Measurements and applications of forest physical properties using canopy crane

Mitsunori YOSHIMURA[1]*, Megumi YAMASHITA[2], Tomoaki ICHIE[3]

[1] Research Institute for Humanity and Nature
[2] Survey College of KINKI
[3] Kochi University

As the most basic knowledge of remote sensing, spectral radiances that are reflected from the surface and received by the sensor have many factors. One of the most important factors is the reflectance properties of the surface such as spatial, spectral and biophysical conditions. Here, we measured three dimensional canopy surface structures under the use of the tropical canopy crane system with 80m height and 75m arm length as our measurement platform. As its results, canopy DSM was generated from the obtained three-dimensional data. The forest floor DEM also was generated by ground survey.

The leaf component of canopy is quantified by its structural attribute Leaf Area Index. LAI (Leaf Area Index) is how many leaves area is projected and accumulated on the unit of ground area. This important parameter regulates a number of ecological processes. Plant canopy analyzer (LAI-2000, Li-Cor) introduces LAI and other attributes from radiation measurements made with a "fish-eye" optical sensor. Measurements made above and below canopy are used to determine canopy light interaction at 5 angles, from which LAI is calculated based on the radiation transfer model in vegetation canopies. Two canopy analyzers were used, one was positioned on the top of canopy access crane in order to collect reference overhead sky readings, and the other was used to gather canopy surface or forest layer readings.

Actually LAIs were measured at various points in vertical and spatial dimension. By combining the results of its measurement, the forest light environment can be considered. Actual is the forest light environment is decided by the vegetation colony structure and vertical radiation distribution. The vertical colony structure can be calculated by canopy DSM and forest floor DEM. The vertical radiation distribution is known as the result of absorbing, defusing, transmitting and intercepting radiation and also defined by Lambert-Beer row. It can be introduced by LAI measurement. In here, the total amount of leaves was estimated by the average leaf area density and total amount of canopy. The average leaf area density is provided as one of the functions of plant canopy analyzer. The total canopy volume is also estimated by GIS software. However this estimation is not only the result of calculation but also provide important information for ecological field.