

Population changes, priorities cause woodlands to increase

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Woody plant encroachment is one of the biggest challenges facing rangelands worldwide, but it consistently has been under-measured and poorly understood, said a Texas A&M AgriLife Research scientist in College Station.

Dr. Matthew Berg, an AgriLife Research postdoctoral research associate in the Texas A&M department of ecosystem and science management, is trying to change both the understanding and measurement with his latest study, which was captured in the July issue of the *Rangeland Ecology and Management* publication.

Berg used time-series aerial imagery and historical census data to quantify changes in population, land ownership patterns and woody cover between 1937 and 2012 in three different settings in Central Texas - a semi-urban watershed almost entirely within the city limits of Lampasas, rural watersheds in Lampasas County and a portion of Burnet County, and the adjoining rural watersheds in Mills County.

Joining Berg in this study were Dr. Bradford Wilcox, AgriLife Research and department of ecosystem science and management, College Station; Dr. Michael Sorice, Virginia Tech; and Dr. Jay Angerer, Dr. Edward Rhodes and Dr. William Fox, all with AgriLife Research at Temple.

The research was funded by grants from the U.S. Department of Agriculture-National Institute of Food and the National Science Foundation, and a Tom Slick Graduate Research Fellowship from the

Texas A&M University College of Agriculture and Life Sciences.

Berg said most past research focused on environmental and ecological connections. This study documents for the first time the relationship between human demographics and the conversion of grassland to woody plant cover, shrubs and woodlands.

In this effort, the scientists were able to document the changes in grassland along with population - and for some, the results might be surprising.

"What we found was unexpected," Berg said. "What makes these relationships remarkable is the strength of the correlations for all three settings, despite large differences in both the direction and timing of changes."

Typically, it is thought that when people move into an area, they clear off the land to build their homes and eventually to build cities. But the reality is, unless they are in the agriculture business, the widespread clearing does not occur, the scientists found.

"Where people moved, woody plants followed," he said. "Only when the size of farms increased did the amount of woody plant cover decrease."

Knowing and understanding these circumstances can help researchers develop long-term land management plans, Berg said. In addition to monitoring woody plant encroachment, studying the demographic trends could help predict where it will become increasingly difficult to apply prescribed burns and where the risk of property damage by wildfires will increase.

"With growing population densities, it will likely mean more shrubs and more risk of wildfire ignitions and higher losses due to wildfires," Berg

said.

Wilcox said over the years, research has pointed toward changes in fire and grazing patterns as key drivers of increasing shrub and tree cover. But the lack of detailed data made it difficult to understand the historical extent, timing and causes of these changes.

"In the ecological science community, there is a growing emphasis on the idea of social ecological systems—studying ecosystems with a special focus on both social and ecological variables that are linked in complex and dynamic ways across multiple scales," Berg said. "Woody plant encroachment is a good fit for this concept, but human factors may have an even more direct and measurable effect on woody plant encroachment than we have recognized."

The small semi-urban area in the study showed increases in shrub cover, but all rural areas showed a surprising decrease in woody plants that lasted at least a half-century, Berg said. In addition, woody cover in one of these rural areas has since rebounded to match that from 75 years ago, while in the other it has remained almost unchanged over the last 60 years.

He said they plotted the long-term woody cover data next to historical census data for these study areas and found almost a perfect match in each area - when human population density decreased, woody plant cover decreased across the landscape.

"In every case and regardless of the time and direction of trends, the close correlation between population and woody cover was remarkable," Berg said.

Digging deeper, they plotted the woody cover against historical farm size in each area. As with population, he said, the average farm size almost

perfectly tracked woody plant cover, though in the opposite direction.

Berg said in most cases when a rebound in population has occurred these were new rural landowners occupying more and smaller farms. Typically, these new landowners had limited or no agricultural background and were seeking recreational opportunities and natural resource amenities.

"Many new rural landowners are driven more by a desire to enjoy natural resources than by profit generation, and they rank natural goods such as wildlife as a high priority," he said. "Because cultivation and forage production are not important economic interests, there is less interest in investing in brush management, and [woody plants](#) increase."

While people may be affected by shrub and tree invasion of grasslands, they are equally likely to bring about these changes in the first place, Berg said.

This connection between population growth and woody plant cover is likely to apply to many other [rangelands](#) around the world, he said. For these reasons, long-term land management decisions and studies of woody plant encroachment should include a close examination of demographic factors.

More information: Demographic Changes Drive Woody Plant Cover Trends—An Example from the Great Plains, [DOI: 10.1016/j.rama.2015.05.004](#)

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