

VARIANCE IN IMAGES OF WOODLANDS - A PROBLEM AND OPPORTUNITY

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Remotely sensed images of woodlands have natural pixel to pixel variance caused by variations in the local area imaged by each pixel - even within areas of consistent overall definition in terms of percent cover. It is shown how an analysis of this variance using the methods of Geostatistics and Mathematical Morphology leads to difficulties for traditional computer based mapping of woodlands as well as providing an opportunity for the extraction of significant structural parameters of forests and woodlands.

Remotely sensed and scanned image data consist of radiance integrated over various wavebands and over a spatial field of view - or pixel - with appropriate geometric sampling. The radiance of the pixels are determined by the tone and texture both of objects and surface covers which are smaller than the pixel and those which form consistent supra-pixel patches or regions. The supra-pixel patches such as 'Woodland' or 'Open Forest' are often the objective of image based mapping.

Pixel radiance is essentially a function of cover and as such can be used to categorize vegetation into cover classes as long as the pixel to pixel variance caused by crown cover variation is not too great. However, it is important not to integrate out this variance too much as it has been shown by Strahler and Li to be sufficient to provide significant information about crown size and spacing. The radiance of an individual pixel is totally insensitive to such information.

Work is in progress by the authors in which the methods of Geostatistics and Mathematical Morphology are being used in conjunction with forest and woodland models to relate image covariance statistics to model parameters. One aspect of this work is the computation of local variance.

It is shown how simple woodland models lead to the conclusions that:

- (i) Even with integration over a Landsat pixel (80 metres) there is enough variance in woodlands to create severe 'spotting' in classified images;

- (ii) For field verification an area of at least 100 metres diameter is needed to stably estimate local cover;
- (iii) That per pixel classification - even of cover - is untenable at the kind of pixel level found in the Thematic Mapper instrument (30 metre pixel); and
- (iv) That for such instruments there exist neighbourhoods of each pixel over which integrated measurements such as cover must be estimated and within which structural parameters of size and density may be derived using local image covariance.