

SCIENCE TO SOLUTIONS



Woody Invasion in the Great Plains Diminishes Water Resources

In Brief:

- Encroaching woody species are rapidly taking over native prairie in the Great Plains, which causes unfortunate ecologic, economic, and hydrologic consequences.
- A new scientific synthesis compiles decades of information across several states on the risks posed by the invasion of eastern redcedar, including multiple impacts on water quality and quantity.
- Collaborative partnerships between landowners, agencies, and scientists are helping maintain healthy agricultural rangelands and sustain water resources for people and wildlife.

Background

The Great Plains cover one-fifth of America, where vast rolling rangelands support valuable farms and ranches as well as grassland-dependent wildlife species. Unfortunately, these rangelands are threatened by the rapid invasion of woody plants. Species like eastern redcedar, Ashe juniper, and mesquite are taking over the prairie in the absence of historic fire patterns.

Research shows that woody encroachment reduces the quality and extent of prairie habitat for both livestock and wildlife. For instance, at-risk upland birds avoid areas with redcedars since their branches give predators places to hide and perch. One study found that [lesser prairie-chickens](#) won't nest in grasslands with more than one tree per acre, and stop using grasslands altogether when tree density reaches three trees per acre.

This vegetation transition is a concern nationally, since its consequences affect the economy and ecology in multiple states. The rate of redcedar encroachment is highest in the central Great Plains, such as Nebraska's Sandhills region. Here, the shift from grassland to woodland-dominated systems is fragmenting critical habitat for the greater prairie-chicken, the American burying beetle, and waterfowl—and it's also changing the water cycle. The hydrologic impacts on the underlying Ogallala Aquifer are particularly worrisome, since this critical water supply must meet the demands of agriculture, energy production, and urban areas.

“Simple transitions in vegetation can have far-reaching impacts. This study shows how trees taking over rangelands can affect working lands, wildlife, and water in complex ways—even impacting our well-being in metro areas.”

— Dirac Twidwell
Ecologist at
University of
Nebraska



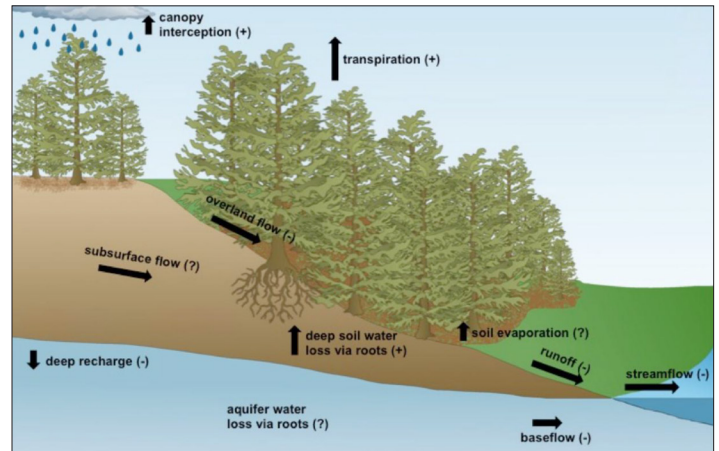
Ranchers in Nebraska cut small cedar seedlings to control the woody invasion of grasslands. This maintains healthy working rangelands and sustains water resources, enhances wildlife habitat, mitigates wildfire risk, and sustains water resources.

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Methods

Scientific experts in hydrology and ecology came together to synthesize nearly seven decades of research on the effects of redcedar encroachment in the Great Plains. The literature review included several recent experiments conducted in the prairies of Texas, Oklahoma, Kansas, and Nebraska to better understand the potential impacts of redcedar invasions on critical water resources.

Motivated in part by inquiries from concerned landowners, the synthesis describes how redcedar encroachment is changing components of the hydrologic cycle. It discusses the expected risks to the water budget when grasslands transition to eastern redcedar woodlands in the Great Plains.



This illustration summarizes the alteration of the water cycle following a grassland transition to redcedar woodland. It shows the net loss to aquifer recharge and streamflow as trees intercept water.

Conclusions

Invading woody species have several impacts on prairie rangelands, including forage loss, increased risk of fire, decreased habitat quality for wildlife, and diminished water resources. Model simulations suggest that complete conversion of rangelands to redcedar woodlands in the central Great Plains **would reduce streamflows by 20 to 40%**.

Since these trees intercept water—in effect “stealing” it from the aquifer and nearby streams—woody encroachment also threatens the long-term availability of irrigation water for crops. Furthermore, **reduced streamflows would result in higher nitrate concentrations** in surface water, impairing water quality for people.

Science in Action

Landowners across the Great Plains are working with the USDA Natural Resources Conservation Service and conservation partners to make rangelands more productive. Farm Bill-funded conservation strategies include targeted removal of invading woody species to restore grassland ecosystems.

Through Working Lands for Wildlife, NRCS has partnered with agricultural producers to remove woody invaders on over 110,000 acres in the Great Plains. This conservation investment improves the quality and quantity of forage for livestock, restores habitat for wildlife, and maintains water resources for people.

Natural Resources Conservation Service

Going forward, it is a scientific priority to **focus on simulations and forecasting studies** in the Northern Great Plains—where the rate of encroachment is lower—to help curtail the progression of redcedar and better understand future risks. These studies can help convey the importance of stewardship to landowners.

As more grassland ecosystems become dominated by woodland species, working rangelands become compromised and less able to supply valuable resources like food, water and habitat. It’s imperative to manage these large landscapes for ecosystem resilience so that we don’t lose the water that sustains communities, wildlife, and agriculture.

Source

Zou, Chris B., Twidwell, Dirac, et. al. 2018. [Impact of Eastern Redcedar Proliferation on Water Resources in the Great Plains USA—Current State of Knowledge](#). *Water*. 10:1768.

USDA Natural Resources Conservation Service: Working Lands For Wildlife. 2019. *Woody Invasion in the Great Plains Diminishes Water Resources*. Science to Solutions Series.

Working Lands for Wildlife, led by USDA’s Natural Resources Conservation Service, a partnership-based, science-driven effort to proactively conserve America’s working agricultural lands and wildlife.