# ABSTRACT

The detection of hierarchically nested structure in a semi-arid savanna as predicted by complex systems theory requires a method that detects context specific multi-scaled pattern in a proxy that represents the net effect of system processes. Statistical assumptions preclude the use of many traditional methods in the detection of hierarchical structure in heterogeneous landscapes so to circumvent statistical barriers to inference I developed a linear scale-space based application to represent multi-scaled woody vegetation structure in a spatially explicit manner. Analysis of a scale-space representation of woody cover across multiple scales explicitly recognizes landscape context and emergent pattern due to the causality principle inherent linear scale-space generation. As a proxy for process in scale and space I utilize the merge events of woody canopy cover, which should theoretically be considered the point at which processes shift domain.

Scale-space representations were analyzed using a spatially explicit discontinuity analysis that compares the distribution of structure across the dimension of scale to that of a neutral model specific to the landscape in question. The application was tested for rigor and ability to detect multi-scaled, context dependent pattern in test datasets. The effects of fire and herbivory on the multi-scaled structure of a semi-arid savanna landscape were compared using the merge events from scale-spaces generated from a 33 year herbivore browser exclosure.

No more hierarchical structure is present in real world savannas than can be expected from random. Hypotheses put forward to explain the results include: procedural and philosophical bias, errors in the application, or that the landscapes are not hierarchically nested. Each hypothesis is discussed in the light of the evidence and after synthesis I discuss that savanna landscapes may have more randomness within the pattern and process than previously acknowledged.