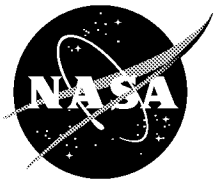
NASA/TM—2000–209891, Vol. 245



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

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

## Volume 245

# BOREAS TGB-12 $^{222}$Rn Activity Data over the NSA

*Susan Trumbore, University of California, Irvine*
*Eric Sundquist and Greg Winston, U.S. Geological Survey, Woods Hole, Massachusetts*

National Aeronautics and
Space Administration

**Goddard Space Flight Center**
Greenbelt, Maryland 20771

November 2000

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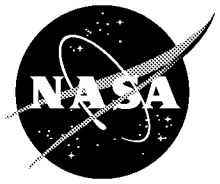

# Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

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National Aeronautics and
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**Goddard Space Flight Center**
Greenbelt, Maryland 20771

November 2000

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# BOREAS TGB-12 $^{222}$Rn Activity Data over the NSA

Susan Trumbore, Eric Sundquist, Greg Winston

## Summary

The BOREAS TGB-12 team made measurements of soil carbon inventories, carbon concentration in soil gases, and rates of soil respiration at several sites to estimate the rates of carbon accumulation and turnover in each of the major vegetation types. Sampling strategies for soils were designed to take advantage of local fire chronosequences, so that the accumulation of carbon in regrowing mosses could be determined. All the data are used to (1) calculate the inventory of carbon and nitrogen in moss and mineral soil layers at NSA sites, (2) determine the rates of input and turnover (using both accumulation since the last stand-killing fire and radiocarbon data), and (3) link changes in soil respiration rate to shifts in the $^{14}C$ content of soil $CO_2$ to determine the average 'age' respired $CO_2$. These $^{222}$Rn activity data were collected from 15-Nov-1993 to 16-Aug-1994 over the NSA sites. They are useful for determining the rate of gas exchange between soil and the overlying atmosphere. The data in this data set are stored in tabular ASCII files.

## Table of Contents



# 1. Data Set Overview

### 1.1 Data Set Identification

BOREAS TGB-12 $^{222}$Rn Activity Data over the NSA

### 1.2 Data Set Introduction

This data set contains seasonal variations in the $^{222}$Rn soil gas concentrations. The data presented represent sampling from the fall of 1993 to the summer of 1994.

### 1.3 Objective/Purpose

The objective of these data is to estimate rates of carbon input, turnover, and accumulation in the soils of each of the major vegetation types at the BOReal Ecosystem-Atmosphere Study (BOREAS) study sites. In addition, the data will be used to relate the estimates of soil carbon dynamics to ecosystem models of the carbon cycle, other measures of carbon cycling dynamics, regional models of soil carbon accumulation, and spatial and temporal models of soil moisture and drainage.

### 1.4 Summary of Parameters

$^{222}Rn$ activity and soil depth were measured over the BOREAS Northern Study Area (NSA). Other parameters measured simultaneously include $CO_2$ concentrations in the soil atmosphere, reported in a separate data set. We concentrated on making measurements during the winter months. Sites for measurements were those also used by Trace Gas Biogeochemistry (TGB)-01 (Crill) and TGB-03 (Moore) for flux measurements and concentration profiles during the growing season.

### 1.5 Discussion

Radon data may be used to estimate the effective diffusivity of gases within the soil atmosphere, or to test models that estimate effective diffusivity from parameters like air-filled porosity. Details may be found in Davidson and Trumbore (1995).

### 1.6 Related Data Sets

BOREAS TGB-12 222Rn Flux Data over the NSA
BOREAS TGB-12 Isotopic Carbon Dioxide Data over the NSA
BOREAS TGB-05 Fire History of Manitoba 1980 to 1991 in Raster Format
BOREAS TE-18 Landsat TM Physical Classification Image of the NSA
BOREAS AFM-12 1-km AVHRR Seasonal Land Cover Classification
BOREAS Regional Soils Data in Raster Format and AEAC Projection
BOREAS Soils Data over the SSA in Raster Format and AEAC Projection
BOREAS TGB-01 Soil CH4 and CO2 Profile Data over the NSA

## 2. Investigator(s)

### 2.1 Investigator(s) Name and Title

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Eric Davidson
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Woods Hole, MA

### 2.2 Title of Investigation

Input, Accumulation and Turnover of Carbon in BOREAS NSA Soils (TGB-12)

### 2.3 Contact Information

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## 3. Theory of Measurements

A static chamber method was used to determine radon fluxes. Chambers are described in Winston et al. (1997) and problems with chamber sampling in Stephens and Sundquist (1998). After chamber emplacement, samples of chamber air were taken at intervals of 30 to 45 minutes and used to fill pre-evacuated Lucas counting cells. The flux is determined from the slope of radon activity versus time. Special pits were instrumented with thermistors (for monitoring soil temperature), Time Domain Reflectometry (TDR) probes (for monitoring soil water content), and soil gas probes (1/8" stainless steel tubing, perforated at one end and inserted 50 to 100 cm laterally into the soil pit wall, capped with 1/8" swagelock union fittings sealed with a septum). Further details are given in Winston et al. (1997) and in Section 4, below.

$^{222}$Rn gas samples were obtained using gas-tight syringes (60 cc), dried (by passing through drierite), and then allowed to fill an evacuated Lucas counting cell coated with phosphor scintillant and decay counted. A description of radon sampling and analysis procedures is given in Davidson and Trumbore (1995).

# 4. Equipment

## 4.1 Sensor/Instrument Description

Because all of the equipment used in this project is common to many other projects and no special procedures were used, description detail has been minimized in this section, and the reader is referred to the appropriate publications.

- Davidson and Trumbore, 1995
- Mathieu et al., 1988
- Stephens and Sundquist, 1998
- Winston et al., 1997

Radon measurements were made using Pylon alpha scintillation counters.

### 4.1.1 Collection Environment

Samples were collected under all environmental conditions. Most measurements represent winter conditions.

### 4.1.2 Source/Platform

Soil.

### 4.1.3 Source/Platform Mission Objectives

The objective was to determine the soil $^{222}Rn$ activity.

### 4.1.4 Key Variables

The key variables measured were $^{222}Rn$ activity and soil depth. $^{222}Rn$ fluxes are also reported.

### 4.1.5 Principles of Operation

None given.

### 4.1.6 Sensor/Instrument Measurement Geometry

Not applicable.

### 4.1.7 Manufacturer of Sensor/Instrument

None given.

## 4.2 Calibration

Radon cell efficiencies were determined in the lab using background air and 226Ra of known activity absorbed to manganese fibers and sealed in a tube. Counting cell backgrounds were determined using ambient air (see Davidson and Trumbore, 1995, for details of radon measurement methods).

### 4.2.1 Specifications

None given.

#### 4.2.1.1 Tolerance

None given.

### 4.2.2 Frequency of Calibration

None given.

### 4.2.3 Other Calibration Information

None.

# 5. Data Acquisition Methods

None given.

# 6. Observations

## 6.1 Data Notes

None given.

## 6.2 Field Notes

None given.

# 7. Data Description

## 7.1 Spatial Characteristics

### 7.1.1 Spatial Coverage

The North American Datum of 1983 (NAD83) coordinates of the sites were:

```
NSA-Old Black Spruce (OBS):       55.88007N, 98.48139W
NSA-Old Jack Pine (OJP):          55.92842N, 98.62396W
NSA-Young Jack Pine (YJP):        55.89575N, 98.28706W
NSA-Gillam Road:                  55.9055 N, 97.70872W
```

### 7.1.2 Spatial Coverage Map

Not available.

### 7.1.3 Spatial Resolution

None given.

### 7.1.4 Projection

Not applicable.

### 7.1.5 Grid Description

Not applicable.

## 7.2 Temporal Characteristics

### 7.2.1 Temporal Coverage

Soil gas flux and concentration measurements were made from November 1993 to August 1994.

### 7.2.2 Temporal Coverage Map

Not applicable.

### 7.2.3 Temporal Resolution

The temporal resolution of the measurements was variable. Some sites were visited once and other were visited multiple times.

## 7.3 Data Characteristics

### 7.3.1 Parameter/Variable

The parameters contained in the data files on the CD-ROM are:

| Column Name |
|---|
| SITE_NAME |
| SUB_SITE |
| DATE_OBS |
| SOIL_DEPTH |
| RADON222_ACTIVITY |
| CRTFCN_CODE |
| REVISION_DATE |

### 7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the data files on the CD-ROM are

| Column Name | Description |
|---|---|
| SITE_NAME | The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type. |
| SUB_SITE | The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument. |
| DATE_OBS | The date on which the data were collected. |
| SOIL_DEPTH | The depth below the soil surface at which the measurement was taken. |
| RADON222_ACTIVITY | RADON-222 activity in air or soil air space. (A becquerel is 1 decay per second.) |
| CRTFCN_CODE | The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable). |
| REVISION_DATE | The most recent date when the information in the referenced data base table record was revised. |

### 7.3.3 Unit of Measurement

The measurement units for the parameters contained in the data files on the CD-ROM are:

| Column Name | Units |
|---|---|
| SITE_NAME | [none] |
| SUB_SITE | [none] |
| DATE_OBS | [DD-MON-YY] |
| SOIL_DEPTH | [millimeters] |
| RADON222_ACTIVITY | [becquerel][meter^-3] |
| CRTFCN_CODE | [none] |
| REVISION_DATE | [DD-MON-YY] |

### 7.3.4 Data Source

The sources of the parameter values contained in the data files on the CD-ROM are:

| Column Name | Data Source |
|---|---|
| SITE_NAME | [BORIS Designation] |
| SUB_SITE | [BORIS Designation] |
| DATE_OBS | Investigator |
| SOIL_DEPTH | Investigator |
| RADON222_ACTIVITY | Pylon alpha scintillation counters |
| CRTFCN_CODE | [BORIS Designation] |
| REVISION_DATE | [BORIS Designation] |

### 7.3.5 Data Range

The following table gives information about the parameter values found in the data files on the CD-ROM.

| Column Name | Minimum Data Value | Maximum Data Value | Missng Data Value | Unrel Data Value | Below Detect Limit | Data Not Cllctd |
|---|---|---|---|---|---|---|
| SITE_NAME | NSA-999-GMR02 | NSA-YJP-FLXTR | None | None | None | None |
| SUB_SITE | TGB12-RDN01 | TGB12-RDN03 | None | None | None | None |
| DATE_OBS | 15-NOV-93 | 16-AUG-94 | None | None | None | None |
| SOIL_DEPTH | 20 | 920 | None | None | None | None |
| RADON222_ACTIVITY | 30 | 201240 | -999 | None | None | None |
| CRTFCN_CODE | CPI | CPI | None | None | None | None |
| REVISION_DATE | 21-AUG-96 | 05-NOV-96 | None | None | None | None |

Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value -- The value that indicates missing data. This is used to indicate that an attempt was made to determine the parameter value, but the attempt was unsuccessful.
Unrel Data Value -- The value that indicates unreliable data. This is used to indicate an attempt was made to determine the parameter value, but the value was deemed to be unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the instruments detection limits. This is used to indicate that an attempt was made to determine the parameter value, but the analysis personnel determined that the parameter value was below the detection limit of the instrumentation.
Data Not Cllctd -- This value indicates that no attempt was made to determine the parameter value. This usually indicates that BORIS combined several similar but not identical data sets into the same data base table but this particular science team did not measure that parameter.

Blank -- Indicates that blank spaces are used to denote that type of value.
N/A -- Indicates that the value is not applicable to the respective column.
None -- Indicates that no values of that sort were found in the column.

### 7.4 Sample Data Record

The following are wrapped versions of data record from a sample data file on the CD-ROM.

```
SITE_NAME,SUB_SITE,DATE_OBS,SOIL_DEPTH,RADON222_ACTIVITY,CRTFCN_CODE,
REVISION_DATE
'NSA-OJP-FLXTR','TGB12-RDN03',15-NOV-93,40.0,360,'CPI',21-AUG-96
'NSA-OJP-FLXTR','TGB12-RDN03',15-NOV-93,130.0,-999,'CPI',21-AUG-96
'NSA-OJP-FLXTR','TGB12-RDN03',15-NOV-93,240.0,-999,'CPI',21-AUG-96
'NSA-OJP-FLXTR','TGB12-RDN03',15-NOV-93,550.0,5640,'CPI',21-AUG-96
'NSA-OJP-FLXTR','TGB12-RDN03',15-NOV-93,850.0,7540,'CPI',21-AUG-96
'NSA-999-GMR02','TGB12-RDN01',16-NOV-93,20.0,846,'CPI',21-AUG-96
'NSA-999-GMR02','TGB12-RDN01',16-NOV-93,85.0,3570,'CPI',21-AUG-96
```

## 8. Data Organization

### 8.1 Data Granularity

The smallest unit of data is the $^{222}Rn$ activity data for a given site on a given day.

### 8.2 Data Format(s)

The Compact Disk-Read-Only Memory (CD-ROM) files contain American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

## 9. Data Manipulations

### 9.1 Formulae

#### 9.1.1 Derivation Techniques and Algorithms

Methods for calculating radon and radiocarbon data are given in Davidson and Trumbore (1995) and Trumbore (1995).

### 9.2 Data Processing Sequence

None given.

#### 9.2.1 Processing Steps

None given.

#### 9.2.2 Processing Changes

None given.

### 9.3 Calculations

None given.

#### 9.3.1 Special Corrections/Adjustments

None given.

### 9.3.2 Calculated Variables
None given.

### 9.4 Graphs and Plots
None given.

## 10. Errors

### 10.1 Sources of Error
Sources of error include inaccuracies in soil collection and instrument errors during running of samples.

### 10.2 Quality Assessment

### 10.2.1 Data Validation by Source
There are many sources of error in flux measurements. The ones associated with the methods used here are detailed in Stephens and Sundquist (1998). Errors involved in soil gas sampling include the possibility that the volume of soil air space sampled (500 cc to 1 liter) represents a far larger volume of soil. Thus, the depth assigned to a soil gas sample (i.e., the depth of the probe) may not represent the average for the interval integrated in the gas sample taken from it (that is, air may be pulled down from above or up from below). Only analytical errors are given in these data sets.

### 10.2.2 Confidence Level/Accuracy Judgment
For radon measurements, accuracy is 10% of the measured value, with most of the error caused by uncertainty in the efficiency of the counting cell.

### 10.2.3 Measurement Error for Parameters
For radon measurements, accuracy is 10% of the measured value, with most of the error caused by uncertainty in the efficiency of the counting cell.

### 10.2.4 Additional Quality Assessments
None.

### 10.2.5 Data Verification by Data Center
Data were examined for general consistency and clarity.

## 11. Notes

### 11.1 Limitations of the Data
None given.

### 11.2 Known Problems with the Data
None given.

### 11.3 Usage Guidance
None given.

### 11.4 Other Relevant Information
None.

## 12. Application of the Data Set

The data can be used for estimation of soil gas exchange rates from $^{222}Rn$ data (or testing of soil gas exchange rates derived from models).

## 13. Future Modifications and Plans

None given.

## 14. Software

### 14.1 Software Description

Calculations of fluxes for radon used linear regression from programs such as Microsoft Excel and Kaleidograph.

### 14.2 Software Access

None.

## 15. Data Access

The TGB-12 $^{222}Rn$ activity 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

None.

## 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

Not applicable.

## 17.2 Journal Articles and Study Reports

Davidson, E.A. and S.E. Trumbore. 1995. Gas diffusivity and production of $CO_2$ in deep soils of the eastern Amazon. Tellus. 47B: 550-565.

Mathieu, G.G. P.E. Biscaye, R.A. Lupton, and D.E. Hammond. 1988. System for measurement of $^{222}Rn$ at low levels in natural waters. Heath Physics 55:989-992.

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.

Stephens, B.B. and E.T. Sundquist. 1998. Measurements of soil surface gas fluxes using closed chamber techniques, submitted for publication

Trumbore, S.E. 1995. Use of isotopes and tracers in the study of emission and consumption of trace gases in terrestrial environments. Chapter 9 in: Matson, P and Harriss, R, (eds.). Biogenic Trace Gases: Measuring Emissions from Soil and Water, Blackwell, Oxford, p. 291-326.

Winston, G.C., E.T. Sundquist, B.B. Stephens, and S.E. Trumbore. 1997. Winter $CO_2$ fluxes in a boreal forest. Journal of Geophysical Research 102(D24):28,795-28,804.

### 17.3 Archive/DBMS Usage Documentation

None.

## 18. Glossary of Terms

None given.

## 19. List of Acronyms

| | |
|---|---|
| AEAC | - Albers Equal-Area Conic |
| AFM | - Airborne Fluxes and Meteorology |
| AMS | - Accelerator Mass Spectrometer |
| ASCII | - American Standard Code for Information Interchange |
| AVHRR | - Advanced Very High Resolution Radiometer |
| BOREAS | - BOReal Ecosystem-Atmosphere Study |
| BORIS | - BOREAS Information System |
| CD-ROM | - Compact Disk-Read-Only Memory |
| DAAC | - Distributed Active Archive Center |
| EOS | - Earth Observing System |
| EOSDIS | - EOS Data and Information System |
| GIS | - Geographic Information System |
| GSFC | - Goddard Space Flight Center |
| HTML | - Hyper-Text Markup Language |
| IRGA | - Infrared Gas Analyzer |
| NAD83 | - North American Datum of 1983 |
| NASA | - National Aeronautics and Space Administration |
| NSA | - Northern Study Area |
| OBS | - Old Black Spruce |
| OJP | - Old Jack Pine |
| ORNL | - Oak Ridge National Laboratory |
| PANP | - Prince Albert National Park |
| TDR | - Time Domain Reflectometry |
| TGB | - Trace Gas Biogeochemistry |
| TM | - Thematic Mapper |
| SSA | - Southern Study Area |
| URL | - Uniform Resource Locator |
| USGS | - United States Geological Survey |
| YJP | - Young Jack Pine |

# 20. Document Information

## 20.1 Document Revision Date

Written: 14-Nov-1997
Last Updated: 08-Jul-1999

## 20.2 Document Review Date(s)

BORIS Review: 10-Jul-1998
Science Review:

## 20.3 Document ID

## 20.4 Citation

For soils data, the U.S. Geological Survey open file reports (see Section 17.2) should be cited. For interpretations, cite submitted Journal of Geophysical Research papers (see Section 17.2). Other citations should refer to the BOREAS Information System (BORIS) data set.

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

Trumbore, S., J. Harden, E. Sundquist, and E. Davidson, "Input, Accumulation and Turnover of Carbon in BOREAS NSA Soils (TGB-12)." In Collected Data of The Boreal Ecosystem-Atmosphere Study. Eds. J. Newcomer, D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers. CD-ROM. NASA, 2000.

Also, cite the BOREAS CD-ROM set as:

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The BOREAS TGB-12 team made measurements of soil carbon inventories, carbon concentration in soil gases, and rates of soil respiration at several sites to estimate the rates of carbon accumulation and turnover in each of the major vegetation types. Sampling strategies for soils were designed to take advantage of local fire chronosequences, so that the accumulation of carbon in regrowing mosses could be determined. All the data are used to (1) calculate the inventory of carbon and nitrogen in moss and mineral soil layers at NSA sites, (2) determine the rates of input and turnover (using both accumulation since the last stand-killing fire and radiocarbon data), and (3) link changes in soil respiration rate to shifts in the $^{14}$C content of soil $CO_2$ to determine the average 'age' respired $CO_2$. These $^{222}$Rn activity data were collected from 15-Nov-1993 to 16-Aug-1994 over the NSA sites. They are useful for determining the rate of gas exchange between soil and the overlying atmosphere. The data in this data set are stored in tabular ASCII files.

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