AN ABSTRACT OF THE THESIS OF

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Title: Hierarchical Analysis of Spatial Pattern and Processes of Douglas-fir Forests.

Abstract approved: _____

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There has been an increased interest in the quantification of pattern in ecological systems over the past years. This interest is motivated by the desire to construct valid models which extend across many scales. Spatial methods must quantify pattern, discriminate types of pattern, and relate hierarchical phenomena across scales. Wavelet analysis is introduced as a method to identify spatial structure in ecological transect data. The main advantage of the wavelet transform over other methods is its ability to preserve and display hierarchical information while allowing for pattern decomposition.

Two applications of wavelet analysis are illustrated, as a means to: 1) quantify known spatial patterns in Douglas-fir forests at several scales, and 2) construct spatially-explicit

hypotheses regarding pattern generating mechanisms. Application of the wavelet variance, derived from the wavelet transform, is developed for forest ecosystem analysis to obtain additional insight into spatially-explicit data. Specifically, the resolution capabilities of the wavelet variance are compared to the semi-variogram and Fourier power spectra for the description of spatial data using a set of one-dimensional stationary and non-stationary processes. The wavelet cross-covariance function is derived from the wavelet transform and introduced as an alternative method for the analysis of multivariate spatial data of understory vegetation and canopy in Douglas-fir forests of the western Cascades of Oregon.