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BOREAS TE-12 SSA Leaf Water Potential Data

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BOREAS TE-12 SSA Leaf Water Potential Data

Elizabeth A. Walter-Shea , Mark A. Mesarch, L. Chen, L. Yang

Summary

The BOREAS TE-12 team collected water potential data in 1993 and 1994 from aspen, jack pine, and black spruce leaves/needles. Collections were made at the SSA FEN, YJP, YA, OA, and OBS sites. Measurements were made using a pressure chamber on a platform in the field. The data are provided in tabular ASCII files.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS TE-12 SSA Water Potential Data

1.2 Data Set Introduction

Measurements of shoot, branchlet, and leaf water potential were made in the field on samples cut for measurement of leaf optical properties and shoot geometry.

1.3 Objective/Purpose

The purpose of this study was to characterize the water potential of boreal forest plant elements.

1.4 Summary of Parameters

Water potential of shoots, branchlets, and leaves/needles of black spruce, jack pine, or aspen samples.

1.5 Discussion

Intensive Field Campaign (IFC)-93:

Measurements were made on samples collected at two sites in the BOReal Ecosystem-Atmosphere Study (BOREAS) Southern Study Area (SSA): near the Nipawin Fen (FEN) and Nipawin Jack Pine (Young-Dry) (YJP). Canopy access was limited to only ground-level collection of samples. Samples from trees could be from various heights within the tree, but were generally from the lower third of the entire canopy height. Aspen [Populus tremuloides], black spruce [Picea mariana], and jack pine [Pinus banksiana] were sampled near the SSA-FEN site. Jack pine needles were sampled at the SSA-YJP site.

IFC-1, -2, -3:

Measurements were made on samples collected at four sites in the SSA: Young Aspen (YA), Old Aspen (OA), YJP, and Old Black Spruce (OBS). Aspen branchlets were sampled at SSA-YA and SSA-OA. Jack pine shoots were sampled at SSA-YJP. Black spruce shoots were sampled at SSA-OBS.

1.6 Related Data Sets

BOREAS TE-07 Sap Flow Data
BOREAS TE-10 Leaf Optical Properties
BOREAS TE-12 SSA Shoot Geometry Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

Elizabeth A. Walter-Shea, Assoc. Professor

2.2 Title of Investigation

Radiation and Gas Exchange of Canopy Elements in a Boreal Forest

2.3 Contact Information

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3. Theory of Measurements

Water potential is a measure of the free energy of water in comparison to the free energy of pure water. The water potential of pure water has been assigned a value of 0 bars. A bar is a pressure unit directory relatable to energy per unit mass (1 bar = 0.1 MPa = 0.987 atmospheres). The chemical energy of water in the biosphere is lower than pure water and therefore values are expressed as negative numbers (Barbour et al., 1980).

Water potential is often measured using a pressure chamber. Measuring the xylem pressure potentials is based on the fact that negative pressures (tensions) exist in the xylem and, when stems are severed, the pressure necessary to force water back to the cut surface is equivalent to the negative pressure in the xylem prior to cutting. An advantage of the pressure chamber lies in the large number of samples that can be measured in a short time. The apparatus has also been made portable so that data may be taken on plants in their native surroundings (Barbour et al., 1980).

Water potential is an important moisture measurement of water transport in a plant and of plant growth. Water potential is one of the variables that can drive stomatal control, allowing the interchange of gases for the photosynthesis process. Water content of the plant also affects the absorption pattern of the plant in the infrared portion of the energy spectrum.

Branchlets or leaves selected for water potential measurements were not the same samples used for optical property or shoot/leaf geometry measurements. (See BOREAS TE-12 Leaf Optical Data for SSA Species.) For conifer samples, branchlets were selected from the same branch used to collect samples for the other measurements. For deciduous samples, leaves selected for water potential measurements were selected from branches near those used for collection of samples for the other measurements.

4. Equipment

4.1 Instrument Description

A pressure chamber designed by Precision Machine Co. was used to measure water potential of shoots and leaves in 1993. Nitrogen gas was used to pressurize the chamber. Precision of this chamber was 0.01 MPa.

The Model 1002 Plant Moisture Stress Measurement Instrument was used in IFC-1, IFC-2, and IFC-3 in 1994. The pressure-measuring transducer was +/- 0.5 % full scale. Nitrogen gas was used to pressurize the chamber. Precision of this chamber is 0.007 MPa.

4.1.1 Collection Environment
All measurements were made in the field.

4.1.2 Source/Platform
None given.

4.1.3 Source/Platform Mission Objectives
None given.

4.1.4 Key Variables
Water potential of shoots, leaves, and leaflets.

4.1.5 Principles of Operation
Nitrogen gas is released into the chamber at an initial rate of less than 0.1 MPa/s and slowed to less than 0.02 MPa/s until water begins to appear on the xylem openings of the stem or petiole.

4.1.6 Instrument Measurement Geometry
The pressure chamber is set on a platform in the field. A magnifying glass and light source are hand-held to help view the xylem elements.

4.1.7 Manufacturer of Instrument
PMS Instrument Company
270 NW Royal Oaks Dr.
Corvallis, OR 97330
(503) 752-7926
(503) 752-7929 (fax)

Precision Machine Company, Inc.
2933 North 36th Street
Lincoln, NE 68504
(402) 467-5528
(402) 467-5530 (fax)

4.2 Calibration

4.2.1 Specifications
No calibration of instruments.

4.2.1.1 Tolerance
None.

4.2.2 Frequency of Calibration
None.

4.2.3 Other Calibration Information
None.

5. Data Acquisition Methods

The CANOPY_LOCATION parameter of the data set is a relative measure based upon the height of the sample location relative to the height of the canopy. Therefore, a sample collected from the top of a short tree in a tall canopy and a sample collected from the bottom of a short tree in a short canopy can both be designated as "low" for the HEIGHT parameter. Samples were collected from HIGH and LOW portions of the canopy at SSA-OBS and SSA-YJP. Samples were collected from LOW portions of the canopy at SSA-FEN.

5.1 Sample Collection

Sample Gathering: FOR IFC-93 and IFC-1, -2, -3: Branchlet samples (defined as a small tree limb consisting of shoots with growth from current year, previous year, and 2 years ago) were cut from plants, covered with damp cheesecloth, sealed in a Ziploc-type storage bag, and stored in a cool ice chest.

5.2 Sample Measurement

For the jack pine and black spruce trees, shoots with at least 3 years of needle growth were cut from the branchlet for water potential measurement. Aspen leaves from SSA-OA have petioles thick enough to maintain xylem integrity and view the xylem elements with the magnifying glass that was used in the field; therefore, individual leaves were used. Aspen leaves from SSA-YA and SSA-FEN were small and tender, so several leaves on a branchlet (usually three leaves) were used.

Samples were draped with wet cheesecloth and placed in a plastic bag. The petiole, branchlet, or shoot end was placed through a rubber stopper so the cut end of the plant element was exposed approximately 5-10 mm through the stopper. The shoot end near the inside side stopper may have been wrapped with clay to assist in sealing the chamber. The stopper was placed in the chamber top and the chamber was sealed. Nitrogen gas was released into the chamber at an initial rate of less than 0.1 MPa/s and slowed to less than 0.02 MPa/s until water began to appear on the xylem openings of the stem. The pressure is recorded by hand and/or electronically. The pressure was released slightly, and then a second measurement was made.

6. Observations

6.1 Data Notes

None.

6.2 Field Notes

Measured: 04-Aug-1993

Coordinated water potential measurement with samples collected for shoot geometry from jack pine shoots collected near SSA-FEN; 3 trees x 1 branch x 3 replications of shoots. Branches from trees 1 and 2 were sunlit and the branch from tree 3 was shaded.

Measured: 04-Aug-1993

Coordinated measurements of water potential, leaf area, and leaf optical properties from aspen near SSA-FEN; 3 trees x 3 branches x 3 replications. The first replication was for a leaf at the top of the branchlet in the second replication was for a leaf in the middle of the branchlet, and the third replication was for a leaf on the lowest part of the branchlet. Branches were selected from the north side of the trees.

Measured: 06-Aug-1993

Coordinated measurements of shoot water potential, leaf gas exchange, leaf optical properties, and shoot geometry on black spruce near SSA-FEN; 3 trees x 4 branches x 3 replications. Tree 1 was sunlit, tree 2 was lightly shaded, and tree 3 was deeply shaded. All trees were about 3 to 3.5 m tall in a grove of trees about 10 m tall.

Measured: 16-Aug-1993

Coordinated water potential measurement with samples collected for shoot geometry from jack pine shoots collected at SSA-YJP; 9 trees x 1 branch x 3 ages x 1 replication of shoot.

Measured: 26-May-1994

Coordinated water potential, shoot geometry, and leaf optical properties on jack pine shoots collected at SSA-YJP; 9 trees x 1 branch x 3 replications. Trees located about 150 m east of the hut and 20-50 m north of the access road. Branches were from the south side of the trees and generally in full sunlight at 1230-1600 local time. Branches were collected from 2-3 m from the soil surface.

Measured: 29-May-1996

Coordinated measurements of water potential, leaf area, and leaf optical property on aspen leaves collected at SSA-YA; 3 trees x 3 branches x 3 replications. Leaves were from branches sampled from the south side of the tree and 1.5-2 m from the soil surface.

Measured: 01-Jun-1994

Coordinated measurements of water potential, leaf optical properties, and shoot geometry from black spruce shoots collected at SSA-OBS; 3 trees x 3 branches x 3 replications. Samples were collected from the top of the trees via the canopy access tower and on the south-facing side of the trees. Branches were sunlit.

Measured: 04-Jun-1994

Coordinated measurements of water potential, leaf optical property, gas exchange measurements, and shoot geometry from jack pine shoots. Samples were collected at SSA-YJP; 4 trees x 1 branch x 3 replications.

Measured: 07-Jun-1994

Coordinated measurements of water potential, leaf optical property, and shoot geometry from black spruce shoots collected at SSA-OBS; 3 trees x 3 branches x 3 replications. Samples were collected from lower in the canopy (approximately 9 m from the soil surface) via the canopy access tower. Branches from tree 1 and 2 were mostly shaded. Branches from tree 3 were sunlit most of the time.

Measured: 07-Jun-1994

Coordinated measurements of water potential, leaf area, and leaf optical properties from aspen collected at SSA-YA; 3 trees x 3 branches x 3 replications from sunlit branches at the top of the canopy.

Measured: 10-Jun-1994

Coordinated measurements of water potential, leaf optical properties, and shoot geometry from jack pine shoots collected at SSA-YJP; 9 trees x 1 branch x 3 replications. Trees located about 150 m east of the hut and 20-50 m south of the access road. Branches were from the south side of trees and sunlit. Branches were collected from the top of the canopy.

Measured: 15-Jun-1994

Coordinated measurements of water potential, leaf area, and leaf optical properties from aspen collected at SSA-YA; 3 trees x 3 branches x 3 replications for the top of the canopy; measured adaxial and abaxial surfaces. Rain fell during measurements.

Measured: 21-Jul-1994
Coordinated measurements of water potential, leaf optical properties, and shoot geometry from jack pine shoots collected at SSA-YJP; 9 trees x 1 branch x 2 replications. Trees were located about 250 m east of the hut and 80 m south of the access road. Branches were from the south side of trees and sunlit. Branches were collected from 1.5-2 m from the soil surface.

Measured: 25-Jul-1994
Coordinated measurements of water potential, leaf optical properties, and shoot geometry on jack pine collected at SSA-YJP; 9 trees x 1 branch x 2 replications. Trees were located about 150 m east of the hut and 20-40 m north of the access road. Branches were from the south side of the trees and sunlit. Branches were collected from the top of the canopy.

Measured: 29-Jul-1994
Coordinated measurements of water potential, leaf area, and leaf optical properties from aspen collected at SSA-YA; 3 trees x 3 branches x 3 replications from the top of the canopy. Branches were sunlit.

Measured: 30-Jul-1994
Coordinated measurements of water potential, leaf optical properties, and shoot geometry from black spruce shoots collected at SSA-OBS; 3 trees x 3 branches x 3 replications. Samples were collected from the top of the canopy via the canopy access tower. Branches were sunlit.

Measured: 02-Aug-1994
Coordinated measurements of water potential, leaf optical properties, and shoot geometry from black spruce shoots collected at SSA-OBS; 3 trees x 3 branches x 3 replications. Samples were collected from lower in the canopy (approximately 9 m from the soil surface) via the canopy access tower. Branches were mostly shaded.

Measured: 04-Sep-1994
Coordinated measurement of water potential, leaf optical properties, and shoot geometry from black spruce shoots collected at SSA-OBS; 3 trees x 3 branches x 3 replications. Samples were collected from lower in the canopy (approximately 9 m from the soil surface) via the canopy access tower. Trees 1 and 3 are sunlit samples and tree 2 is shaded.

Measured: 04-Sep-1994
Coordinated measurements of water potential, leaf area, and leaf optical properties from aspen collected at SSA-YA; 3 trees x 3 branches x 3 replications from sunlit branches at the top of the canopy.

Measured: 17-Sep-1994
Coordinated measurement of water potential, leaf optical properties, and shoot geometry from black spruce shoots collected at SSA-OBS; 3 trees x 3 branches x 3 ages x 3 replications. Samples were collected from the top of the canopy via the canopy access tower.

Measured: 11-Sep-1994
Coordinated measurements of water potential, leaf optical properties, and shoot geometry from jack pine shoots collected at SSA-YJP; 9 trees x 1 branch x 2 replications. Trees were located about 150 m east of the hut and 20-40 m north of the access road. Branches were collected from the top of the canopy.

Measured: 14-Sep-1994
Coordinated measurements of water potential, leaf optical properties, and shoot geometry from jack pine shoots collected at SSA-YJP; 9 trees x 1 branch x 2 replications. Trees were located about 100 m east of the hut and 20-40 m north of the access road. Branches were from the south side of the trees and sunlit. Branches were collected from 2-3 m from the soil surface from trees near the canopy access scaffolding.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

Samples were collected from portions of the canopy at SSA-OBS, SSA-YJP, and SSA-FEN sites. The North American Datum of 1983 (NAD83) coordinates for the sites are:

	Latitude	Longitude
SSA-FEN-FLXTR	53.80206°N	104.61798°W
SSA-OA-FLXTR	53.62889°N	106.19779°W
SSA-OBS-FLXTR	53.98717°N	105.11779°W
SSA-YA-FLXTR	53.65601°N	105.32314°W
SSA-YJP-FLXTR	53.87581°N	104.64529°W

7.1.2 Spatial Coverage Map

Not applicable.

7.1.3 Spatial Resolution

Shoot selection came from a branch approximately 30 to 70 cm long.

7.1.4 Projection

Not applicable.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

Water potential measurements were made from 3 to 20 minutes after the branch was cut from the tree.

7.2.1 Temporal Coverage

Branches were collected from 1530 to 0023 Greenwich Mean Time (GMT). Measurements were not made continuously (IFC-93 04-Aug to 20-Aug-1993; IFC1-94 26-May to 15-Jun-1994; IFC2-94 21-Jul to 02-Aug-1994; IFC3-94 04-Sep to 14-Sep-1994).

7.2.2 Temporal Coverage Map

The following list gives the date, site, and type of samples collected:

Date	Site	Species
04-Aug-1993	SSA-FEN	Jack Pine
04-Aug-1993	SSA-FEN	Aspen
06-Aug-1993	SSA-FEN	Black Spruce
16-Aug-1993	SSA-YJP	Jack Pine
19-Aug-1993	SSA-FEN	Aspen
20-Aug-1993	SSA-FEN	Black Spruce
26-May-1994	SSA-YJP	Jack Pine
29-May-1994	SSA-YA	Aspen
01-Jun-1994	SSA-OBS	Black Spruce
04-Jun-1994	SSA-YJP	Jack Pine
06-Jun-1994	SSA-OA	Aspen
07-Jun-1994	SSA-OBS	Black Spruce
07-Jun-1994	SSA-YA	Aspen

10-Jun-1994	SSA-YJP	Jack Pine
15-Jun-1994	SSA-YA	Aspen
21-Jul-1994	SSA-YJP	Jack Pine
25-Jul-1994	SSA-YJP	Jack Pine
29-Jul-1994	SSA-YA	Aspen
30-Jul-1994	SSA-OBS	Black Spruce
02-Aug-1994	SSA-OBS	Black Spruce
04-Sep-1994	SSA-OBS	Black Spruce
04-Sep-1994	SSA-YA	Aspen
07-Sep-1994	SSA-YA	Aspen
11-Sep-1994	SSA-YJP	Jack Pine
14-Sep-1994	SSA-YJP	Jack Pine

7.2.3 Temporal Resolution

A typical water potential measurement required approximately 3 to 5 minutes.

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
TIME_OBS
SPECIES
CANOPY_LOCATION
TREE_ID
SAMPLE_ID
NUM_OBS
MEAN_WATER_POTENTIAL
SDEV_WATER_POTENTIAL
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.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were collected.
DATE_COLLECTED	The date on which the samples were collected.
TIME_COLLECTED	The Greenwich Mean Time (GMT) when the samples were collected.
SPECIES	Botanical (Latin) name of the species (Genus species).
CANOPY_LOCATION	Location in the canopy from which the sample was taken.

The CANOPY_LOCATION parameter of the data set is a relative measure based upon the height of the sample location relative to the height of the canopy. Therefore, a sample collected from the top of a short tree in a tall canopy and a sample collected from the bottom of a short tree in a short canopy can both be designated as "low" for the HEIGHT parameter. Samples were collected from HIGH and LOW portions of the canopy at SSA-OBS and SSA-YJP. Samples were collected from LOW portions of the canopy at SSA-FEN. Canopy access at SSA-OBS was limited to the locations of the Terrestrial Ecology (TE) scaffolding towers.

TREE_ID	Identifier of the mapped tree or plant stem.
SAMPLE_ID	The sample identifier used by data collectors (see documentation for a detailed description).
NUM_OBS	Number of observations of the given sample used to calculate given values.
MEAN_WATER_POTENTIAL	The mean water potential.
SDEV_WATER_POTENTIAL	The standard deviation of the water potential.
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]
TIME_OBS	[HHMM GMT]
SPECIES	[none]
CANOPY_LOCATION	[none]
TREE_ID	[none]
SAMPLE_ID	[none]
NUM_OBS	[counts]
MEAN_WATER_POTENTIAL	[megaPascals]
SDEV_WATER_POTENTIAL	[megaPascals]
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	[PLEASE COMPLETE]
SUB_SITE	[PLEASE COMPLETE]
DATE_OBS	[PLEASE COMPLETE]
TIME_OBS	[PLEASE COMPLETE]
SPECIES	[PLEASE COMPLETE]
CANOPY_LOCATION	[PLEASE COMPLETE]
TREE_ID	[PLEASE COMPLETE]
SAMPLE_ID	[PLEASE COMPLETE]
NUM_OBS	[PLEASE COMPLETE]
MEAN_WATER_POTENTIAL	[PLEASE COMPLETE]
SDEV_WATER_POTENTIAL	[PLEASE COMPLETE]
CRTFCN_CODE	[PLEASE COMPLETE]
REVISION_DATE	[PLEASE COMPLETE]

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	SSA-90A-FLXTR	SSA-YJP-FLXTR	None	None	None	None
SUB_SITE	9TE12-WRP01	9TE12-WRP01	None	None	None	None
DATE_OBS	04-AUG-93	14-SEP-94	None	None	None	None
TIME_OBS	1343	2331	None	None	None	None
SPECIES	N/A	N/A	None	None	None	None
CANOPY_LOCATION	Bottom	Top	None	None	None	None
TREE_ID	1	73	None	None	None	None
SAMPLE_ID	940001	99999	None	None	None	None
NUM_OBS	1	9	None	None	None	None
MEAN_WATER_POTENTIAL	-2.51	-.07	None	None	None	None
SDEV_WATER_POTENTIAL	-.6	0	-999	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	28-AUG-97	28-AUG-97	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 records from a sample data file on the CD-ROM.

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,SPECIES,CANOPY_LOCATION,TREE_ID,SAMPLE_ID,
NUM_OBS,MEAN_WATER_POTENTIAL,SDEV_WATER_POTENTIAL,CRTFCN_CODE,REVISION_DATE
'SSA-FEN-FLXTR','9TE12-WRP01',04-AUG-93,1745,'Pinus bankisana','Bottom',68,
'99999',3,-.12,-.06,'CPI',28-AUG-97
'SSA-FEN-FLXTR','9TE12-WRP01',04-AUG-93,1752,'Pinus bankisana','Bottom',69,
'99999',3,-.09,-.04,'CPI',28-AUG-97
```

8. Data Organization

8.1 Data Granularity

The smallest unit of data tracked by the BOREAS Information System (BORIS) is the average water potential for a tree.

8.2 Data Format

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

Not applicable.

9.1.1 Derivation Techniques and Algorithms

Not applicable.

9.2 Data Processing Sequence

9.2.1 Processing Steps

Water potential for each tree was calculated based on separate shoot and/or branch measurements.

9.2.2 Processing Changes

Not applicable.

9.3 Calculations

9.3.1 Special Corrections/Adjustments
Not applicable.

9.3.2 Calculated Variables
Not applicable.

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of Error
Some leakage of pressure from the stopper seal in the Precision Machine pressure chamber may have resulted in overestimates of water potential. There was confusion in distinguishing between the flow of the sap from the xylem and pitch vessels. Pitch is under less tension and exudes first when pressure is applied; thus, water potential may be underestimated if pitch was mistaken for sap.

10.2 Quality Assessment

10.2.1 Data Validation by Source
None given.

10.2.2 Confidence Level/Accuracy Judgment
None given.

10.2.3 Measurement Error for Parameters
None given.

10.2.4 Additional Quality Assessments
None given.

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
These data are acceptable for use with consideration of the above-mentioned known problems with the data and estimated errors.

11.4 Other Relevant Information
Acknowledgment of other research staff who assisted in measurements:

Liquang Chen, UNL graduate student Brian P. Lang, UNL undergraduate student Cynthia J. Hays, UNL Research Technologist Dr. Blaine L. Blad, Agricultural Department Head at UNL

12. Application of the Data Set

Water potential is useful for studying the transpiration rates of plants.

13. Future Modifications and Plans

None given.

14. Software

14.1 Software Development

None given.

14.2 Software Access

None given.

15. Data Access

The TE-12 SSA water potential 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/Instrument/Data Processing Documentation
Barbour, M.G., J.H. Burk, and W.D. Pitts. 1980. Terrestrial Plant Ecology. The Benjamin/Cummings Publishing Company, Inc.

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).

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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

ASCII - American Standard Code for Information Interchange
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
FC - Field Campaign
FEN - Nipawin Fen site
FFC - Focused Field Campaign
GIS - Geographic Information System
GMT - Greenwich Mean Time
GSFC - Goddard Space Flight Center
HTML - HyperText Markup Language
IFC - Intensive Field Campaign
NAD83 - North American Datum of 1983
NASA - National Aeronautics and Space Administration
NSA - Northern Study Area
OA - Old Aspen
OBS - Old Black Spruce
OJP - Old Jack Pine
ORNL - Oak Ridge National Laboratory
PANP - Prince Albert National Park
RSS - Remote Sensing Science
SA - Surface area of the leaf
SSA - Southern Study Area
TE - Terrestrial Ecology
UNL - University of Nebraska - Lincoln
URL - Uniform Resource Locator
YA - Young Aspen
YJP - Nipawin Young-Dry Jack Pine

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The BOREAS TE-12 team collected water potential data in 1993 and 1994 from aspen, jack pine, and black spruce leaves/needles. Collections were made at the SSA FEN, YJP, YA, OA, and OBS sites. Measurements were made using a pressure chamber on a platform in the field. The data are provided in tabular ASCII files.

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