

Changing Grasslands

Interactions between native and non-native vegetation

By Susan McGinley

Drought disrupts the balance of a mature landscape. Vegetation with more aggressive characteristics often fills in bare spots as native plants die, and remains even when regular moisture returns. After the droughts in the early 1900s, before exotic grasses were seeded deliberately in southeastern Arizona (see below), native mesquite trees began to invade rangelands. Their deep root systems could draw water from a greater depth in the soil than the grass roots were able to reach.

This shift caused many grasslands to convert to woodlands unsuitable for grazing. The dynamics of the grasslands changed, requiring different management strategies.

Dave Williams is conducting basic research to learn more about what goes on underground in these rangelands.

As a rangeland ecologist in the School of Renewable Natural Resources, he's interested in how native and introduced plant species react, given changes in climate and rising atmospheric levels of carbon dioxide.

"We're looking at the interaction between the grasses and mesquite plants by studying their physiology and their ability to use resources such as water and nitrogen from the soil," Williams says. "We want to understand the ways they interact below the ground that would affect their success in the system." This research takes into account seasonal patterns of precipitation that affect the availability of water and nutrients in soil.

Out on the Santa Rita Range in southern Arizona, Williams and his research team staked out a series of plots three years ago. He is working



D Williams

Dan Koepke, undergraduate student assistant, collects soil samples for analysis

History

Sixty years ago Lehmann lovegrass looked like a good idea. One of the so-called "miracle grasses" prized for its aggressive growth habit, it was widely seeded across rangeland in southeastern Arizona from the 40s through the 70s to help add more nutritive forage for cattle. Repeated droughts and overgrazing had killed off native grasses, so ecologists introduced several exotic grass species from Asia and Africa to help stabilize depleted rangelands. Of these, the South African Lehmann lovegrass proved the most successful.

Yet by the 1970s it had become a problem. Advancing far beyond its area of artificial seeding, Lehmann lovegrass started to encroach on intact, high quality native grassland. It began to displace native species such as sideoats grama, three-awns, and cane beardgrass, and remains a problem today.

During the last 20 years the conservation movement has advocated a more sustained, natural grass production, and the introduction of alien grasses to control erosion has ceased. Scientists in the UA School of Renewable Resources are studying the ways non-native grasses interact with different types of native vegetation to find out what makes them successful and how they alter the natural systems. They hope their findings will help rangeland managers, policy makers, ecologists and members of conservation organizations who deal with alien grass species make informed decisions about how and when to limit their expansion and impact.



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Lehmann Lovegrass (*Eragrostis Lehmanniana* Nees)

“Where Lehmann lovegrass is dominant, it potentially causes nitrogen to become immobilized in soil and less available to the other plants in the system.”

with graduate student Alessandra Fravolini, undergraduate Dan Koepke, and Vickie Gempko, a lab technician. They marked off sections in a large transect where Lehmann lovegrass had been seeded in the 40s, an area where this grass has recently invaded, plus an area where there wasn't much of it at all.

Since then, they have regularly monitored water stress levels and soil conditions under mesquite and Lehmann lovegrass, and under grasslands without Lehmann lovegrass.

The team determines carbon and nitrogen levels in the soil through soil tests they run back in the lab on campus. Walking along each plot, they regularly count the number and type of native herbs and grasses and Lehmann lovegrass in each.

Three years ago Williams began the study by looking at how Lehmann lovegrass affected the nitrogen fertility of soil. The team found that the ratio of soil carbon to soil nitrogen was higher on sites where Lehmann lovegrass was abundant.

“This ratio is an important predictor of nitrogen availability in the soil,” Williams says. “Where Lehmann lovegrass is dominant, it potentially causes nitrogen to become immobilized in soil and less available to the other plants in the system. That’s one way we’ve found that Lehmann lovegrass can change the system.”

The researchers are also checking various soil conditions that might influence patterns of rooting in native mesquite that would make the range more susceptible to Lehmann lovegrass invasions.

“Ranchers are very interested in controlling mesquite on their rangeland,” Williams explains. “Eventually

this research could influence management decisions about when to graze and when not to graze.” Timing is crucial, since grazing of Lehmann lovegrass during certain climate conditions could actually promote the mesquite expansion ranchers want to avoid.

Soil type makes a difference, too, Williams has found. He has studied the way grass and native mesquite interact on well-drained alluvial soils on bajadas in contrast to soils that have developed on pleistocene alluvium, which has a higher clay content. Mesquite is less prevalent on the clay soils, he says. The pattern of root system development in mesquite may be very different on these two soils, which has implications for competition between mesquite and introduced grasses for soil water and nutrients.

Since it’s not feasible or even desirable to eliminate mesquite completely, Williams notes that there are strategies to encourage native species to recover on a site. Seeding native grasses and herbs during the right time of the monsoon after mesquite removal may reduce the chances of having the area become dominated by Lehmann lovegrass. This research can set the stage for management decisions in the restoration of native ranges.

“People don’t really think about the consequences of nonnative species introductions and invasions,” Will-

iams says. “During the last two centuries humans have mixed up the flora and fauna of the different continents.” We do rely on non-native species for our crops, he adds. Yet anyone can order exotic flowers and grasses out of a catalog and plant them, so the effect can be haphazard. “State, federal and national agencies don’t coordinate any of this. As an example, we now have fountain grass—an exotic ornamental from North Africa—in Tucson, moving into the natural vegetation with unknown consequences for the future.”

And so it is with Lehmann lovegrass. “Lehmann lovegrass has both good and bad aspects to it,” Williams says. “People like it as a tool to improve their pastures, but the catch is that many non-native plants don’t stay where they’re put.” ❖

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Lehmann lovegrass on Santa Rita Experimental Range in southern Arizona.

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