Application of new tree species counting method using high- resolution satellite data in an old-growth *Chamaecyparis obtusa* forest in central Japan

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Abstract

The goal of this study was to verify the accuracy of identifying the number of trees of each dominant species in an old-growth *Chamaecyparis obtusa* forest, using four commercial satellites: IKONOS, QuickBird, Geoeye-1, and WorldView-2, which yield high-resolution data with spatial resolutions of 1 m or less.

We developed a method of counting the number of coniferous trees by species within forest compartments by combining an individual tree crown delineation technique with a treetop detection technique, using high spatial resolution optical sensor data as follows:
1) The study site was located in an old-growth *Chamaecyparis obtusa* forest, which is more than 300 years old, in Akasawa Forest Reserve, central Japan. The forest is the most beautiful and representative *C. obtusa* forest in Japan. Its timber is also expensive, because it is used for building temples and Shinto shrines. Our field investigation was conducted from 2009 to 2011. Detailed stand information was available for four 1-ha (100m x 100m) stands with varied topographic and stand conditions. All trees ≥6 cm in diameter at breast height (DBH) were measured in the stands. The survey noted species, DBH, height (H), tree position, and strata (upper, intermediate, or understory layer).
2) A new method of counting the number of coniferous trees by species developed by combining an individual tree crown delineation technique with a treetop detection technique, was applied within the four stands.
3) The data derived from these techniques were registered in a forest database.

4) Detailed one-on-one comparisons with field stand maps and tree top maps derived from the new method were conducted.

The accuracy of the number of dominant trees classified by species ranged from 81.5% to 94.5% within varied topographic and growth conditions. As a further application, we extended our method to include the total Akasawa Reserve Forest of about 1,000 ha and extracted 345,661 dominant *C. obtusa* trees.

Practical forest management can be enhanced by registering the output of this technology in a forest geographical information system database. This approach is mostly useful for conifer plantations containing medium- to old-age trees, to all over the world as high resolution data archive are done, link to LiDAR and UAV data as further research.

Reference

Katoh, M., Gougeon, F., 2012, Improving the Precision of Tree Counting by Combining Tree Detection with Crown Delineation and Classification on Homogeneity Guided Smoothed High Resolution (50 cm) Multispectral Airborne Digital Data, Journal of Remote Sensing, (4) 1411-1424