Total Leaf Tissue Water Potential (FIFE)

Summary:

The Total Leaf Tissue Water Potential Data Set was collected during the summer months of 1988 and 1989. The objective of this study was to determine the influence of plant water status on surface reflectance factors.

Measurements were made at six stations on Indian grass, switch grass, Big bluestem, little bluestem, and tall dropseed. Leaf water potential measurements were usually made on the same leaf that optical measurements were made and on leaves of surrounding plants. Measurements were made on the most recently expanded leaf of the selected plant unless specified. Measurements were also made of older green and yellow leaves on a plant. Leaf water potential measurements can be linked with the leaf optical properties data if the plant number in both sets of data are known.

Plant water potential values measured just before dawn will provide the highest plant water potential (smallest negative value) during the day and also provides a reasonable estimate of the soil water potential. It is hypothesized that as the leaf water potential decreases (large negative value) that there may be some change in the internal structure of the leaf that would be detectable in one or more of the Nebraska Multiband Leaf Radiometer (NMLR - instrument used during leaf optical measurements) wavebands. It is also hypothesized that the amounts of water in a leaf will be lowest at low water potential and that this might also be detectable with the NMLR especially in the mid-IR wavebands.

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1. Data Set Overview:

Data Set Identification:

Total Leaf Tissue Water Potential (FIFE)
(Total Leaf Tissue Water Potential).

Data Set Introduction:

The Total Leaf Tissue Water Potential Data Set was collected from June 1 through August 12 1988, and from June 14 through August 12, 1989. The objective of this study was to determine the influence of plant water status on surface reflectance factors. Measurements were made at six stations in the FIFE study area. Measurements were made on Indian grass, Switch grass, Big bluestem, little bluestem, and tall dropseed.

Objective/Purpose:

The objective was to determine the influence of plant water status on surface reflectance factors.

Summary of Parameters:

Total leaf tissue water potential.

Discussion:

1988: Measurements were made at three stations: 10 (sitegrid = 3414-PBB), 811 (sitegrid = 4439-PBB), and 31 (sitegrid = 2139-PBB). Measurements were made on the most recently expanded leaf of the selected plant unless specified. Measurements were also made of older green and yellow leaves on a plant. Measurements were made on Indian grass, Switch grass and Big bluestem. Measurements were usually coordinated with leaf optical measurements (i.e., leaf water potential measurements were made on the same leaf that optical measurements were made and on leaves of surrounding plants. Occasionally predawn measurements were made. Leaf water potential measurements can be linked with the leaf optical properties data if the plant number in both sets of data are known.

1989: Measurements were made at three stations: 906 (sitegrid = 2133-PBB), 916 (sitegrid = 4439-PBB) and 966 (sitegrid = 2437-PBB). Measurements were made on Big bluestem, Indian grass, and Switch grass at all three sites. Little bluestem was measured at site 916 (sitegrid = 4439-PBB) and tall dropseed was measured at site 906 (sitegrid = 2133-PBB).

Related Data Sets:

- Vegetation Biomass, Production and Consumption at Selected Sites.
- Mowing Experiment Biophysical Measurements.
- Exotech Surface Reflectances for the Mowing Experiment.
- Standing Crop and Nitrogen Content along a Transect.
- Leaf Optical Properties from UNL.
- Surface Reflectance Measured with a Mast-borne MMR.
- SE-590 Reflectance Factors and Radiances from UNL.
- Leaf Area Index and PAR Determined from UNL Light Bar Measurements.
- Indirect leaf Area Index Obtained from the UNL Light Wand.

FIS Data Base Table Name:

LEAF_WATER_POTENTIAL_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Blaine L. Blad, Professor and Head
Elizabeth A. Walter-Shea, Asst. Professor
University of Nebraska

Title of Investigation:

Measuring and Modeling Near-Surface Reflected and Emitted Radiation Fluxes at the FIFE study area.

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Requested Form of Acknowledgment.

The Total Leaf Tissue Water Potential data were collected by B.L. Blad, E.A. Walter-Shea, C.J. Hays, and M.A. Mesarch of the University of Nebraska.

3. Theory of Measurements:

Since transpiration rates at night are small or near zero the water potential inside the plant comes into equilibrium with the water potential of the soil in the root zone. Therefore plant water potential values measured just before dawn will provide the highest plant water potential (i.e., smallest negative value) during the day and will also provide a reasonable estimate of the soil water potential. It is hypothesized that as the leaf water potential decreases (i.e., large negative value) that there may be some change in the internal structure of the leaf that would be detectable in one or more of the Nebraska Multiband Leaf Radiometer (NMLR - instrument used during leaf optical measurements) wavebands.

It is also hypothesized that the amounts of water in a leaf will be lowest at low water potential and that this might also be detectable with the NMLR especially in the mid-IR wavebands.

4. Equipment:

Sensor/Instrument Description:

A pressure chamber manufactured by Precision Machine, Inc. Lincoln, NE connected to a tank of compressed nitrogen was used for this study. A slitted gasket was used for sealing the leaf blade in the chamber.

Collection Environment:

Ground-based.

Source/Platform:

Ground.

Source/Platform Mission Objectives:

The aim was to measure leaf water potential.

Key Variables:

Total leaf tissue water potential.

Principles of Operation:

A leaf is excised from the plant and placed in the chamber with a small portion of the cut end of the leaf protruding through the seal. Pressure is applied to the tissue until an endpoint is reached at which water just appears at the cut end of the leaf blade. When water appears, the pressure applied to the tissue is equal to the negative of the leaf water potential (Campbell 1990).

Sensor/Instrument Measurement Geometry:

Not applicable.

Manufacturer of Sensor/Instrument:

Precision Machine, Inc.
2933 N. 36th St.
Lincoln, NE 68504
(402) 467-5528

Calibration:

Not applicable.

5. Data Acquisition Methods:

The leaf blade was inserted into a humidified plastic bag, to prevent water loss from the leaf blade and a rise in leaf temperature during the measurement period. The leaf was then cut from the plant using a razor blade and placed in the pressure chamber with a small portion of the cut end of the leaf blade protruding through the seal. Pressure was then applied until an endpoint was reached, when water appeared at the cut end of the leaf blade. The endpoint pressure was recorded. A magnifying glass was used to facilitate seeing the water. The procedure was repeated to obtain a second end point pressure measurement.

The two measurements were made to ensure that the rate of pressure increase was slow enough to give the water in the leaf time for equilibration. If the second measurement is lower than the first the rate of pressure increase was probably too high (Campbell 1990). The two measurements should be approximately the same (+/-1.033 bar).

6. Observations:

Data Notes:

Not available.

Field Notes:

1988.

- June 1: Measurements were made at site 811(4439-PBB) on leaves with leaf optical measurements and leaves of surrounding plants.
- June 2: Measurements were made at site 10(3414-PBB) on leaves with leaf optical measurements.
- June 29: Measurements were made at site 811(4439-PBB) on leaves of surrounding plants near were leaf optical measurements were made.
- June 30: Measurements were made at Site 811(4439-PBB) on leaves with leaf optical measurements and leaves of surrounding plants.
- July 6: Predawn measurements at Site 31 (2139-PBB) and measurements on leaves with leaf optical measurements.
- July 14: Predawn measurements at site 811(2139-PBB) and on leaves with leaf optical measurements and leaves of surrounding plants.
- Aug. 9: Measurements at site 811(2139-PBB) on leaves of surrounding plants near were leaf optical measurements were made. Measurements were also made on the second and fourth most recently expanded leaves and a yellow leaf that had leaf optical measurements.
- Aug. 10: Measurements at site 811(2139-PBB) on leaves with leaf optical measurements and leaves of surrounding plants.
- Aug. 12: Measurements at site 811(2139-PBB) were not in conjunction with leaf optical measurements.

1989.

- June 14: Measurements were made at site 966(2437-PBB) on leaves with leaf optical measurements and leaves of surrounding plants.
- July 11: Measurements were made at site 966(2437-PBB) on leaves with leaf optical measurements.
- July 13: Measurements were made at site 966(2437-PBB) on leaves with leaf optical measurements and leaves of surrounding plants.
- July 26: Measurements were made at site 916(4439-PBB) on leaves with leaf optical measurements.
- July 27: Predawn measurements at site 916(4439-PBB) and on leaves with leaf optical measurements.
- July 28: Predawn measurements at site 916(4439-PBB) and measurements on leaves with leaf optical measurements. Measurements were also made on leaves that were not in conjunction with leaf optical measurements.
- July 29: Predawn measurements were made at site 916(4439-PBB).
- Aug. 1: Predawn measurements were made at site 916(4439-PBB) and measurements on leaves with leaf optical measurements.
- Aug. 2: Measurements were made at site 916(4439-PBB) on leaves with leaf optical measurements.
- Aug. 4: Measurements were made at site 916(4439-PBB) on leaves with leaf optical measurements.
- Aug. 5: Measurements were made at site 916(4439-PBB) on leaves with leaf optical measurements.

- Aug. 6: Predawn measurements were made at site 906(2133-PBB) and measurements on leaves with leaf optical measurements and measurements on leaves that were not in conjunction with leaf optical measurements.
- Aug. 7: Predawn measurements were made at site 906(2133-PBB) and measurements on leaves with leaf optical measurements.
- Aug. 8: Predawn measurements were made at site 916(4439-PBB) and measurements on leaves with leaf optical measurements.
- Aug. 10: Predawn measurements were made at site 906(2133-PBB) and measurements on leaves with leaf optical measurements.
- Aug. 12: Predawn measurements at site 916(4439-PBB) and measurements on leaves with leaf optical measurements.

7. Data Description:

Spatial Characteristics:

The FIFE study area, with area extent of 15 km by 15 km, is located south of the Tuttle Reservoir and Kansas River, and about 10 km from Manhattan, Kansas, USA. The northwest corner of the area has UTM coordinates of 4,334,000 Northing and 705,000 Easting in UTM Zone 14.

Spatial Coverage:

Data samples were collected and measurements were made at several sites of the FIFE study area. Representative areas of the site were sampled. Species were selected to be representative of the site. Below is a list of FIFE sites from which data were collected:

SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
2133-PBB	906	4329726	711604	39 05 34	-96 33 12	443
2437-PBB	966	4329150	712375	39 05 15	-96 32 41	
3317-PBB	810	4327463	708463	39 04 24	-96 35 25	420
4139-PBB	831	4325850	712780	39 03 28	-96 32 27	385
4439-PBB	916	4325193	712773	39 03 06	-96 32 28	443
4439-PBB	811	4325219	712795	39 03 07	-96 32 27	445

SITEGRID	SLOPE	ASPECT
2133-PBB	1	TOP
2437-PBB		
3317-PBB	13	W
4139-PBB	3	W
4439-PBB	2	N
4439-PBB	2	N

Spatial Coverage Map:

Not available.

Spatial Resolution:

These are point data.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

Measurements were made from June 1 through August 12 1988, and from June 14 through August 12, 1989. The measurement time ranged from 1011 to 2409 GMT. Measurements were not made continuously.

The specific dates of data collection were:

```
01-JUN-88          14-JUN-89          04-AUG-89
02-JUN-88          11-JUL-89          05-AUG-89
29-JUN-88          13-JUL-89          06-AUG-89
30-JUN-88          26-JUL-89          07-AUG-89
06-JUL-88          27-JUL-89          08-AUG-89
14-JUL-88          28-JUL-89          10-AUG-89
09-AUG-88          29-JUL-89          12-AUG-89
10-AUG-88          01-AUG-89
12-AUG-88          02-AUG-89
```

Temporal Coverage Map:

Not available.

Temporal Resolution:

Measurements were made throughout a day. Measurements of one leaf required 1 to 4 minutes. The optimum time interval from one leaf to the next was generally about 2 to 3 minutes during a measurement period.

Data Characteristics:

The SQL definition for this table is found in the LEAF_H20.TDF file located on FIFE CD-ROM Volume 1.

Parameter/Variable Name	Parameter/Variable Description	Range	Units	Source
SITEGRID_ID	This is a FIS grid location code. Site grid codes (SSEE-III) give the south (SS) and east (EE) cell number in a 100x100 array of 200m square cells. The last 3 characters (III) are an instrument identifier.			FIS
STATION_ID	The station ID designating the location of the observations.	810, 811, 831, 906, 916, 966		FIS
OBS_DATE	The date of the observation.	min = 01-JUN-88, max = 12-AUG-89		FIS
OBS_TIME	The time the observation was taken, which is after the leaf was cut (see CUT_TIME).	min = 1011, max = 2409	[GMT]	FIS
OBS_SECONDS	The seconds part of the OBS_TIME.	min = 0, max = 60	[seconds]	FIS
SPECIES_NAME	The common name of the plant being measured.	Big Bluestem, Indian Grass, Little Bluestem, Switch Grass, Tall Dropseed		FIS
LTER_SPECIES_CODE	The LTER species code (see table VEG_SPECIES_REF) for the species of the leaf measured.	2, 3, 15, 18, 21		FIS

OBS_SEQUENCE This is the number of the observation sequence made on the same leaf sample. A leaf sample is identified by the same CUT_TIME and CUT_SECONDS.	min = 1, max = 12		FIS
CUT_TIME The time that the leaf was cut.	min = 1031, max = 2225	[GMT]	FIS
CUT_SECONDS The second part of the CUT_TIME.	min = 1, max = 60	[seconds]	FIS
WATER_POTNTL The leaf water potential. This value is actually negative, even though it is reported as positive.	min = 0, max = 6.888	[Mega-Pascals]	FIS
FIFE_DATA_CRTFCN_CODE The FIFE Certification Code for the data, in the following format: CPI (Certified by PI), CPI-??? (CPI - questionable data).	* CPI=Checked by Principal Investigator		FIS
LAST_REVISION_DATE data, in the format (DD-MMM-YY).	max = 18-MAR-91		

Footnote:

Decode the FIFE_DATA_CRTFCN_CODE field as follows:

The primary certification codes are: EXM Example or Test data (not for release) PRE Preliminary (unchecked, use at your own risk) CPI Checked by Principal Investigator (reviewed for quality) CGR Checked by a group and reconciled (data comparisons and cross checks)

The certification code modifiers are: PRE-NFP Preliminary - Not for publication, at the request of investigator. CPI-MRG PAMS data which is "merged" from two separate receiving stations to eliminate transmission errors. CPI-??? Investigator thinks data item may be questionable.

Sample Data Record:

SITEGRID_ID	STATION_ID	OBS_DATE	OBS_TIME	OBS_SECONDS	SPECIES_NAME
2437-PBB	966	14-JUN-89	1534	19	BIG BLUESTEM

```
2437-PBB        966       14-JUN-89     1534        54       BIG BLUESTEM
2437-PBB        966       14-JUN-89     1538        16       BIG BLUESTEM
2437-PBB        966       14-JUN-89     1538        34       BIG BLUESTEM
```

LTER_SPECIES_CODE	OBS_SEQUENCE	CUT_TIME	CUT_SECONDS	WATER_POTNTL
2	1	1532	59	.5170
2	2	1532	59	.7240
2	3	1537	6	.5520
2	4	1537	6	.5860

FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE
CPI	18-MAR-91
CPI	18-MAR-91
CPI	18-MAR-91
CPI	18-MAR-91

8. Data Organization:

Data Granularity:

This data set contains point data. Measurements were made from June 1 through August 12 1988, and from June 14 through August 12, 1989. Measurements were not made continuously.

A general description of data granularity as it applies to the IMS appears in the EOSDIS Glossary.

Data Format:

The CD-ROM file format consists of numerical and character fields of varying length separated by commas. The character fields are enclosed with a single apostrophe. There are no spaces between the fields. Each file begins with five header records. Header records contain the following information: Record 1 Name of this file, its table name, number of records in this file, path and name of the document that describes the data in this file, and name of principal investigator for these data. Record 2 Path and filename of the previous data set, and path and filename of the next data set. (Path and filenames for files that contain another set of data taken at the same site on the same day.) Record 3 Path and filename of the previous site, and path and filename of the next site. (Path and filenames for files of the same data set taken on the same day for the previous and next sites (sequentially numbered by SITEGRID_ID)). Record 4 Path and filename of the previous date, and path and filename of the next date. (Path and filenames for files of the same data set taken at the same site for the previous and next date.) Record 5 Column names for the data within the file, delimited by commas. Record 6 Data records begin.

Each field represents one of the attributes listed in the chart in the *Data Characteristics Section* and described in detail in the TDF file. These fields are in the same order as in the chart.

9. Data Manipulations:

Formulae:

Derivation Techniques and Algorithms:

```
PAVG = P((1) + P(2)Ù)/2                                    [Eq.1]
```

where,
P(1 or 2) = endpoint pressure reading (psi)
PAVG = average endpoint pressure reading (psi)

```
WATERPOT = -0.0068948 * PAVG                               [Eq.2]
```

where,
PAVG = average endpoint pressure reading (psi)
WATERPOT = total leaf water potential (MPa)

If the difference between the two endpoint pressure readings were greater than 1.033 bars (15 psi) the data were discarded (see the *Data Acquisition Methods Section*).

Data Processing Sequence:

Processing Steps:

Equation 1 is used to calculate the average endpoint pressure reading from the chamber. Equation 2 is used to convert psi to MPa and to calculate the total leaf water potential. The total leaf water potential is equal to the negative of the applied pressure at the endpoint (Campbell 1990).

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

None.

Calculated Variables:

- Average endpoint pressure from the chamber
- Total leaf water potential

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Errors can result if the leaf sample: 1) is allowed to lose moisture, 2) temperature is allowed to rise in the chamber, or 3) is not tightly sealed by the chamber gasket (Hsiao 1990).

Sometimes it is difficult to detect the exact time and pressure when water first exudes from the leaf as the wetting can be subtle. This will cause leaf water potentials to be slightly lower than they actually are.

The rate of pressure increase in the chamber must be slow enough to give the water in the leaf time for equilibration. If the pressure is increased too rapidly the pressure reading will be too high (Campbell 1990). Water loss from the leaf and temperature increase of leaf and chamber should be kept to a minimum for an accurate measurement.

Quality Assessment:

Data Validation by Source:

Data were validated by looking for consistency of readings of different leaves taken during a given measurement period. If leaf water potential values were too low then an additional leaf was selected for measurement and any seemingly erroneous data were omitted.

Data are also validated by the repeated readings on a single leaf. If leaf water potential values differed more than 15 psi the data were omitted and an additional leaf was selected.

Confidence Level/Accuracy Judgment:

It is very difficult (if not impossible) to determine the precision and accuracy of plant water potential measurements. Readings on the same leaf are generally repeatable to one bar or less.

Measurement Error for Parameters:

No quantitative assessment was made, see the *Confidence Level/Accuracy Judgment* .

Additional Quality Assessments:

FIS staff applied a general Quality Assessment (QA) procedure to the data to identify inconsistencies and problems for potential users. As a general procedure, the FIS QA consisted of examining the maximum, minimum, average, and standard deviation for each numerical field in the data table. An attempt was made to find an explanation for unexpected high or low values, values outside of the normal physical range for a variable, or standard deviations that appeared inconsistent with the mean. In some cases, histograms were examined to determine whether outliers were consistent with the shape of the data distribution.

The discrepancies, which were identified, are reported as problems in the *Known Problems with the Data Section*.

Data Verification by Data Center:

The data verification performed by the ORNL DAAC deals with the quality of the data format, media, and readability. The ORNL DAAC does not make an assessment of the quality of the data itself except during the course of performing other QA procedures as described below.

The FIFE data were transferred to the ORNL DAAC via CD-ROM. These CD-ROMs are distributed by the ORNL DAAC unmodified as a set or in individual volumes, as requested. In addition, the DAAC has incorporated each of the 98 FIFE tabular datasets from the CD-ROMs into its online data holdings. Incorporation of these data involved the following steps:

- copying the entire FIFE Volume 1, maintaining the directory structure on the CD-ROM.
- using data files, documentation, and SQL code provided on the CD-ROM to create a database in Statistical Analysis System (SAS).
- creating transfer files to transfer the SAS metadata database to Sybase tables.

Each distinct type of data (i.e. "data set" on the CD-ROM), is accompanied by a documentation file (i.e., .doc file) and a data format/structure definition file (i.e., .tdf file). The data format files on the CD-ROM are Oracle SQL commands (e.g., "create table") that can be used to set up a relational database table structure. This file provides column/variable names, character/numeric type, length, and format, and labels/comments. These SQL commands were converted to SAS code and were used to create SAS data sets and subsequently to input data files directly from the CD-ROM into a SAS dataset. During this process, file names and directory paths were captured and metadata was extracted to the extent possible electronically. No files were found to be corrupted or unreadable during the conversion process.

Additional Quality Assurance procedures were performed as follows:

- Statistical operations were performed to calculate minimum and maximum values for all numeric fields and to create a listing of all values of the character fields. During this process, it was determined that various conventions were used to represent missing values. (Note: no modifications were made to any data by the DAAC). In most cases, missing value identification conventions were discussed in the accompanying .doc file. Based on a visual check of the minimum and maximum values, no glaring errors or holes were identified that might indicate errors introduced during CD-ROM mastering by the FIFE project or data ingest by the DAAC.
- Some minor inconsistencies and typographical errors were identified in some of the character fields and column labels, however, no modifications were made to the data by the DAAC.
- Some conversions of ASCII data were necessary to move the data from a DOS platform to a UNIX platform. Standard operating system conversion utilities were used (e.g., dos2unix).

- Much of the metadata required for archival is imbedded in the narrative documentation accompanying the data sets and extracted manually by DAAC staff who have read the .doc files provided on the CD-ROM and have hand entered this information into the metadata database maintained by the DAAC. QA procedures have been performed on these metadata to identify and eliminate typographical errors and inconsistencies in naming conventions, to ensure that all required metadata is present, and to ensure the accuracy of file names and paths for retrieval.
- Data requested for distribution to users are checked to verify that files copied from disk to other media remain uncorrupted.

As errors are discovered in the online tabular data by investigators, users, or DAAC staff, corrections are made in cooperation with the principal investigators. These corrections are then distributed to users. CD-ROM data are corrected when re-mastering occurs for replenishment of CD-ROM stock.

11. Notes:

Limitations of the Data:

Not available.

Known Problems with the Data:

1988:

- None.

1989:

- Station 966 (sitegrid = 2437) on 11-JUL-89 had a questionable leaf water potential value of -6.888.

Usage Guidance:

While potential is negative in value, the data in this data set is reported as positive values because they have been multiplied by a negative constant.

To be able to link leaf water potential data with the leaf optical data one needs to know the plant number in both data sets.

This data could be used in conjunction with other data measured using the following instruments:

1988:

- Schedular (surface temperature, air temperature, relative humidity, and vapor pressure deficit),
- Everest Model 112C IRT (surface temperature),
- Everest Model 4000 (surface temperature, mounted with MMR),
- A-Frame (net radiation, incoming and reflected shortwave and PAR radiation),
- MMR (surface radiances, reflectances and temperature),
- calculated incoming longwave radiation (used to correct surface temperatures),
- topography of plots,
- leaf optical measurements,
- LI-COR LAI-2000 (indirect LAI measurements),
- LI-COR LI-191SA Line Quantum (indirect LAI, APAR and IPAR, not in conjunction with MMR measurements), and
- destructive LAI measurements by UNL.

1989:

- SE-590 (surface radiances and reflectances, mounted with MMR),
- Everest Model 4000 (surface temperature, mounted with MMR),
- Schedular (surface temperature, air temperature, and relative humidity at station 966),
- A-Frame (net radiation, incoming and reflected shortwave, and emitted longwave),
- MMR (surface radiances, reflectances and temperature),
- calculated incoming longwave radiation (used to correct surface temperatures),
- topography of plots, leaf optical measurements,
- LAI-2000 (indirect LAI measurements),
- LI-COR LI-191SA Line Quantum (APAR and IPAR in conjunction with MMR measurements), and
- destructive LAI measurements by UNL.

Any Other Relevant Information about the Study:

None.

12. Application of the Data Set:

This data set can be utilized to determine the influence of plant water status on surface reflectance factors. Leaf water potential measurements can be linked with the leaf optical properties data if the plant number in both sets of data are known.

13. Future Modifications and Plans:

The FIFE field campaigns were held in 1987 and 1989 and there are no plans for new data collection. Field work continues near the FIFE site at the Long-Term Ecological Research (LTER) Network Konza research site (i.e., LTER continues to monitor the site). The FIFE investigators are continuing to analyze and model the FIFE data from the field campaigns to produce new data products.

14. Software:

Software to access the data set is available on the all volumes of the FIFE CD-ROM set. For a detailed description of the available software see the *Software Description Document*.

15. Data Access:

Contact Information:

ORNL DAAC User Services
Oak Ridge National Laboratory

Telephone: (865) 241-3952
FAX: (865) 574-4665
Email: ornldaac@ornl.gov

Data Center Identification:

ORNL Distributed Active Archive Center
Oak Ridge National Laboratory
USA

Telephone: (865) 241-3952
FAX: (865) 574-4665
Email: ornldaac@ornl.gov

Procedures for Obtaining Data:

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

Data Center Status/Plans:

FIFE 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:

The Total Leaf Tissue Water Potential data are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

\DATA\BIOLOGY\LEAF_H20\GRIDxxxx\ydddgrid.LWP

Where *xxxx* is the four digit code for the location within the FIFE site grid. Note: capital letters indicate fixed values that appear on the CD-ROM exactly as shown here, lower case indicates characters (values) that change for each path and file.

The format used for the filenames is: *ydddgrid.sfx,* where *grid* is the four-number code for the location within the FIFE site grid, *y* is the last digit of the year (e.g. 7 = 1987, and 9 = 1989), and *ddd* is the day of the year (e.g., 061 = sixty-first day in the year). The filename extension (.*sfx*), identifies the data set content for the file (see the *Data Characteristics Section*) and is equal to .LWP for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

Campbell, G.S. 1990. Instrumentation of studying vegetation canopies for remote-sensing in optical and thermal infrared regions - water potential in soils and plants. Remote Sensing Reviews. 5:249-261.

Journal Articles and Study Reports.

Hsiao, T.C. 1990. Measurements of Plant Water Status. In Stewart, B.A. and D.R. Nielson (eds.). Irrigation of Agricultural Crops. Agronomy Monograph. 30:244-279.

Archive/DBMS Usage Documentation.

Contact the EOS Distributed Active Archive Center (DAAC) at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee (see the *Data Center Identification Section*). Documentation about using the archive and/or online access to the data at the ORNL DAAC is not available at this revision.

18. Glossary of Terms:

A general glossary for the DAAC is located at Glossary.

19. List of Acronyms:

APAR Absorbed Photosynthetically Active Radiation CD-ROM Compact Disk-Read Only Memory DAAC Distributed Active Archive Center EOSDIS Earth Observing System Data and Information System FIFE First ISLSCP Field Experiment FIS FIFE Information System IPAR Intercepted Photosynthetically Active Radiation IRT Infrared Thermometer ISLSCP International Satellite Land Surface Climatology Project LAI Leaf Area Index MMR Modular Multiband Radiometer NMLR Nebraska Multiband Leaf Radiometer ORNL Oak Ridge National Laboratory UNL University of Nebraska - Lincoln URL Uniform Resource Locator UTM Universal Transverse Mercator

A general list of acronyms for the DAAC is available at Acronyms.

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Warning: This document has not been checked for technical or editorial accuracy by the FIFE Information Scientist. There may be inconsistencies with other documents, technical or editorial errors that were inadvertently introduced when the document was compiled or references to preliminary data that were not included on the final CD-ROM.

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