

COMPARISON OF AVIRIS AND AISA FOR CHEMISTRY MAPPING

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ABSTRACT

Hyperspectral sensing can provide valuable information on forest species and forest health. Airborne hyperspectral sensing of forest chemistry, such as chlorophyll and nitrogen, is one such means of providing estimates of forest health [1]. Foliar pigments are directly involved with the photosynthetic process and therefore, intimately tied to vegetation vigor. The following study is focused on the comparison of forest chemistry products derived from separate hyperspectral data sources.

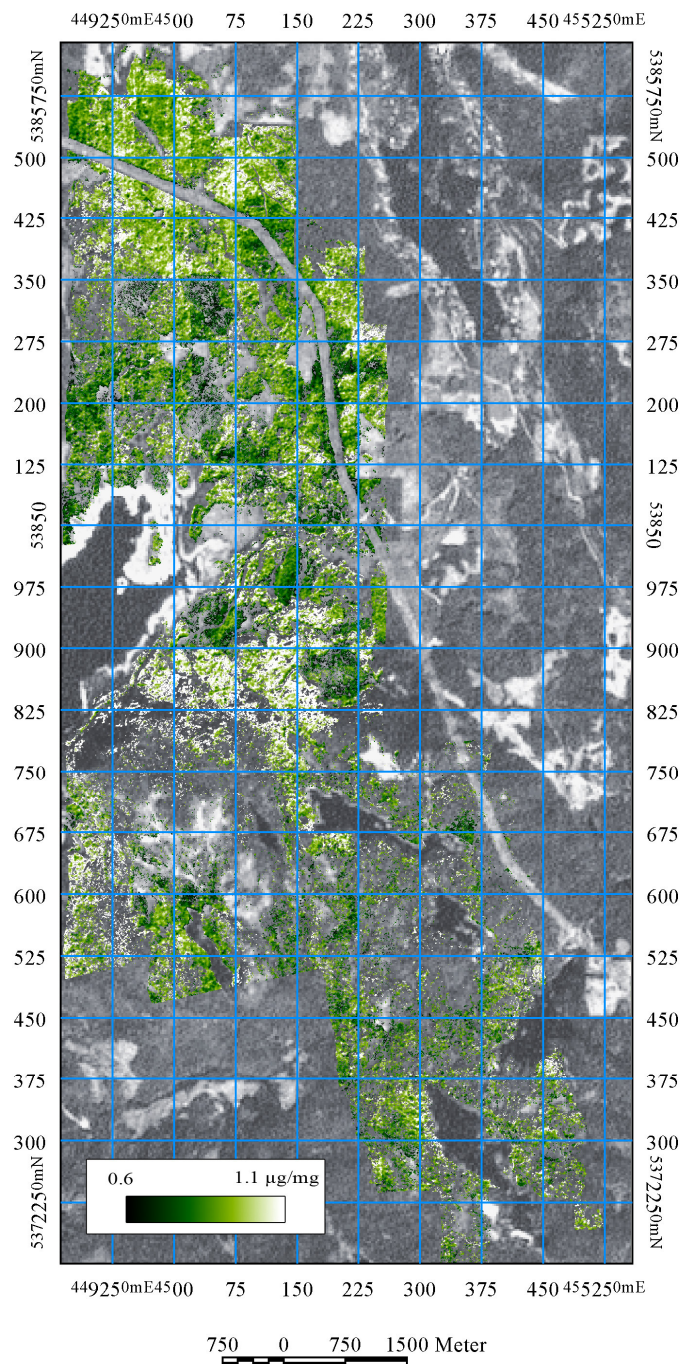
On July 25, 2006, AISA hyperspectral data were acquired over the Greater Victoria Watershed District (GVWD) test site. The 492 spectral bands of the University of Victoria's AISA sensor were geometrically corrected to 2m pixels with the aid of airborne navigation files and a digital surface model (DSM) derived from LIDAR data. In the summer of 2002 a NASA AVIRIS dataset was acquired at a 4m spatial resolution.

AISA with its higher spectral and spatial resolution offers the potential to separate ground cover (salal) from the forest overstory and to provide separate measurements of chemistry for both layers. Salal (*Gaultheria shallon*), a broad-leafed bush, is the dominant understory in the wetter portions of our GVWD test site. Salal can have high reflectance of 80% at 800 nm. In the drier portions of the site, the understory is dark soil and litter. To accurately map forest chemistry, it is important to identify the understory and stratify the forests by understory type. This was done to create separate relationships for mapping chemistry by sensor and by forest units.

The GVWD test site has extensively sampled and well established ground data plots. These plots were used to calibrate the chemical relationships with reflectance. For the AISA and AVIRIS comparisons, spectral relationships were established between the AISA (adjusted to AVIRIS spectral and spatial resolution) and AVIRIS sensors from selected temporally invariant calibration targets. This between-sensor calibration placed the AISA data on the same calibration basis as the AVIRIS data. The calibrated reflectance data were used to generate forest species classifications, endmember fractions, and chemistry estimates for the test site. Average classification accuracies exceeded 89% in mapping major forest species [2].

The predicted chlorophyll from AVIRIS agreed with the foliar sampled values ($r^2=0.98$). For nitrogen, there was good agreement between the predicted values and reference samples (AISA: $r^2=0.97$). These products were used to create maps of chemistry for the forested portion of the GVWD test site (figure 1). While the reference plot chemistry suggested that AISA chemistry prediction performed well, it was evident that there was a significant bidirectional reflectance effect within the AISA forest chemistry products; this effect was absent in that derived from AVIRIS data.

AISA Estimated Total Chlorophyll The Greater Victoria Watershed District



REFERENCES

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