

# SNF SITE CHARACTERIZATION VALIDATION

## Summary:

This data set documentation is currently in work. In the interim, an abstract of the entire Superior National Forest (SNF) data collection activity from which the SNF Site Characterization Validation Data Set is a product is being provided.

During the summers of 1983 and 1984, the National Aeronautics and Space Administration (NASA) conducted an intensive experiment in a portion of the Superior National Forest (SNF) near Ely, Minnesota, U.S.A. The purpose of the experiment was to investigate the ability of remote sensing to provide estimates of biophysical properties of ecosystems, such as leaf area index (LAI), biomass, and net primary productivity (NPP). The study area covered a 50 x 50 km area centered at approximately 48 degrees North latitude and 92 degrees West longitude in northeastern Minnesota at the southern edge of the North American boreal forest. The SNF is mostly covered by boreal forest. Boreal forests were chosen for this project because of their relative taxonomic simplicity, their great extent, and their potential sensitivity to climatic change. Satellite, aircraft, helicopter, and ground observations were obtained for the study area.

These data comprise a unique data set for the investigation of the relationships between the radiometric and biophysical properties of vegetated canopies. This is perhaps the most complete data set of its type ever collected over a forested region. A key goal of the experiment was to use the aircraft measurements to scale up to satellite observations for the remote sensing of biophysical parameters.

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## **1. Data Set Overview:**

### **Data Set Identification:**

SNF Site Characterization Validation.

### **Data Set Introduction:**

These data comprise a unique data set for the investigation of the relationships between the radiometric and biophysical properties of vegetated canopies. This is perhaps the most complete data set of its type ever collected over a forested region.

### **Objective/Purpose:**

The purpose of this study was to investigate the ability of remote sensing to provide estimates of biophysical properties of ecosystems, such as leaf area index (LAI), biomass, and net primary productivity (NPP). A key goal of the experiment was to use the aircraft measurements to scale up to satellite observations for the remote sensing of biophysical parameters.

### **Summary of Parameters:**

This data set includes the following information: coverage by vegetation, diameter at breast height, biomass, leaf area index, NPP, understory leaf extension, canopy coverage, reflectance, and transmittance.

### **Discussion:**

This data set documentation is currently in work. In the interim, an abstract of the entire Superior National Forest (SNF) data collection activity from which the SNF Site Characterization Validation data set is a product is being provided.

In the interim, we are providing an abstract of the entire Superior National Forest (SNF) data collection activity from which the SNF Site Characterization Validation data set is a product that we have incorporated into the ORNL DAAC search and order systems.

During the summers of 1983 and 1984, the National Aeronautics and Space Administration (NASA) conducted an intensive experiment in a portion of the Superior National Forest (SNF) near Ely, Minnesota, U.S.A. The purpose of the experiment was to investigate the ability of remote sensing to provide estimates of biophysical properties of ecosystems, such as leaf area index (LAI), biomass, and net primary productivity (NPP). The study area covered a 50 x 50 km area centered at approximately 48 degrees North latitude and 92 degrees West longitude in northeastern Minnesota at the southern edge of the North American boreal forest. The SNF is

mostly covered by boreal forest. Boreal forests were chosen for this project because of their relative taxonomic simplicity, their great extent, and their potential sensitivity to climatic change. Satellite, aircraft, helicopter, and ground observations were obtained for the study area. These data comprise a unique data set for the investigation of the relationships between the radiometric and biophysical properties of vegetated canopies. This is perhaps the most complete data set of its type ever collected over a forested region.

Detailed vegetation data were collected on the ground for about 100 sampled sites. These sites represent a range of stand density and age for spruce and aspen and also include jackpine and mixed stands. At each site, five circular subplots of 16 meters in diameter were sampled within a large plot of 60 meters in diameter. Within the subplots, all woody stems over 2 meters in height were tallied by species, diameter, and height. Within each subplot, coverage by vegetation was determined for the canopy, subcanopy and understory. Thirty each of black spruce and aspen trees from outside the plots were sacrificed and dimension analysis relations developed between diameter at breast height, biomass and leaf area index. Also, above-ground NPP was estimated for each test site. For the aspen sites, bark area and understory leaf area indexes were found. During the spring, measurements of understory leaf extension and canopy coverage were made on several days to describe the phenology of an aspen stand.

Measurements of the optical properties of canopy components were made for wavelengths between 0.35 and 2.1 micrometers. Reflectance and transmittance properties of leaves and needles of eight major overstory tree species and three understory shrubs were measured. Multiple measurements of aspen and spruce allow an investigation of the variability of optical properties within a species, spagnum moss and leaf litter. Above-canopy reflectance was observed by a helicopter-mounted Barnes Modular Multiband Radiometer (MMR). The helicopter MMR data have a spatial resolution of approximately 32 meters. In 1983, 10 days of data were collected between May and October, with a total of 105 sites observed. In 1984, 8 days of data were collected between May and September, with a total of 29 sites observed. Several sites have multiple observations, to allow studies of seasonal variation. Thematic Mapper Simulator (TMS) data were collected from the NASA C-130 flying over the SNF. The flights were in a 'criss-cross' pattern to allow observation of the same location with multiple sun and view angles. The TMS scans out to 50 degrees off nadir; in flights at 5000 feet above ground level, a nadir pixel covers 3.81 meters along the scan. Three days of TMS data are presented; these data have been atmospherically corrected and calibrated to determine surface reflectance. A key goal of the experiment was to use the aircraft measurements to scale up to satellite observations for the remote sensing of biophysical parameters.

### **Related Data Sets:**

Not available.

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

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

Dr. Forrest G. Hall  
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Ms. Jaime E. Nickeson  
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Dr. Kerry D. Woods  
Bennington College

Dr. Celeste Jarvis  
NASA Headquarters

**Title of Investigation:**

Biophysical, Morphological, Canopy Optical Property, and Productivity Data on the Superior National Forest.

**Contact Information:**

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**3. Theory of Measurements:**

Not available.

**4. Equipment:**

**Sensor/Instrument Description:**

**Collection Environment:**

Ground-based.

**Source/Platform:**

Field Investigation.

**Source/Platform Mission Objectives:**

Not available.

**Key Variables:**

- Forest composition/structure
- Litter characteristics
- Scattering

**Principles of Operation:**

Not available.

**Sensor/Instrument Measurement Geometry:**

Not available.

**Manufacturer of Sensor/Instrument:**

Not available.

**Calibration:**

Not available.

**5. Data Acquisition Methods:**

Not available.

**6. Observations:****Data/Field Notes:**

Not available.

**7. Data Description:****Spatial Characteristics:**

The study area covered a 50 x 50 km area centered at approximately 48 degrees North latitude and 92 degrees West longitude in northeastern Minnesota at the southern edge of the North American boreal forest.

### Temporal Characteristics:

During the summers of 1983 and 1984, the National Aeronautics and Space Administration (NASA) conducted an intensive experiment in a portion of the Superior National Forest (SNF) near Ely, Minnesota, U.S.A.

### Data Characteristics:

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Variable Name/ Description	Long Name	SAS Type	Generic Type
1 grid_id "Grid ID"	GRID_ID	\$ 5	CHAR(5)
2 plot_id "Plot ID within the site"	PLOT_ID	8	NUMBER(3,0)
3 photo_id "Photo ID for site location"	PHOTO_ID	8	NUMBER(4,0)
4 obs_date "Observation date in DD-MON-YY format (e.g. 01-JAN-90)"	OBS_DATE	\$ 12	DATE
5 pct_rock "Percent of ground cover that is rock"	PCT_ROCK	8	NUMBER(3,0)
6 pct_soil "Percent of ground cover that is bare soil"	PCT_SOIL	8	NUMBER(3,0)
7 pct_herb "Percent of ground cover that is herbaceous matter"	PCT_HERB	8	NUMBER(3,0)
8 pct_shrb "Percent of ground cover that is shrub"	PCT_SHRUB	8	NUMBER(3,0)

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"Percent of ground cover that is low shrubs"

---

9 pct\_othr PCT\_OTHER 8 NUMBER(3,0)  
"Percent of ground cover that is other materials (identified by OTHER\_ID)"

---

10 other\_id OTHER\_ID \$ 12 CHAR(12)  
"Other ground cover: water, dead matter, etc."

---

11 shrbspec SHRUB\_SPECIES \$ 6 CHAR(6)  
"Shrub species code (see SNF plant species reference file, spec\_ref.dat)"

---

12 shrbcvr SHRUB\_COVER 8 NUMBER(3,0)  
"Percent of coverage of the low shrub layer that is specified by SHRUB\_SPECIES for the plot"

---

13 subcspec SUBCAN\_SPECIES \$ 6 CHAR(6)  
"Subcanopy species code (see SNF plant species reference file, spec\_ref.dat)"

---

14 subc\_cvr SUBCAN\_COVER 8 NUMBER(3,0)  
"Percent of coverage of the subcanopy layer that is specified by SUBCAN\_SPECIES for the plot"

---

15 subcstem SUBCAN\_STEMS 8 NUMBER(3,0)  
"Number of tree stems of subcanopy species specified by SUBCAN\_SPECIES within a 2 meter radius of the plot center"

---

16 subc\_ht SUBCAN\_HEIGHT 8 NUMBER(3,0)  
"Average height of subcanopy species specified by SUBCAN\_SPECIES within a 2 meter radius of the plot center"

---

17 can\_spec CANOPY\_SPECIES \$ 6 CHAR(6)  
"Canopy species code (see SNF plant species reference file, spec\_ref.dat)"

---

18	prismcnt	PRISM_COUNT	8	NUMBER(3,0)
"The BAF prism count of all tree stems for the species specified by CANOPY_SPECIES"				
19	can_clos	CANOPY_CLOSURE	8	NUMBER(4,0)
"Percent canopy closure of entire overstory of plot"				
20	grid_n		8	
"Grid ID (numeric for sorting)"				
21	plot_n		8	
"Plot ID (numeric for sorting)"				

### Sample Data Record:

Not available at this time.

## 8. Data Organization:

Not available.

### Data Granularity:

A general description of data granularity as it applies to the IMS appears in the [EOSDIS Glossary](#).

### Data Format:

The data files associated with this data set consist of numeric and character fields of varying lengths aligned in columns. The first row of each data file contains the 8 character SAS variable name that links to the data format definition file. Character fields are enclosed in double quotes and numeric fields are listed without quotes.

Missing data values can be of two varieties:

1. Values that were identified as missing in the original data files. Missing numeric values of this type are identified in these data as -999.
2. Those holes that were created as a result of combining files that contained a slightly different variable set. Missing values of this type are identified in these data files as empty double quotes for character fields and a single period, '.' for numeric fields.

## 9. Data Manipulations:



Not available.

## **10. Errors:**

### **Sources of Error:**

Not available.

### **Quality Assessment:**

#### **Data Validation by Source:**

Not available.

#### **Confidence Level/Accuracy Judgment:**

Not available.

#### **Measurement Error for Parameters:**

Not available.

#### **Additional Quality Assessments:**

Not available.

#### **Data Verification by Data Center:**

The Superior National Forest data were received from the Goddard Space Flight Center in three media:

- As data dumps from the original Oracle SNF database maintained by GSFC, transferred electronically from the GSFC system to the ORNL system;
- As ASCII files that mirrored the tables published in the Tech Memo; and
- As hard copy (Tech Memo).

Data from both electronic sources were input into SAS by ORNL DAAC data management staff and compared using computer code developed to process the SNF data. In many cases, the data values from both sources were found to be identical. In some cases, however, differences were identified and the providers of the data were consulted to resolve inconsistencies.

Additionally, some variable columns were available in one source, but not the other for various reasons. For example, some calculated variables/columns were provided in the ASCII files (reflecting the Tech Memo tables) that were not stored in the Oracle database for purposes of space conservation.

For similar reasons, coded values were used for many of the site and species identifier variables. A separate reference table was provided to link the coded variable with its definition (e.g., the SPECIES\_REF file and the SITE\_REF file).

The database produced by the ORNL DAAC is a hybrid product that is a composite of data and information extracted from all three source media. In data sets where coded variables were included, the code definition variables have been added to improve usability of the data set as a stand-alone product.

Therefore the ASCII files that are available through the ORNL DAAC on-line search and order systems are output from a data set that is a product of the essential core of numeric data provided by the data source (GSFC), augmented with additional descriptive information provided by GSFC and reorganized by the ORNL DAAC into a data structure consistent with other similar data sets maintained by the ORNL DAAC.

## **11. Notes:**

### **Limitations of the Data:**

Not available.

### **Known Problems with the Data:**

None known at this revision.

### **Usage Guidance:**

Not available.

### **Any Other Relevant Information about the Study:**

None.

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

The aircraft measurements in this data set can be used to scale up to satellite observations for the remote sensing of biophysical parameters.

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

None known at this revision.

## **14. Software:**

Not available.

## **15. Data Access:**

### **Contact Information:**

ORNL DAAC User Services  
Oak Ridge National Laboratory  
Telephone: (865) 241-3952  
Fax: (865) 574-4665  
E-mail: [ornldaac@ornl.gov](mailto:ornldaac@ornl.gov)

### **Data Center Identification:**

ORNL Distributed Active Archive Center  
Oak Ridge National Laboratory  
Telephone: (865) 241-3952  
Fax: (865) 574-4665  
E-mail: [ornldaac@ornl.gov](mailto:ornldaac@ornl.gov)

### **Procedures for Obtaining Data:**

Users may place requests by telephone, electronic mail, or fax. Data are also available via the World Wide Web at <http://daac.ornl.gov>.

### **Data Center Status/Plans:**

The Superior National Forest Data are available from the ORNL DAAC. Please contact the ORNL DAAC User Services Office for the most current information about these data.

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

Available via FTP or on CD-ROM.

## **17. References:**

Not available.

### **Archive/DBMS Usage Documentation.**

Contact the ORNL DAAC, Oak Ridge, Tennessee (see the [Data Center Identification Section](#)).

## **18. Glossary of Terms:**

A general glossary is located at [EOSDIS Glossary](#).

## **19. List of Acronyms:**

URL Uniform Resource Locator

A general list of acronyms is available at <http://cdiac.ornl.gov/pns/acronyms.html>.

## **20. Document Information:**

Not available (citation revised September 23, 2002).

### **Document Review Date:**

March 3, 1997.

### **Document ID:**

ORNL-SNF\_SITE\_86.

### **Citation:**

Please cite this data set as follows (citation revised September 23, 2002):

Hall, F. G., K. F. Huemmrich, D. E. Strebel, S. J. Goetz, J. E. Nickeson, and K. D. Woods. 1996. SNF Site Characterization Validation. [Superior National Forest Site Characterization Validation]. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. [doi:10.3334/ORNLDAAC/188](https://doi.org/10.3334/ORNLDAAC/188).

Based on F. G. Hall, K. F. Huemmrich, D. E. Strebel, S. J. Goetz, J. E. Nickeson, and K. D. Woods, Biophysical, Morphological, Canopy Optical Property, and Productivity Data from the Superior National Forest, NASA Technical Memorandum 104568, National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland, U.S.A., 1992.

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