Forest Structure Mapping and WorldView-2

Remote sensing techniques are cost- and time-effective and are non-destructive methods compared to conventional forest inventory methods which involve extensive fieldwork. Different types of optical satellite imagery with different spatial and spectral resolution have been examined for estimating biophysical parameters of natural forests and plantations over the past decades. Some of these data, such as SPOT-5, IKONOS and Quickbird, were useful for local and precise forest inventory due to their high spatial resolution, while such data as MODIS and ASTER were adequate for global inventory due to their high spectral resolution and wide swath.

Research over more than 30 years has proved that the most useful wavelengths for forest structure mapping are in the visible and near-infrared bands in which the vegetation reveals spectral responses to different parameters which can be related to growth and health. Consequently, an increase in the number of bands within this range should be beneficial. On the other hand, higher spatial resolution usually limits the ability to also acquire the data at higher spectral resolution. Launched in October 2009, WorldView-2 can be considered as the first spaceborne instrument providing a reasonable spectral resolution, 8 spectral bands in visible and near-infrared wavelengths, and simultaneously capturing data in a high spatial resolution which is 2 metres. This sensor provides four traditional remote sensing bands including blue (448-508nm), green (511-581nm), red (629-689nm) and near-infrared 1, NIR1 (772-890nm) bands. In addition, it acquires data in four new bands including coastal blue (401-453nm), yellow (589-627nm), red edge (704-744nm) and near-infrared 2, NIR2 (862-954nm). Consequently, this satellite gives users and researchers the opportunity to produce a wide range of useful spectral and textural information due to its high spectral and spatial resolutions.

Our experience with a pine plantation has shown that coastal blue band, which is known to be an insensitive wavelength to vegetation changes, is useful as a normalising factor in band ratios for reducing the effect of atmosphere and background on vegetation-sensitive bands such as green or yellow. Yellow and red edge bands, which are individually sensitive to the structural parameters of forests, can be used to develop some new vegetation indices which are more useful for estimating biophysical parameters compared to the traditional indices. NIR2 also shows better performance when it is used in vegetation indices such as NDVI compared to NIR1. Being high resolution also causes textural information to be more efficient than spectral information for estimating biophysical parameters. Moreover, using the extracted attributes of all 8 bands can improve the capability of the four traditional bands for forest structure mapping, especially for mean height, mean DBH and stocking due to the high spatial resolution of the data. However, the estimation of stand volume and basal area remains questionable due to interference of shadows and background effects that occur in all high-resolution images. Perhaps this issue can be overcome by fusing these data with Lidar data which gives vertically shadow-free information.