TITLE: Self-organization of landscape patterning

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ABSTRACT: Self-organization is a process of evolution where complex structures emerge from a random disordered initial state through repeated application of simple rules. By altering the rules and comparing the resulting patterns with those observed in nature, it is possible to test hypotheses about environmentally driven evolution in natural processes such as landscape pattern formation.

In this paper, a stochastic, two-dimensional cellular automaton with periodic boundary conditions was applied to a landscape pattern from southern Wisconsin prior to Euro-American settlement, consisting of general topological features such as prairies, savannas, open forests, and closed forests. The cellular automaton evolves using one simple rule: At each time step, the content of each cell is replaced by one chosen randomly from some neighborhood of radius r. This single-parameter model gives realistic time-varying landscapes for values near r = 5 km.

The increase in organization can be measured by the statistical distribution of cluster sizes and the fractal dimension of the patterns. These topological properties are found to be independent of initial conditions and compare well with the same quantities calculated for the natural landscape. The results suggest that the simple rule suffices to explain major statistical and spatial characteristics of the observed landscape.

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AUDIO VISUAL NEEDS: Beamer for a PowerPoint presentation.