



GREAT PLAINS Grasslands Extension Partnership



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Rangeland production lost to woody encroachment in Great Plains grasslands

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Key Takeaways

- 22.4 million tons of rangeland production are lost annually in the Great Plains to woody encroachment, and losses continue to increase every year.
- Losses in rangeland production were equivalent to 37 million round bales and the annual forage need of 4.7 million cows.
- The economic damages due to woody encroachment were estimated to be \$323 million in 2019.
- Cumulative losses from 1990-2019 were nearly 350 million tons, valued at more than \$4.5 billion. This loss equates to more than 583 million round bales and the annual forage need of over 73 million cows.
- The Great Plains accounts for approximately 95% of the nation's lost rangeland production to woody encroachment.
- Without changes in management, record losses in rangeland production are expected to continue.
- Going forward, management should employ risk-reduction strategies, defend intact grasslands cores from woody encroachment, and strategically grow cores over time. New guidance can be found at <https://cedarliteracy.unl.edu>.

Annual Rangeland Production Lost to Woody Encroachment



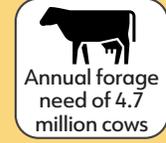
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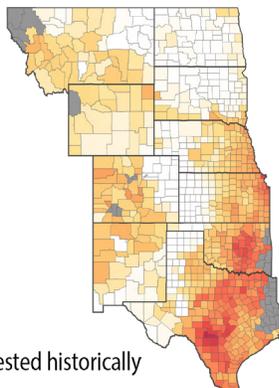
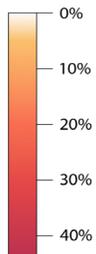
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Production losses in 2019



Annual rangeland production losses

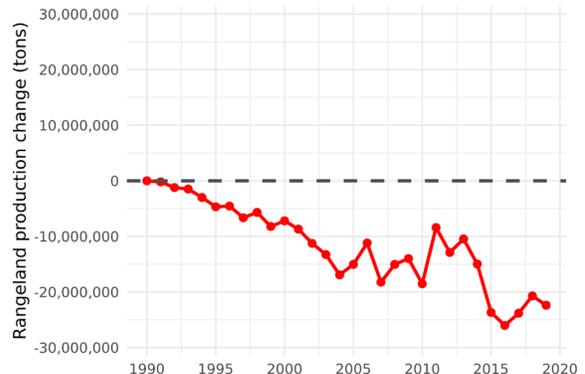


Fig. 1. Rangeland production losses to woody encroachment in the Great Plains.

Woody encroachment takes rangeland out of agricultural production

Woody plant encroachment is one of the two largest threats driving grassland collapse in the Great Plains [1]. From 1990-2019, tree cover increased by over 17 million acres, representing the most extensive change in rangeland vegetation over this time period [2]. The result is reduced rangeland production. Rangelands in the 10-state Great Plains region lost 22.4 million tons of forage production to woody encroachment in 2019, while nearly 350 million tons were lost from 1990-2019 (Fig. 1; Table 1) [2].

Rangeland scientists are now able to track woody encroachment and associated losses in rangeland production at county, state, and national scales as a result of recent innovations in rangeland monitoring [2,3]. Rangeland production losses are modeled using a 1990 baseline and are the result of increasing tree cover since 1990. The results confirm an overwhelming trend of woody encroachment in the 10-state Great Plains region. Production losses from this region account for a staggering 95% of all production lost to woody encroachment in western U.S. rangelands.

Record losses are expected to continue without risk reduction strategies [1]. Losses in production have steadily increased since 1990 (when satellite-based monitoring data became available). Every year, more rangeland production, critical to agriculture and wildlife, is being lost to woody encroachment. The most severe losses have occurred in southern Great Plains states like Texas and Oklahoma, while states in the central and northern Great Plains have experienced more recent losses due to encroachment (Table 1).

Table 1. Annual rangeland production losses to woody plant encroachment (WPE) in the Great Plains.

	Rangeland production (tons) ^a	Rangeland production lost to WPE (tons) ^a	Equivalency metrics for understanding losses		
			Round bales lost ^b	Cows supported ^c	Economic losses ^d
North Dakota	11,130,966	14,189	23,648	2,993	\$268,882
South Dakota	24,246,024	145,352	242,253	30,665	\$4,513,180
Wyoming	15,799,568	209,285	348,808	44,153	\$4,955,869
Colorado	14,059,223	262,232	437,053	55,323	\$5,105,657
New Mexico	15,873,691	291,875	486,458	61,577	\$4,915,175
Montana	24,130,281	297,051	495,085	62,669	\$7,660,945
Nebraska	23,908,316	419,328	698,880	88,466	\$17,964,012
Kansas	29,993,183	1,525,841	2,543,068	321,907	\$29,708,124
Oklahoma	30,741,853	4,491,096	7,485,160	947,489	\$54,387,173
Texas	102,505,037	14,716,404	24,527,340	3,104,727	\$193,667,877
Great Plains	292,388,141	22,372,653	37,287,755	4,719,969	\$323,146,892
Cumulative 30-year Total	7,586,856,458	349,937,323	583,228,872	73,826,439	\$4,507,464,711

^aRangeland production statistics are representative of the year 2019.

^bRound bale equivalency calculations are based on a 1,200-lb round bale.

^cCow equivalency calculations represent the annual forage need of a cow and are based on 790-lb of forage per Animal Unit Month (AUM) for a 12-month period.

^dEconomic equivalency calculations are based on cash rental rates for each state.

Facts about woody encroachment in the Great Plains

- No state has prevented losses in rangeland production from woody encroachment.
- No state has reversed losses in production after woody encroachment begins to rapidly displace grasslands.
- The problem of lost production is repeated in one state after the next as the problem expands into regions where encroachment was once thought to be impossible:
 - Production losses in Nebraska once looked like those of South Dakota, but in 2019 Nebraska lost over 419,000 tons.
 - Kansas once looked like Nebraska, but lost over 1,500,000 tons of rangeland production in 2019.
 - Oklahoma once looked like Kansas, but lost nearly 4,500,000 tons of rangeland production in 2019.
- Without implementing risk-reduction strategies, woody encroachment will continue to reduce rangeland production and erode many other goods and services provided by grasslands across the Great Plains.

New guidance for reducing woody encroachment

Reactive management that narrowly targets mature trees and patches of trees has been unable to prevent rangeland production losses because the problem is not dealt with until impacts occur. Unfortunately, focusing on clearing mature trees promotes rapid reinvasion due to seed and seedlings that are left behind after tree clearing. Ultimately, this approach has required producers to constantly manage brush, which does not save on operating costs.

A new approach prioritizes integrated management across all stages of woody encroachment (Fig. 2) [1]. This approach focuses on removing seed sources and then following up to deplete the seedbank, thereby restoring the site and reducing future management requirements. Ultimately, the goal is to maintain intact grasslands and grow them through integrated management. Learn more about guidance for reducing woody encroachment at <https://cedarliteracy.unl.edu>.

New Order of Business... Maintain Your Intact Grasslands

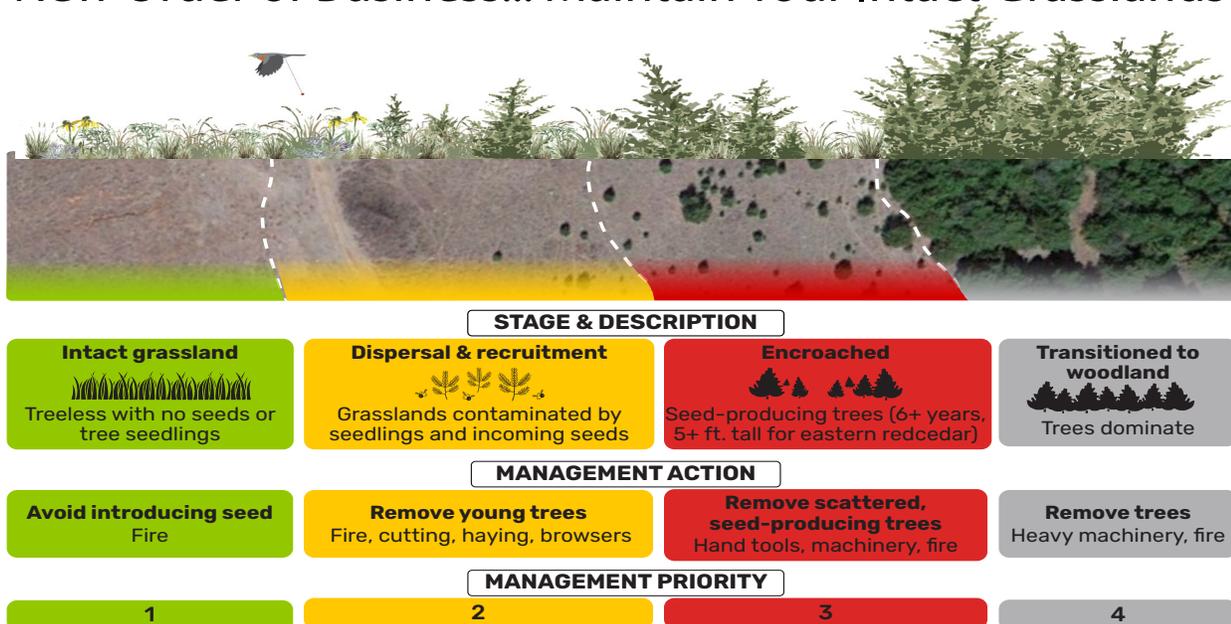


Fig. 2. Guidance for reducing woody encroachment considers how management can be implemented across all stages of the encroachment process to reduce underlying risks that make grasslands vulnerable to encroachment.

Go to <https://www.wfw.org/yieldgap/> to learn more about production losses in your state or county.

Data product and source: Scott Morford, University of Montana and USDA-NRCS Working Lands for Wildlife

References

- [1] D. Twidwell, D. T. Fogarty, and J. R. Weir, "Reducing woody encroachment in grasslands: A risk and vulnerability guide," Oklahoma Coop. Ext. Serv., no. E-1054, 2021.
- [2] S. L. Morford et al., "Herbaceous production lost to tree encroachment in United States rangelands," J. Appl. Ecol., vol. 59, no. 12, pp. 2971–2982, Dec. 2022.
- [3] M. O. Jones, D. E. Naugle, D. Twidwell, D. R. Uden, J. D. Maestas, and B. W. Allred, "Beyond inventories: emergence of a new era in rangeland monitoring," Rangel. Ecol. Manag., vol. 73, no. 5, Sep. 2020.

