STATISTICAL ANALYSIS OF COMPUTED TOMOGRAPHY SCAN DATA IN PLANT CANOPY STUDIES

P. Dutilleul

Department of Plant Science, McGill University, Macdonald Campus, Ste-Anne-de-Bellevue, Canada

Email: *pierre.dutilleul@mcgill.ca*

This paper is about a new type of data and a new type of statistical method to be used in plant canopy studies. The "new data" are X-ray computed tomography (CT) scan data collected on plant canopies, and the "new statistical method" is fractal analysis performed from skeletonized three-dimensional images constructed from the CT scan data collected, the objective being to quantify the complexity of plant canopy architecture. X-ray CT scanning is a technology originally designed for medical applications, essentially diagnostics. I will discuss the specific aspects of CT scan data (also called "CT numbers") for plant canopies, and will explain why they represent indirect measures of density of the different parts of a plant canopy. I will show (1) how the fractal dimension estimated with the cube-counting procedure can change, depending on whether the constructed three-dimensional image of a leafless plant structure is skeletonized or not, and (2) that the outcome of the fractal dimension estimation procedure depends on the definition of the range, number, and values of cube side lengths. Results of an experiment with temporal repeated measurements will be presented, including original, raw and skeletonized three-dimensional images and fractal dimension estimates on which time effects were tested; the experimental plant species is pyramidal cedar (*Thuja occidentalis*, Fastigiata). Such results help improve our understanding of the photosynthesis process at the whole-plant scale.