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STATE OF THE ART OF LANDSAT CLASSIFICATION ACCURACY ASSESSMENT

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Methods of assessing Landsat classification accuracy are necessary in order for any classification to be evaluated and improved. Continuous improvement of the ways to assess accuracy is an important key to the further use of Landsat data. Improved methods of accuracy determination and analysis will assist investigators in developing applications of Landsat imagery. The most common means of expressing accuracy is a percentage based on the number of correctly classified pixels divided by the total number tallied from ground truth. This assessment is usually done as an afterthought without much regard for statistical correctness. As a result, there are no standardized methods or standardized terminology for accuracy determination. Problems also arise in failure to differentiate between site specific and non-site specific accuracy. However, other more powerful means of determination and analysis have been tried and better methods are now being developed.

FOREST STAND DELINEATION FROM UNSUPERVISED CLASSIFICATION OF OPTIMAL LANDSAT SPECTRAL, LANDSAT TEXTURE AND TOPOGRAPHIC CHANNELS

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Landsat data, in conjunction with collateral data sources such as synthesized texture channels and digital terrain models, can be used to delineate forest stands and other ecological land units found in the coniferous North American forest environment. Incorporation of texture and terrain channels enhances site-specific stratification of Landsat data, promoting delineation of forest stand units of a size and homogeneity approaching those found on manually prepared maps used in the management of timber, range, wildlife, watershed and recreational resources.

The procedure is a joint research effort between the Jet Propulsion Laboratory of the California Institute of Technology and the University of California at Santa Barbara. The classification approach includes 1) compressing Landsat spectral data into one or two new channels of data using ratio and principle components techniques; 2) generating two texture measures where one channel emphasizes tonal contrast derived from statistical texture techniques and the other emphasizes spatial extent and shape using image segmentation procedures; 3) processing National Cartographic Information Center - U.S. Geological Survey Digital Terrain information into elevation, slope and aspect channels; 4) reducing the number of synthesized channels by using divergence analysis to identify channels not contributing significantly to the separation of preliminary training classes; 5) introducing spatial constraints by including line and sample coordinates into the unsupervised classification algorithm; and 6) properly weighting selected spectral, texture and terrain channels such that no single data set overpowers the others in unsupervised classification.

The combination of spectral tone, tonal texture, spatial texture, topographic data and line and sample location coordinates, is likely to be sufficient for the stand delineation task because each contributes a separate, independent piece of information towards the stand delineation problem. Spectral tone is most important for recognizing the existence of a feature and combines with the topographic data to provide species information. Tonal texture measures the neighborhood contrast of spectral tones providing an indication of relative timber volume. Spatial texture stratifies tone to quantify the spatial extent and shape of tonal patterns. The topographic information provides a powerful independent parameter well known to improve forest classification accuracies because of its ecological predictive effect. Inclusion of line and sample coordinates introduces a strong spatial constraint designed to permit analyst regulation over the automatic merging of distant and unrelated, but similar appearing features.

Target area for generation of maps delineating forest stands and related ecological land units is the 220 square kilometer Doggett Creek watershed located in the Klamath National Forest of northern California. The mountainous topography ranges from 500 to 2100 meters in elevation, and bears a variety of important coniferous timber types including douglas fir, ponderosa pine, white and red fir, and several miscellaneous hardwoods such as black oak and madrone.

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