SOLS SNIPPETS—SUSTAINABILITY

How do humans impact plant communities?

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With the human population of the earth already greater than 6 billion, it is evident that ecological theory needs to incorporate human actions. This is especially true with regard to natural plant communities - if we are going to sustain these areas in the future. My research centers on how plant resources and plant communities are impacted by disturbances (e.g. fire and grazing in grasslands).

Grasslands and savannas constitute over 40% of the global landscape. Their sensitivity to changes in land management and climate can have dramatic ecological and social consequences. Temperate grasslands are important from both agronomic and ecological perspectives. Grasslands sequester and retain large amounts of soil carbon and, thus, they are an important component of the global carbon cycle. In addition, grassland ecosystems of the U.S. Great Plains produce much of the nation's grain, meat, and fiber. Key to the successful management of such ecosystems is the understanding of the mechanisms that drive reductions in the extent and quality of grasslands, and forecasting the sustainability of the remaining tracts of these ecosystems as land use and global change threats intensify.

My research has shown one immediate threat to these grasslands is the expansion of native woody species. The cover and abundance of woody species in grasslands and savannas are increasing worldwide, and the purported drivers of the increase in woody plant abundance are numerous, including changes in climate, CO_2 concentration, nitrogen deposition, and grazing, fire and disturbance regimes. All of these drivers are related to human activity, therefore it is critical that human actions are incorporated into ecological theory.

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When is an emerging infectious disease a force in extinction?

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Extinction is inevitable—more than 99.9% of Earth's species are extinct – but determining the cause is difficult. Modern amphibians appear to be the exception. There is increasing evidence that we are in the midst of a singular opportunity to study the biology of extinction across a vertebrate class. According to the first global assessment of amphibians, almost half of all populations are declining and nearly 10% of species are close to extinction or presumed extinct.

Paleontologists suggest various causes for mass extinctions, but rarely is disease considered. Late in the 20th century, as herpetologists reported amphibians missing within protected parks and reserves, they suggested these "enigmatic" losses were a result of emerging infectious diseases (EIDs). Our research program focuses on the question: When is emerging infectious disease a force in extinction? and tests the hypothesis that a chytrid fungus is the cause of amphibian declines and perhaps, extinctions. We also study an alternative model system – ranaviruses that infect frogs and salamanders – in which populations experience epidemics, but species do not become extinct.

As research yields the capacity to predict where the next declines and extinctions might occur, it raises a series of ethical and policy questions: Should species be removed before an infection emerges? If so, where should they be housed and for how long? Who makes such a decision? What policies should be changed in response to what appears to be a global amphibian pathogen? Our lab group analyzes how the research and conservation communities are answering these questions, especially in light of an emerging research area called ecological ethics. The lab's research informs a variety of issues related to sustainability.

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