projection.

### **7.1.4 Projection**

The area mapped is projected in the ellipsoidal version of AEAC projection. The projection has the following parameters:

Datum: North American Datum of 1983 (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 data are gridded in 1,000-m intervals.

## **7.2 Temporal Characteristics**

### **7.2.1 Temporal Coverage**

Each raster image represents the fires that occurred during that year. The years between 1980 and 1991 (inclusive) are in this data set.

### **7.2.2 Temporal Coverage Map**

Not available.

### **7.2.3 Temporal Resolution**

The temporal resolution of this data set is 1 year.

## **7.3 Data Characteristics**

These data simply indicate the presence or absence of a fire in a particular year. The value of a pixel indicates the year in which the fire occurred at that pixel. For example, if a pixel has a value of 83, a fire occurred in 1983 in that pixel. Pixels where no fire occurred for that year have a value of zero (0).

### **7.3.1 Parameter/Variable**

Fire occurrence in a given year.

### **7.3.2 Variable Description/Definition**

The occurrence of a fire in a given year.

### **7.3.3 Unit of Measurement**

Unitless but coded value.

### **7.3.4 Data Source**

Forestry Canada

### **7.3.5 Data Range**

0 (zero) if no fire occurred to 91 (for the year 1991).

## **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 all of the raster layers and their supporting files.

### 8.2 Data Format(s)

#### 8.2.1 Uncompressed Data Files

The Manitoba fire history data set contains 13 total files, of which some contain American Standard Code for Information Interchange (ASCII) information and others contain binary numbers. The first file is a descriptive ASCII header file that describes the content of the other files. The next 12 binary files (files 2 to 13) contain the raster image data as 8-bit values.

File	Pixels	Lines	Bytes per pixel	Description
File 1	Not applicable			ASCII header file
File 2	1000	1000	1	Image of 1980 fires
File 3	1000	1000	1	Image of 1981 fires
File 4	1000	1000	1	Image of 1982 fires
File 5	1000	1000	1	Image of 1983 fires
File 6	1000	1000	1	Image of 1984 fires
File 7	1000	1000	1	Image of 1985 fires
File 8	1000	1000	1	Image of 1986 fires
File 9	1000	1000	1	Image of 1987 fires
File 10	1000	1000	1	Image of 1988 fires
File 11	1000	1000	1	Image of 1989 fires
File 12	1000	1000	1	Image of 1990 fires
File 13	1000	1000	1	Image of 1991 fires

Each of the binary files (2 to 13) contain 1,000 8-bit pixels in each of 1,000 lines. The range of values in the binary files is from 0 (zero) to the last two digits of the year (e.g., 89 for 1989).

#### 8.2.2 Compressed CD-ROM Files

On the BOREAS CD-ROMs, file 1 listed above is stored as ASCII text files; however, files 2-13 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

None.

### 9.2 Data Processing Sequence

### **9.2.1 Processing Steps**

BOREAS Information System (BORIS) staff gridded the coverages separately for each year. The fire history data processing steps were:

- Reproject the vector data to the BOREAS grid projection.
- Rasterize the vector files.
- Write the gridded layer 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**

Potential sources of error in the original data set could be interpretation or digitizing error. As indicated above, the data were hand traced onto photocopied maps based on air observations. No precision mapping of the fire boundaries was done. There is also the possibility that the data could have been gridded incorrectly, although visual inspection of the data was done to ensure against this.

### **10.2 Quality Assessment**

#### **10.2.1 Data Validation by Source**

Each gridded file/layer was spot checked to make sure that the gridding procedure assigned a digital number (DN) to each fire polygon.

#### **10.2.2 Confidence Level/Accuracy Judgment**

Although the gridding procedure itself is highly accurate, there is some question as to the positional accuracy of the original data. The location of the fire boundaries could be off by as much as a few kilometers. 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**

Unknown.

#### **10.2.5 Data Verification by Data Center**

As noted previously, BORIS personnel reviewed the data layers visually as vector plots and raster data layers. Direct quantitative checking of the data was not performed.

## **11. Notes**

### **11.1 Limitations of the Data**

The precision and accuracy of this data set put some limitations on the use of these data. The data set should not be used for comparison to mapping products derived from high-resolution imagery (e.g., air photos). Care should be taken when comparing it to Landsat TM or imagery with smaller pixel sizes.

### **11.2 Known Problems with the Data**

As indicated above, the locational accuracy of these data is suspect because of the way in which the data were collected (see Section 5).

### **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**

None.

## **12. Application of the Data Set**

Some investigators who have been using AVHRR data have found these data useful because they are on a scale that is suitable for 1,000-m x 1,000-m AVHRR pixels. This product would be useful as ground truth for comparing to image classifications from AVHRR imagery.

## **13. Future Modifications and Plans**

None.

## **14. Software**

### **14.1 Software Description**

BORIS staff used the ARC/INFO (Version 7) software and related tools to process the original vector data to this raster form. The ARC/INFO software is a proprietary package developed and distributed by 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. (ESRI)  
380 New York St.  
Redlands, CA 92373-8100

Gzip is available from many Web sites across the Internet (for example, ftp site [prep.ai.mit.edu/pub/gnu/gzip-\\*.\\*\)](http://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 fire history data of Manitoba from 1980 to 1991 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](mailto:ornldaac@ornl.gov) or [ornl@eos.nasa.gov](mailto:ornl@eos.nasa.gov)

### **15.2 Data Center Identification**

Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics  
<http://www-eosdis.ornl.gov/>.

### **15.3 Procedures for Obtaining Data**

Users may obtain data directly through the ORNL DAAC online search and order system [<http://www-eosdis.ornl.gov/>] and the anonymous FTP site [<ftp://www-eosdis.ornl.gov/data/>] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

### **15.4 Data Center Status/Plans**

The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

## **16. Output Products and Availability**

### **16.1 Tape Products**

These data can be made available on 8-mm, Digital Archive Tape (DAT), or 9-track tapes at 1600 or 6250 Bytes Per Inch (BPI).

### **16.2 Film Products**

None.

### **16.3 Other Products**

These data are available on the BOREAS CD-ROM series.

## **17. References**

### **17.1 Platform/Sensor/Instrument/Data Processing Documentation**

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

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
AVHRR	- Advanced Very High Resolution Radiometer
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
GIS	- Geographic Information System
GSFC	- Goddard Space Flight Center
LRRC	- Land Resource Research Branch
NAD83	- North American Datum of 1983
NASA	- National Aeronautics and Space Administration
NSA	- Northern Study Area
ORNL	- Oak Ridge National Laboratory
PANP	- Prince Albert National Park
SSA	- Southern Study Area
TGB	- Trace Gas Biogeochemistry
TM	- Thematic Mapper
UTM	- Universal Transverse Mercator
URL	- Uniform Resource Locator

## **20. Document Information**

### **20.1 Document Revision Dates**

Written: 21-Feb-1997

Revised: 03-Feb-1999

### **20.2 Document Review Dates**

BORIS Review: 20-Jun-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 original data set was produced by:

Canadian Forest Service-Ontario Region  
Great Lakes Forestry Centre  
1219 Queen St.  
East Sault Ste. Marie, Ontario, Canada P6A 5M7

Forestry Canada's willingness to supply the data and the efforts by BORIS staff to grid, check, and document the data are greatly appreciated.

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

Stocks, B.J. and R.G. Zepp, "Trace Gas Exchange in the Boreal Forest Biome: Effects of Fire and Beaver Activity." 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**



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13. ABSTRACT (Maximum 200 words)  The BOREAS TGB-5 team collected several data sets related to the effects of fire on the exchange of trace gases between the surface and the atmosphere. This raster format data set covers the province of Manitoba between 1980 and 1991. The data were gridded into the AEAC projection from the original vector data. The original vector data were produced by Forestry Canada from hand-drawn boundaries of fires on photocopies of 1:250,000-scale maps. The locational accuracy of the data is considered fair to poor. When the locations of some fire boundaries were compared to Landsat TM images, they were found to be off by as much as a few kilometers. This problem should be kept in mind when using these data. The data are stored in binary, image format files.				
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