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Southern Great Plains 1997 Hydrological Experiment: Vegetation Sampling and Data Documentation

by
Steven E. Hollinger
Illinois State Water Survey
Craig S.T. Daughtry
United States Department of Agriculture

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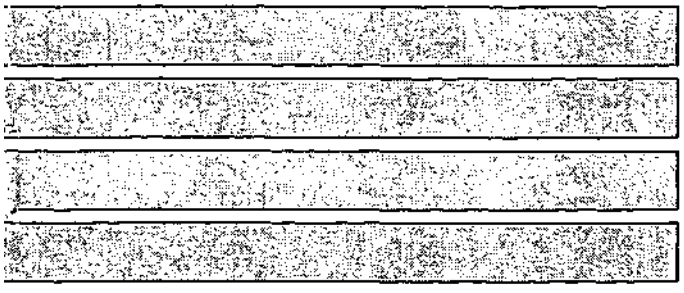

Illinois State Water Survey
Atmospheric Environment Section
Champaign, Illinois

A Division of the Illinois Department of Natural Resources

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Steven E. Hollinger
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Craig S. T. Daughtry
Plant Physiology/Remote Sensing
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REPORT

to

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Steven E. Hollinger
Principal Investigator

Atmospheric Environment Section
Illinois State Water Survey
2204 Griffith Drive
Champaign, Illinois 61820-7495

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ABSTRACT

Soil moisture plays a major role in regulating the energy balance at the land surface and the growth of plants. Research is ongoing to develop new procedures to monitor soil moisture across large regions of the country. A promising tool appears to be passive microwave sensors on airborne or space platforms. Passive microwave instruments, however, are affected by the vegetation on the land surface, which acts to degrade the accuracy of the soil moisture estimates. To further explore the use of passive microwave sensors to monitor soil moisture, a large multi-disciplinary research program was conducted in the Southern Great Plains region of Oklahoma in the summer of 1997. Included in the land surface monitoring were extensive measurements of the vegetation in grass/pasture and wheat fields located in the Little Washita watershed near Chickasha, at the Agricultural Research Service facility near El Reno, and at the Atmospheric Radiation Measurement /Cloud and Radiation Testbed (ARM/CART) Central Facility near Lamont, Oklahoma. This report presents these vegetative measurements and an analysis of the differences between the three sampling areas and the vegetative types. Green and brown standing biomass and surface residue biomass were sampled in a total of 48 fields, including one corn field. From these biomass samples the water content of the aboveground biomass was determined. Leaf area index (LAI), fraction of absorbed photosynthetically active radiation (fAPAR), and plant height were also measured. The greatest differences were observed between different vegetative covers. Green biomass was greatest in the grass/pasture fields, while brown biomass and surface residue were greatest in the harvested wheat fields. The most water was found in the grass/pasture canopies, with the majority of water located in the green standing biomass. Vegetation in the Central Facility and Little Washita sampling areas was very similar. Most of the grass fields in the El Reno sampling area were ungrazed and had significantly greater biomass, LAI, and fAPAR than the grass fields in the other two sampling areas. These data represent a snapshot of the vegetation conditions during the 24 June - 5 July 1997 period.

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INTRODUCTION

Vegetation cover on the soil surface affects the accuracy of remotely sensed soil moisture estimates from passive microwave instruments (Jackson and Schmugge, 1991; Jackson, 1997a). This effect is due to the attenuation of the microwave emission from the soil and the additional radiative flux emission from the vegetation (Engman and Chauhan, 1995). While vegetation affects the sensitivity of the brightness temperature to soil moisture changes at all microwave frequencies, the effect is greater at higher frequencies (Jackson, 1997a).

When estimating soil moisture over a large region, it is necessary to develop a complete characterization of the surface vegetation over the region (Schultz, 1988). Such a vegetation characterization includes vegetation type, vegetative biomass above the surface, water content of the vegetation (Jackson et al., 1982), and surface residue and its water content (Schmugge et al., 1988). While remote sensing techniques can be used to detect leaf area index (Price and Bausch, 1995; Carlson and Ripley, 1997) and vegetation biomass (Wigneron et al., 1995), ground observations are needed to calibrate the models for different vegetation types and growth stages.

This document describes the vegetation sampling procedures and the vegetation data collected as part of the Southern Great Plains (SGP) 1997 Hydrological Experiment conducted in central Oklahoma from 18 June - 18 July 1997. The major objectives of the SGP 1997 Hydrological Experiment were to measure soil moisture using the L-band Electronically Scanned Thinned Array Radiometer (ESTAR), to evaluate the influence of soil moisture on the local surface energy budget, and to evaluate the influence of the mesoscale variability of the surface energy budget on the development of the convective boundary layer. The ESTAR, a passive microwave radiometer with an operation frequency of 1.4 gigahertz (GHz), was flown on an aircraft. Satellite data from the Special Sensor Microwave Imager (SSM/I) and Landsat Thematic Mapper (TM) were also acquired to produce a 30 meter (m) vegetation classification and a 30 m vegetation parameter database.

METHODS

Vegetation sampling was concentrated in three sampling areas in central Oklahoma, the Little Washita watershed (LW) southwest of Chickasha, Oklahoma; at the United States Department of Agriculture (USDA) Agricultural Research Center (ER) near El Reno, Oklahoma, just west of Oklahoma City; and at the Atmospheric Radiation Measurement /Cloud and Radiation Testbed (ARM/CART) Central Facility (CF) near Lamont, Oklahoma. Vegetation sampling included measurements of green standing biomass, brown standing biomass, surface residue biomass, leaf area index (LAI), and plant height. Four independent photosynthetically active radiation (PAR) flux density measurements—two above the plant canopy and two below the canopy—were made at each sampling location. From these field samples, water content, fraction absorbed PAR (fAPAR), green and brown LAI, and specific foliage area (SFA) were derived to further describe the surface vegetation. This section describes the field sampling protocol and procedures used to compute the derived variables.

Vegetation Sampling Scheme

A detailed project description and sampling plan can be found in Jackson (1997b). The sampling scheme proposed in Table 1 was designed to collect samples from prairie/pasture (80%), wheat (10%), and other crops (10%). The initial scheme split prairie and pasture. However, during the sampling process, this separation was not clear so the prairie and pasture classifications were combined into a single class called grass/pasture. Samples were collected from a total of 48 fields, including one corn *(Zea mays* L.) field. Approximately 59 percent of the fields were grass/pasture, 35 percent wheat, and 6 percent other crops. The corn field and a Bermuda grass field harvested for hay (LW14) were the two other crops sampled.

Vegetation samples were collected from the fields used for gravimetric and profile soil moisture measurements. A single sample of ripe, unharvested wheat was taken from ER15 near the edge of the unharvested wheat to minimize disturbance to the standing crop. Fields with mixed vegetation included LW01 and CF06. Vegetation sampling crews were trained in LW01 which included short Bermuda grass and wheat stubble. The CF06 site was a partially tilled,

Table 1. Proposed and Actual Distribution of Vegetation Sampling Sites.

	Grass/Pasture		*Wheat*		*Crops*		*Total*	
Sample Area	*Proposed (80%)*	*Actual (59%)*	*Proposed (10%)*	*Actual (35%)*	*Proposed (10%)*	*Actual (6%)*	*Proposed*	*Actual*
Little Washita (LW)	16	16	*2*	5	*2*		20	23
El Reno (ER)	8	11	1	5	1	r_0	10	16
Central Facility (CF)	8	2	1	7	1	0	10	9
Other	16	0	2	0	2	0	20	0
Total sites	48	29	6	17	6	3	60	49

Notes: *'Zea mays* L. at LW01, and Bermuda grass field harvested for hay at LW14.

harvested wheat field. Two samples were taken from the harvested but unfilled portion of the field and one residue estimate was taken from the tilled area of the field.

Vegetation measurements were taken during the period from 24 June-5 July. From 5-10 July, the drying samples were measured daily until all the samples were dry as determined by no further reduction in mass.

Vegetation Sampling Procedures

Each field was sampled at three different locations. Two sub-samples were collected at each sample location, resulting in six green standing biomass, six brown standing biomass, and six surface residue biomass measurements from each field. The leaf area index (LAI) and the components of fAPAR were measured at five locations for each sub-sample (one in the sampling frame and four within 3 m of the frame) resulting in 30 LAI and fAPAR measurements for each field. In addition, vertical and oblique photographs were taken of each sample location. Latitude and longitude were recorded as well as the general weather conditions at the time of sampling. Coordinates for the nearest meteorological station were also recorded. The meteorological stations were operated by either the Oklahoma Mesonet, the ARM/CART program, or the Agricultural Research Service (ARS) Micronet program. A summary of the procedures used to collect the different vegetation variables is presented below.

Sampling locations were approximately 100 m apart at a minimum of 100 m from the field edges. Once the sample location was identified, a three-sided square metal frame (0.71 m on a side) was pushed through the vegetation at the soil surface. A Global Positioning System (GPS) receiver (PLGR+, Rockwell International[1]) provided latitude and longitude with an accuracy of 3 to 5 m. The second sub-sample was located within 5 m of the first sub-sample.

Descriptions of the vegetation type, growth stage, and conditions of the sky, vegetation, and soil during the sampling time were recorded on the data form (Figure 1). An oblique photograph centered on the sampling frame was taken from a distance of 3 to 5 m. A vertical photograph centered on the sampling frame was taken by holding the camera at shoulder height with the lens facing the surface. The roll and frame number of each picture were recorded on the data form.

Leaf area index (LAI) was measured in the sample frame with a plant canopy analyzer (LAI-2000, LiCor, Inc., Lincoln, Nebraska). A reading above the canopy was followed by five readings below the canopy as described by Welles and Norman (1991). During the measurements, the canopy and LAI-2000 were shaded from the direct sun using a large umbrella. This procedure was repeated at four locations around the sampling frame, within 3 m of the

[1]Instrument names are provided here for completeness and do not imply endorsement of these products by the USDA-ARS, the Illinois State Water Survey, or the University of Illinois over other similar or suitable instruments.

SGP-97 VEGETATION DATA SHEET

DATE (Mo/Dy/Yr)_____ TIME (24-hour clock)_____

Meteorological Station _____ *Latitude* _____*deg.* _____*min.* _____*sec.*

Longitude _____*deg.* _____*min.* _____*sec.*

Site No.:_____ **Plot:** _____(usually 3 plots/site: A, B, or C)

CF = Central Facility
ER = El Reno
LW = Little Washita

Latitude: _____deg. _____min. _____sec.
Longitude:_____deg. _____min. _____sec.

Vegetation Type:_____ **Growth Stage:**_____

Native grass, Bermuda Grass
Wheat, Sorghum, Corn, Alfalfa, etc.

Vegetative, Reproductive, Mature, Harvested
Grazed, Mowed, Tilled

Plant height, cm

Sample 1 (1)_____ (2)_____ (3)_____ (4)_____ (5)_____ Mean_____

Sample 2 (1)_____ (2)_____ (3)_____ (4)_____ (5)_____ Mean_____

Residue Cover, % (number of residue hits for each line-transect)

Sample 1 (1)_____ (2)_____ (3)_____ (4)_____ (5)_____ Mean_____

Sample 2 (1)_____ (2)_____ (3)_____ (4)_____ (5)_____ Mean_____

Photo ID (Roll number, Frame Number):

Sample 1 Oblique_____ Vertical_____ *Sample 2* Oblique_____ Vertical _____

Comments:

Weather Conditions: **Sky**_____ Wind_____ Pcpn_____

Surface Conditions: Vegetation: **Dry**___ **Wet**___ **Dew**___
Soil: **Dry**___ **Wet**___ **Dew**___

Sample Area (usually 0.50 m^2): *Sample 1*_____ *Sample 2*_____

BIOMASS

		Wet		**Dry**	
	Bag Wt.	*Sample I*	*Sample 2*	*Sample I*	*Sample 2*
Green Standing Biomass	____g	____g	____g	____g	____g
Brown Standing Biomass	____g	____g	____g	____g	____g
Surface Residue Biomass	____g	____g	____g	____g	____g

Collection Team

Team Leader _____
Team Assistant _____
Data Entry Person: _____

Weighing Personnel

Wet _____ Date_____
Dry _____ Date_____
Date: _____

Figure 1. Sample of data sheet used to record the vegetation data in the field.

frame. The LAI-2000 actually measures the "foliage area index" and cannot distinguish between leaves, stems, and other structures that block incoming radiation. Leaves were predominate in the grass fields, thus it was assumed that the LAI-2000 was measuring the LAI. Standing wheat stubble with few or no leaves present dominated the the harvested wheat fields. In this case it was assumed that the LAI-2000 was measuring the foliage area index. This report refers to all LAI-2000 measurements as LAI.

A Sunceptometer (Decagon Devices, Pullman, Washington), an AccuPAR (Decagon Devices, Pullman, Washington), and a Line Quantum Sensor (LI-191, LiCOR Inc., Lincoln, Nebraska) were used to measure PAR flux densities. Although each sampling team used a different instrument, the errors introduced by the instruments should be small (Acock et al., 1994). Care was taken to level the instrument before each reading. Incoming photosynthetically active radiation (S) was measured above the canopy with the instrument level and facing upward. The PAR transmitted (T_C) through the vegetation canopy was measured near the soil surface with the sensor level and facing upward. The PAR reflected from the canopy (R_C) was measured with the instrument facing downward at 1 m above the vegetation. The PAR reflected by the soil (R_s) was estimated as the product of bare soil reflectance (R_{BS}) from tilled wheat fields and T_C (Daughtry et al., 1992).

Vegetation height was measured at five spots within the sampling frame and recorded on the data form. After the various measurements of the canopy within and around the sampling frame were completed, a meter stick was used to form the fourth side of the sampling frame, and the standing vegetation was clipped at the soil surface. All vegetation within the volume defined by the sampling frame was clipped and collected. If a plant extended from outside the frame into the frame volume, or from inside the frame to outside, only the part of the plant within the frame volume was clipped and included in the sample. All clipped vegetation was then separated into either green or brown vegetation that was bagged and weighed separately. The vegetative surface residue was collected from the soil surface and placed in a separate bag and weighed.

The collected samples were weighed in an area sheltered from the wind as soon as the team exited the field. From the time that the first sample was collected until it was weighed was approximately 90 minutes. At the end of each day, the samples were placed in a forced-air dryer at approximately 50 ° C until dry. After four days, several representative bags were weighed, allowed to dry for another day, and re-weighed. This procedure was repeated daily until there was no further decrease in mass.

Tilled Wheat Field Sampling

Vegetation samples were not taken from harvested wheat fields that had been tilled. Instead, a measure of the crop residue cover was obtained using a line-transect (Laflen et al., 1981; Morrison et al., 1993). The 15.2 m line had 100 beads or orange marks evenly spaced. At each sample location, the line-transect was stretched diagonally across the direction of tillage, and coincidences of the markers and pieces of crop residue on the soil surface were visually counted. The line-transect was moved to a different area and another count taken. This procedure

was repeated until five counts were taken at each field sample location. The number of coincidences or "hits" divided by the total number of points observed (usually 500) is the fraction of residue cover.

Derived Variables

The water content of the green and brown standing vegetation, and surface residue were computed as grams per square meter (g m^{-2}) and as percent of wet biomass. The percent water content (% Water) was computed as

$$\%Water = 100*(B_W - B_d) / B_w \quad [1]$$

where B_w is wet biomass and B_d is dry biomass. The difference between wet and dry biomass gives the mass of water held in the green and brown standing vegetation, and surface residue. Water content (W_m) in g m^{-2} was computed as

$$W_m = (B_w - B_d)/A_s \quad [2]$$

where A_s is the area sampled: 0.5 m^2.

Absorbed PAR (APAR) is the algebraic sum of incoming and outgoing flux densities measured above and below a plant canopy (Asrar et al., 1989). Determination of APAR by the vegetation requires measuring four streams of radiation: 1) PAR incoming at the top of the canopy (S), 2) PAR transmitted through the canopy to the soil surface (T_C), 3) PAR reflected by the soil back into the canopy (R_S), and 4) PAR reflected by the canopy (R_C) (Asrar et al., 1989; Daughtry et al., 1992). Absorbed PAR of the canopy may be computed as

$$APAR = (S + R_S)-(T_C + R_C). \quad [3]$$

Since APAR is strongly affected by incident flux variations, the PAR flux measurements were normalized by S as follows:

$$fT_C = T_C / S \quad [4]$$
$$fR_C = R_C / S \quad [5]$$
$$fR_S = fT_C(R_{BS}/S) \quad [6]$$

where fT_C is the fraction of PAR transmitted to the soil surface, fR_C is the fraction of PAR reflected above the canopy, and fR_S is the fraction of PAR transmitted through the canopy and reflected by the soil back into the canopy. The mean soil PAR reflectance factor (R_{BS} /S) from the tilled wheat fields was 0.1026. The fraction of absorbed PAR (fAPAR) was calculated as

$$fAPAR = (1 + fR_S) - (fT_C + fR_C). \quad [7]$$

The green leaf area index (LAI_g) was computed as total LAI weighted by the ratio of green standing biomass divided by total standing biomass. Specific foliage area (SFA) was computed by dividing total leaf area index by total standing biomass. Specific foliage area provides a conversion factor to estimate biomass coverage from leaf area derived from reflectance data.

Quality Control

Data collected by the PAR sensors (AccuPAR, Sunceptometer, Line Quantum Sensor) and LAI-2000 leaf area meters were downloaded daily and scanned for missing observations and obviously erroneous data using a spreadsheet. The most common and easily corrected errors were measurements taken in the wrong order, e.g., transmitted PAR measured before incoming PAR. Data from the LAI-2000 were exported in both text and spreadsheet formats. The spreadsheet format was used to compute the field mean and standard errors.

Vegetation data from the "SGP97 Vegetation Data Sheet" were entered into a Paradox database and manually checked for entry errors. The vegetation data were further checked during data analysis by comparing means and variances of the samples within a field. When questionable data were found, data were checked against the original data sheets to determine if an entry error had been made. The data analysis was completed by importing the vegetation data from the Paradox database into a spreadsheet where calculations of the derived variables were made.

Analysis Procedures

The means and standard error of the means for the measured and computed variables (Table 2) were calculated for each field. The standard error of the mean is the standard deviation

Table 2. Variables for Which Means **and** Variances were **Computed.**

Variable	*Units*
Green standing biomass	gm^{-2}
Brown standing biomass	gm^{-2}
Surface residue biomass	gm^{-2}
Leaf area index (foliage area index)	$m^2 m^{-2}$
Fraction Transmitted PAR at soil surface (fT_C x 100)	%
Fraction Reflected PAR from the soil (fR_S x 100)	%
Fraction Reflected PAR above canopy (fR_C x 100)	%
Fraction Absorbed PAR (fAPAR x 100)	%
Percent water content	%
Total water in vegetation	gm^{-2}
Specific Leaf Area	$m^2 kg^{-1}$

Table 3. Mean and Standard Error of Measured Variables for Each Field at the Central Facility, El Reno, and Little Washita Locations.

			Green standing biomass						Brown standing biomass						Surface residue biomass						Leaf Area Index	
			Wet		Dry		Water		Wet		Dry		Water		Wet		Dry		Water			
Site	Vegetation type	Num obs	($g\ m^2$)		($g\ m^2$)		(% H_2O)		($g\ m^{-2}$)		($g\ m^{-2}$)		(% H_2O)		($g\ m^{-2}$)		($g\ m^{-2}$)		(% H_2O)			
CF01	Grass*	3	213.3	(44.5)	81.5	(12.8)	61.0	(2.2)	15.0	(3.8)	11.0	(3.7)	25.8	(13.0)	55.3	(26.5)	38.4	(19.4)	32.6	(2.4)	1.5	(0.2)
CF02	Wheat	3	97.0	(10.1)	35.1	(4.0)	63.8	(1.6)	--†		118.0	(12.0)			0.3	(0.3)	0.1	(0.1)	80.0		2.3	(0.4)
CF03	Wheat	3	131.5	(20.1)	36.9	(6.9)	72.3	(1.1)	119.5	(11.9)	104.6	(7.1)	11.8	(4.1)	39.5	(35.4)	32.6	(29.4)	18.8	(1.7)	1.3	(0.3)
CF04	Wheat	3	22.1	(9.3)	6.5	(2.8)	69.2	(3.1)	185.8	(11.4)	178.2	(10.6)	4.0	(0.7)	321.7	(38.7)	297.5	(38.5)	7.8	(1.0)	0.7	(0.0)
CF05	Wheat	3	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	241.7	(31.2)	236.9	(31.1)	2.0	(0.5)	318.4	(28.9)	305.9	(29.0)	4.0	(0.5)	1.2	(0.1)
CF06	Wheat	2	180.1	(57.7)	46.5	(12.3)	73.7	(1.6)	223.6	(23.7)	203.4	(21.4)	9.0	(0.1)	156.5	(25.8)	129.7	(26.0)	17.6	(3.0)	1.4	(0.2)
CF07	Tilled‡	3	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
CF08	Grass	3	466.0	(94.8)	202.4	(37.3)	56.2	(0.9)	82.4	(23.1)	72.0	(19.7)	12.2	(1.9)	311.2	(84.8)	251.0	(64.3)	18.2	(3.5)	2.6	(0.2)
CF09	Wheat	3	11.2	(6.2)	3.4	(1.9)	70.0	(1.5)	308.4	(56.2)	295.4	(54.1)	4.3	(0.6)	582.9	(175.5)	466.6	(138.3)	17.8	(6.7)	1.0	(0.1)
ER01	Grass	3	1,403.1	(300.5)	460.1	(83.9)	66.7	(1.2)	133.4	(30.4)	97.2	(17.8)	25.8	(3.4)	967.1	(135.0)	509.9	(51.5)	46.6	(2.3)	4.7	(0.3)
ER02	Grass	3	1,093.0	(37.6)	401.1	(40.7)	63.3	(3.6)	71.5	(35.8)	57.8	(29.0)	19.2	(1.9)	933.3	(53.3)	595.2	(24.4)	36.1	(1.1)	3.8	(0.3)
ER03	Grass	3	923.7	(204.5)	314.1	(64.0)	65.6	(1.0)	161.3	(152.4)	77.3	(72.1)	47.1	(5.4)	54.3	(39.4)	23.0	(16.5)	57.0	(1.0)	4.5	(0.4)
ER04	Grass	3	1,458.3	(163.7)	397.8	(30.1)	72.5	(1.1)	8.1	(4.9)	4.3	(2.3)	42.1	(12.4)	1,371.6	(153.7)	599.9	(38.1)	55.4	(4.7)	4.4	(0.5)
ER05	Grass	3	678.7	(105.4)	281.1	(32.1)	58.1	(1.8)	22.8	(22.8)	16.2	(16.2)	28.8	(---)	193.2	(84.5)	130.6	(50.8)	29.5	(3.4)	2.4	(0.2)
ER06	Grass	3	660.8	(59.0)	290.2	(38.6)	56.4	(2.9)	20.5	(6.3)	13.0	(3.4)	35.0	(4.4)	432.6	(22.0)	286.3	(8.9)	33.5	(3.8)	3.2	(0.2)
ER07	Grass	3	956.3	(95.8)	357.3	(9.7)	62.1	(2.8)	36.1	(21.3)	26.3	(14.1)	21.9	(4.6)	532.7	(52.9)	416.6	(40.6)	21.8	(1.0)	4.4	(0.6)
ER08	Grass	3	616.0	(142.1)	219.1	(45.0)	63.7	(2.0)	81.3	(48.9)	66.7	(46.7)	24.7	(17.5)	614.0	(293.0)	462.8	(239.9)	27.4	(3.2)	3.6	(0.1)
ER09	Grass	3	241.3	(22.7)	111.1	(14.4)	54.3	(2.4)	45.7	(20.0)	30.3	(13.2)	32.5	(1.2)	81.7	(28.6)	53.1	(19.4)	35.4	(1.7)	2.7	(0.2)
ER10	Wheat	3	1.2	(0.4)	0.2	(0.0)	83.3	(3.3)	269.6	(27.4)	260.2	(25.9)	3.4	(0.9)	1,318.9	(898.8)	355.2	(18.6)	38.0	(25.7)	0.7	(0.0)
ER11	Wheat	3	23.8	(19.1)	5.6	(3.8)	73.8	(9.9)	180.4	(30.3)	167.4	(29.8)	7.5	(1.0)	330.7	(162.0)	148.2	(52.3)	34.3	(23.4)	0.6	(0.0)
ER12	Wheat	3	1.3	(1.3)	0.03	(0.0)	97.5		255.3	(44.8)	242.1	(42.9)	5.2	(0.6)	554.3	(109.4)	502.7	(97.8)	9.1	(1.1)	1.1	(0.2)
ER13	Tilled	3		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
ER14	Grass	3	881.8	(244.6)	231.8	(36.8)	71.6	(3.8)	24.7	(12.8)	16.8	(8.9)	47.2	(16.4)	264.8	(82.7)	215.2	(63.9)	18.2	(3.4)	1.9	(0.7)
ER15	Wheat	4	35.4	(13.3)	12.3	(6.0)	71.7	(5.7)	417.8	(174.7)	410.7	(175.9)	2.6	(1.0)	227.1	(27.1)	199.7	(24.0)	12.0	(3.1)	1.9	(0.5)
ER16	Grass	3	662.7	(162.2)	179.0	(44.8)	72.7	(1.7)	100.0	(25.0)	65.4	(24.3)	40.1	(11.0)	171.9	(61.7)	92.2	(32.2)	46.3	(1.6)	4.0	(0.4)
LW01	Mixed	6	184.0	(89.3)	112.8	(64.7)	45.0	(6.5)	164.2	(108.3)	136.2	(100.1)	25.9	(11.1)	118.3	(47.8)	101.3	(46.2)	19.1	(10.8)	0.8	(0.3)
LW02	Grass	3	350.2	(101.1)	161.0	(41.7)	53.3	(3.4)	184.1	(133.8)	158.1	(119.0)	18.5	(3.7)	159.7	(56.2)	141.2	(51.4)	13.6	(3.7)	2.2	(0.7)
LW03	Grass	3	375.7	(34.9)	168.0	(30.9)	55.5	(6.8)	147.6	(145.6)	108.9	(107.8)	38.0	(12.0)	231.8(	157.0)	148.3	(98.9)	33.4	(5.8)	1.8	(0.5)
LW04	Grass	5	313.7	(38.3)	108.0	(26.1)	66.4	(4.8)	23.4	(22.9)	16.4	(16.0)	26.5	(3.7)	73.0	(57.0)	54.5	(44.1)	31.6	(4.3)	1.8	(0.3)
LW05	Grass	3	502.9	(143.8)	170.2	(32.1)	64.3	(4.8)	9.8	(3.0)	7.6	(2.4)	25.1	(6.2)	220.8	(90.4)	187.5	(78.3)	16.9	(2.8)	1.8	(0.2)
LW06	Grass	3	111.7	(50.0)	40.6	(16.1)	61.5	(2.5)	22.0	(15.5)	18.1	(12.6)	16.8	(1.8)	17.7	(17.7)	12.2	(12.2)	30.9	(--.-)	0.9	(0.2)
LW07	Bermuda	3	711.8	(59.8)	280.9	(19.9)	60.4	(0.7)	6.1	(1.9)	3.6	(1.3)	43.8	(6.0)	136.7	(15.6)	111.9	(12.5)	18.0	(0.7)	2.2	(0.2)
LW08	Wheat	3	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	240.7	(30.3)	234.1	(28.8)	2.7	(0.7)	388.3	(146.1)	360.3	(128.9)	6.0	(1.7)	1.6	(0.1)
LW09	Grass	3	525.1	(95.3)	221.8	(37.3)	57.4	(1.2)	79.6	(60.7)	65.8	(52.3)	35.1	(16.0)	210.3	(95.6)	172.4	(79.5)	22.4	(5.6)	2.8	(0.4)
LW10	Grass	3	386.3	(119.1)	146.8	(38.1)	60.3	(2.7)	12.3	(3.9)	9.9	(2.9)	17.9	(4.7)	33.3	(19.6)	26.6	(15.9)	22.2	(3.3)	1.4	(0.2)
LW11	Grass	3	939.5	(163.5)	245.8	(27.3)	73.2	(2.3)	68.9	(31.3)	43.9	(20.7)	42.9	(7.4)	494.3	(174.4)	319.5	(116.2)	34.9	(4.3)	3.6	(0.9)
LW12	Grass	3	344.0	(79.0)	139.8	(30.4)	59.0	(1.7)	173.0	(18.9)	136.7	(20.7)	21.6	(3.3)	246.7	(26.8)	180.6	(20.8)	26.9	(0.9)	3.4	(0.4)
LW13	Grass	3	450.2	(165.1)	147.1	(47.2)	66.1	(2.0)	11.9	(4.1)	7.6	(2.7)	35.6	(5.6)	57.3	(32.9)	44.0	(24.4)	23.1	(3.9)	1.4	(0.1)
LW14	Bermuda	3	255.9	(56.4)	95.6	(23.6)	57.7	(1.4)	9.5	(2.9	6.7	(2.2)	29.3	(2.4)	265.5	(93.5)	215.6	(87.5)	25.7	(9.9)	1.0	(01)
LW15	Grass	3	269.6	(97.0)	129.8	(49.8)	52.6	(1.1)	9.6	(4.7)	8.0	(4.4)	36.1	(21.3)	127.8	(56.8)	114.2	(53.0)	12.0	(2.0)	1.3	(0.1)
LW16	Grass	3	122.7	(45.9)	53.1	(21.0)	57.4	(1.6)	2.2	(2.2)	1.2	(1.2)	45.5	(--)	73.3	(41.4)	47.4	(26.4)	36.0	(1.8)	0.6	(0.2)
LW17	Grass	3	540.8	(86.4)	234.0	(38.5)	56.7	(2.2)	53.0	(25.1)	35.4	(18.4)	32.8	(11.1)	186.3	(28.3)	163.5	(24.3)	12.1	(1.6)	2.2	(0.4)
LW18	Grass	3	316.7	(91.6)	173.0	(49.1)	45.0	(1.8)	71.0	(22.7)	58.9	(18.4)	16.3	(1.2)	173.3	(75.8)	137.2	(52.5)	17.2	(4.9)	2.2	(0.3)
LW19	Grass	3	427.1	(112.9)	158.6	(27.9)	61.2	(3.5)	15.9	(4.2)	11.2	(2.3)	27.5	(4.0)	91.3	(14.6)	76.4	(14.6)	17.3	(3.0)	1.3	(0.1)
LW20	Tilled	3		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
LW21	Tilled	3		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
LW22	Wheat	3	23.5	(10.4)	5.2	(2.2)	77.8	(3.1)	211.3	(8.0)	200.5	(78)	5.1	(0.6)	248.1	(47.5)	233.8	(42.8)	5.6	(1.5)	0.7	(0.0)
LW23	Wheat	3	0.0	(0.0)	0.0	(0.0)			254.7	(12.9)	241.5	(11.5)	5.1	(0.4)	326.4	(69.2)	306.0	(68.8)	7.0	(1.7)	1.1	(0.2)
LWMZ	Com	3	1,498.5	(133.3)	309.3	(31.4)	79.4	(0.7)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	4.0	(0.4)

Notes: *Grass = Prairie, grass/pasture. † —missing data. ‡ Tilled fields by definition have 0 biomass. Biomass on these fields was not measured directly.

divided by the square root of the number of observations used to compute the mean and standard deviation.

The vegetation variables (Table 3) were analyzed by computing the sum of the two sub-samples from each sample site, and the mean and standard error of the three sample sites in each field. An analysis of variance was conducted using the SAS PROC MIXED routine. The least significant differences computed from the analysis of variance were used to determine the significance of the means of vegetation within each location, and the differences in vegetation means across locations.

RESULTS

The vegetation biomass, LAI and PAR means and standard errors are presented for each vegetative type, and sampling area. A brief discussion of the differences between sampling areas and vegetation type is also presented. Appendix I, Table AI. 1 presents vegetation type, growth stage, and latitude and longitude of each sample. Appendix I includes the weather and surface conditions at the time of sampling at the Central Facility (Table AI.2), El Reno (Table AI.3), and Little Washita watershed (Table AI.4); vegetation height and biomass measurements at the Central Facility (Table AI.5), El Reno (Table AI.6), and Little Washita watershed (Table AI.7); and LAI, fAPAR for the Central Facility (Table AI.8), El Reno (Table AI.9), and Little Washita watershed (Table AI. 10).

Wet Biomass

Differences in wet biomass were greatest between vegetation cover types (Table 4). Wet green standing biomass was greatest in the grass/pasture fields and least in the harvested wheat fields. Significantly more wet green standing biomass was measured at El Reno than at either the Central Facility or the Little Washita watershed. Wet green standing biomass was slightly greater in the Little Washita watershed grass/pasture fields than at the Central Facility. However, this difference was not significant.

While not statistically significant, the wet green standing biomass in harvested wheat fields was greatest at the Central Facility and least in the Little Washita watershed. During the sampling period, the Central Facility was the wettest of the three sample areas and the harvested wheat fields had more weeds and volunteer wheat than the other two sampling areas.

Wet brown standing biomass was greatest in the wheat fields and least in the grass/pasture fields. There were no significant differences in the wet brown standing biomass among the three sampling areas in either the grass/pasture fields or the wheat fields. The greatest wet brown standing biomass in both the grass/pasture and harvested wheat fields was measured at El Reno, and the least at the Central Facility.

Wet surface residue showed greater differences between sampling areas than between cover types. The most surface residue was measured in the harvested wheat fields at El Reno,

Table 4. Means and Standard Errors of the Means for Wet Biomass by Cover Type in the Central Facility (CF), El Reno (ER), and Little Washita (LW) Areas.

			Wet biomass			
Cover type	*Area*	*n*	*Green standing ($g\ m^{-2}$)*	*Brown standing ($g\ m^{-2}$)*	*Surface residue ($g\ m^{-2}$)*	*Total ($g\ m^{-2}$)*
Grass	CF	6	340 ± 140 bc*	48 ± 39 b	183± 178 ab	572 ± 315 b
	ER	33	871± 85 a	64 ± 16 b	511 ± 90 ab	1445 ± 163 a
	LW	53	406± 49 b	52 ± 13 b	164 ± 61 b	623 ± 108 b
Wheat	CF	17	71 ± 94 c	215 ± 25 a	239 ± 104 ab	569 ± 202 b
	ER	12	18 ± 108 c	238 ± 27 a	612 ± 248 a	867 ± 274 ab
	LW	9	9 ± 125 c	236 ± 19 a	321± 145 ab	564 ± 285 b
Mature Wheat	ER	1	4	935	176	1115
Com	LW	3	1499 ± 133	0	0	1499 ± 133

Note: *Within each column, grass and wheat means followed by the same letter are not significantly different according to $LSD_{0.05}$ test. Data for other vegetation types are reported but were not included in the statistical analysis due to insufficient numbers of samples.

and the least in the grass/pasture fields in the Little Washita watershed. These two extreme surface residue measurements were significantly different from each other. However, they were not significantly different from the other cover/sampling area combinations.

Total wet biomass at El Reno was significantly greater than at either the Central Facility or Little Washita areas. Total wet biomass in the El Reno grass/pasture and harvested wheat fields were not significantly different. Across sampling areas, the total wet biomass in the wheat fields was not significantly different. The greatest total wet biomass was found in the corn field, followed by the grass/pasture, and unharvested wheat fields.

Dry Biomass

Dry green standing biomass in harvested wheat fields at all three sampling areas was significantly less than in grass/pasture fields (Table 5). However, the dry green standing biomass in harvested wheat fields was not significantly different across the areas. Dry green standing biomass in grass/pasture fields was significantly greater in the El Reno area than in either the Central Facility or the Little Washita areas.

Dry brown standing biomass showed the same pattern across cover type and sampling areas as the wet brown standing biomass. Dry standing biomass in wheat was significantly greater than dry brown standing biomass in the grass/pasture fields.

Table 5. Means and Standard Errors of the Means for Dry Biomass by Cover Type in the Central Facility (CF), El Reno (ER), and Little Washita (LW) Areas.

			Dry biomass			
Cover type	*Area*	*n*	*Green standing (gm^{-2})*	*Brown standing ($g\ m^{-2}$)*	*Surface residue ($g\ m^{-2}$)*	*Total ($g\ m^{-2}$)*
Grass	CF	6	142 ± 47 b*	42 ± 33 b	145± 107 ab	328± 154 ab
	ER	33	295 ± 21 a	43 ± 14 b	308 ± 46 a	645 ± 66 a
	LW	53	157 ± 17 b	41 ± 11 b	126 ± 37 b	324 ± 53 b
Wheat	CF	17	21 ± 94 c	189 ± 20 a	207 ± 62 ab	417 ± 90 b
	ER	12	6± 35 c	227 ± 24 a	306 ± 76 a	538± 109 ab
	LW	9	2± 41 c	225 ± 27 a	300 ± 87 ab	527± 126 ab
Mature Wheat	ER	1	0.5	932	143	1076
Corn	LW	3	309 ± 31	0 0	309 ± 31	

Note: *Within each column, grass and wheat means followed by the same letter are not significantly different according to $LSD_{0.05}$ test. The data for other vegetation types are reported but were not included in the statistical analysis due to insufficient numbers of samples.

Dry surface residue at El Reno, in both the harvested wheat and grass/pasture fields, was significantly greater than in grass/pasture fields in the Little Washita watershed. The remaining cover type and sampling area combinations were not significantly different.

Total dry biomass was greatest in the El Reno grass/pasture fields and least in the Little Washita grass/pasture fields. Both the grass/pasture fields in the Little Washita watershed and the harvested wheat fields at the Central Facility had significantly less total dry biomass than the El Reno grass/pasture fields. The greatest total dry biomass was measured in the mature unharvested wheat field. The corn field had the least total dry biomass.

Aboveground Water Mass

The water mass in the green standing biomass was greater in the grass/pasture cover types than in the harvested wheat (Table 6). This is due mostly to the greater green biomass in the grass/pasture fields. Water mass in the El Reno grass/pasture fields was significantly greater than in the grass/pasture fields in the Little Washita watershed and at the Central Facility. Water mass in the Central Facility grass/pasture fields was not significantly different from that in the harvested wheat fields at all three sample areas. The percent water content, computed by Eq. 1, was greater in the green biomass in harvested wheat fields than in the green biomass in grass/pasture fields. Percent water content in the wheat fields of the three sample areas ranged from 67 percent in the Little Washita wheat fields to 72 percent in the El Reno and Central

Table 6. Means and Standard Errors of the Means for Aboveground Water Mass by Cover Type in the Central Facility (CF), El Reno (ER), and Little Washita (LW) Areas.

			Water mass			
Cover Type	*Area*	*n*	*Green standing ($g\ m^{-2}$)*	*Brown standing ($g\ m^{-2}$)*	*Surface residue ($g\ m^{-2}$)*	*Total ($g\ m^{-2}$)*
Grass	CF	6	198 ± 121 be*	7 ± 11 a	39 ± 125 bc	244 ± 216 b
	ER	33	576± 52 a	21 ± 5 a	202 ± 53 ab	800 ± 92 a
	LW	53	249 ± 41 b	12 ± 4 a	38± 43 c	299 ± 74 b
Wheat	CF	17	51 ± 70 c	12± 7 a	31 ± 72 bc	97 ± 139 b
	ER	12	13 ± 86 c	11 ± 8 a	305 ± 89 a	329 ± 153 b
	LW	9	6± 99 c	10 ± 9 a	21 ± 102 c	37± 177 b
Mature Wheat	ER	1	3	3	33	39
Corn	LW	3	1189 ± 32	0	0	1189 ± 32

Note: *Within each column, grass and wheat means followed by the same letter are not significantly different according to $LSD_{0.05}$ test. The data for other vegetation types are reported but were not included in the statistical analysis due to insufficient numbers of samples.

Facility wheat fields. The water content was 56 percent in the grass/pasture fields at the Central Facility, 66 percent in the El Reno grass/pasture fields, and 61 percent in the Little Washita watershed grass/pasture fields. The greatest water mass and water content (79 percent) in green standing biomass was measured in the Little Washita watershed corn field.

Water mass in the brown standing biomass ranged from 7 to 21 $g\ m^{-2}$ (Table 6). Water content in the brown standing biomass in the grass/pasture fields was 33 percent in the El Reno sample area, 23 percent in the Little Washita sample area, and 15 percent at the Central Facility. Water content of the brown standing biomass in harvested wheat fields was 5 percent at both the Central Facility and El Reno sample areas, and 4 percent in the Little Washita area. The differences between the percent water content in the two different cover types is due to the effect of the standing green biomass. Because the green standing biomass is transpiring, the humidity in the canopy is greater than in the harvested wheat fields, thus allowing the brown standing biomass to retain more water.

Water mass in the surface residue was greatest in the El Reno sampling area. The water mass in the surface residue in both the grass/pasture and harvested wheat fields was significantly greater than water mass in the surface residue of both vegetative types in the Little Washita sampling area (Table 6). The absolute mass of water in the surface residue at both the Central Facility and in the Little Washita sampling area are approximately the same. However, the water

mass in the Central Facility grass/pasture and harvested wheat surface residue was not significantly different from the grass/pasture surface residue water mass at El Reno. This was due to the large variations of water mass at both the Central Facility and El Reno sampling sites. The water content in the surface residue ranged from 21 to 40 percent in the grass/pasture fields at the three sampling areas, and from 6 to 50 percent in the harvested wheat fields.

Total water mass in the aboveground vegetation and surface residue was significantly greater in the grass/pasture field in the El Reno sampling area (Table 6) than at the two other sampling areas. Total water mass in the grass/pasture fields at both the Central Facility and Little Washita sampling areas was only slightly less than the total water mass in the harvested wheat fields at El Reno. There are large differences among the total water mass across vegetation type and sampling area. However, there are few significant differences due to the large variability of the total water mass as seen in the large standard errors of the means. Total water content of the aboveground biomass ranged from 6 to 38 percent in the harvested wheat fields to 43 to 55 percent in the grass/pasture fields in the three sampling areas.

Leaf Area and Plant Height

Consistent with the greater amounts of green and brown standing biomass in the grass/pasture fields in the El Reno sampling area, both total and green leaf area index (LAI) were significantly greater than the LAI of the grass/pasture fields at the other two sample areas (Table 7). The green LAI from the harvested wheat fields was significantly less than the grass/pasture fields. The largest average LAI was measured in the corn field. The mean grass/pasture LAI at the El Reno sampling area was only slightly less than the corn field LAI. Several El Reno grass/pasture fields had mean LAIs greater than the corn field (Table 3).

The specific foliage area of the grass/pasture fields was significantly greater than of the harvested wheat fields (Table 7) due to the absence of leaves in the harvested wheat fields. Although the specific foliage area was greater at the Central Facility sampling area than at the other two areas, it was not significantly greater.

The El Reno grass/pasture fields had the tallest average plant height, approximately 1.7 times taller than either the wheat fields in the three sampling areas or the grass/pasture fields in the Little Washita and Central Facility sampling areas (Table 7). The grass/pasture fields at the Central Facility and Little Washita sampling areas were not significantly different from each other or from the height of the harvested wheat fields. Plants in the corn and unharvested wheat fields were both taller than the harvested wheat and grass/pasture fields. With more samples, it would most likely demonstrate that the corn plants were significantly (statistically) taller than the grass/pasture fields at the El Reno area.

Photosynthetically Active Radiation

The plants in the corn field absorbed the greatest fraction of PAR followed by the grass/pasture fields within the El Reno sample area (Table 8). This is consistent with the greater

Table 7. Means and Standard Errors of the Means for Total Leaf Area Index (LAI), Green LAI, and Specific Foliage Area (SFA) by Cover Type in the Central Facility (CF), El Reno (ER), and Little Washita (LW) Areas.

Cover Type	Area	n	Total LAI (m^2 m^{-2})	Green LAI (m^2 m^{-2})	Specific Foliage Area (m^2 g^{-1})	Plant Height (cm)
Grass	CF	6	2.0 ± 0.6 bc*	1.6 ± 0.4 b	13.5 ± 2.4 a	22 ± 8 b
	ER	33	3.6 ± 0.2 a	3.1 ± 0.2 a	11.6 ± 1.0 a	43 ± 3 a
	LW	53	1.9 ± 0.2 b	1.50 ± 0.1 b	11.4 ± 0.8 a	29 ± 3 b
Wheat	CF	17	1.3 ± 0.3 be	0.1 ± 0.3 c	5.4 ± 1.5 b	24 ± 5 b
	ER	12	0.9 ± 0.4 c	<0.1 ± 0.3 c	4.2 ± 1.7 b	24 ± 6 b
	LW	9	1.1 ± 0.5 be	<0.1 ± 0.4 c	5.0 ± 1.9 b	29 ± 7 b
Mature Wheat	ER	1	3.4 ± 0.4	0.0	3.6	64
Corn	LW	3	4.0 ± 0.6	4.0 ± 0.6	13.3 ± 2.6	243 ± 18

Note: *Within each column, grass and wheat means followed by the same letter are not significantly different according to $LSD_{0.05}$ test. The data for other vegetation types are reported but were not included in the statistical analysis due to insufficient numbers of samples.

LAI and green biomass measured within these fields. The fraction of PAR reflected from the soil (fRs) was measured in harvested and tilled wheat fields in each sample area, and it is equal to the fraction of PAR reflected from the canopy (fRc). For the grass/pasture, harvested wheat, mature wheat, and corn fields, fRs is estimated using Eq. 6 with fRc of the bare soil for each sampling area used as R_{BS}.

DISCUSSION

Significant differences were found in the measured vegetation variables as a function of location and vegetation type. As expected, these differences were associated with differences in the amount of vegetative growth on the surface. The greatest variability was observed in the grass/pasture sites across the three sampling areas. Standing brown biomass in the harvested wheat fields was relatively constant across the three sampling areas. This would be expected because harvest practices tend to be rather constant and leave approximately the same length of stubble standing after the grain is harvested. Differences in the wheat green standing biomass were a function of the length of time after harvest and soil moisture between the time of harvest and sampling. In those areas where the soil moisture was high and more than a week had passed between harvest and sampling, considerable green biomass was observed in the harvested wheat fields. The largest green biomass in harvested wheat was measured in the fields at the Central Facility. These wheat fields had been harvested before the last week in June. Rainfall in the Central Facility area was quite high during the period from 20-30 June. This resulted in

Table 8. Means and Standard Errors of the Means for Fraction Absorbed PAR (fAPAR), Fraction Reflected PAR by Soil (fRs), Fraction Transmitted PAR through the Canopy (fTc), and Fraction Reflected PAR by Canopy (fRc) by Cover Type in the Central Facility (CF), El Reno (ER), and Little Washita (LW) Areas.

			Photosynthetically Active Radiation,			
			*fAPAR** *(x 100)*	*fRs (x 100)*	*fTc (x 100)*	*fRc (x 100)*
Cover Type	*Area*	*n*	*(%)*	*(%)*	*(%)*	*(%)*
Grass	CF	6	50.2 ± 10.4 b†	4.9 ± 1.2 a	48.0 ± 11.6 a	6.7 ± 0.6 ab
	ER	33	75.2 ± 4.4 a	2.2 ± 0.5 b	21.2 ± 4.9 b	5.7 ± 0.2 b
	LW	53	52.0 ± 3.6 b	4.8 ± 0.4 a	46.5 ± 4.0 a	6.2 ± 0.2 b
Wheat	CF	17	44.8 ± .1b	5.5 ± 0.7 a	53.7 ± 6.7 a	7.1 ± 0.3 a
	ER	12	42.6 ± 7.4 b	5.7 ± 0.8 a	56.0 ± 8.3 a	7.2 ± 0.4 a
	LW	9	41.6± 8.5 b	5.9 ± 1.0 a	57.1 ± 9.4 a	7.2 ± 0.5 a
Mature Wheat	ER	1	na	na	na	na
Com	LW	3	91.4 ± 0.7	0.4 ± 0.1	4.0 ± 0.7	5.0 ± 0.2
Soil	CF	3	0	10.6 ± 0.3	1.0	10.6 ± 0.3
	ER	3	0	10.8 ± 0.7	1.0	10.8 ± 0.7
	LW	6	0	9.9 ± 0.1	1.0	9.9 ± 0.1

Notes: *fAPAR = ((1 + fRs) - (fTc + fRc)).† Within each column, grass and wheat means followed by the same letter are not significantly different according to $LSD_{0.05}$ test. The data for other vegetation types are reported but were not included in the statistical analysis due to insufficient numbers of samples.

significant growth of weeds and volunteer wheat. Conditions were drier in the western regions of the Little Washita sampling area where most of the wheat fields were located, resulting in very little volunteer wheat or weed growth in the standing stubble.

Water content as a percent of wet green biomass was a function of the age of plants and rainfall. This is supported by the large water content in the volunteer wheat and weeds sampled from the harvested wheat sites compared to the water content in the grass/pasture fields. Water content in the corn was also quite high compared to the grass/pasture fields.

Water content in the brown standing biomass was higher in the grass/pasture sites than in harvested wheat fields. This difference was due to the different exposures of the brown standing biomass to the atmosphere. Green standing biomass surrounded the brown standing biomass in the grass/pasture fields reducing the exposure of the brown standing biomass to the wind and sun. Brown standing biomass, the predominate form of vegetation in the harvested wheat fields, was not sheltered from the wind or sun. In addition, the evapotranspiration would be less in the harvested wheat fields, so the humidity would be lower in the canopy than in the grass/pasture field canopies.

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APPENDIX I: VEGETATION SAMPLING DATA

Table AI.l. Vegetation Characteristics of Each Field, and Geographic Co-ordinates of the Samples Taken at the ARM/CART Central Facility, El Reno, and Little Washita Locations.

	Vegetation	*Growth*	*Sample A*		*Sample B*		*Sample C*	
Field	*type*	*stage*	*Latitude*	*Longitude*	*Latitude*	*Longitude*	*Latitude*	*Longitude*
CF01	Native Grass	Reproductive	36° 36'12.52"	-97° 29'06.77"	36° 36'12.95"	-97° 29'03.96"	36° 36'11.06"	-97° 29'06.29"
CF02	Wheat	Harvested	36° 36'12.15"	-97° 29'11.43"	36° 36'12.42"	-97° 29'14.48"	36° 36'10.25"	-97° 29'13.72"
CF03	Wheat	Harvested	36° 36'31.76"	-97° 29'32.63"	36° 36'31.82"	-97° 29'25.57"	36° 36'32.91"	-97° 27'37.23"
CF04	Wheat	Harvested	36° 37'17.42"	-97° 29'50.73"	36° 37'17.09"	-97° 29'46.14"	36° 37'17.27"	-97° 29'41.57"
CF05	Wheat	Harvested	36° 37'08.94"	-97° 28'54.01"	36° 37'06.20"	-97° 28'54.10"	36° 37'03.29"	-97° 28'54.23"
CF06	Wheat	Harvested	36° 36'34.98"	-97° 28'54.18"	36° 36'41.75"	-97° 28'57.36"	36° 36'39.97"	-97° 28'53.78"
CF07	Wheat	Tilled	36° 36'33.98"	-97° 31'02.93"	36° 36'32.40"	-97° 31'08.57"	36° 36'41.91"	-97° 31'02.95"
CF08	Pasture	Vegetative	36°36'35.90"	-97° 32'17.53"	36° 36'34.67"	-97° 32'20.86"	36° 36'31.76"	-97° 32'22.65"
CF09	Wheat	Harvested	36° 35'10.16"	-97° 30'52.55"	36° 35'12.80"	-97° 30'50.85"	36° 35'15.96"	-97° 30'50.73"
CF10	Sorghum	Vegetative						
ER01	Pasture	Vegetative	35° 33'35.73"	-98° 01'02.69"	35° 33'33.12"	-98° 01'00.01"	35° 33'30.08"	-98° 01'05.43"
ER02	Pasture	Vegetative	35° 33'32.30"	-98° 00'52.62"	35° 33'29.35"	-98° 00'52.44"	35° 33'25.88"	-98° 00'52.36"
ER03	Pasture	Reproductive	35° 33'23.17"	-98°00'45.96"	35° 33'24.99"	-98° 00'47.05"	35° 33'24.13"	-98° 00'48.34"
ER04	Nat ive Grass	Mature	35° 33'19.86"	-98°00'39.61"	35° 33'21.41"	-98° 00'36.46"	35° 33'24.39"	-98° 00'35.67"
ER05	Nat ive Grass	Reproductive	35° 32'51.95"	-98° 02'08.43"	35° 32'54.47"	-98° 02'16.12"	35° 32'56.07"	-98° 02'07.55"
ER06	Nat ive Grass	Reproductive	35° 32'52.23"	-98° 01'59.43"	35° 32'52.34"	-98° 01'59.28"	35° 32'57.44"	-98° 01'57.57"
ER07	Nat ive Grass	Vegetative	35° 32'30.10"	-98° 02'10.72"	35° 32'29.43"	-98° 02'14.82"	35° 32'26.17"	-98° 02'13.72"
ER08	Nat ive Grass	Reproductive	35° 32'31.01"	-98° 01'57.32"	35° 32'27.36"	-98° 01'54.31"	35° 32'25.38"	-98° 01'58.18"
ER09	Native Grass	Reproductive	35° 33'48.11"	-98° 03'53.33"	35° 33'52.34"	-98° 03'47.16"	35° 33'57.18"	-98° 03'49.51"
ER10	Wheat	Harvested	35° 33'01.48"	-98° 04'14.61"	35° 32'58.90"	-98° 04'17.83"	35° 33'01.30"	-98° 04'20.51"
ER11	Wheat	Harvested	35° 33'01.57"	-98° 03'51.85"	35° 32'59.23"	-98° 03'53.52"	35° 32'59.20"	-98° 03'56.91"
ER12	Wheat	Harvested	35° 32'34.06"	-98° 04'41.57"	35° 32'33.13"	-98° 04'37.49"	35° 32'30.18"	-98° 04'30.61"
ER13	Wheat	Tilled	35° 32'18.87"	-98° 03'44.76"	35° 32'21.40"	-98° 03'47.41"	35° 32'24.15"	-98° 03'47.80"
ER14	Pasture	Vegetative	35° 52'49.48"	-97° 54'44.95"	35° 52'48.34"	-97° 54'48.44"	35° 52'47.07"	-97° 54'44.30"
ER15	Wheat	Harvested	35° 34'00.46"	-98° 01'16.00"	35° 34'00.34"	-98° 01'19.69"	35° 33'58.38"	-98° 00'07.06"
ER15D	Wheat	Mature	35° 34'06.24"	-98° 01'5.30"				
ER16	Native Grass	Reproductive	35° 33'45.66"	-98° 00'21.89"	35° 33'47.65"	-98° 00'18.74"	35° 33'46.15"	-98° 00'15.52"

Table AI.1. (concluded).

Field	Vegetation type	Growth stage	Sample A		Sample B		Sample C	
			Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
LW01	Bermuda Grass	Reproductive	35° 02'43.42"	-97° 55'00.49"	35° 02'43.64"	-97° 55'00.17"	35° 02'43.37"	-97° 55'00.56"
LW01W	Wheat	Harvested	35° 02'43.94"	-97° 55'02.20"	35° 02'44.03"	-97° 55'01.65"	35° 02'43.05"	-97° 55'01.53"
LW02	Pasture	Vegetative	34° 57'35.09"	-97° 58'47.09"	34° 57'29.74"	-97° 58'48.25"	34° 57'29.08"	-97° 58'52.07"
LW03	Pasture	Vegetative	34° 57'24.33"	-98° 04'37.01"	34° 57'31.38"	-98° 04'40.34"	34° 57'28.92"	-98° 04'45.75"
LW04	Native Grass	Reproductive	34° 57'26.11"	-98° 05'00.41"	34° 57'28.62"	-98° 05'03.37"	34° 57'25.33"	-98° 05'32.84"
LW04DE	Native Grass	Mature	34° 57'26.99"	-98° 05'29.71"	34° 57'25.85"	-98° 05'26.63"		
LW05	Native Grass	Reproductive	34° 57'25.39"	-98° 05'51.71"	34° 57'24.38"	-98° 05'44.39"	34° 57'27.44"	-98° 05'42.40"
LW06	Native Grass	Reproductive	34° 57'01.07"	-98° 07'39.36"	34° 57'01.92"	-98° 07'35.93"	34° 57'00.56"	-98° 07'32.28"
LW07	Bermuda Grass	Grazed	34° 54'56.17"	-98° 17'34.42"	34° 54'55.26"	-98° 17'30.81"	34° 54'52.30"	-98° 17'33.88"
LW08	Wheat	Harvested	34° 52'59.76"	-98° 12'18.44"	34° 52'56.77"	-98° 12'18.19"	34° 52'55.81"	-98° 12'14.72"
LW09	Pasture	Vegetative	34° 53'49.10"	-98° 10'49.71"	34° 53'52.06"	-98° 10'50.45"	34° 53'52.11"	-98° 10'43.26"
LW10	Native Grass	Grazed	34° 53'08.11"	-98° 01'25.46"	34° 53'06.46"	-98° 01'27.48"	34° 53'08.39"	-98° 01'27.55"
LW11	Grass	Reproductive	34° 55'36.79"	-97° 57'53.74"	34° 55'34.44"	-97° 57'56.45"	34° 55'36.84"	-97° 57'58.52"
LW12	Native Grass	Reproductive	34° 55'29.21"	-97° 57'13.46"	34° 55'31.25"	-97° 57'15.75"	34° 55'33.93"	-97° 57'17.01"
LW13	Pasture	Grazed	34° 54'51.63"	-97° 57'20.74"	34° 54'54.97"	-97° 57'20.05"	34° 54'51.48"	-97° 57'14.51"
LW14	Bermuda Hay	Harvested	34° 56'13.19"	-98° 04'27.84"	34° 56'12.54"	-98° 04'24.52"	34° 56'09.64"	-98° 04'25.52"
LW15	Native Grass	Mature	34° 52'43.29"	-97° 54'59.14"	34° 52'42.33"	-97° 54'54.76"	34° 52'43.78"	-97° 54'52.36"
LW16	Pasture	Mature	34° 47'47.09"	-97° 59'32.69"	34° 47'45.26"	-97° 59'35.68"	34° 47'47.25"	-97° 59'37.97"
LW17	Pasture	Vegetative	34° 48'26.08"	-98° 01'24.08"	34° 48'23.82"	-98° 01'21.29"	34° 48'26.97"	-98° 01'20.35"
LW18	Native Grass	Reproductive	34° 51'20.74"	-98° 08'10.89"	34° 51'21.89"	-98° 08'08.13"	34° 51'24.38"	-98° 08'06.20"
LW19	Pasture	Vegetative	34° 48'27.36"	-98° 08'29.06"	34° 48'27.03"	-98° 08'28.50"	34° 48'26.09"	-98° 08'29.18"
LW20	Wheat	Tilled	34° 54'57.06"	-98° 17'03.20"	34° 54'55.08"	-98° 17'05.87"	34° 54'51.90"	-98° 17'06.29"
LW21	Wheat	Tilled	34° 54'44.93"	-98° 16'41.53"	34° 54'42.96"	-98° 16'44.51"	34° 54'43.00"	-98° 16'48.46"
LW22	Wheat	Harvested	34° 54'44.82"	-98° 16'37.48"	34° 54'42.69"	-98° 16'35.14"	34° 54'43.75"	-98° 16'32.35"
LW23	Wheat	Harvested	34° 54'26.81"	-98° 16'04.65"	34° 54'25.54"	-98° 16'00.52"	34° 54'23.23"	-98° 16'02.71"
LWMZ	Corn	Reproductive	35° 02'49.65"	-97° 55'11.67"	35° 02'48.41"	-97° 55'07.64"	35° 02'49.90"	-97° 55'15.26"

Table AI.2. Central Facility at Lamont Weather and Surface Conditions as Described by the Sampling Teams at the Time of Sampling.

				Weather Conditions		*Surface Conditions*	
Date	*Field*	*Sample*	*Sky*	*Wind*	*Precipitation*	*Vegetation*	*Soil*
07/03/97	CF01	A	Clear	Light	None	Dry	Wet
07/03/97	CF01	B	Clear	Moderate	None	Dry	Moist
07/03/97	CF01	C	Clear	Moderate	None	Dry	Wet
07/03/97	CF02	A	Clear	Moderate	None	Dry	Wet
07/03/97	CF02	B	Mostly Clear	Moderate	None	Dry	Dry
07/03/97	CF02	C	Clear	Moderate	None	Dry	Dry
07/03/97	CF03	A	Sct Clouds	Moderate	None	Dry	Moist
07/03/97	CF03	B	Sct Cu	Moderate	None	Dry	Wet
07/03/97	CF03	C	Sct Cu	Moderate	None	Dry	Dry
07/03/97	CF04	A	Sct Cu	S 10-15	None	Dry	Wet
07/03/97	CF04	B	Sct Cu	S 10	None	Dry	Wet
07/03/97	CF04	C	Sct Cu	SW 10	None	Dry	Dry
07/03/97	CF05	A	Sct Cu	Moderate	None	Dry	Wet
07/03/97	CF05	B	Sct Cu	Moderate	None	Dry	Wet
07/03/97	CF05	C	Sct Cu	Moderate	None	Dry	Wet
07/03/97	CF06	A	Sct	Moderate	None	Dry	Wet
07/03/97	CF06	B	Sct	Moderate	None	Dry	Wet
07/03/97	CF06	C	Sct	Light	None	Dry	Wet
07/03/97	CF07	A	Sct Cu	Moderate	None	Dry	Wet
07/03/97	CF07	B	Clear	Light	None	Dry	Wet
07/03/97	CF07	C	Sct	5-10	None	Dry	Dry
07/03/97	CF08	A	Clear	Light	None	Dry	Dry
07/03/97	CF08	B	Clear	Moderate	None	Dry	Dry
07/03/97	CF08	C	Clear	Moderate	None	Dry	Dry
07/03/97	CF09	A	Clear	Light	None	Dry	Wet
07/03/97	CF09	B	Clear	Light	None	Dry	Wet
07/03/97	CF09	C	Clear	Moderate	None	Dry	Wet

Notes: Sky conditions: Sct = scattered and Cu = cumulus. Wind conditions: S = south; SW = southwest; and numbers indicate estimated wind speed in miles per hour.

Table AI.3. El Reno Weather and Surface Conditions as Described by the Sampling Teams at the Time of Sampling.

				Weather Conditions		*Surface Con ditions*	
Date	*Field*	*Sample*	*Sky*	*Wind*	*Precipitation*	*Vegetation*	*Soil*
06/27/97	ER01	*A*	Clear w/Ci	Light	None	Dew	Wet
06/27/97	ER01	B	Clear, High Ci	Light	None	Dry	Wet
06/27/97	ER01	C	Clear, High Ci	Light	None	Dry	Wet
06/27/97	ER02	A	Partly Cldy	Light	None	Dry	Dry
06/27/97	ER02	B	Partly Cldy	Light	None	Dry	Dry
06/27/97	ER02	C	Partly Cldy	Light	None	Dry	Dry
06/27/97	ER03	A	Clear, High Ci	Light	None	Dew	Wet
06/27/97	ER03	B	Sct Ci	Light	None	Dew	Wet
06/27/97	ER03	C	Sct Ci	Light	None	Dry	Wet
06/27/97	ER04	A	Partly Cldy	Light	None	Dew	Wet
06/27/97	ER04	B	Partly Cldy	Light	None	Dry	Moist
06/27/97	ER04	C	Partly Cldy	Light	None	Dry	Moist
06/25/97	ER05	A	Sct Bkn Ci	Moderate	None	Dry	Dry
06/25/97	ER05	B	Clear	Light	None	Dry	Dry
06/25/97	ER05	C	Mostly Clear	Light	None	Dry	Dry
06/25/97	ER06	A	Mostly Clear	Light	None	Dry	Dry
06/25/97	ER06	B	Mostly Clear	Light	None	Dry	Dry
06/25/97	ER06	C	Mostly Clear	Light	None	Dry	Dry
06/25/97	ER07	A	Clear	Light	None	Dry	Dry
06/25/97	ER07	B	Clear	Light	None	Dry	Dry
06/25/97	ER07	C	Clear	Light	None	Dry	Dry
06/25/97	ER08	A	Clear	Moderate	None	Dry	Dry
06/25/97	ER08	B	Sct	Moderate	None	Dry	Dry
06/25/97	ER08	C	Sct	Moderate	None	Dry	Dry
06/27/97	ER09	A	Bkn Cu	Moderate	None	Wet	Wet
06/27/97	ER09	B	Bkn Cu	Moderate	None	Dry	Wet
06/27/97	ER09	C	Bkn Cu	Moderate	None	Dry	Wet
07/02/97	ER10	A	Clear	Light	None	Dry	Moist
07/02/97	ER10	B	Clear	Light	None	Dry	Wet
07/02/97	ER10	C	Clear	Light	None	Dry	Moist
07/02/97	ER11	A	Clear	Light	None	Dry	Moist
07/02/97	ER11	B	Clear	Light	None	Dry	Moist
07/02/97	ER11	C	Clear	Light	None	Dry	Moist
07/02/97	ER12	A	Clear	Light	None	Dry	Dry
07/02/97	ER12	B	Clear	Very Light	None	Dry	Wet
07/02/97	ER12	C	Clear	Light	None	Dry	Wet
07/02/97	ER13	A	Clear	Light	None	Dry	Dry
07/02/97	ER13	B	Clear	Light	None	Dry	Dry
07/02/97	ER13	C	Clear	Light	None	Dry	Dry

Notes: Sky conditions: Bkn = broken; Ci = cirrus; Cu = cumulus; Cldy = cloudy; and Sct = scattered.
Wind conditions: S = south; SW = southwest; and numbers indicate estimated wind speed in miles per hour.

Table AI.3. (concluded).

			Weather Conditions			*Surface Conditions*	
Date	*Field*	*Sample*	*Sky*	*Wind*	*Precipitation*	*Vegetation*	*Soil*
07/02/97	ER14	A	Clear	Light	None	Dry	Dry
07/02/97	ER14	B	Clear	Light	None	Dry	Dry
07/02/97	ER14	C	Clear	Light	None	Dry	Dry
07/02/97	ER15	A	Clear	Calm	None	Dry	Dry
07/02/97	ER15	B	Mostly Sunny	Light	None	Dry	Moist
07/02/97	ER15	C	Sct Cu	Light	None	Dry	Wet
07/02/97	ER15	D	Clear	Light	None	Dry	Wet
06/27/97	ER16	A	Mostly Cldy	Light	None	Dry	Moist
06/27/97	ER16	B	Mostly Cldy	Moderate	None	Dry	Moist
06/27/97	ER16	C	Mostly Cldy	SW 10	None	Dry	Moist

Notes: Sky conditions: Bkn = broken; Ci = cirrus; Cu = cumulus; Cldy = cloudy; and Sct = scattered.
Wind conditions: S = south; SW = southwest; and numbers indicate estimated wind speed in miles per hour.

Table AI.4. Little Washita Weather and Surface Conditions as Described by the Sampling Teams at the Time of Sampling.

				Weather Conditions		*Surface Conditions*	
Date	*Field*	*Sample*	*Sky*	*Wind*	*Precipitation*	*Vegetation*	*Soil*
06/24/97	LW01	A	Scattered	Gusty	Dry	Dry	Dry
06/24/97	LW01	B	Scattered Clouds	Windy	None	Dry	Dry
06/24/97	LW01	C	Cloudy	Very Windy	None	Dry	Dry
06/24/97	LW01W	A	Scattered	Light	None	Dry	Dry
06/24/97	LW01W	B	Partly Cloudy	10-15	None	Dry	Dry
06/24/97	LW01W	C	Sct Clouds	Windy	None	Dry	Dry
06/28/97	LW02	A	Mostly Sunny	Light	None	Dry	Dry
06/28/97	LW02	B	Mostly Sunny	Medium	None	Dry	Dry
06/28/97	LW02	C	Mostly Sunny	Medium	None	Dry	Dry
06/26/97	LW03	A	Partly Cloudy	Light	5 hrs. prior	Dry	Moist
06/26/97	LW03	B	Sct Clouds	Minimal	5 hrs. prior	Dry	Wet
06/26/97	LW03	C	Mostly Cloud	Minimal	Sprinkling	Wet	Wet
06/26/97	LW04	A	Sct to Cloudy	Light	5 hrs prior	Dry	Wet
06/26/97	LW04	B	Bkn Clouds	Calm	5 hrs prior	Dry	Wet
06/26/97	LW04	C	Partly Cloudy	Light	5 hrs prior	Dry	Wet
06/26/97	LW04	D	Mostly Clear	Light	5 hrs prior	Dry	Moi
06/26/97	LW04	E	Mostly Cloudy	Light	5 hrs prior	Dry	Moi
06/28/97	LW05	A	Partly Cloudy	SSW10	0	Dry	Dry
06/28/97	LW05	B	Sct Clouds	Breezy	Dry	DRy	Wet
06/28/97	LW05	C	Partly Cloudy	SW5	0	Dry	Dry
06/28/97	LW06	A	Bkn Cu Ci	Moderate	None	Dry	Wet
06/28/97	LW06	B	Bkn Cu	Moderate	None	Dry	Wet
06/28/97	LW06	C	Bkn Cu	Light	AM TRW	Dry	Wet
06/30/97	LW07	A	Clear	High	None	Dry	Dry
06/30/97	LW07	B	Clear	High	None	Dry	Dry
06/30/97	LW07	C	Clear	High	None	Dry	Dry
07/01/97	LW08	A	Clear	Moderate	None	Dry	Dry
07/01/97	LW08	B	Clear	High	None	Dry	Dry
07/01/97	LW08	C	Mostly Clear	High	None	Dry	Dry
07/01/97	LW09	A	Clear	Moderate	None	Dry	Dry
07/01/97	LW09	B	Clear	Moderate	None	Dry	Dry
07/01/97	LW09	C	Clear	Moderate	None	Dry	Dry
07/05/97	LW10	A	Bkn Cu, Ci,	Light	None	Dew	Dry
07/05/97	LW10	B	Bkn Cu, Ci	Light	None	Dew	Dry
07/05/97	LW10	C	Bkn Cu, Ci	Light	None	Dry	Dry
06/28/97	LW11	A	Partly Cloudy	S5-10	AM Shower	Wet	Wet
06/28/97	LW11	B	Mostly Cloudy	S5	AM Shower	Dry	Moist
06/28/97	LW11	C	Mostly Cloudy	SW5	AM Shower	Dry	Dry
06/28/97	LW12	A	Bkn	Light	AM Shower	Dry	Wet
06/28/97	LW12	B	Bkn Cu, Ci	Very Light	AM Shower	Dry	Wet

Notes: Sky conditions: Bkn = broken; Ci = cirrus; Cu = cumulus; Cldy = cloudy; and Sct = scattered.
Wind conditions: S = south; SW = southwest; and numbers indicate estimated wind speed in miles per hour.

Table AI.4. (concluded).

				Weather Conditions		*Surface Conditions*	
Date	*Field*	*Sample*	*Sky*	*Wind*	*Precipitation*	*Vegetation*	*Soil*
06/28/97	LW12	C	Bkn Cu	Light	AM Shower	Dry	Wet
06/28/97	LW13	A	Clear	Light	AM Shower	Dry	Dry
06/28/97	LW13	B	Mostly Sunny	Light	AM Shower	Dry	Dry
06/28/97	LW13	C	Mostly Sunny	Light	AM Shower	Dry	Dry
06/28/97	LW14	A	Partly Cloudy	SW 10	None	Dry	Dry
06/28/97	LW14	B	Partly Cloudy	S 10	None	Dry	Dry
06/28/97	LW14	C	Mostly Clear	SW 10	None	Dry	Dry
07/05/97	LW15	A	Mostly Cloudy	Light	None	Dry	Dry
07/05/97	LW15	B	Partly Cloudy	0-5	None	Day	Dry
07/05/97	LW15	C	Bkn As, Ci	Light	None	Dry	Dry
07/05/97	LW16	A	Partly Cloudy	Light	None	Dew	Dew
07/05/97	LW16	B	Partly Cloudy	Light	None	Dew	Dew
07/05/97	LW16	C	Partly Cloudy	NW 1-5	None	Dry	Moist
07/05/97	LW17	A	Mostly Sunny	Light	None	Dry	Dry
07/05/97	LW17	B	Mostly Sunny	Light	None	Dry	Dry
07/05/97	LW17	C	Mostly Cloudy	Light	None	Dry	Dry
07/01/97	LW18	A	Clear	Very Light	None	Dry	Dry
07/01/97	LW18	B	Clear	Light	None	Dry	Dry
07/01/97	LW18	C	Clear	Light	None	Dry	Dry
07/01/97	LW19	A	Clear	Moderate	None	Dry	Dry
07/01/97	LW19	B	Clear	Light	None	Dry	Dry
07/01/97	LW19	C	Clear	Light	None	Dry	Dry
07/01/97	LW20	A	Clear	High	None	Dry	Dry
07/01/97	LW20	B	Clear	High	None	Dry	Dry
07/01/97	LW20	C	Clear	High	None	Dry	Dry
07/01/97	LW21	A	Clear	S 5-10	None	Dry	Dry
07/01/97	LW21	B	Clear	Moderate	None	Dry	Dry
07/01/97	LW21	C	Clear	Moderate	None	Dry	Dry
06/30/97	LW22	A	Clear	S 10-15	None	Dry	Dry
06/30/97	LW22	B	Clear	S 10-15	None	Dry	Dry
06/30/97	LW22	C	Clear	S 10-15	None	Dry	Dry
06/30/97	LW23	A	Clear	Strong	None	Dry	Wet
06/30/97	LW23	B	Clear	Strong	None	Dry	Wet
06/30/97	LW23	C	Clear	Mod	None	Dry	Wet
07/05/97	LWZM	A	Clear	Calm	None	Dry	Dry
07/05/97	LWZM	B	Clear	Light	None	Dry	Dry
07/05/97	LWZM	C	Clear	Light	None	Dry	Dry

Notes: Sky conditions: Bkn = broken; Ci = cirrus; Cu = cumulus; Cldy = cloudy; and Sct = scattered.
Wind conditions: S = south; SW = southwest; and numbers indicate estimated wind speed in miles per hour.

Table A1.5. Vegetation Plant Height, Green and Brown Standing Biomass, Surface Residue Biomass, and Water Content at the Central Facility Fields. Values are the Mean for Each Field Sub-sample.

		Green Standing			*Brown Standing*			*Surface Residue*		
Field	*Plant height (cm)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*
CF01A	23.3	301.0	107.1	64.42	21.0	18.4	11.90	108.0	76.8	28.89
CF01B	10.5	183.0	70.1	61.69	8.0	6.9	13.75	34.0	23.2	31.76
CF01C	20.2	156.0	67.3	56.86	16.0	7.7	51.88	24.0	15.1	37.08
CF02A	23.3	77.0	28.4	63.12	~~93.0~~	~~141.0~~	—	1.0	0.2	80.00
CF02B	19.2	105.0	34.8	66.86	~~52.0~~	~~112.3~~	—	0.0	0.0	0.00
CF02C	24.4	109.0	42.2	61.28	~~100.0~~	~~100.7~~	—	0.0	0.0	0.00
CF03A	24.0	141.4	39.9	71.78	136.2	109.5	19.60	110.2	91.3	17.15
CF03B	24.1	160.3	47.0	70.68	126.0	113.7	9.76	0.0	0.0	0.00
CF03C	25.3	92.8	23.7	74.46	96.4	90.6	6.02	8.3	6.6	20.48
CF04A	18.1	5.5	2.0	63.64	164.0	157.5	3.96	364.7	341.2	6.44
CF04B	24.7	37.8	11.5	69.58	202.7	192.1	5.23	244.5	220.7	9.73
CF04C	24.1	22.9	5.9	74.24	190.6	185.0	2.94	355.9	330.6	7.11
CF05A	31.0	0.0	0.0	0.00	268.0	265.3	1.01	286.1	272.3	4.82
CF05B	53.9	0.0	0.0	0.00	277.5	270.7	2.45	376.0	363.7	3.27
CF05C	27.3	0.0	0.0	0.00	179.5	174.8	2.62	293.0	281.6	3.89
CF06A	64.2*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
CF06B	24.6	122.4	34.2	72.06	199.9	182.8	8.95	182.3	155.7	14.59
CF06C	34.2	237.8	58.7	75.32	247.3	224.7	9.14	130.7	103.7	20.66
CF07A	44.3*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
CF07B	30.2*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
CF07C	47.2*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
CF08A	18.2	326.0	148.2	54.54	100.2	90.5	9.68	468.1	374.0	20.10
CF08B	44.1	646.8	274.0	57.64	110.5	92.8	16.02	288.2	222.0	22.97
CF08C	18.2	425.2	185.0	56.49	36.6	32.6	10.93	177.2	156.9	11.46
CF09A	33.0	21.3	6.7	68.54	385.4	366.6	4.88	737.0	506.9	31.22
CF09B	38.1	0.0	0.0	0.00	340.8	330.3	3.08	778.9	683.4	12.26
CF09C	26.0	12.3	3.5	71.54	199.1	189.2	4.97	232.8	209.6	9.97

Notes: Numbers struck out are the measured numbers which contain errors and should not be used in any analysis. A dash indicates no data are available.
* Value is percent residue cover on tilled field.

Table AI.6. Vegetation Plant Height, Green and Brown Standing Biomass, Surface Residue Biomass, and Water Content at the El Reno Fields. Values are the Mean for Each Field Sub-sample.

		Green Standing			*Brown Standing*			*Surface Residue*		
Field	*Plant height (cm)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*
ER01A	50.6	851.1	302.8	64.42	194.2	132.6	31.72	1003.6	531.1	47.08
ER01B	62.1	1885.1	589.3	68.74	103.1	76.7	25.61	1180.6	586.7	50.30
ER01C	66.4	1473.2	488.1	66.87	102.9	82.4	19.92	717.1	412.0	42.55
ER02A	49.5	1133.2	476.3	57.97	105.5	83.3	21.04	1022.3	637.4	37.65
ER02B	67.0	1017.8	390.3	61.65	109.0	90.1	17.34	837.9	552.8	34.03
ER02C	43.4	1127.9	336.7	70.15	0.0	0.0	0.00	939.8	595.4	36.65
ER03A	45.1	1048.0	368.7	64.82	0.0	0.0	0.00	0.0	0.0	0.00
ER03B	43.7	524.0	186.6	64.39	18.0	10.5	41.67	32.0	14.1	55.94
ER03C	69.3	1199.0	386.9	67.73	466.0	221.3	52.51	131.0	55.0	58.02
ER04A	64.2	1775.0	449.0	74.70	16.9	7.7	54.44	1656.9	587.0	64.57
ER04B	51.1	1228.0	344.7	71.92	0.0	0.0	0.00	1328.0	671.5	49.44
ER04C	49.8	1372.0	399.8	70.86	7.4	5.2	29.73	1130.0	541.3	52.10
ER05A	50.4	888.0	345.3	61.11	0.0	0.0	0.00	139.0	100.6	27.63
ER05B	33.6	594.7	248.0	58.29	68.3	48.6	28.84	81.7	61.5	24.72
ER05C	33.4	553.3	250.0	54.82	0.0	0.0	0.00	358.8	229.6	36.01
ER06A	34.1	560.6	214.2	61.79	18.3	13.3	27.32	418.6	303.1	27.59
ER06B	33.0	764.8	340.4	55.49	32.3	18.6	42.41	475.7	283.1	40.49
ER06C	46.0	657.1	315.9	51.93	10.8	7.0	35.19	403.4	272.7	32.40
ER07A	50.6	800.3	342.1	57.25	77.9	53.7	31.07	638.5	497.3	22.11
ER07B	52.3	937.9	354.5	62.20	22.3	18.4	17.49	478.9	384.0	19.82
ER07C	38.8	1130.7	375.2	66.82	8.1	6.7	17.28	480.8	368.6	23.34
ER08A	49.7	347.0	138.9	59.97	169.0	156.8	7.22	1182.0	932.9	21.07
ER08B	41.2	671.0	224.0	66.62	0.0	0.0	0.00	205.0	144.7	29.41
ER08C	57.4	830.0	294.4	64.53	75.0	43.4	42.13	455.0	310.9	31.67
ER09A	31.3	197.0	82.5	58.12	61.0	40.5	33.61	132.0	88.6	32.88
ER09B	36.7	272.0	122.9	54.82	70.0	46.3	33.86	80.0	49.1	38.63

Table AI.6. (concluded).

Field	Plant height (cm)	Green Standing			Brown Standing			Surface Residue		
		Wet biomass ($g\ m^{-2}$)	Dry biomass ($g\ m^{-2}$)	Water content (%)	Wet biomass ($g\ m^{-2}$)	Dry biomass ($g\ m^{-2}$)	Water content (%)	Wet biomass ($g\ m^{-2}$)	Dry biomass ($g\ m^{-2}$)	Water content (%)
ER09C	29.2	255.0	127.8	49.88	6.0	4.2	30.00	33.0	21.6	34.55
ER10A	21.9	0.5	0.1	80.00	305.3	290.0	5.01	452.0	391.3	13.43
ER10B	26.6	2.0	0.2	90.00	215.8	208.7	3.29	373.0	329.5	89.43
ER10C	23.5	1.0	0.2	80.00	287.7	282.0	1.98	388.5	344.8	11.25
ER11A	23.4	61.8	12.8	79.29	178.6	163.0	8.73	86.6	73.8	14.78
ER11B	18.5	8.8	4.0	54.55	128.8	118.2	8.23	637.2	121.7	80.90
ER11C	26.7	0.8	0.1	87.50	233.7	221.0	5.43	268.3	249.2	7.12
ER12A	24.2	4.0	0.1	97.50	261.0	244.2	6.44	519.0	461.8	11.02
ER12B	17.0	0.0	0.0	0.00	175.0	166.8	4.69	759.0	688.9	9.24
ER12C	32.5	0.0	0.0	0.00	330.0	315.3	4.45	385.0	357.5	7.14
ER13A	44.3*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
ER13B	30.2*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
ER13C	47.2*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
ER14A	18.5	1313.0	292.1	77.75	28.0	19.7	29.64	429.0	339.9	20.77
ER14B	19.0	866.4	238.0	72.53	45.0	30.5	32.22	165.5	128.6	22.30
ER14C	7.7	466.0	165.2	64.55	1.0	0.2	80.00	200.0	177.2	11.40
ER15A	22.5	36.8	10.5	71.47	261.9	256.3	2.14	186.3	176.3	5.37
ER15B	26.2	68.4	28.9	57.75	304.2	289.4	4.87	285.4	239.5	16.08
ER15C	20.8	33.0	9.3	71.82	170.0	164.7	3.12	261.0	239.6	8.20
ER15D	63.7	3.5	0.5	85.71	935.2	932.3	0.31	175.8	143.2	18.54
ER16A	42.2	883.3	255.4	71.09	110.0	71.8	34.73	270.5	139.4	48.47
ER16B	27.7	346.5	100.4	71.02	137.4	104.0	24.31	187.0	106.5	43.05
ER16C	17.5	758.2	181.1	76.11	52.5	20.4	61.14	58.2	30.7	47.25

Note: * Value is percent residue cover on tilled field.

Table AI.7. Vegetation Plant Height, Green and Brown Standing Biomass, Surface Residue Biomass, and Water Content at the Little Washita Fields. Values are the Mean for Each Field Sub-sample.

		Green Standing			*Brown Standing.*			*Surface Residue*		
Field	*Plant height (cm)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*
LW01A	5.7	263.8	140.2	46.85	0.0	0.0	0.00	0.0	0.0	0.00
LW01B	5.5	168.8	68.6	59.36	0.0	0.0	0.00	103.0	52.2	49.32
LW01C	4.5	0.0	0.0	0.00	314.0	183.6	41.53	111.8	107.2	4.11
LW01WA	40.2	0.0	0.0	0.00	643.6	614.8	4.47	189.0	150.8	20.21
LW01WB	38.2	579.6	418.6	27.78	0.0	0.0	0.00	305.8	297.6	2.68
LW01WC	31.6	92.0	49.6	46.09	27.8	19.0	31.65	0.0	0.0	0.00
LW02A	23.6	266.5	142.2	46.64	62.7	46.9	25.20	183.9	168.9	8.16
LW02B	42.2	551.4	240.7	56.35	451.3	395.9	12.28	242.6	213.1	12.16
LW02C	24.9	232.7	100.0	57.03	38.3	31.4	18.02	52.5	41.7	20.57
LW03A	34.8	387.1	224.8	41.93	438.8	324.3	26.09	545.2	346.0	36.54
LW03B	25.3	310.3	118.5	61.81	4.0	2.0	50.00	57.8	45.0	22.15
LW03C	38.8	429.7	160.6	62.63	0.0	0.0	0.00	92.4	54.0	41.56
LW04A	70.5	439.0	210.5	52.05	115.0	80.3	30.17	45.0	29.2	35.11
LW04B	11.1	266.0	72.9	72.59	0.0	0.0	0.00	0.0	0.0	0.00
LW04C	15.3	226.6	95.3	57.94	0.0	0.0	0.00	298.6	229.7	23.07
LW04D	16.4	361.5	92.6	74.38	2.2	1.7	22.73	21.3	13.5	36.62
LW04E	12.1	275.5	68.9	74.99	0.0	0.0	0.00	0.0	0.0	0.00
LW05A	30.5	788.5	223.5	71.66	4.1	2.7	34.15	307.2	252.5	17.81
LW05B	39.3	390.0	174.4	55.28	14.0	10.1	27.86	40.0	31.5	21.25
LW05C	28.5	330.2	112.7	65.87	11.4	9.9	13.16	315.3	278.4	11.70
LW06A	20.3	207.0	71.2	65.60	52.0	42.3	18.65	0.0	0.0	0.00
LW06B	16.8	90.0	34.2	62.00	14.0	11.9	15.00	53.0	36.6	30.94
LW06C	12.7	38.0	16.4	56.84	0.0	0.0	0.00	0.0	0.0	0.00
LW07A	22.4	605.9	248.4	59.00	9.4	5.6	40.43	119.6	96.9	18.98
LW07B	26.7	812.8	317.1	60.99	6.2	4.0	35.48	122.5	102.2	16.57
LW07C	23.6	716.7	277.2	61.32	2.7	1.2	55.56	167.9	136.7	18.58
LW08A	19.1	0.0	0.0	0.00	182.0	177.6	2.42	307.0	294.5	4.07
LW08B	30.3	0.0	0.0	0.00	257.0	252.7	1.67	672.0	609.1	9.36
LW08C	29.3	0.0	0.0	0.00	283.0	272.0	3.87	186.0	177.3	4.68

Table AI.7. (continued).

		Green Standing			*Brown Standing*			*Surface Residue*		
Field	*Plant height (cm)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*
LW09A	22.6	340.2	151.9	55.35	4.5	1.5	66.67	28.2	18.8	33.33
LW09B	42.6	577.1	234.1	59.44	199.8	169.3	15.27	251.3	213.6	15.00
LW09C	39.1	657.9	279.5	57.52	34.6	26.5	23.41	351.5	284.7	19.00
LW10A	30.0	418.0	163.5	60.89	10.0	7.7	23.00	72.0	57.8	19.72
LW10B	19.8	166.0	74.1	55.36	7.0	6.2	8.57	8.0	5.7	28.75
LW10C	25.1	575.0	202.9	64.71	20.0	15.6	22.00	20.0	16.4	18.00
LW11A	33.1	1250.7	281.5	77.49	95.5	60.3	36.86	412.8	236.0	42.83
LW11B	46.3	871.0	263.8	69.71	104.7	68.7	34.38	828.7	549.0	33.75
LW11C	38.1	696.9	192.2	72.42	6.6	2.8	57.58	241.3	173.4	28.14
LW12A	41.8	222.0	98.0	55.86	165.0	122.4	25.82	260.0	186.2	28.38
LW12B	34.8	318.0	122.3	61.54	209.0	177.5	15.07	195.0	142.1	27.13
LW12C	58.2	492.0	199.0	59.55	145.0	110.2	24.00	285.0	213.4	25.12
LW13A	21.0	451.7	163.5	63.80	16.2	11.7	27.78	121.3	90.7	25.23
LW13B	12.3	163.5	58.3	64.34	3.7	2.5	32.43	38.7	32.7	15.50
LW13C	29.4	735.5	219.4	70.17	15.9	8.5	46.54	11.9	8.5	28.57
LW14A	15.5	117.2	48.7	58.45	9.4	6.2	34.04	391.1	335.4	14.24
LW14B	17.2	253.8	114.5	54.89	14.6	10.7	26.71	322.5	266.2	17.46
LW14C	14.8	306.6	123.5	59.72	4.4	3.2	27.27	82.8	45.3	45.29
LW15A	22.8	463.6	229.5	50.50	17.5	15.6	10.86	235.6	216.0	8.32
LW15B	19.9	171.2	78.5	54.15	1.4	0.3	78.57	104.9	89.1	15.06
LW15C	18.7	174.0	81.5	53.16	10.0	8.1	19.00	43.0	37.6	12.56
LW16A	13.5	214.6	95.1	55.68	6.6	3.6	45.45	148.7	94.7	36.31
LW16B	10.5	75.2	29.6	60.64	0.0	0.0	0.00	65.3	43.9	32.77
LW16C	17.9	78.4	34.7	55.74	0.0	0.0	0.00	5.9	3.6	38.98
LW17A	53.4	601.9	285.2	52.62	102.3	72.2	29.42	206.9	175.3	15.27
LW17B	28.4	370.3	158.6	57.17	20.0	16.9	15.50	130.3	116.7	10.44
LW17C	41.2	650.2	258.1	60.30	36.8	17.1	53.53	221.7	198.4	10.51

Table AI.7. (concluded).

		Green Standing			*Brown Standing*			*Surface Residue*		
Field	*Plant height (cm)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*	*Wet biomass ($g\ m^{-2}$)*	*Dry biomass ($g\ m^{-2}$)*	*Water content (%)*
LW18A	22.0	134.0	75.0	44.03	26.0	22.3	14.23	99.0	90.6	8.48
LW18B	93.5	420.0	216.1	48.55	88.0	73.6	16.36	96.0	79.0	17.71
LW18C	56.8	396.0	228.0	42.42	99.0	80.8	18.38	325.0	242.1	25.51
LW19A	19.6	271.2	110.6	59.22	14.2	10.6	25.35	112.3	98.9	11.93
LW19B	17.2	363.6	158.2	56.49	9.6	7.5	21.88	98.3	81.2	17.40
LW19C	30.7	646.5	207.1	67.97	23.8	15.4	35.29	63.2	49.0	22.47
LW20A	45.9*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
LW20B	45.4*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
LW20C	48.2*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
LW21A	75.4*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
LW21B	81.1*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
LW21C	77.1*	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
LW22A	20.9	10.3	1.8	82.52	207.6	194.4	6.36	174.4	163.4	6.31
LW22B	25.4	16.1	4.5	72.05	199.8	191.0	4.40	233.0	226.6	2.75
LW22C	33.6	44.1	9.4	78.68	226.6	216.0	4.68	336.9	311.3	7.60
LW23A	42.9	0.0	0.0	0.00	266.2	253.2	4.88	345.9	327.7	5.26
LW23B	28.6	0.0	0.0	0.00	268.8	252.8	5.95	435.4	412.8	5.19
LW23C	29.8	0.0	0.0	0.00	229.0	218.6	4.54	198.0	177.4	10.40
LWZMA	265.3	1748.7	359.0	79.47	0.0	0.0	0.00	0.0	0.0	0.00
LWZMB	208.0	1453.0	317.6	78.14	0.0	0.0	0.00	0.0	0.0	0.00
LWZMC	255.5	1293.7	251.3	80.58	0.0	0.0	0.00	0.0	0.0	0.00

Note: * Value is percent residue cover on tilled field.

Table AI.8. Leaf Area Index, Percent of Photosynthetically Active Radiation Transmitted to the Soil (fT_C), Reflected above the canopy (fR_C), Reflected from the Soil Back into the Canopy (fR_S), and Absorbed by the Canopy (fAPAR) at the Central Facility Fields. Values are the Means of 10 Measurements for Each Plot.

	Leaf	*Photosynthetically Active Radiation*			
Field	*area index**	*fR_C (%)*	*fT_C (%)*	*fR_S (%)*	*fAPAR (%)*
CF01A	1.35	6.99	51.54	5.29	46.76
CF01B	1.82	7.64	60.52	6.21	38.05
CF01C	1.31	6.20	56.46	5.79	43.13
CF02A	2.31	5.67	28.68	2.94	68.59
CF02B	2.96	6.66	31.44	3.23	65.13
CF02C	1.68	7.69	49.19	5.05	48.17
CF03A	1.05	7.75	43.10	4.42	53.57
CF03B	1.95	5.72	42.43	4.35	56.20
CF03C	0.88	9.20	63.93	6.56	33.43
CF04A	0.67	7.43	77.40	7.94	23.11
CF04B	0.73	7.66	62.64	6.43	36.13
CF04C	0.69	6.78	62.64	6.43	37.01
CF05A	1.47	6.53	50.03	5.13	48.58
CF05B	1.27	7.13	52.00	5.34	46.20
CF05C	0.98	7.38	48.53	4.98	49.07
CF06A	0	9.03	100.00	9.03	0.00
CF06B	1.23	7.02	72.40	7.43	28.01
CF06C	1.59	5.55	38.47	3.95	59.93
CF07A	0	10.95	100.00	10.95	0.00
CF07B	0	10.29	100.00	10.29	0.00
CF07C	0	-	100.00	-	0.00
CF08A	2.15	7.43	40.76	4.18	55.99
CF08B	2.90	6.16	37.01	3.80	60.63
CF08C	2.67	5.88	41.76	4.28	56.64
CF09A	1.00	7.36	49.31	5.06	48.39
CF09B	1.30	5.80	61.23	6.28	39.25
CF09C	0.79	7.45	79.02	8.11	21.63

Notes: A dash indicates no data were available.*Includes all standing green and brown plant material.

Table AI.9. Leaf Area Index, Percent of Photosynthetically Active Radiation Transmitted to the Soil (fT_C), Reflected above the Canopy (fR_C), Reflected from the Soil Back into the Canopy (fR_S), and Absorbed by the Canopy (fAPAR) at the El Reno Fields. Values are the Means of 10 Measurements for Each Plot.

	Leaf	*Photosynthetically Active Radiation*			
Field	*area index**	*fR_C (%)*	*fT_C (%)*	*fR_S (%)*	*fAPAR (%)*
ER01A	4.13	5.24	7.88	0.81	87.69
ER01B	5.10	4.45	7.62	0.78	88.71
ER01C	4.75	4.33	8.83	0.91	87.75
ER02A	3.85	3.42	16.57	1.70	81.71
ER02B	4.20	6.01	22.87	2.35	73.46
ER02C	3.30	4.69	23.30	2.39	74.40
ER03A	4.27	5.89	5.98	0.61	88.75
ER03B	3.94	2.04	19.07	1.96	80.84
ER03C	5.14	6.05	4.54	0.47	89.87
ER04A	5.40	4.93	2.33	0.24	92.98
ER04B	3.65	4.83	8.73	0.90	87.33
ER04C	4.17	4.97	4.94	0.51	90.59
ER05A	2.51	5.26	35.84	3.68	62.58
ER05B	1.89	5.50	58.45	6.00	42.05
ER05C	2.71	5.30	26.88	2.76	70.58
ER06A	2.90	4.92	24.47	2.51	73.12
ER06B	3.20	5.33	17.94	1.84	78.57
ER06C	3.47	6.59	6.40	0.66	87.66
ER07A	3.70	5.59	12.94	1.33	82.80
ER07B	5.56	5.54	6.80	0.70	88.35
ER07C	4.02	6.09	28.34	2.91	68.47
ER08A	3.40	5.70	19.81	2.03	76.52
ER08B	3.76	4.65	17.86	1.83	79.32
ER08C	3.63	7.08	5.18	0.53	88.27
ER09A	3.11	6.65	21.28	2.18	74.25
ER09B	2.71	5.76	28.73	2.95	68.46
ER09C	2.35	8.55	32.37	3.32	62.40
ER10A	0.64	8.60	70.30	7.21	28.31
ER10B	0.64	7.80	71.33	7.32	28.19
ER10C	0.67	7.95	57.21	5.87	40.71
ER11A	0.51	7.38	59.90	6.15	38.87
ER11B	0.56	7.23	53.60	5.50	44.67
ER11C	0.66	4.83	56.33	5.78	44.62
ER12A	1.26	7.76	70.85	7.27	28.66
ER12B	0.73	4.91	81.06	8.32	22.35
ER12C	1.34	7.00	40.00	4.10	57.10

Notes: A dash indicates no data were available. *Includes all standing green and brown plant material.

Table AI.9 (concluded).

Field	Leaf area index*	Photosynthetically Active Radiation			
		fR_C (%)	fT_C (%)	fR_S (%)	fAPAR (%)
ER13A	0	9.77	100.00	9.79	0.00
ER13B	0	10.72	100.00	10.72	0.00
ER13C	0	12.02	100.00	12.02	0.00
ER14A	2.99	5.45	32.80	3.37	65.12
ER14B	2.18	4.87	64.21	6.59	37.51
ER14C	0.53	7.23	90.22	9.26	11.81
ER15A	1.73	-	-	-	-
ER15B	1.32	7.48	24.55	2.52	70.49
ER15C	1.28	7.61	46.23	4.74	50.90
ER15D	3.37	-	-	-	-
ER16A	4.60	6.84	7.02	0.72	86.86
ER16B	3.28	12.36	18.54	1.90	71.00
ER16C	3.98	6.31	11.86	1.22	83.05

Notes: A dash indicates no data were available. *Includes all standing green and brown plant material.

Table AI.10. Leaf Area Index, Percent of Photosynthetically Active Radiation Transmitted to the Soil (fT_C), Reflected above the Canopy (fR_C), Reflected from the Soil Back into the Canopy (fR_S), and Absorbed by the Canopy (fAPAR) at the Little Washita Fields. Values are the Means of 10 Measurements for Each Plot.

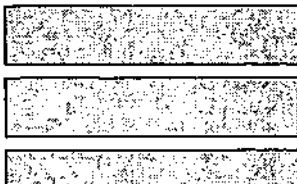
Field	Leaf area iIndex*	Photosynthetically Active Radiation			
		fRc (%)	fTc (%)	fRs (%)	fAPAR (%)
LW01A	0.17	~~31.57~~†	~~100.32~~	~~0.00~~	68.43
LW01B	0.18	7.09	97.99	10.05	4.98
LWOIC	0.03	5.96	53.47	5.49	46.05
LWOIWA.	1.48	5.08	60.06	6.16	41.02
LWOIWB	1.46	–	–	–	–
LWOIWC	1.42	–	–	–	–
LW02A	2.93	5.63	53.99	5.54	45.92
LW02B	2.81	6.40	35.20	3.61	62.01
LW02C	0.89	6.51	72.88	7.48	28.08
LW03A	1.54	5.19	72.24	7.41	29.98
LW03B	2.73	5.67	58.83	6.04	41.54
LW03C	1.10	5.80	80.63	8.27	21.84
LW04A	2.92	5.25	48.56	4.98	51.18
LW04B	1.36	5.20	62.64	6.43	38.59
LW04C	1.62	5.74	57.81	5.93	42.38
LW04D	1.70	5.79	55.07	5.65	44.79
LW04E	1.27	5.88	50.63	5.19	48.68
LW05A	2.02	5.64	17.98	1.84	78.23
LW05B	1.89	7.02	41.43	4.25	55.80
LW05C	1.36	7.76	37.09	3.81	58.95
LW06A	1.22	7.79	72.50	7.44	27.15
LW06B	0.89	6.90	82.94	8.51	18.67
LW06C	0.58	6.52	87.89	9.02	14.61
LW07A	1.72	4.96	50.01	5.13	50.17
LW07B	2.49	5.70	33.89	3.48	63.88
LW07C	2.42	6.08	28.83	2.96	68.04
LW08A	1.65	7.47	45.51	4.67	51.69
LW08B	1.40	6.31	71.85	7.37	29.21
LW08C	1.60	6.23	49.45	5.07	49.39
LW09A	1.99	7.17	57.55	5.90	41.18
LW09B	3.22	6.03	37.47	3.84	60.35
LW09C	3.11	5.20	26.30	2.70	71.20
LW10A	1.68	7.13	37.60	3.86	59.12
LW10B	1.00	5.81	53.08	5.45	46.56
LW10C	1.39	4.83	26.41	2.71	71.47
LW11A	5.24	6.32	4.65	0.48	89.51

Notes: A dash indicates no data were available. *Includes all standing green and brown plant material. † Numbers struck out are measured numbers which contain errors and should not be used in any analysis.

Table AI.10 (concluded).

Field	Leaf area index*	Photosynthetically Active Radiation			
		fR_C (%)	fT_C (%)	fR_S (%)	fAPAR (%)
LW11B	3.19	5.38	7.48	0.77	87.91
LW11C	2.27	5.73	23.36	2.40	73.31
LW12A	4.13	6.63	17.66	1.81	77.52
LW12B	2.62	7.82	24.44	2.51	70.25
LW12C	3.45	5.86	19.30	1.98	76.82
LW13A	1.42	6.34	68.07	6.98	32.58
LW13B	1.18	6.40	85.05	8.73	17.28
LW13C	1.70	5.47	61.09	6.27	39.71
LW14A	0.75	5.97	63.83	6.55	36.75
LW14B	1.16	5.25	38.96	4.00	59.79
LW14C	1.10	6.19	53.57	5.50	45.74
LW15A	1.28	6.03	68.86	7.06	32.18
LW15B	1.09	6.48	52.32	5.37	46.57
LW15C	1.52	7.03	57.21	5.87	41.63
LW16A	0.92	6.82	38.12	3.91	58.97
LW16B	0.47	6.95	63.22	6.49	36.32
LW16C	0.27	8.08	70.58	7.24	28.58
LW17A	3.03	5.03	12.70	1.30	83.57
LW17B	1.64	5.34	47.34	4.86	52.18
LW17C	1.84	6.65	51.79	5.31	46.87
LW18A	1.60	6.49	40.90	4.20	56.81
LW18B	2.47	7.38	18.95	1.94	75.61
LW18C	2.64	8.50	8.94	0.92	83.48
LW19A	1.17	6.44	59.47	6.10	40.19
LW19B	1.38	6.10	44.51	4.57	53.95
LW19C	1.29	5.73	40.00	4.10	58.37
LW20A	0.00	10.03	100.00	10.03	0.00
LW20B	0.00	9.71	100.00	9.71	0.00
LW20C	0.00	9.82	100.00	9.82	0.00
LW21A	0.00	-	100.00	-	0.00
LW21B	0.00	-	100.00	-	0.00
LW21C	0.00	-	100.00	-	0.00
LW22A	0.70	6.31	67.75	6.95	32.89
LW22B	0.77	8.24	59.48	6.10	38.38
LW22C	0.70	7.66	54.20	5.56	43.70
LW23A	1.16	7.24	49.45	5.07	48.39
LW23B	1.41	7.67	61.46	6.31	37.18
LW23C	0.81	7.39	54.76	5.62	43.47
LWZMA	4.18	5.10	3.11	0.32	92.11
LWZMB	3.15	5.35	5.28	0.54	89.91
LWZMC	4.63	4.66	3.61	0.37	92.10

Notes: A dash indicates no data were available. *Includes all standing green and brown plant material.

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