

# Documentation of Ruokolahti Campaign Finland, June 2000

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## **Summary:**

The objectives of this campaign were to:

1. Obtain LAI/FPAR in Ruokolahti needle leaf forest and validate the MODIS LAI/FPAR algorithm.
2. Describe the spatial variability of LAI/FPAR for the sites.
3. Investigate the scale effect on LAI/FPAR measurement and retrieval.

The campaign lasted from June 14 to June 21, 2000, in Ruokolahti forest, Finland, which is a typical needle leaf forest. During this one week period, the following canopy parameters were measured: LAI, FPAR, canopy reflectance, canopy transmittance and soil reflectance. LAI values were measured with two LAI-2000 canopy analyzers, FPAR values were measured with an ACCUPAR ceptometer, canopy reflectance, transmittance and soil reflectance values were measured with an ASD spectrometer and an LI-1800 spectrometer. All these instruments can be connected to computers to save the data as ASCII files.

## **Investigators**

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## **Title of Investigation**

Collection of LAI and FPAR Data Over Ruokolahti needle leaf forest

## Sampling strategy

A 1km\*1km site was chosen as our sampling site. From the CCD image taken from aircraft, we classified the canopy in this site into 3 different classes: open area, regular forest and dense forest. Three plots were measured, one at each corresponding to these 3 classes: PY for open area, PW for regular forest and PX for dense forest. In each plot, we laid out a grid with 25m resolution. The whole 1km site was also laid out in a grid by at 50 m resolution. Following table gives the necessary information about these plots.

	Whole site	PX	PY	PW
Size(m <sup>2</sup> )	1km*1km	100*150	100*150	200*200
Resolution (m)	50	25	25	25
Biome class	N/A	Dense forest	Open area	Regular forest
UTM position (Zone 35)	(590965E,6822776N)	(591152E,6822371N) (591285E, 6822306N)	(591052E, 6822815N) (591123E, 6822651N)	(590604E, 6822524N) (590789E, 6822305N)

## Data Acquisition Methods

### *Leaf Area Index:*

The LAI-2000 plant canopy analyzer is composed of a LAI-2070 control unit and a LAI-2050 sensor head. The control unit has connectors for two sensor heads, two connectors for other LI-COR sensors, and a connector for RS-232 communication. The sensor head projects the image of its nearly hemispheric view onto five detectors arranged in concentric rings (approximately 0-13, 16-28, 32-43, 47-58, 61-74 degrees). Radiation above 490 nm is rejected.

Two LAI-2000 were used to measure LAI values, one sensor was set to remote above mode and put in an open area to measure the incident radiation every 15 seconds. The other one was used inside the forest to measure the transmittance of each grid point. The two sensors had been calibrated following the method described in the menu. The measurements were taken during dusk, shortly before and after sunset or overcast day. We always use a 270 degree mask to eliminate the effect of operator's shadow.

### *FPAR:*

An ACCUPAR ceptometer was used to measure FPAR. This instrument measures the radiation between 400 and 700 nm wavelength. Only one ACCUPAR was used in our measurement. For each grid point, we measured the incidence above canopy first, then the transmittance and reflectance of the canopy. FPAR can be calculated from these measurements.

Due to the difficulty of getting incidence and canopy transmittance/reflectance simultaneously, we only measured the FPAR over open area.

*Canopy Transmittance and Reflectance:*

Two instruments were used to measure canopy transmittance and reflectance: an ASD spectrometer and an LI-1800 spectrometer. They both measure the spectrum in the visible and near infrared bands. The ASD measures the spectrum from 350 to 1085 nm, and the LI-1800 measures spectrum from 400 to 1100 nm. These two instruments were calibrated by measuring the incidence simultaneously.

For transmittance measurements, we used a cosine receptor over the sensor to measure the hemispheric incidence. The LI-1800 was put in an open area to measure the incident radiation. The ASD was used to measure the transmitted radiation inside the forest at each grid point.

For reflectance measurements, we used a helicopter to fly over the canopy, the ASD was mounted under the helicopter and faced nadir. At the same time, the LI-1800 was put in an open area, measuring incident hemispheric radiation every 2 minutes. The field of view used for the ASD is 25 degree, so the resulting reflectance is HDRF.

*Soil reflectance:*

Soil reflectance was measured by the ASD, using a 10 degree field view tube. For each grid point, we first measure the reference panel, then face the sensor to nadir. Reflectance can be directly read from the ASD output.

**Data acquired for each plot**

<i>measurement</i>	<i>Whole site</i>	<i>PX</i>	<i>PY</i>	<i>PW</i>
LAI	+	+	+	+
FPAR	-	-	+	-
transmittance	-	+	-	-
reflectance	+	+	+	+
Soil reflectance	-	-	+	-