LAI-2200 Plant Canopy Analyzer

For fast, precise, and reliable non-destructive Leaf Area Index measurements

LI-COR®
Biosciences

Novel Technology for Non-Destructive Plant Canopy Analysis

The LAI-2200 Plant Canopy Analyzer computes Leaf Area Index (LAI) and a variety of other canopy structure attributes from radiation measurements made with a "fish-eye" optical sensor. Measurements made above and below the canopy are used to determine the interception of light by the canopy at 5 zenith angles. LAI is computed with this data using a well-established model of radiative transfer in plant canopies.

Built for the Field

From its weather-resistant construction to its light-weight ergonomic design, every aspect of the LAI-2200 is built for the rigors of field work. The LAI-2200 provides large data storage capacity, long battery life, and these features:

- **Automatic data logging - for simpler data collection and more robust data sets**
- **Intuitive menu-based interface**
- **Advanced setup options on the console**

Why choose the LAI-2200?

- **Simplicity:** intuitive setup and operation
- **Confidence:** field proven and scientifically validated
- **Versatility:** computes LAI of forests, crops, grasslands, hedges, and individual plant canopies
- **Robust data:** instantly calculates leaf area index, mean foliage inclination angle, canopy gap fraction, and numerous statistical parameters

Fast, Simple Measurements

Measurements made with the LAI-2200 are rapid when compared with other indirect techniques. The LAI-2200 does not require a direct beam of solar radiation, so you don't have to wait for the sun angle to change or for a clear day. In addition, measurements can be made under a variety of sky conditions; obscured sun is best, but measurements can be made on clear days using the proper techniques. Flexible configurations allow the LAI-2200 to be used in a variety of canopies, ranging in size from short grasses to tall forests.

Row Crops

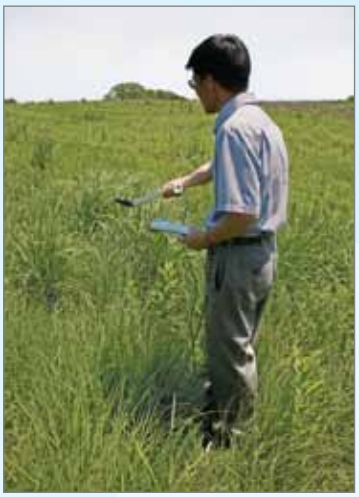
Row crops are easily measured with the LAI-2200. If the canopy is uniform, a wide field of view is suitable. For non-uniform canopies, use a narrow field of view (obtained by using a view restrictor) and a larger sample size to accurately calculate LAI.

Consider the LAI-2200TC package:

- Two optical sensors
- One console
- For computing LAI in tall canopies

Forest Canopies

Forest canopies can be measured using a single optical sensor or two sensors. With two optical sensors, one sensor is placed in a clearing with a view of the sky. This sensor logs data automatically at specified intervals, while a second sensor is used to make below-canopy readings in the forest canopy. Data from each sensor can be merged on the console for on-site calculation of LAI.



Grasslands

Grasslands are among the easiest canopy types to measure with the LAI-2200. Since the optical sensor is small, it can be placed in short grass canopies without altering the canopy structure. A view cap should be used to block any foreign objects from view.

Isolated Trees

Foliage density, rather than LAI, is the result when measuring an isolated tree canopy. For a typical tree canopy, measurements are taken around the tree trunk in each cardinal direction

Hedges

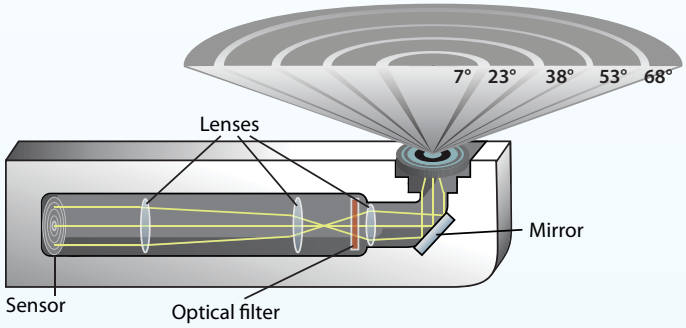
Just like with isolated trees, foliage density is the result when measuring hedges. With hedges, it may be necessary to exclude rings that do not “view” any vegetation. This can be accomplished on the LAI-2200 console or with the FV2200 software. With FV2200, you can also compute canopy volume, drip-line LAI, and other parameters.

How it Works

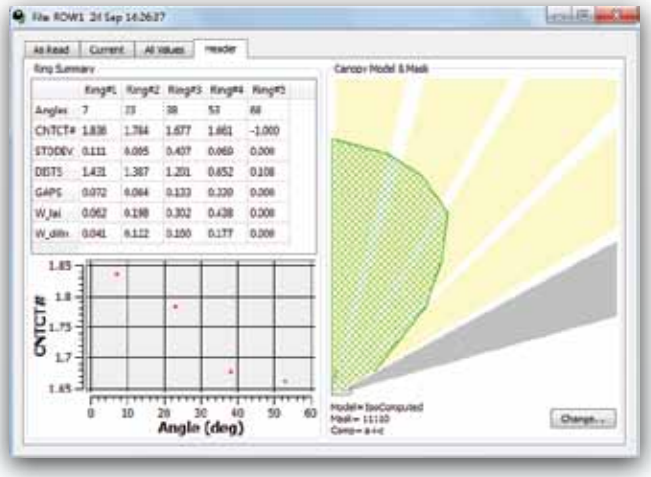
The LAI-2200 builds upon the proven technology of its predecessor - the LAI-2000. The LAI-2200 provides a modernized user interface, versatile configuration options, and improved data analysis features.

It calculates the interception of blue light (320-490 nm) at 5 zenith angles (148° field-of-view) from readings taken above and below the canopy. These data are then used to compute foliage amount and orientation using well established theory and algorithms (see references below). These are implemented in the instrument's console, so you can see results right in the field.

The underlying theory is based on assumptions of randomness in foliage position, which all real canopies violate to some extent. Simple adjustments to measurement protocol (e.g. choice of view cap, appropriate sampling scheme, etc.) can make the LAI-2200 a very effective tool in a wide range of natural and agronomic settings. The LAI-2200 also computes a clumping factor (Ryu et al, 2010), which indicates how much the canopy appears to depart from random.



Data can be read live in the field and later processed using the exclusive FV2200 software. FV2200 provides powerful data processing options, including 3 additional inversion methods, ring masking, and tools to compute canopy volume.



- USB data transfer - drag-and-drop data files to your computer
- Optimized for sensitivity to blue radiation, which is reflected and transmitted minimally by living vegetation
- Measures up to a 360° azimuthal view providing a large sample area for good spatial averaging

References:

Lang, A. R. G. 1987. Simplified estimate of leaf area index from transmittance of the sun's beam. Aric. & For. Meteor. 41: 179-186.

Miller, J. B. 1967. A formula for average foliage density. Aust. J. Bot. 15: 141-144.

Norman, J. M. and G. S. Campbell. 1989. Canopy structure. In: Plant Physiological Ecology: Field methods and instrumentation. (Eds. R. W. Pearcy, J. Ehlringer, H. A. Mooney, and P. W. Rundel). Chapman and Hall, London and New York, pp. 301-325.

Ryu, Y., Nilson, T., Kobayashi, H., Sonnentag, O., Law, B.E., & Baldocchi, D.D. (2010). On the correct estimation of effective leaf area index: Does it reveal information on clumping effects? Agricultural and Forest Meteorology, 150, 463-472.

Learn more about the LAI-2200 at www.licor.com/lai

Ordering Information

LAI-2200 Plant Canopy Analyzer:
Includes one LAI-2250 Optical Sensor with interface cable, LAI-2270 Control Unit, carrying case, RS-232 cable, USB cable, view-restrictors, 6 "AA" batteries, belt clip, and FV2200 software (Windows®, Macintosh®, Linux®).

LAI-2270 Control Unit:
For use with the LAI-2250 Optical Sensor(s). Includes carrying case, RS-232 cable, USB cable, 4 "AA" batteries, belt clip, and FV2200 software (Windows®, Macintosh®, Linux®).

LAI-2250 Optical Sensor:
For use with the LAI-2270 Control Unit. Includes interface cable, view restrictors, and 2 "AA" batteries.

LAI-2200TC Plant Canopy Analyzer-Tall Canopy Package:
Two LAI-2250 Optical Sensors with two interface cables, one LAI-2270 Control Unit, carrying case, RS-232 cable, USB cable, view-restrictors, 8 "AA" batteries, belt clip, and FV2200 software (Windows®, Macintosh®, Linux®). Recommended for forests or other tall canopies.

Specifications

LAI-2200 General

Operating Temperature Range: -20 to 50 °C.

Humidity Range: 0 – 95% RH, non-condensing conditions.

LAI-2270 Control Unit

Sensor Inputs: 2 connectors for optical sensor interface cables. 2 connectors for LI-COR Radiation Sensors (quantum, pyranometer, or photometric).

Memory: 128 MB for data storage (over 1.5 million readings).

Keypad: 22 button tactile response keypad. 10 alphanumeric keys, 9 function/control keys.

Display: 128 × 64 graphics LCD display.

Communications: USB (as mass storage device); RS-232.

Clock: Year, Month, Day, Hour, Minute, Second. Accuracy of ±3 min/month.

Power Requirements: 4 "AA" batteries (alkaline, NiMH, or lithium).

Battery Life: 140 hours with 4 "AA" alkaline batteries, no optical sensor attached. 80 hours with 4 "AA" alkaline batteries, with one optical sensor attached.

Size: 20.9 x 9.8 x 3.5 cm (8.2" x 3.9" x 1.4").

Weight: 0.454 kg (1.0 lb) with batteries.

LAI-2250 Optical Sensor

Inputs: 1 bulkhead connector for console interface.

Memory: 1 MB for data storage (up to 25,000 records).

Keypad: 2 button tactile response keypad.

Indicators: 3 sunlight readable LEDs.

Clock: Year, Month, Day, Hour, Minute, Second. Accuracy of ±3 min/month.

Power Requirements: 2 "AA" batteries (alkaline, NiMH, lithium).

Battery Life: 180 hours with 2 alkaline batteries.

Wavelength Range: 320-490 nm.

Radiation Rejection: >99% from 490-650 nm; >99.9% above 650 nm.

Nominal Angular Coverage: Ring 1: 0.0-12.3°; Ring 2: 16.7-28.6°; Ring 3: 32.4-43.4°; Ring 4: 47.3-58.1°; Ring 5: 62.3-74.1°.

Lens Coating: MgF_2 for improved transmission at oblique angles (external and internal lenses).

View Caps: Provide azimuthal masking of view into quadrants of 0°, 10°, 45°, 90°, 180°, and 270°.

Size: 63.8 L x 2.9 W x 2.9 D cm (25.1" x 1.125" x 1.125") (Endcap: 4.4 W x 5.1 D cm; 1.75" x 2.0").

Weight: 0.845 kg (1.86 lbs) with batteries.

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The LI-COR board of directors would like to take this opportunity to return thanks to God for His merciful providence in allowing LI-COR to develop and commercialize products, through the collective effort of dedicated employees, that enable the examination of the wonders of His works.

"Trust in the LORD with all your heart and do not lean on your own understanding. In all your ways acknowledge Him, and He will make your paths straight."
—Proverbs 3:5,6

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