Soil mapping may indicate success of brush control method

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COLLEGE STATION – Mapping the long-term reaction of woody plants to brush-control techniques can help landowners prioritize management practices to maximize the effectiveness of costly brush reduction, according to a Texas A&M AgriLife Research study.

Determining how soil texture impacts the resilience of a shrubland can help achieve the best use of funds for increasing the effectiveness and duration of brush removal, said Dr. Bill Rogers, AgriLife Research professor in College Station.

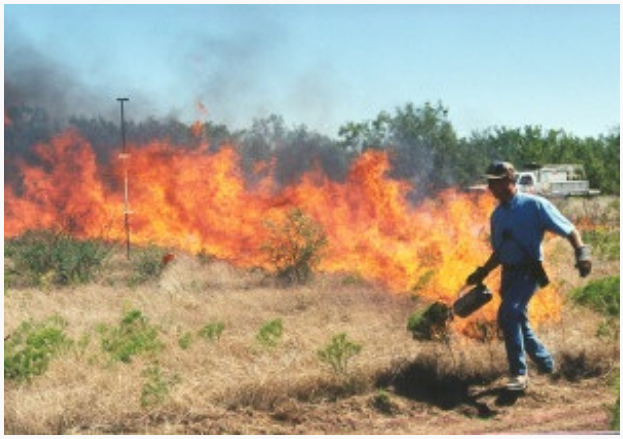
A Texas A&M AgriLife Research study looked at using traditional brush management techniques, but assessing their effectiveness across different soil types. (Texas A&M AgriLife Communications photos by Kay Ledbetter)

“Shrubland resilience varies across soil types: implications for operationalizing resilience in ecological restoration,” is the title of the study published in the journal Ecological Applications.

The paper is authored by Dr. Carissa Wonkka and Dr. Dirac Twidwell, both former graduate students of Rogers now at the University of Nebraska-Lincoln, and Dr. Jason West and Rogers, both in the Texas A&M University department of ecosystem science and management.

Rogers said scientists and land managers have been trying to use scientific principles for brush control, “but it’s all been kind of arm-wavy with terms such as thresholds, transitions and alternative steady states being discussed but with limited success applying them to real-world problems.”

The difficult reality is land managers need to be able to identify when a threshold, which is the transition between two different vegetative states, is about to be crossed and also figure out how to intervene using various management efforts to return the ecosystem to the more desired state, he said.



Fire was one of the methods of brush control examined in the study. (Texas A&M AgriLife Communications photo)

For instance, Rogers said, if grassland existed for many years until junipers began encroaching and turning the site to shrubland, this change becomes exceptionally difficult to restore to grassland and can affect the value and use of that property.

“We haven’t quantified these thresholds yet to be able to say what is required to effectively restore encroached rangelands,” Rogers said. “We want to take these ideas and find a way to make them more useful, but it’s really hard to do.”

The study approached the situation from a more operational standpoint and looked at using traditional brush management techniques, but assessing their effectiveness across different soil types, he said.

“By looking at the trajectory of the plant community following brush management techniques across different soil types, we were able to identify the resilience of shrub communities on certain soils to those management efforts,” Wonkka said.

Knowing the resilience of shrub communities on different soils will allow land managers to determine where to invest time and money on brush management in order to get the most out of their expenditure, Rogers said.

The study was funded by the Wintergarden Groundwater District, with West as the principal investigator. West was studying how different brush management strategies influenced groundwater recharge of the Carrizo-Wilcox Aquifer.

“We were able to set up on a private ranch and look at how different treatments affected not only groundwater recharge, but also the plant community dynamics and how they responded to the various management practices,” Rogers said.

Brush removal is more effective at restoring grasslands in shrub communities on fine-textured clay soils than on coarse-textured sandy soils, which are more resistant to brush removal techniques, Wonkka said.

“Shrubland resilience to chemical and mechanical brush removal was highest on coarse soils,” she said. “On these soils, brush removal temporarily restored grassland dominance, but woody plants quickly regained pretreatment levels.

“However, shrublands on fine soils did not recover following treatments, continuing to be grass-dominated for the duration of the study.”

Rogers said different soil textures result in different amounts of water reaching deep soils. Clay soils retain water in the shallow layers where they are more available to grasses, whereas water moves more rapidly through sandy soils. Woody plants have deeper roots than grasses, so sandy soils provide relatively more resources to the roots of resprouting shrubs after brush management, thus increasing their resilience in these soil types and lessening the effectiveness of landowners’ restoration efforts.

Wonkka said this study highlights a simple approach for prioritizing restoration actions by mapping the locations of different soil attributes that support shrub-dominated areas with differing levels of resilience to brush control.

“We believe this study will provide scientific insights that will translate into management improvements that will help rangeland restoration and eventually food production,” Rogers said.

The full research study can be found at http://onlinelibrary.wiley.com/doi/10.1890/15-0066/full.

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