Forests and prairies exist side-by-side with sharp transitions between the two. On a global scale, climate best explains these transitions. But on a local scale, what environmental factor determines whether a landscape becomes a forest or a prairie?

We hypothesized that prairies and forests are likely two alternative stable states maintained by fire regimes, which are ultimately controlled by climate and soil moisture.

What makes a prairie or a forest?

- Forest and prairie ecosystems historically exist side-by-side with sharp transitions between the two.
- On a global scale, climate best explains these transitions. But on a local scale, what environmental factor determines whether a landscape becomes a forest or a prairie?

Conclusions

- Climate and soil water holding capacity are not enough to tip an ecosystem into a prairie.
- Whether a landscape becomes a prairie or a forest depends on both fire return interval and soil water holding capacity.
- Fire may create a feedback loop:
  - Fire kills competitive trees, helping grass. Fire may create a feedback loop:
  - Grasses serve as a fuel and spread fire. This feedback loop could drive the sharp prairie-forest transition.

Methodology

- We used the ED2 ecosystem model to understand influences on the prairie-forest boundary.
- We tested twelve different climate, soil, and fire scenarios (Figure 1).
- We allowed each ecosystem to self-assemble for 500 years in a simplified grass-oak system.
- We used fractional tree cover to classify the results as prairie, forest, or savanna ecosystems (Figure 2).

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