

Where people move, woody plants follow

A summary of: *Demographic changes drive woody plant cover trends—An example from the Great Plains.*

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INTRODUCTION

The phenomenon of grassland conversion to shrublands and woodlands—known as woody plant encroachment—continues to receive increasing attention in rangelands worldwide. This transformation has major consequences for the ecological services rangelands provide and the people that depend on them.

A lengthy research record points toward changes in fire and grazing patterns as key drivers of increasing shrub and tree cover. However, the lack of detailed data from most rangelands makes it difficult to understand the precise 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. 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. For the first time, Berg et al. (2015) document the relationship

Highlights

- Woody plant cover closely tracked long-term trends in population and average farm size.
- Changing land ownership patterns may lead to new management objectives that favor much higher levels of woody plant cover.
- Rangeland research and land managers should pay special attention to local and regional demographic trends.

between human demographic changes and woody plant encroachment.

THE STUDY

Using historical aerial photos, we mapped shrub and tree cover over a period of 75 years in two rural areas and one semi-urban area (90 square miles total) in central Texas. What we found was unexpected. Despite widespread anecdotes of continuous shrub encroachment over the last 100 years, the story on the ground was very complex. The small semi-urban area did show increases in shrub cover, but all rural areas showed a surprising *decrease* in woody plant that lasted at least a half-century. 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.

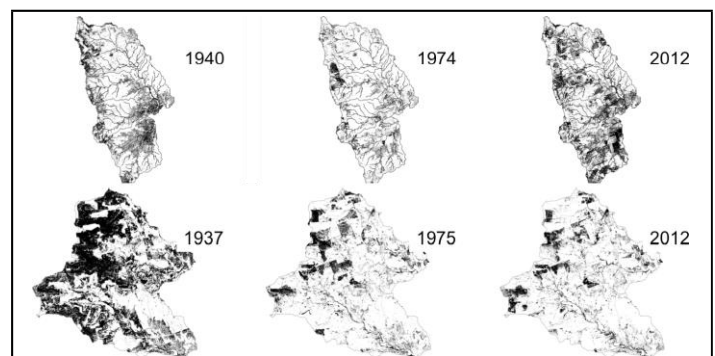


Figure 1. Woody plant cover in two rural watersheds has been very dynamic over long periods. Each closely followed trends in population and average farm size.

To tease apart these puzzling differences, we plotted the long-term woody cover data next to historical census data for the rural and semi-urban study areas. We found almost a perfect match in each area. When human population decreased, woody plant cover decreased across the landscape. When population increased, woody plants were close behind. In every case and regardless of the timing and direction of trends, the close correlation between population and woody cover was remarkable. But since the addition or loss of a single person does not automatically result in one more or fewer shrub, we dug deeper to uncover the mechanisms at work. We also plotted woody cover against historical data on average farm size in each area. As with population, average farm size almost perfectly tracked woody plant cover, though in the opposite direction. When the size of farms grew larger, woody cover decreased. When the average size of farms decreased, woody cover expanded at a similar rate.

RESULTS

What do these similar trends mean? Comparing them with local histories, the social and economic reasons for population and agricultural changes become clear. Large swaths of the Great Plains experienced population declines beginning in the first half of the 20th century. While some locations have experienced a rebound, most of these result from the growth of adjacent urban centers. In contrast with the rural area in this study that did not experience an increase in population, the area where population and woody plant cover rebounded is close to a number of major highways and only 60 miles from downtown Austin.

In many landscapes across the Great Plains, when a rebound in population has occurred, it has not resulted in a replacement of earlier residents engaged in agriculture. Rather, these newcomers have a new and unique mix of objectives focused on lifestyle, recreation, and investment. Properties that were farmed historically are subdivided and often undergo major shifts in their management focus. A review of literature from many of the world's rangelands, particularly in the developed world, tells a similar story of population replacement and evolving priorities. Many of these same rangelands have experienced dramatic changes in woody plant cover.



Figure 2. Rangelands are snapshots of interacting historical and current management objectives. Changing landowners and priorities have major impacts on rangeland structure and function.

People are affected by shrub and tree invasion of grasslands. Yet much more than a simple one-way exchange, humans have a profound role in bringing about these changes in the first place. The close connection between population growth and woody plant cover may be widespread and serve as an indicator of ongoing fragmentation and changing objectives in many of the world's rangelands. In addition to foreshadowing local changes that may lead to woody plant encroachment, demographic trends may also predict both the increasing difficulty of applying prescribed burns and also the growing risk of property damage by wildfires. For these reasons, long-term land management decisions and studies of woody plant encroachment should include a close examination of demographic factors.

REFERENCES

[Berg, Matthew D., Michael G. Sorice, Bradford P. Wilcox, Jay P. Angerer, Edward C. Rhodes, William E. Fox. 2015. A summary of Demographic changes drive woody plant cover trends-An example from the Great Plains. *Rangeland Ecology & Management* 68:315-321.](#)