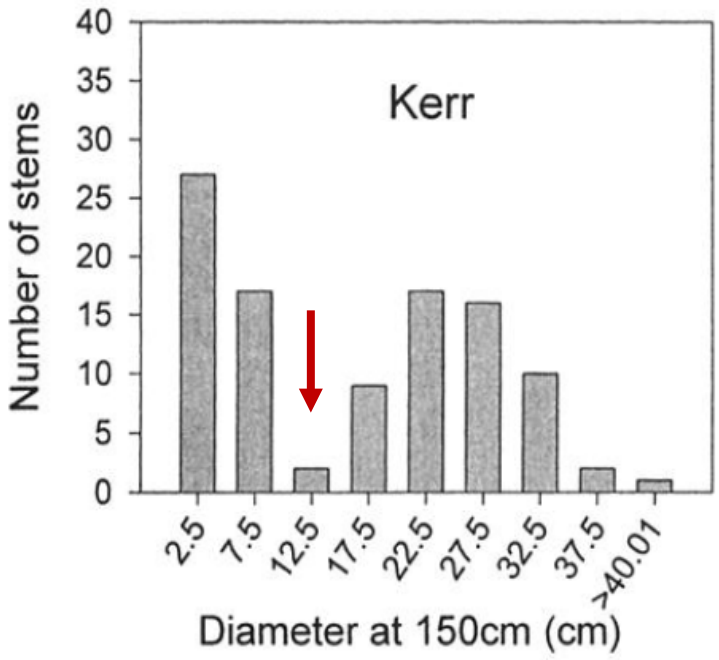
Long-term effects of prescribed thinning + fire, and white-tailed deer exclusion, on woody species composition in a central Texas woodland

Rebecca E. Carden, UT Austin
Christina M. Andruk, Iona College
Lee Kaplan, UT Austin
Carl Schwope, US Fish & Wildlife Service
James M. Mueller, US Fish & Wildlife Service
Scott Rowin, US Fish & Wildlife Service
Norma L. Fowler, UT Austin




Oak regeneration failure has been documented across the United States and elsewhere

Lack of mid-sized oak saplings, but mature oak trees and oak seedlings are common



Russell and Fowler 2002

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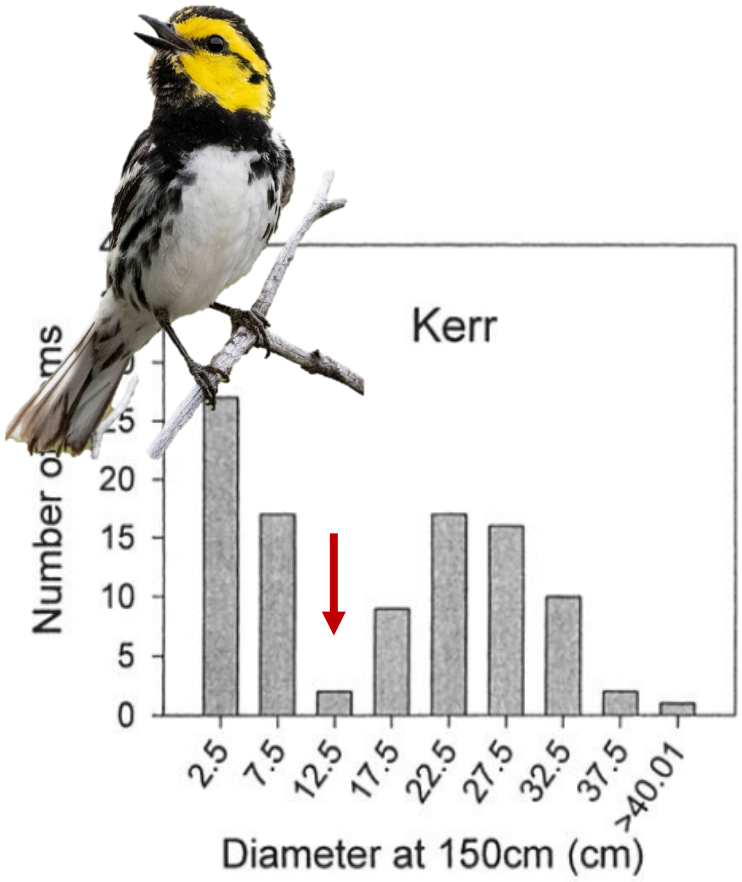

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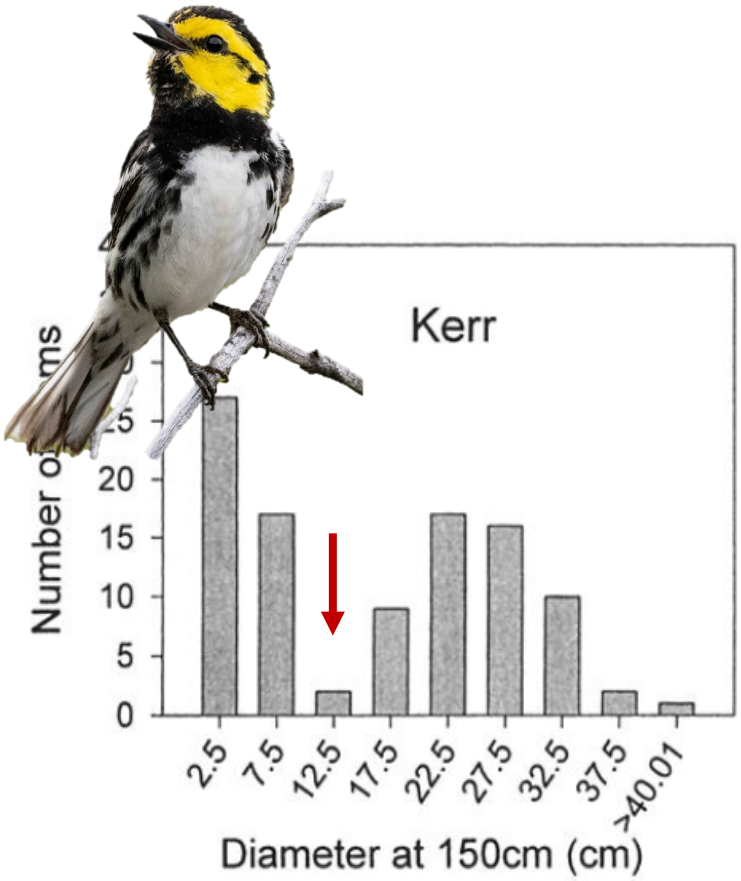
Multiple potential causes



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The oak-fire hypothesis

Purdue Dept. of Forestry and Natural Resources/Michael Saunders

The oak-fire hypothesis

Fire can kill oak competitors that shade oak seedlings

- As seedlings in a woodland, many non-oak species invest in growing tall to reach the sunlight

- But oaks often invest in large root systems

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Fire can kill oak competitors that shade oak seedlings

- As seedlings in a woodland, many non-oak species invest in growing tall to reach the sunlight
- But oaks often invest in large root systems
- This allows oaks to resprout vigorously after fire

The oak-fire hypothesis

Theoretically, it makes a lot of sense that regular surface fires may stimulate oak regeneration

However, prescribed burn experiments have had mixed results

Deer may affect oak regeneration as well

Deer populations have increased dramatically since the mid-1900's

Like fire suppression, this is a national trend

Deer may affect oak regeneration as well

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Overabundant deer that browse small trees can prevent seedlings from growing into the sapling size class

Deer commonly browse oaks

Deer commonly browse recently burned areas

Can prescribed fire, deer management, or a combination of the two be used to increase oak sapling and mature tree recruitment?

We expected that both fire and deer management would increase oak regeneration

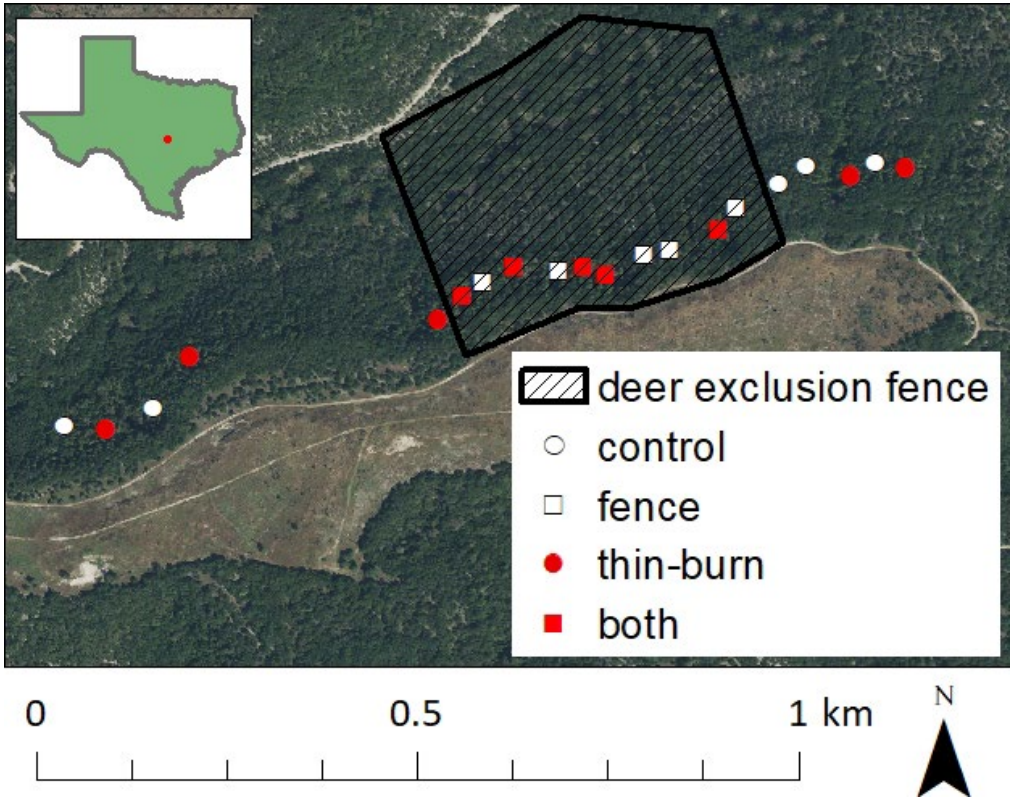
Study at the Balcones Canyonlands National Wildlife Refuge

common overstory trees

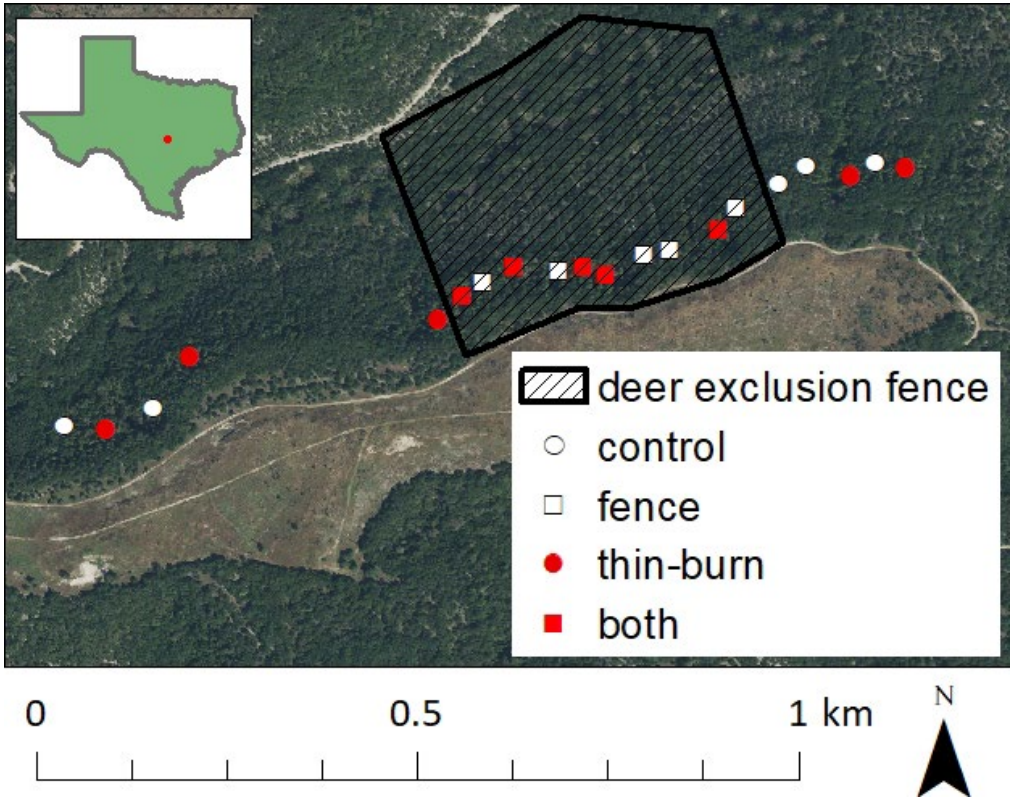
common understory shrubs and small trees

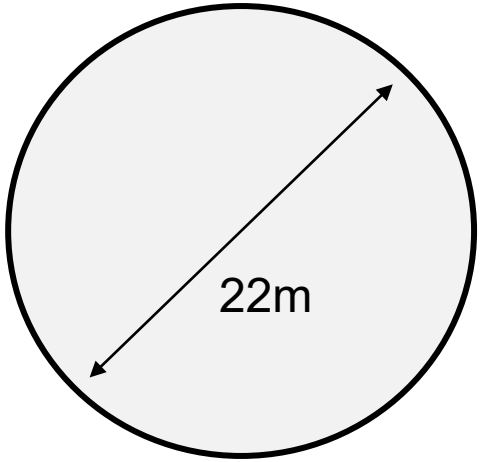
photos from the Lady Bird Johnson Wildflower Center

Plots were established in 2009, and treatments were implemented in 2010

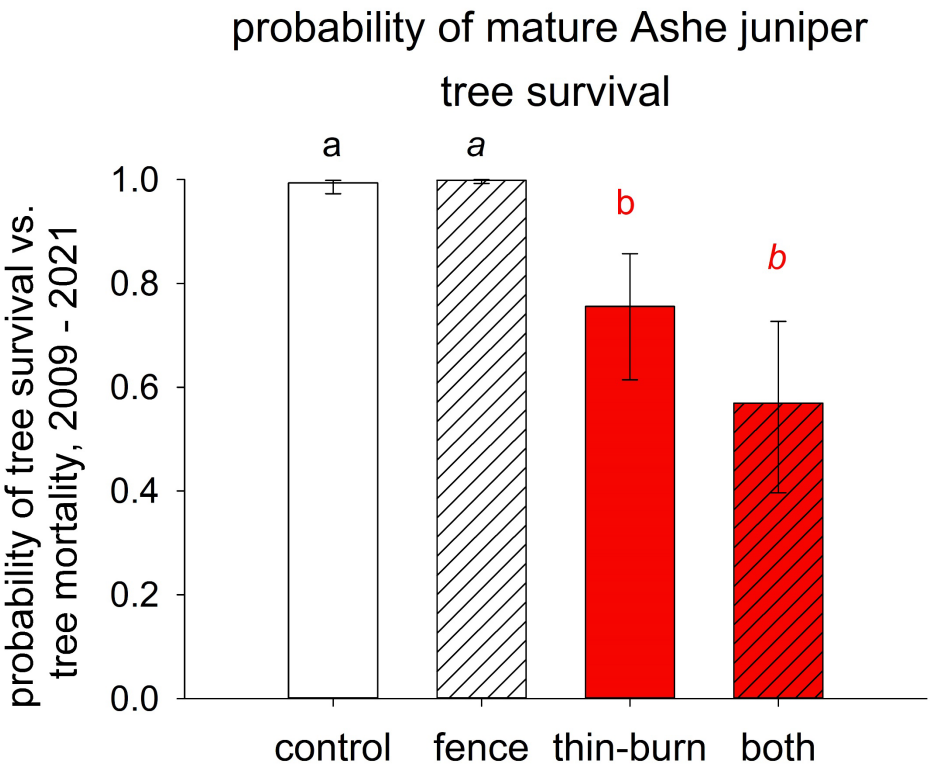


Woody plant diversity and abundance was measured in each plot

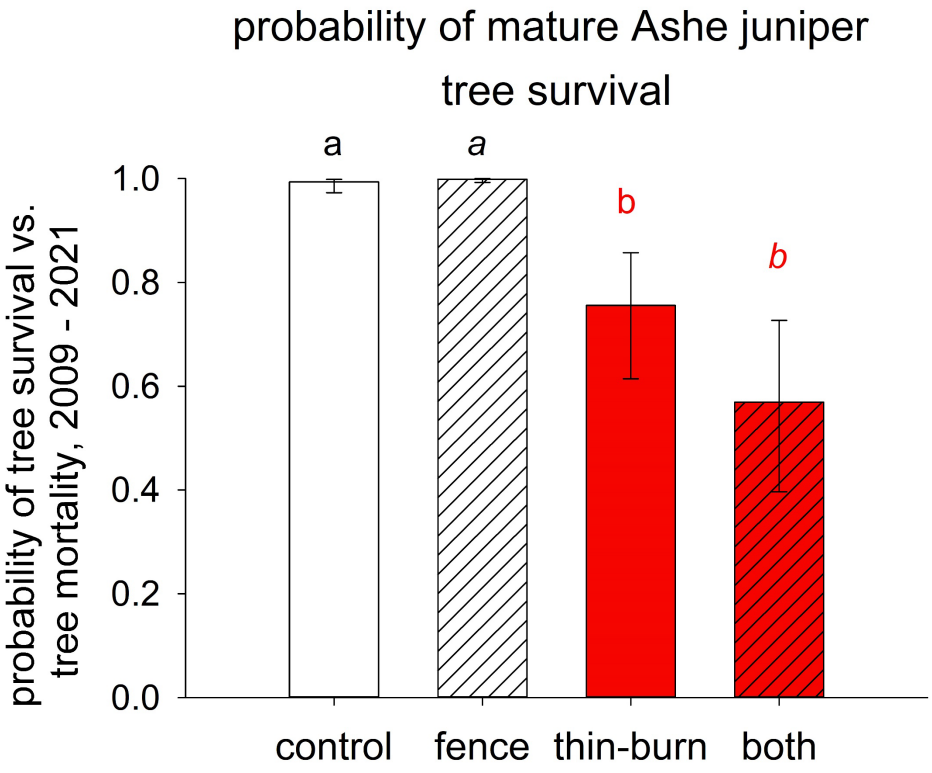


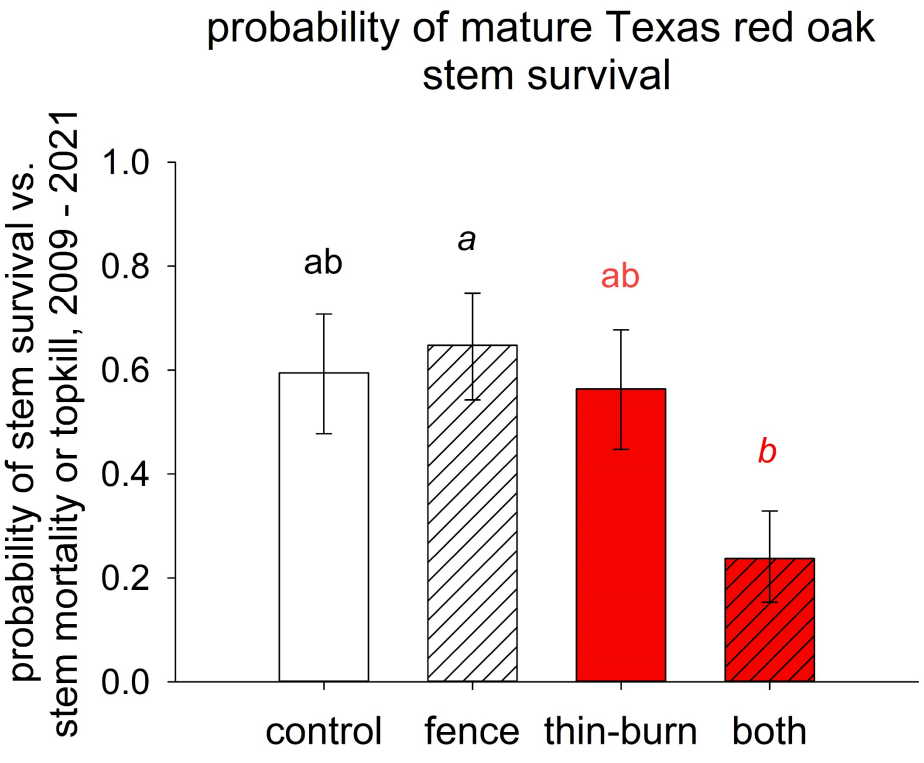


Some mature Ashe juniper trees were killed by the fires

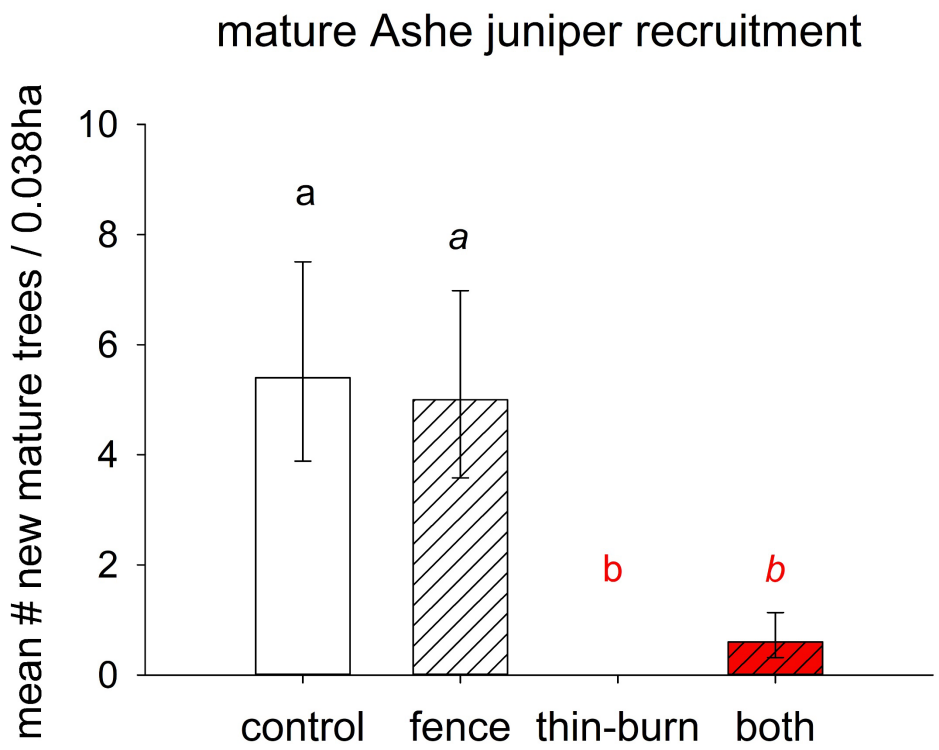


Some mature Texas red oak stems were topkilled or killed across all treatments

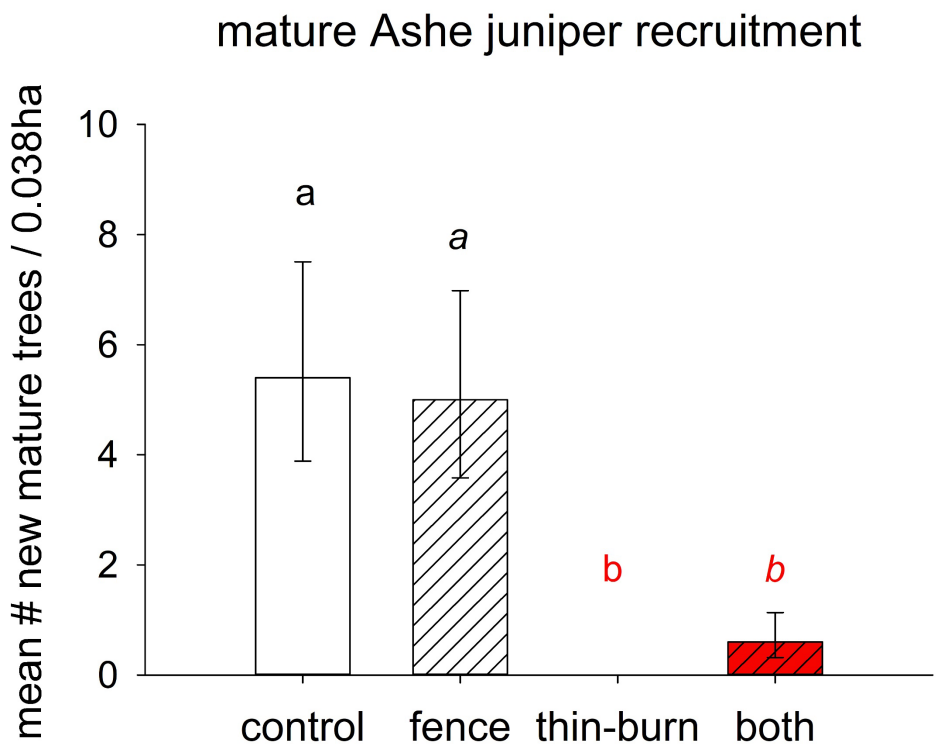


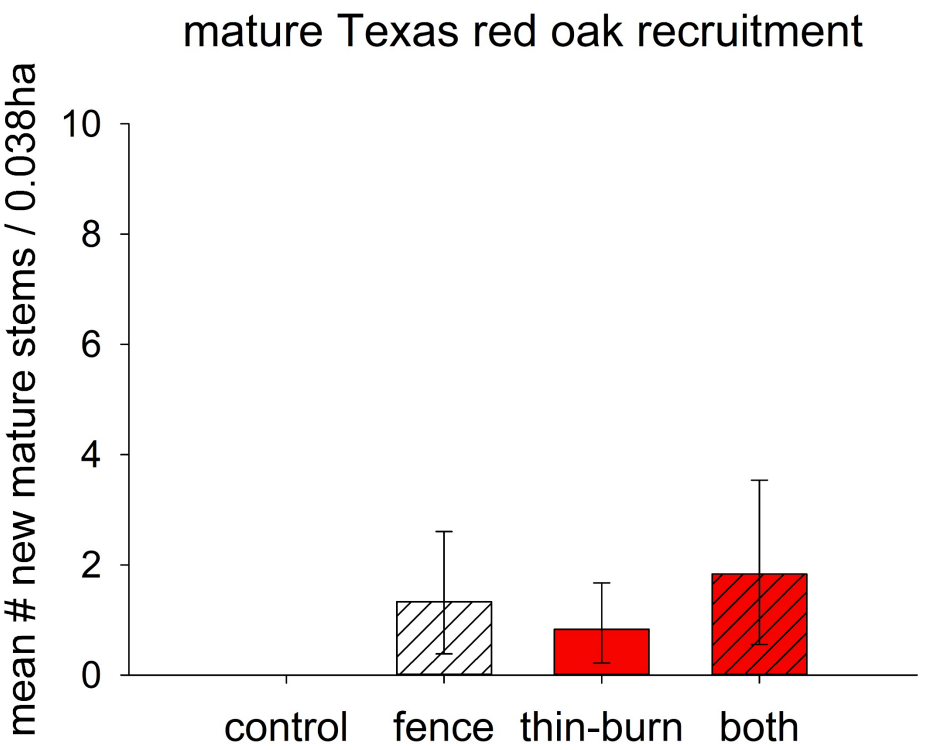


Mature Ashe juniper trees were recruited to the canopy in unburned plots



Few oaks were recruited to the canopy

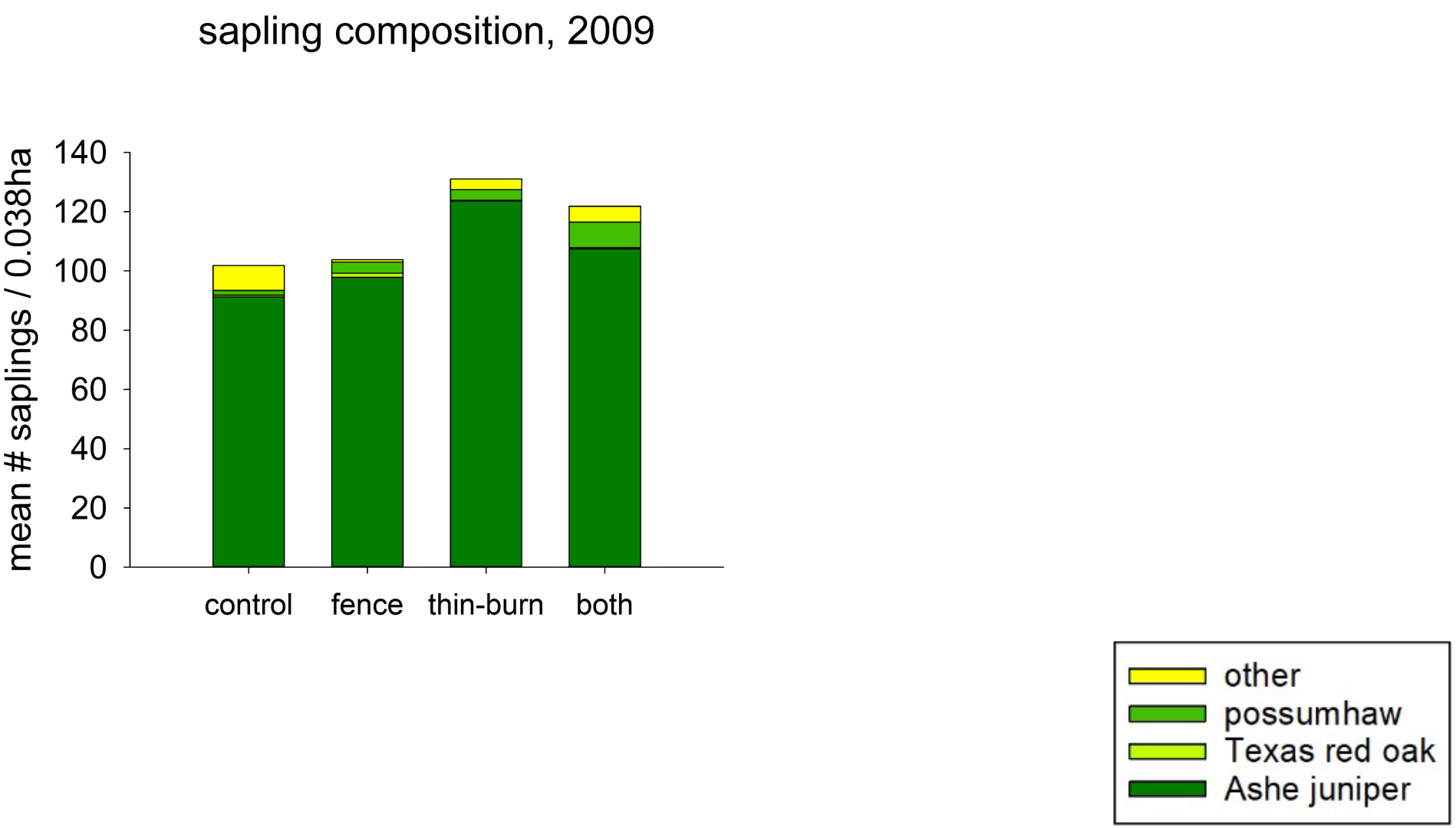




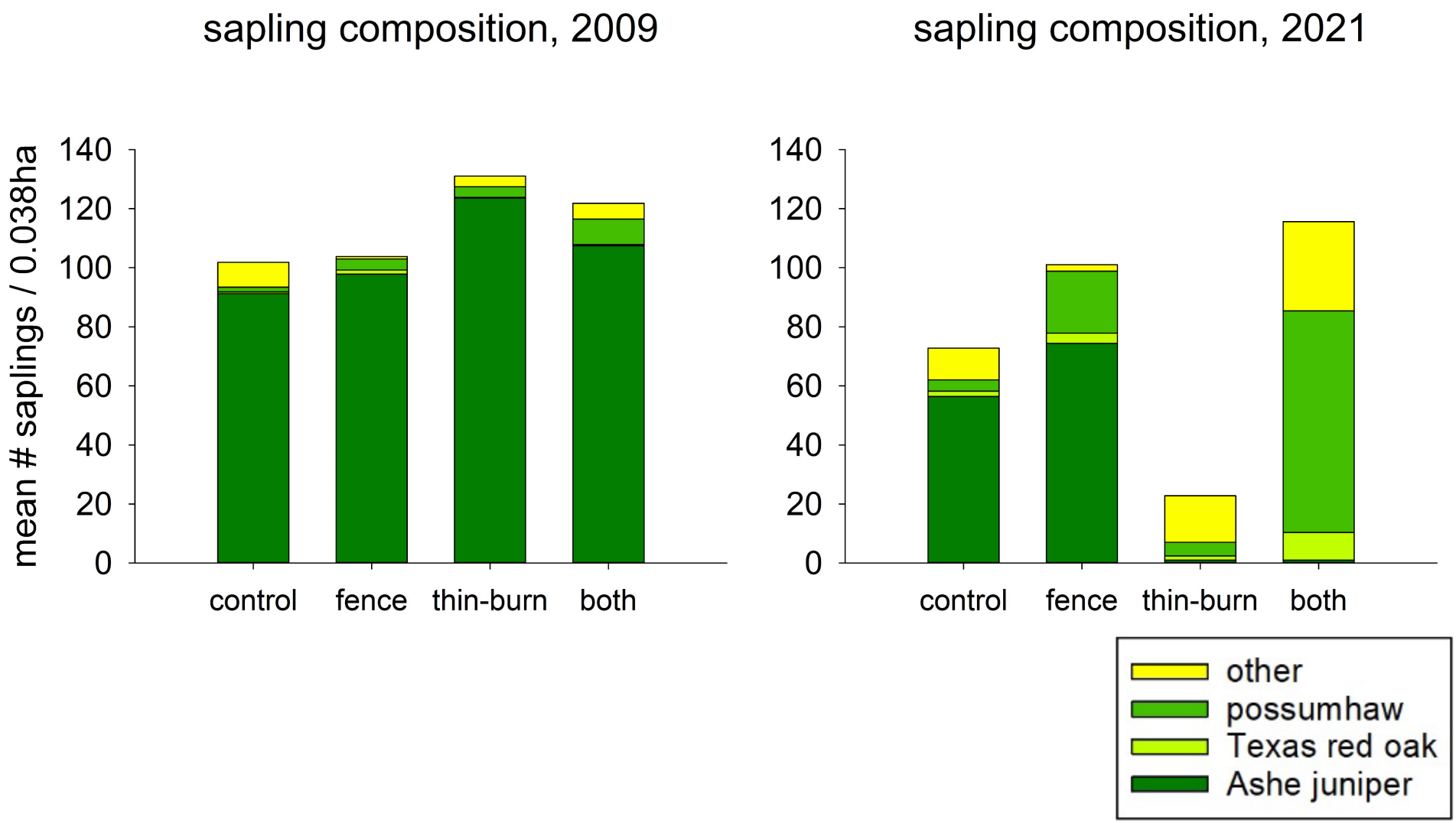
When mature Texas red oak were lost in unburned plots, they were replaced in the canopy by Ashe juniper saplings.

When mature Texas red oaks and Ashe juniper were lost in thinned-burned plots, they have not yet been replaced in the canopy by any species.

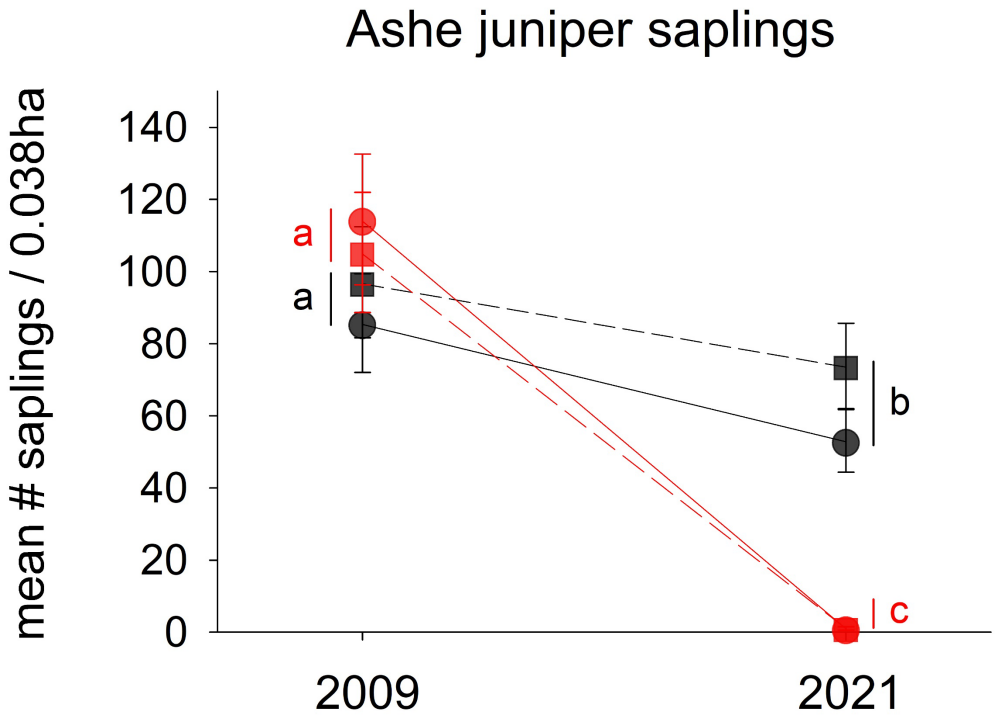
Before any treatments, Ashe junipers were the most common saplings and Texas red oak saplings were very uncommon

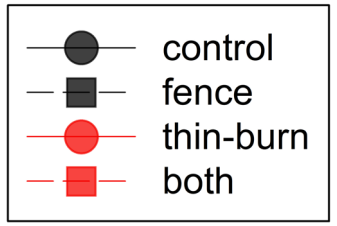


By 2021, sapling composition and density had changed in the thinned-burned plots



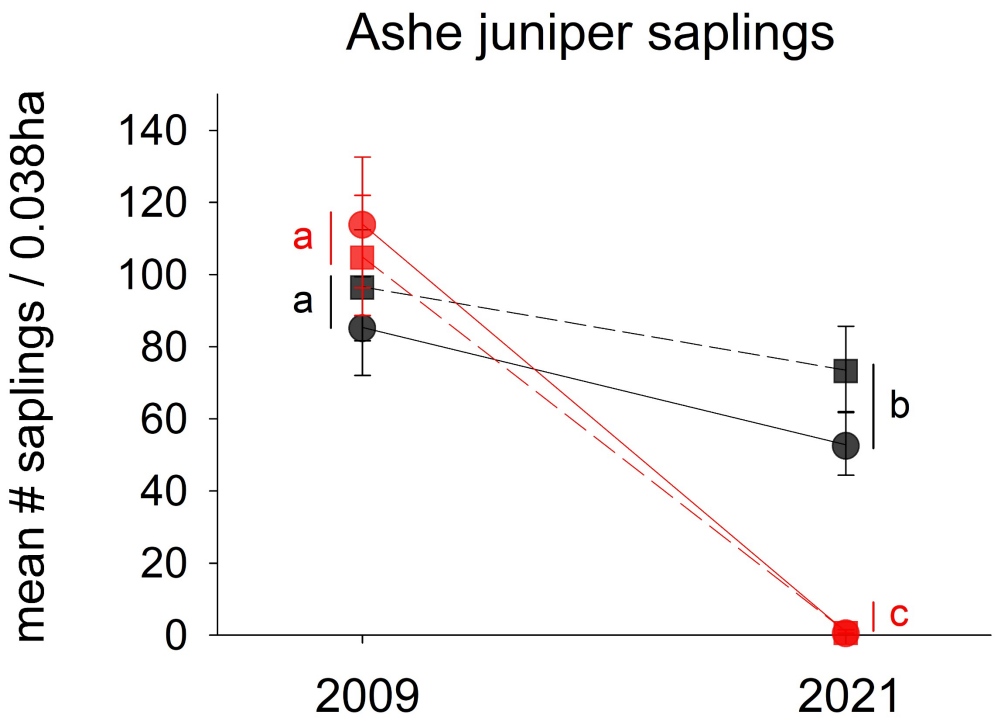
By 2021, Ashe juniper saplings had not recovered in any of the thinned-burned plots, where they were thinned in 2010

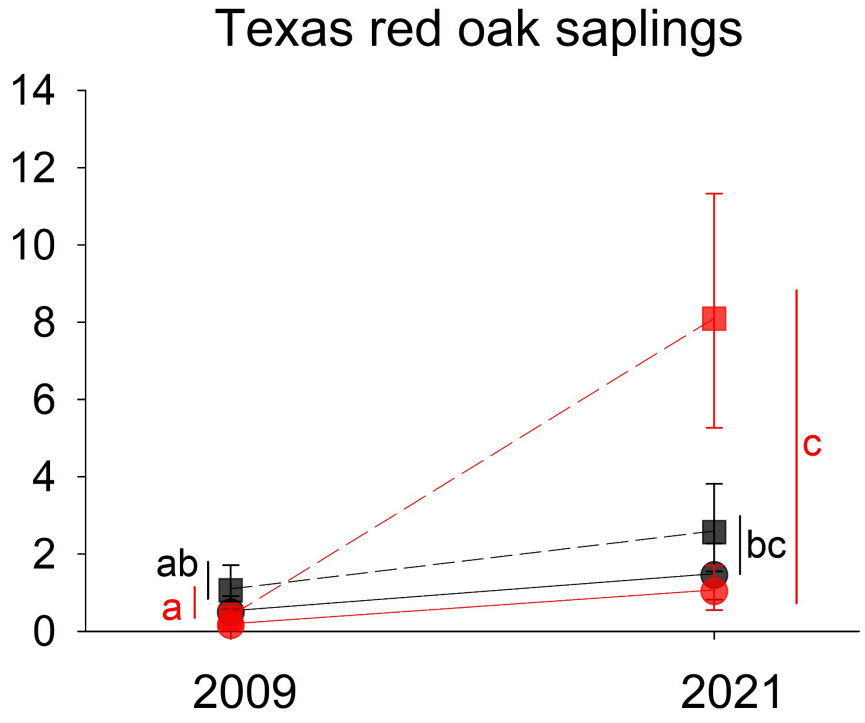


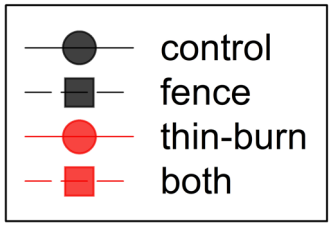


photos from the Lady Bird Johnson Wildflower Center website

Fenced + thinned-burned plots had the highest number of Texas red oak saplings







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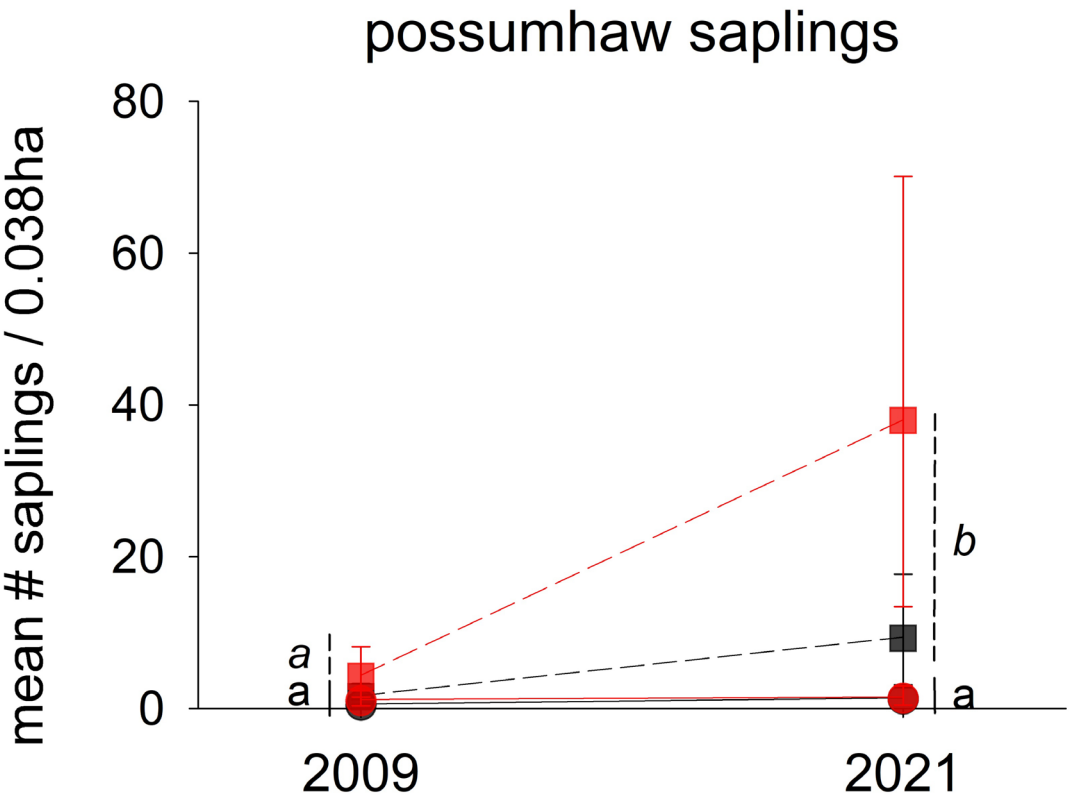
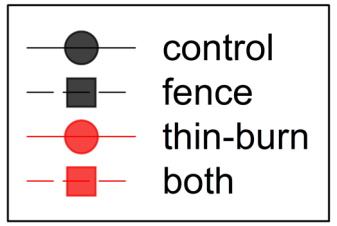
Fenced + thinned-burned plots also had the highest number of possumhaw saplings





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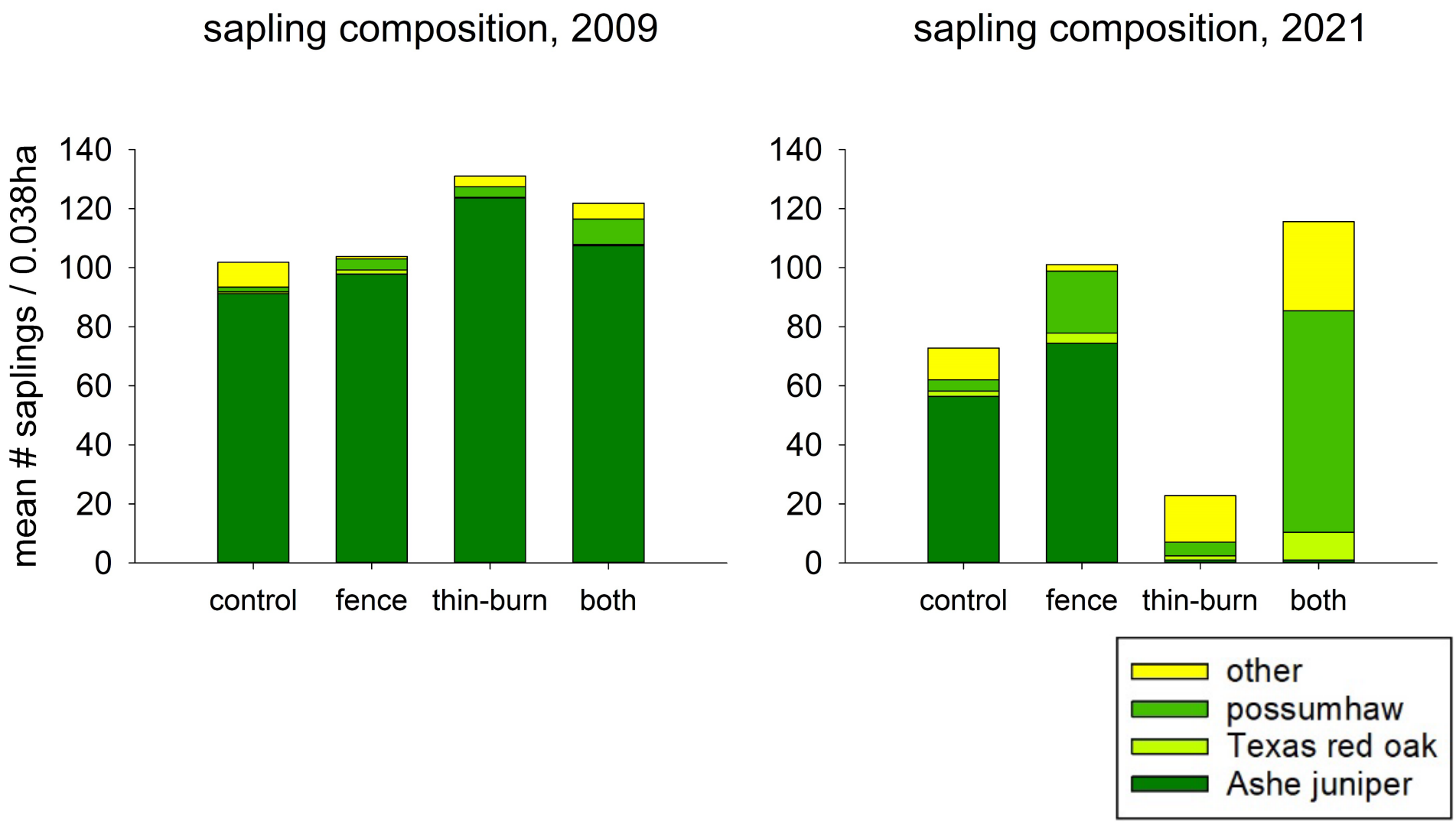
Following prescribed thinning and burning, deer access determined sapling composition



Our results suggest that perhaps both prescribed fires and deer management are necessary to increase oak regeneration

So, what are the realistic management options?

Larger prescribed burns may reduce deer browsing impacts after fire, compared to the small burns used in this study

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Because deer prefer to eat possumhaw over Texas red oak, there may be an optimal deer density where deer eat possumhaw, but not oaks, after prescribed burns

Thank you!

The US Fish & Wildlife Service: Jeff Adams, Jennifer Brito, Chris Harper, Kelly Purkey, Jim Mueller, Scott Rowin, Carl Schwope, Cixto Saucedo

Dr. Norma Fowler's lab at UT Austin: Christina Andruk, Whitney Behr, Ashley Green, Devin Grobert, Lee Kaplan, Carolyn Whiting

More questions or comments? Contact rebeccacarden@utexas.edu