Ecosystem benefits from fire and future consequences of not burning

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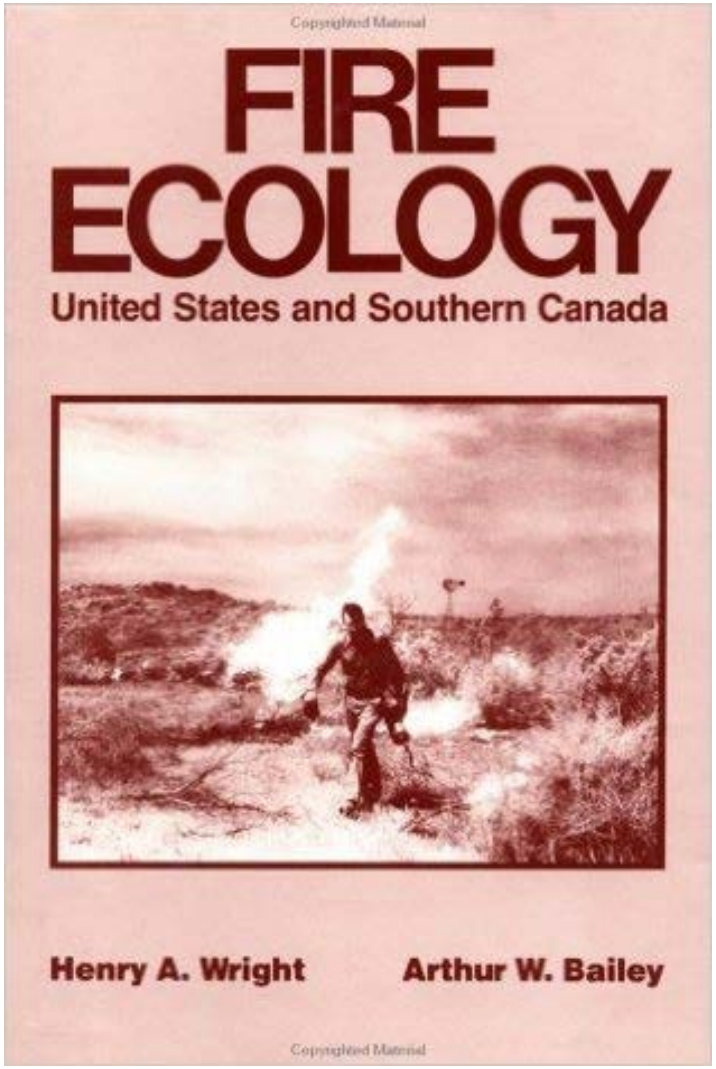
(Potential) Ecosystem benefits from fire:



<u>From Wright and Bailey (1983)</u>
Burn dead debris
Increase herbage yields
Increase utilization of coarse grasses
Increase availability of forage
Improve wildlife habitat
Control cool-season invaders
Control undesirable shrubs and trees

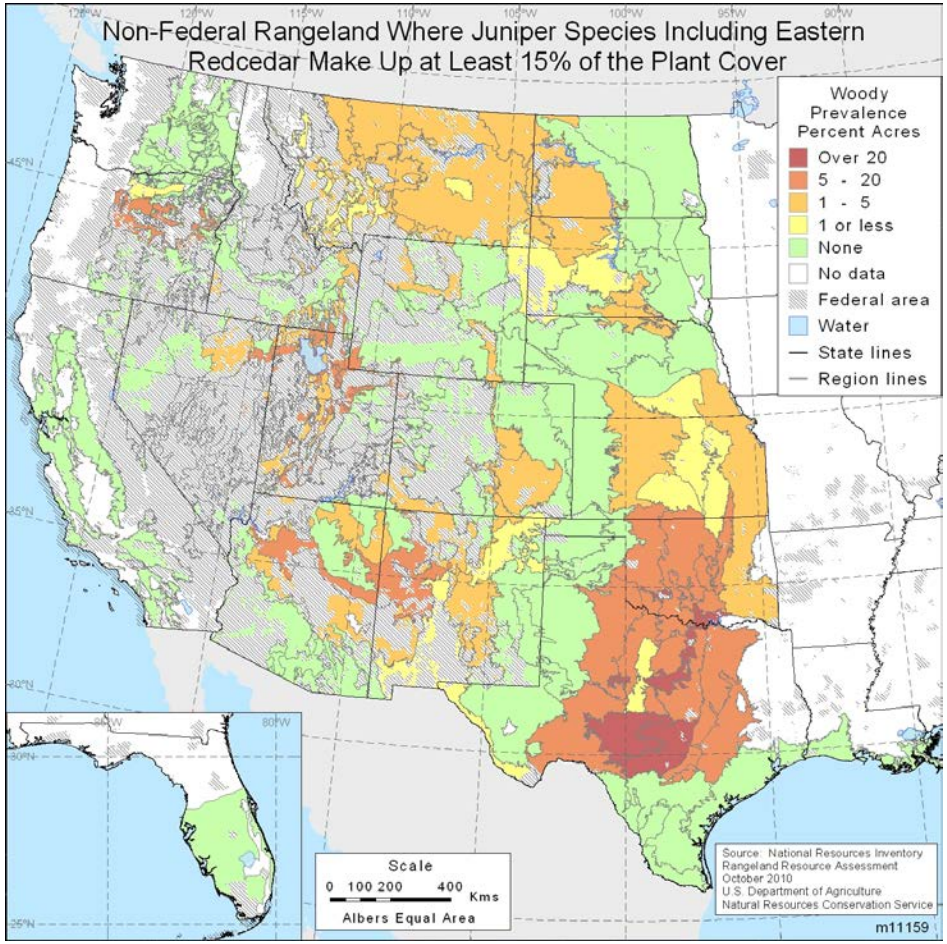
Achieve several benefits simultaneously rather than requiring multiple costly techniques

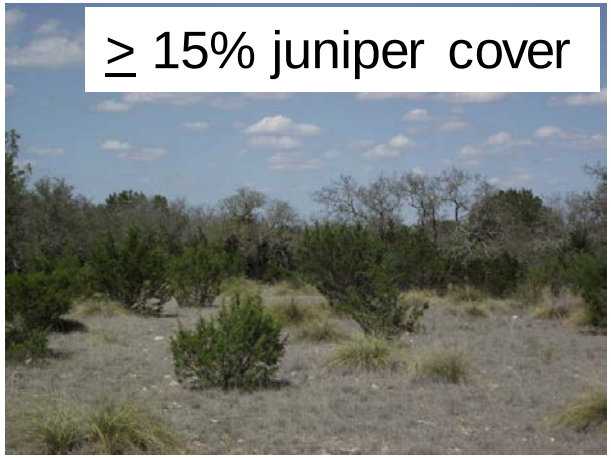
[Note that there is no mention of *how much* increase or control can be imposed with fire – binary classification]

Long-term invasion in the Great Plains:

Long-term invasion in the Great Plains:

Juniper invasion is moving north, transforming the Great Plains

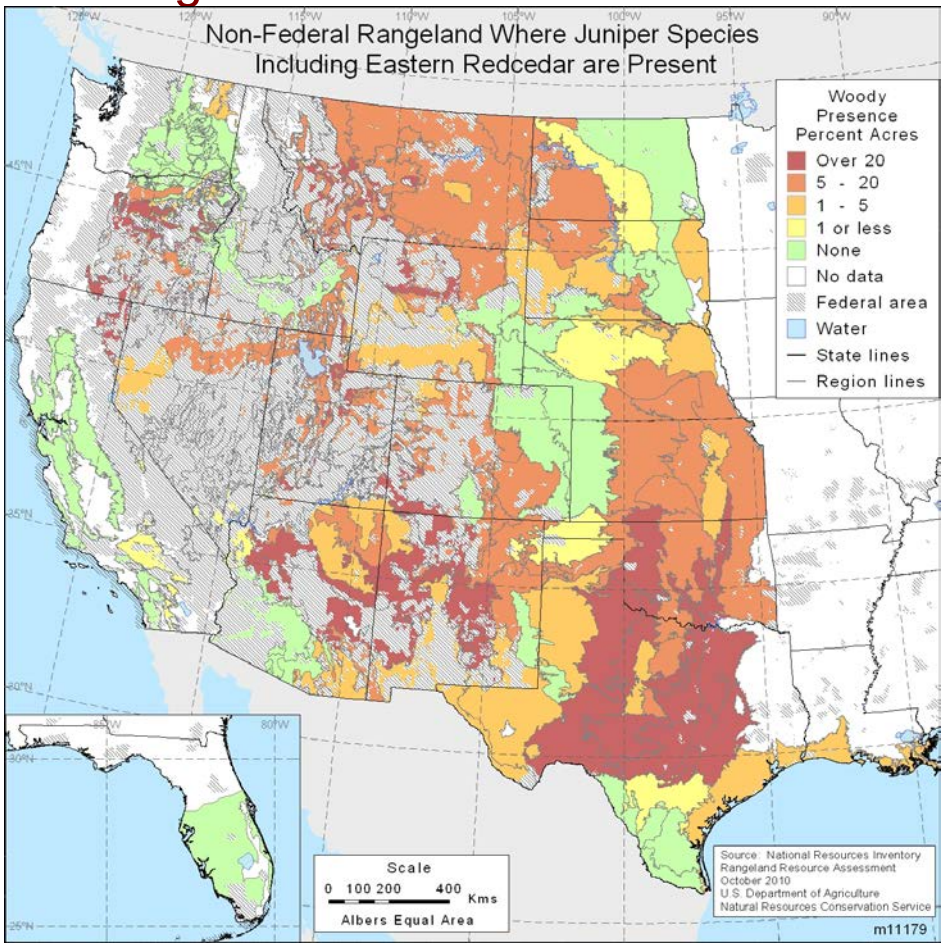


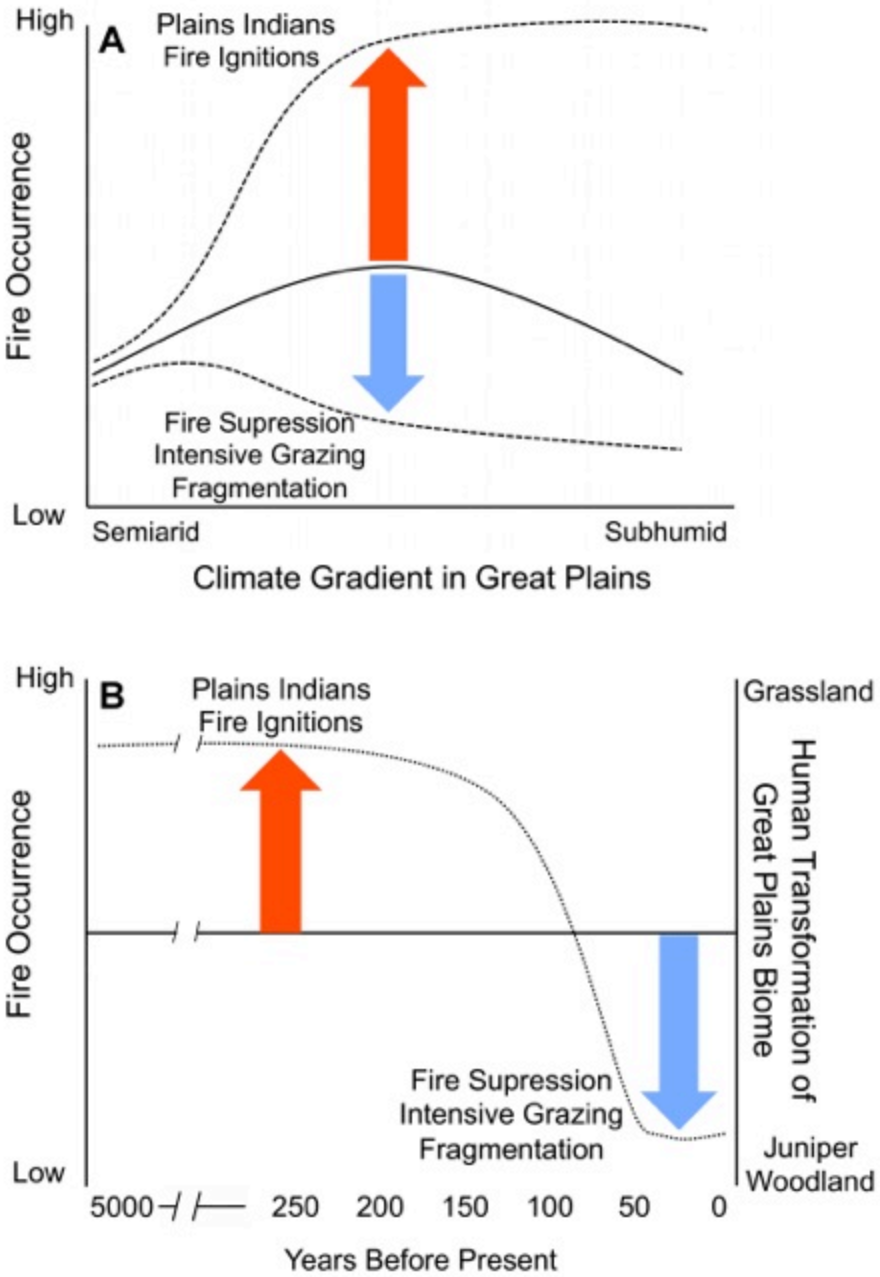


Twidwell et al. 2013 *Frontiers in Ecology and the Environ.*

Juniper invasion is moving north, transforming the Great Plains:

This is a consequence of human changes in fire regimes



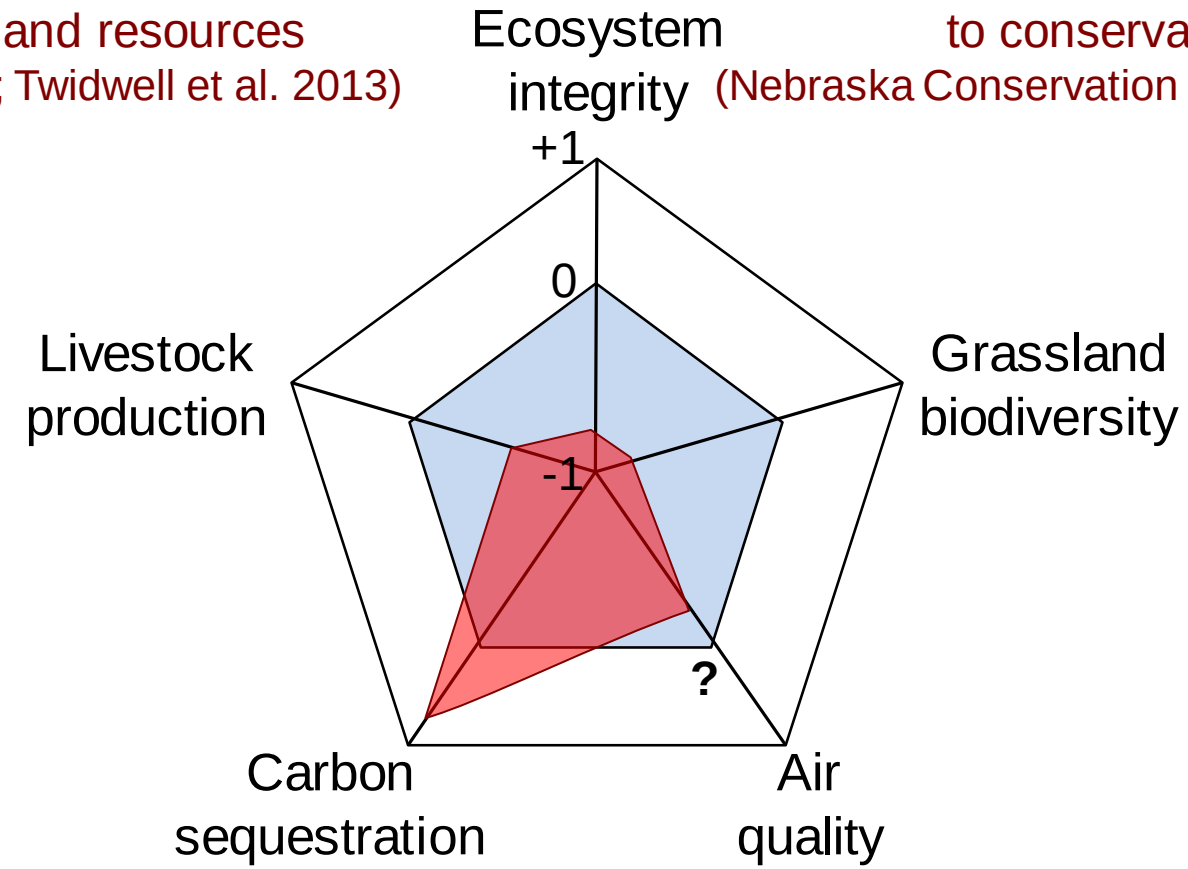


Twidwell et al. 2013 *Frontiers in Ecology and the Environ.*

Ecosystem service assessment following a grassland to juniper woodland regime shift

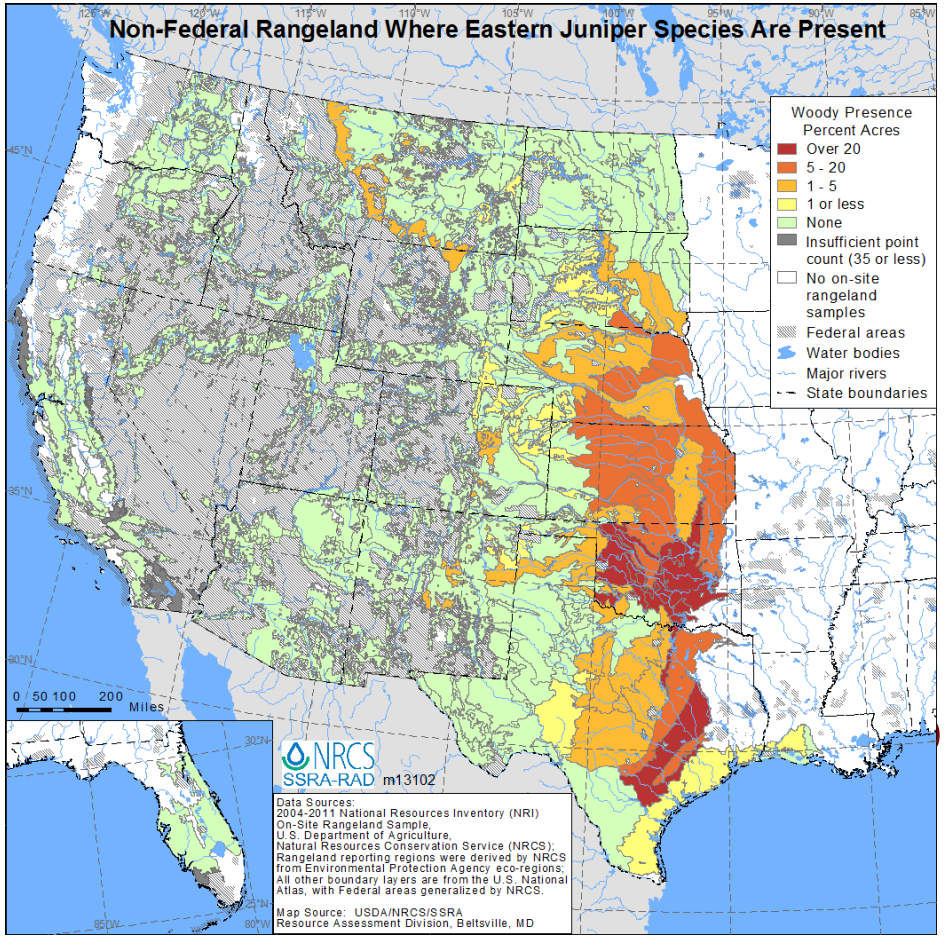
Juniper invasions: one of the greatest threats to rangeland resources (Engle et al. 2008; Twidwell et al. 2013)

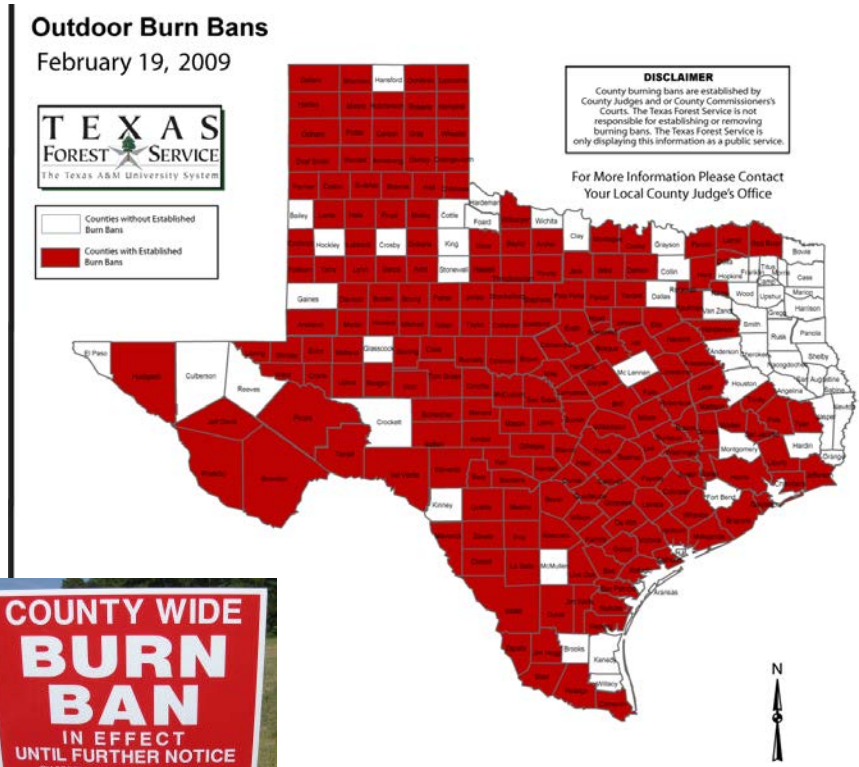
Juniper invasions: the greatest threat to conservation in Nebraska (Nebraska Conservation Roundtable, 2014)

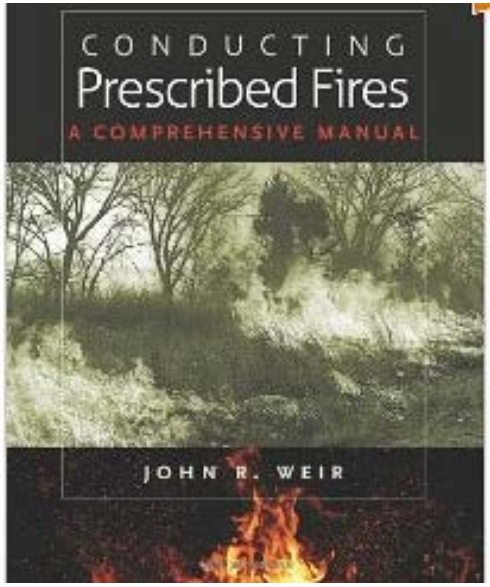


based on review by Twidwell et al. 2013 *Frontiers in Ecology and the Environ.*

Inadvertent grassland conversions: a consequence of losing humanity's affinity to fire







Twidwell et al. 2013 *Frontiers in Ecology and the Environ.*

Juniper invasions - one of the greatest threats to rangeland resources in the Great Plains

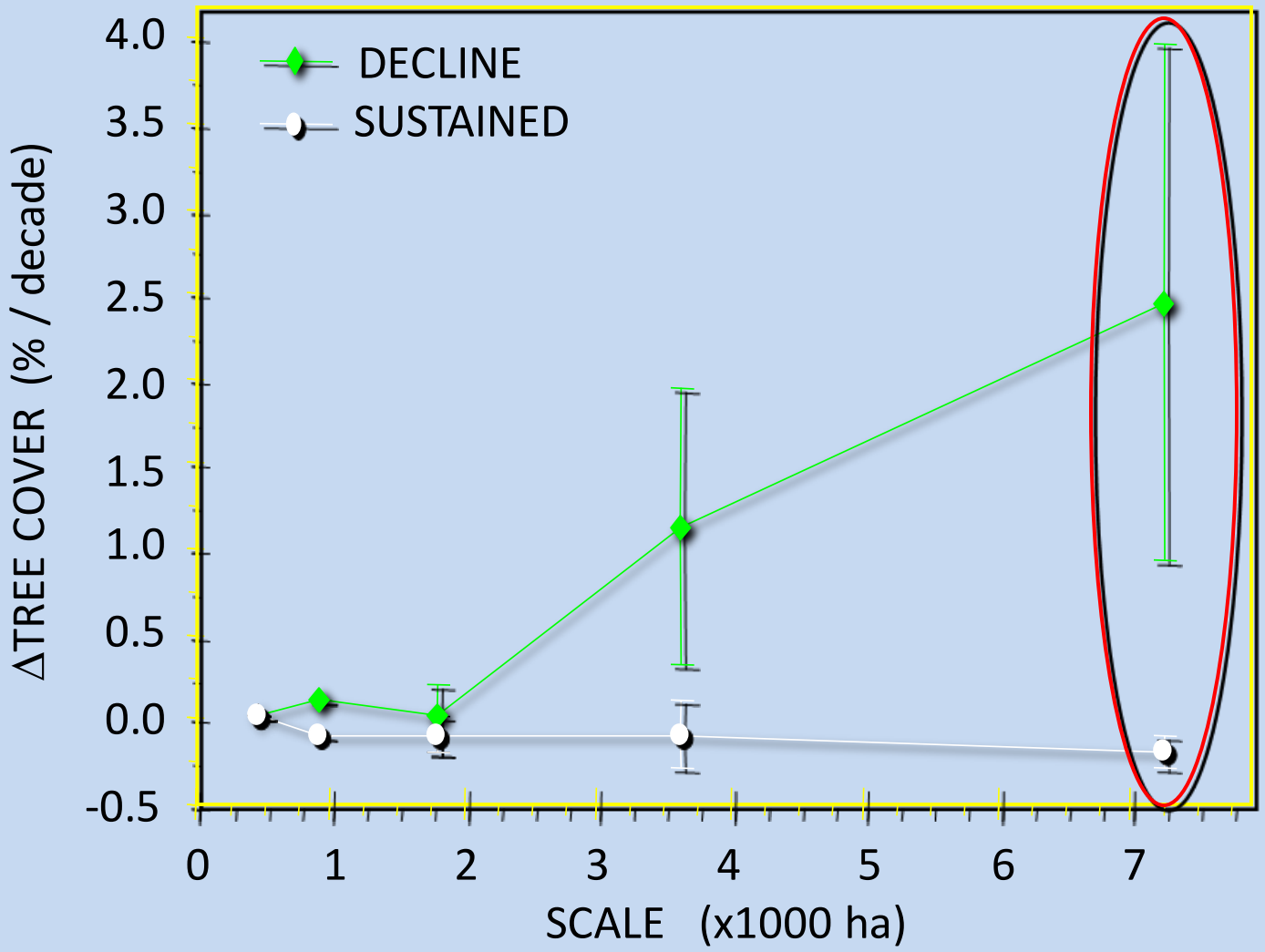
- Engle *et al.* 2008; Twidwell et al. 2013

Grassland 	**Ecosystem Service**	**Juniper woodland** 
High	Grassland biodiversity	Low
Low	Aboveground carbon sequestration	High
Moderate	Resilience to rapid carbon loss	Low
Varies	Stream flow and groundwater recharge	Varies
High	Livestock production	Low
Varies	Wildfire suppression potential	Low to None

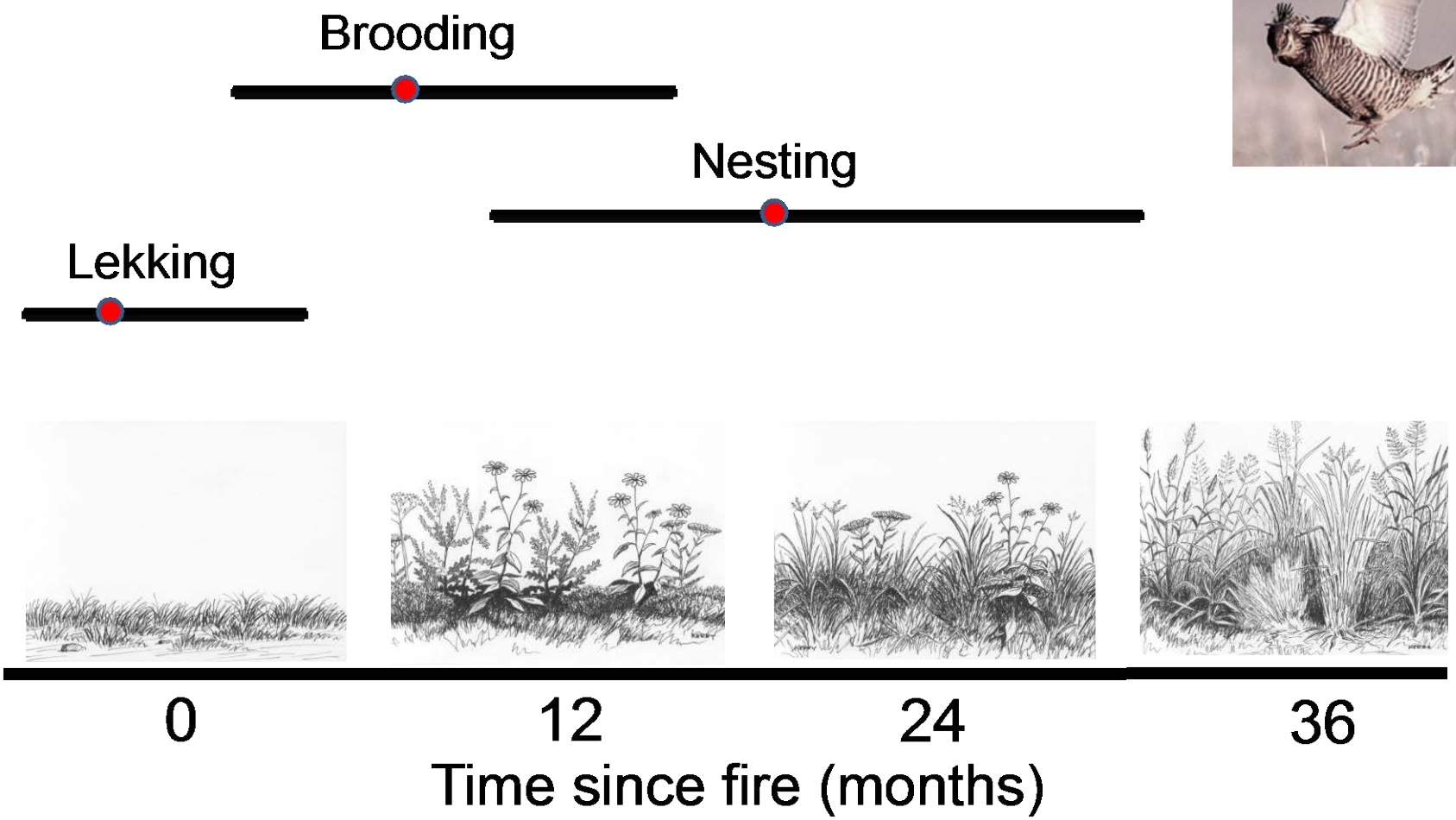
Twidwell et al. 2013 *Frontiers in Ecology and the Environ.*


Photo: T. Hovick

Declining populations of LPCs were associated with small changes in juniper cover at large scales

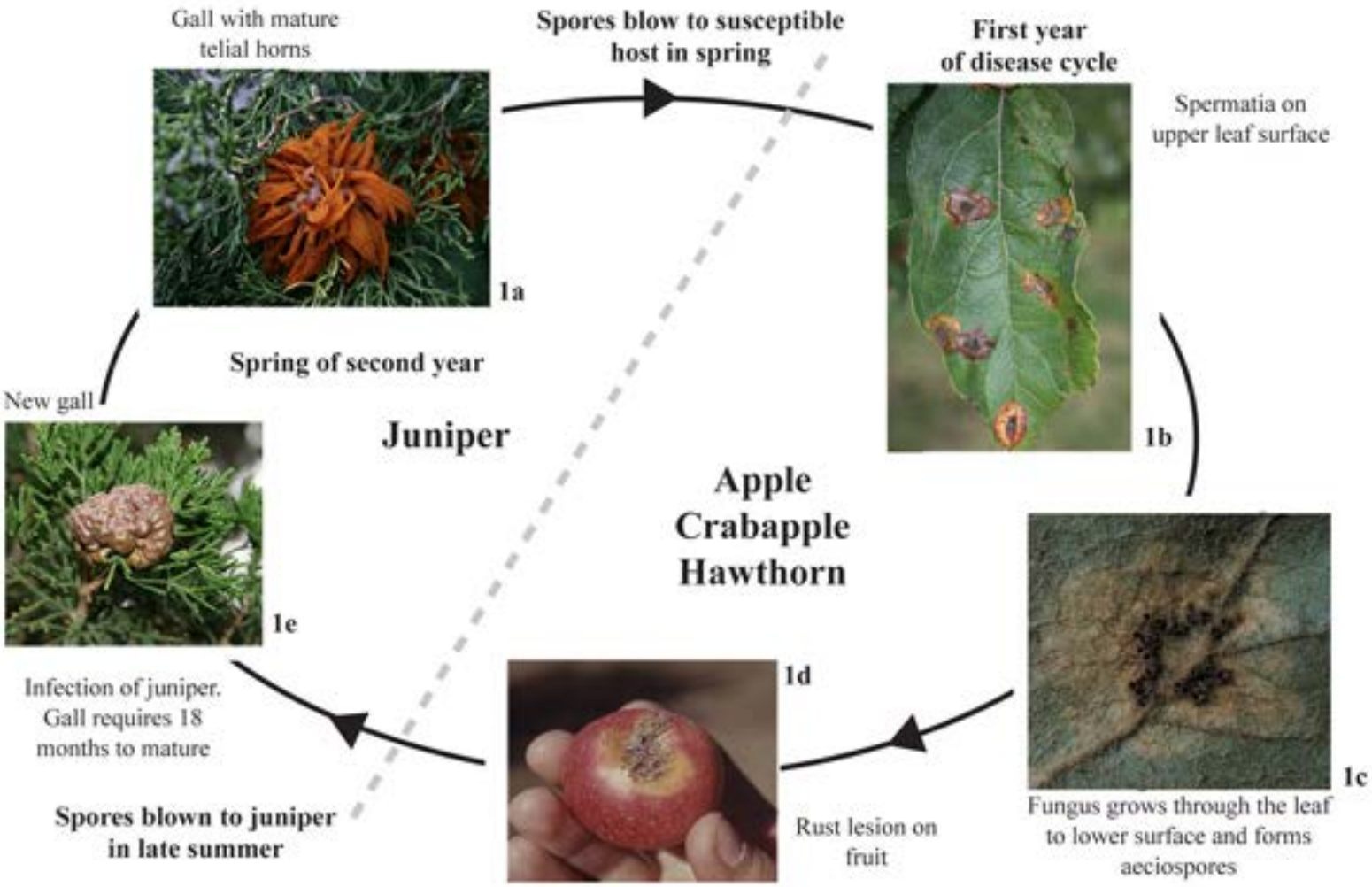


Greater Prairie Chickens Require Variable Habitat Types Occurring on the Landscape Simultaneously



Hovick et al. *in review*

Cedar-Apple Rust

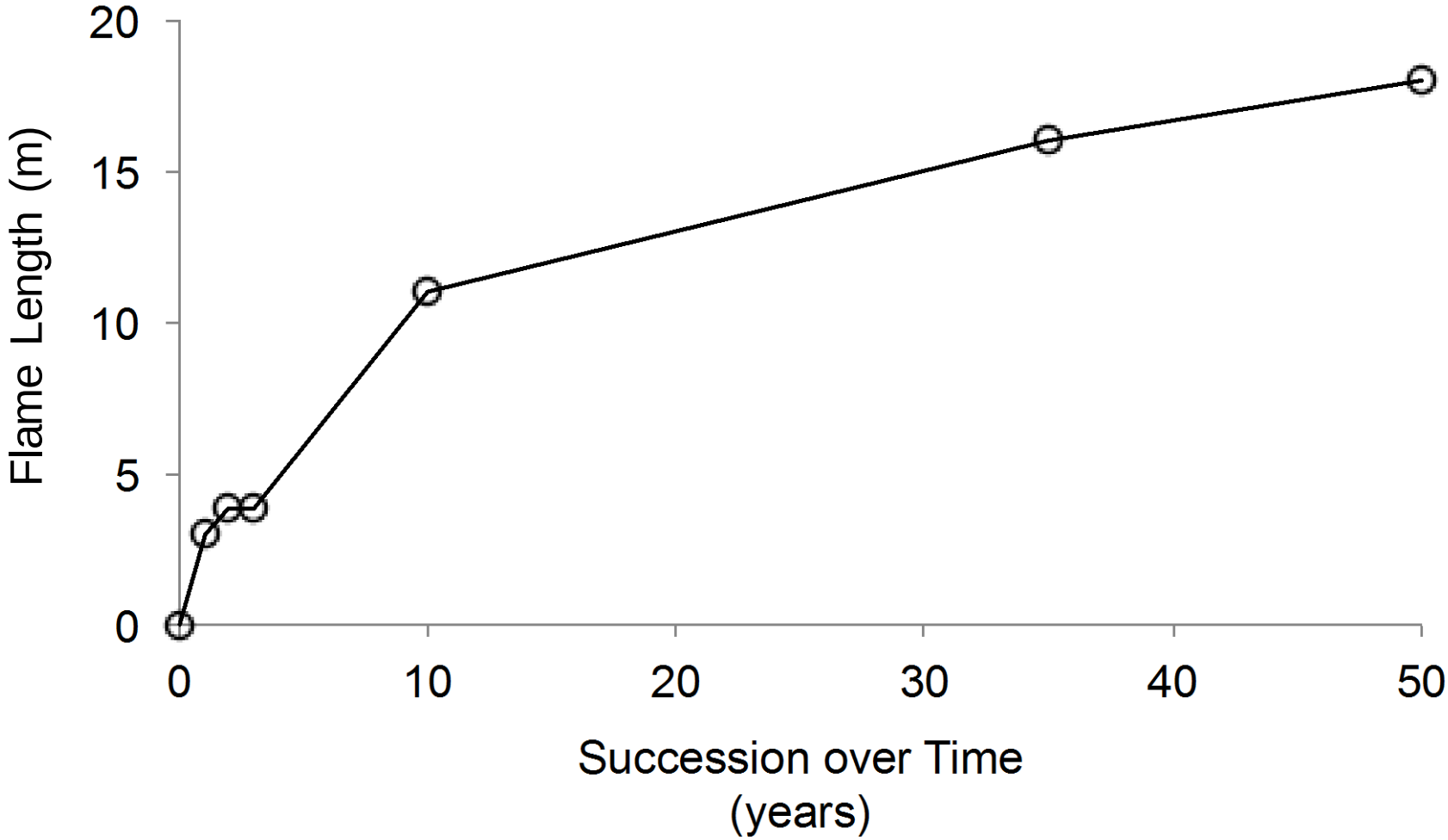


UNL Extension

(2013) The Oklahoma Allergy & Asthma Clinic has issued this alert…

VERY HIGH RANGE: Allergy alert. The alert is due to cedar pollen. This is an extreme exposure situation.


533
FIRE / RESCUE
"Smoke Detectors Save Lives"



Grassland

J. Savanna

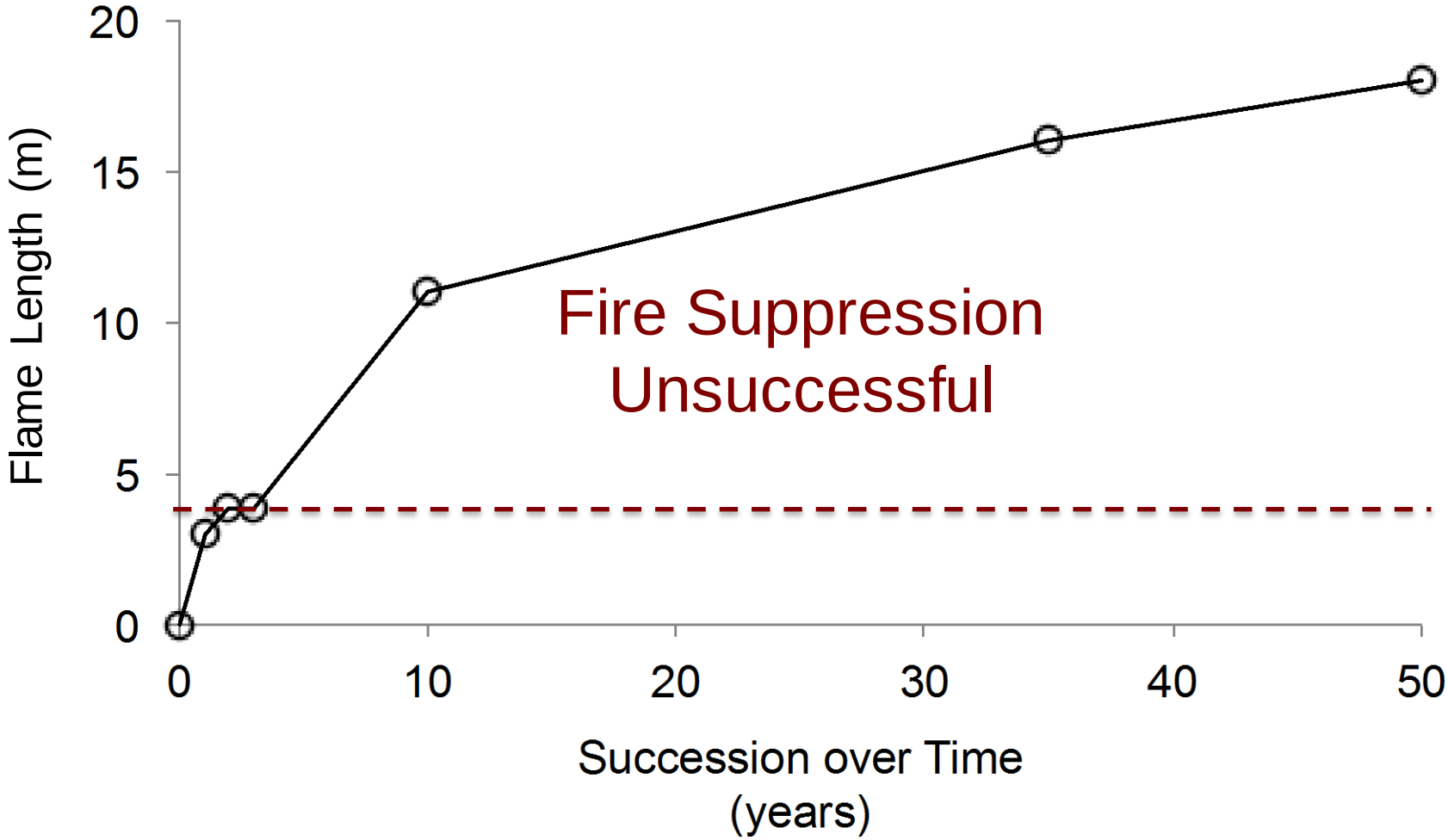
J. Woodland

J. Forest

Fire Suppression Guidelines

Flame Length (feet)	Fireline Intensity (BTU ft^{-1} s^{-1})	Fire Suppression Interpretation
< 4	< 100	Fire can be attacked at head and flanks with hand tools; hand line should hold fire
4 – 8	100 – 500	Fires too intense for direct attack on head; hand line unreliable; mechanized equipment can be effective (plows, dozers, pumpers)
8 – 11	500 – 1,000	Fires present serious control problems (crowning, torching and spotting)
> 11	> 1,000	Crowning, spotting, and major fire runs probable; control at head of fire ineffective

Andrews and Rothermel 1986



Grassland

J. Savanna

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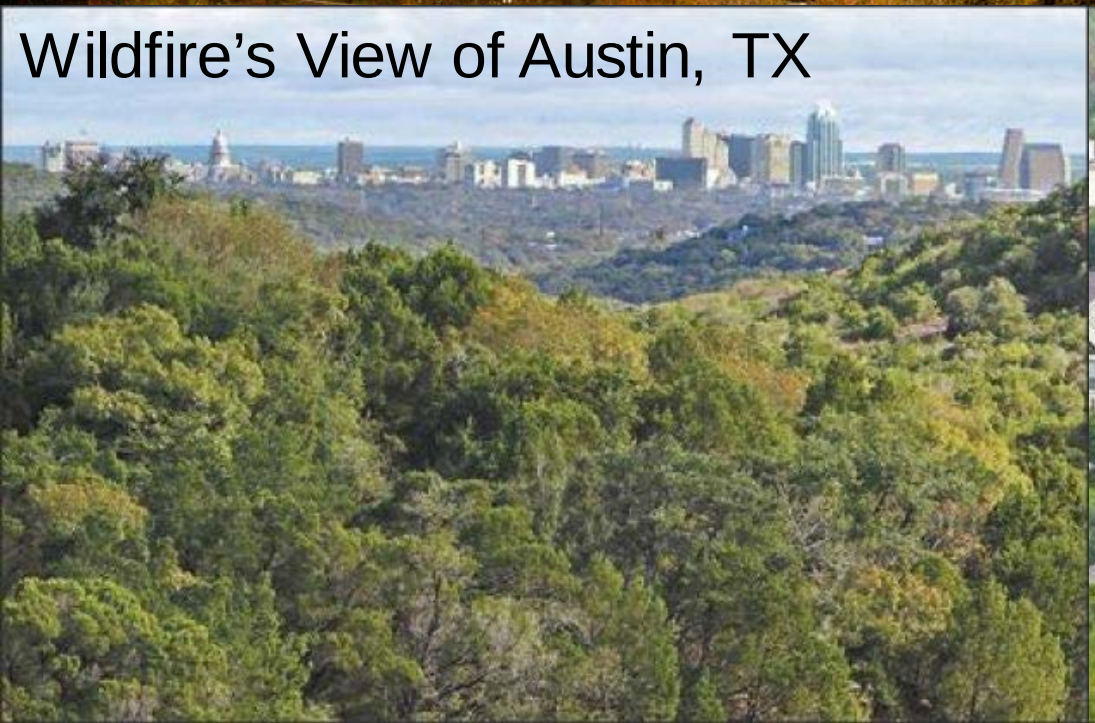
J. Forest

Austin, TX's View of Bastrop Wildfire

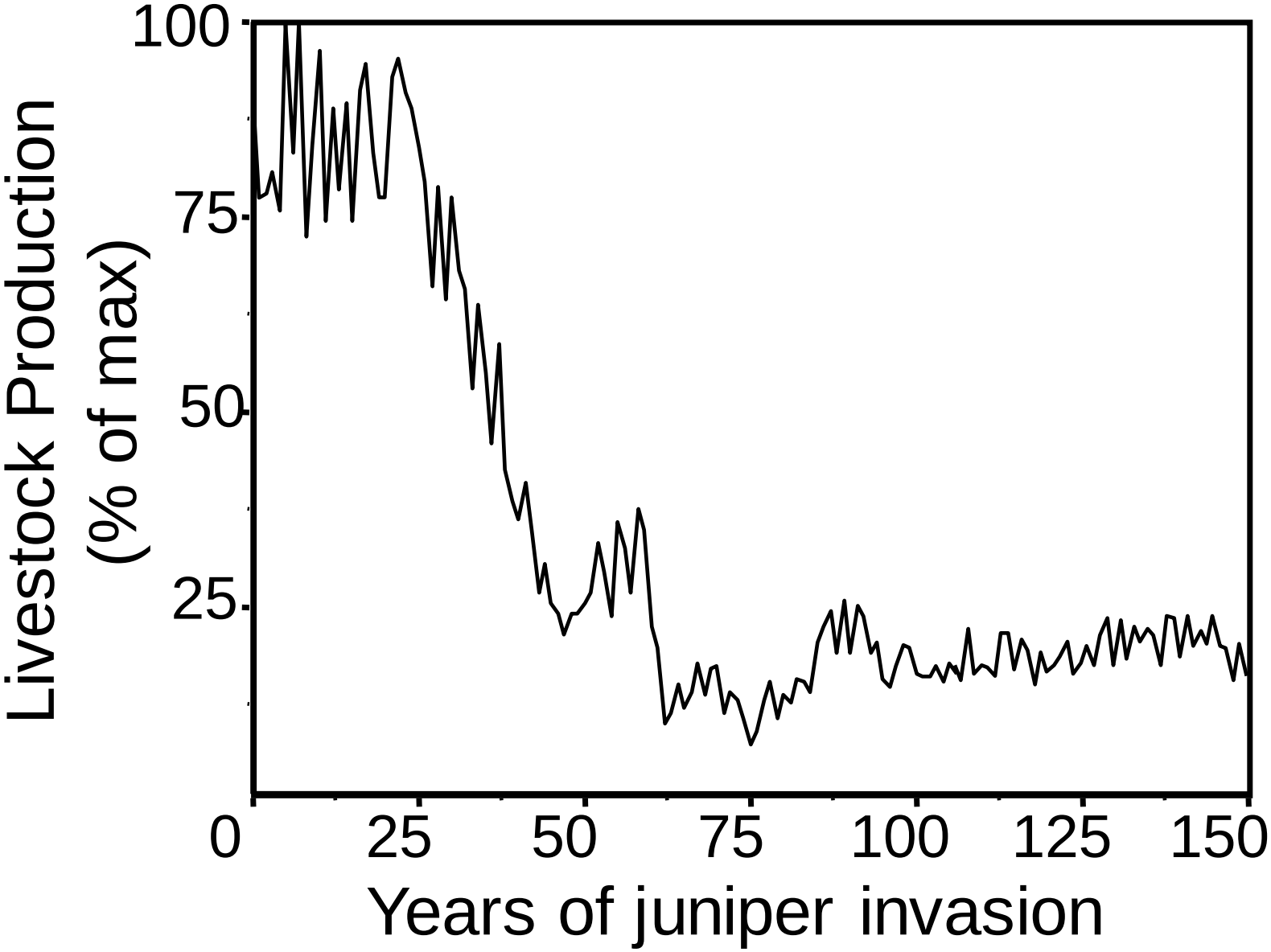
Wildfire's View of Austin, TX



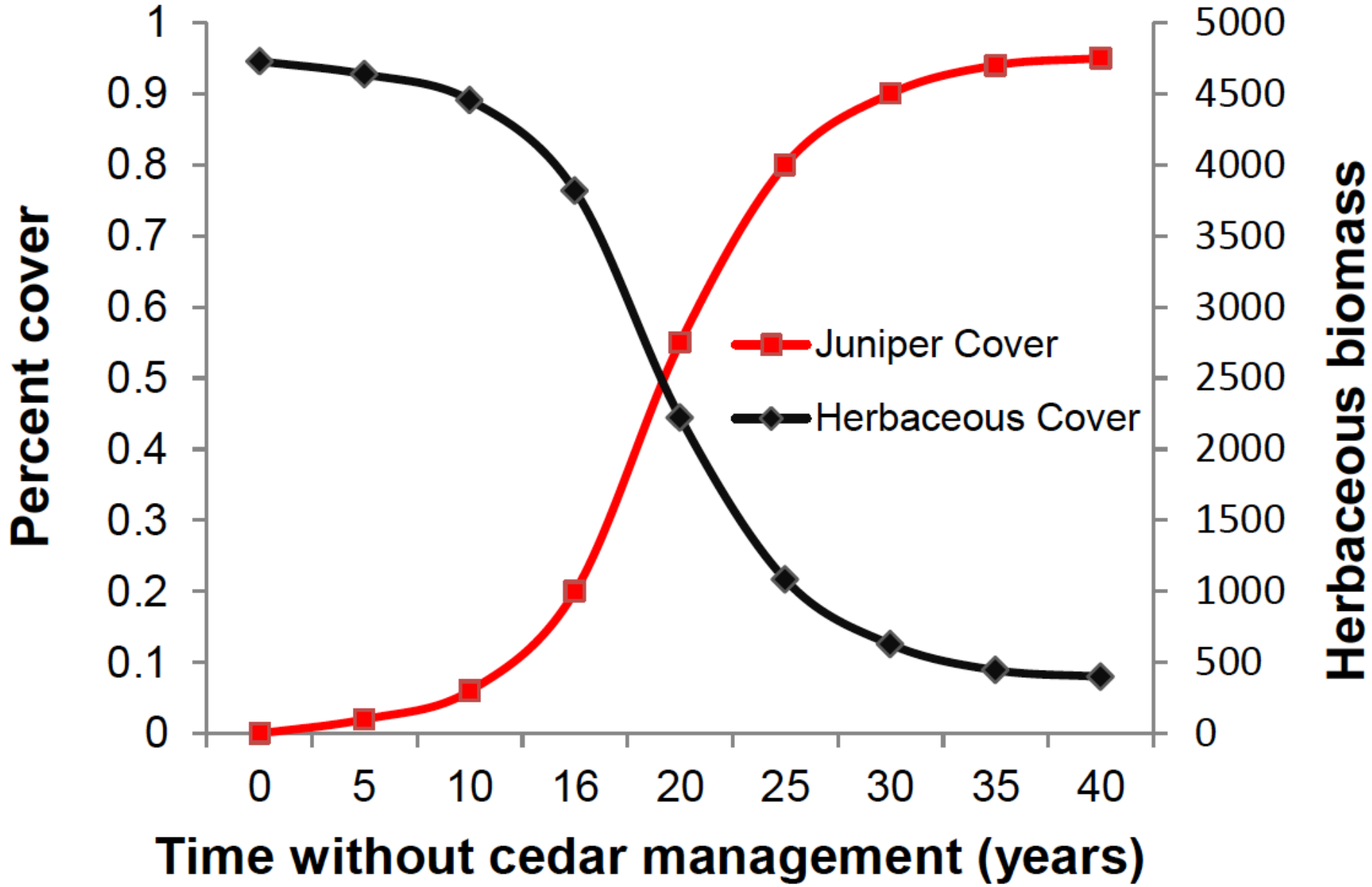
Photos: GILBERT W. ARIAS

Historical Stocking Rate Decline

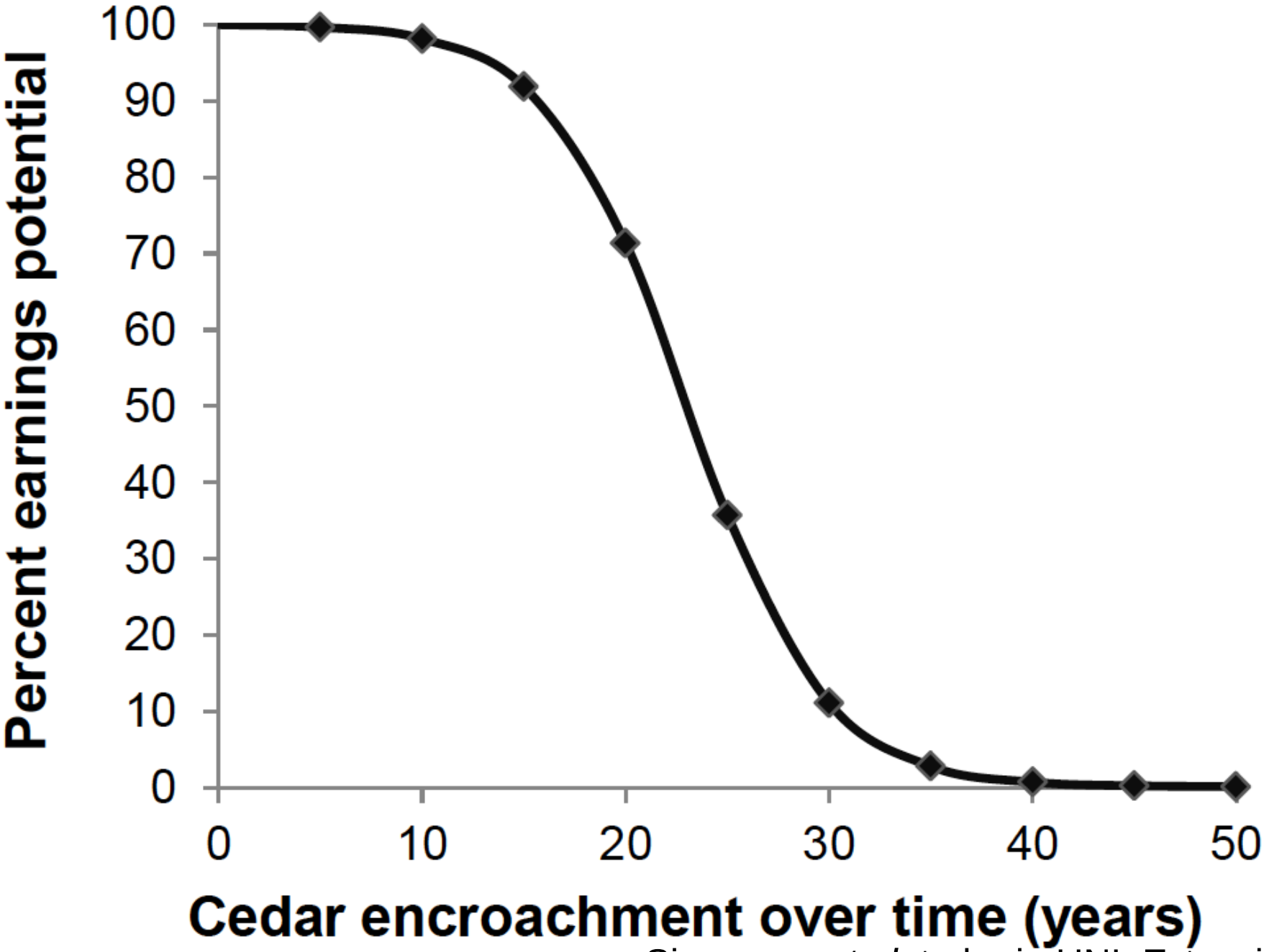
Texas A&M Sonora Experiment Station



Fuhlendorf *et al.* 2008



Simonsen *et al.* to be in UNL Extension



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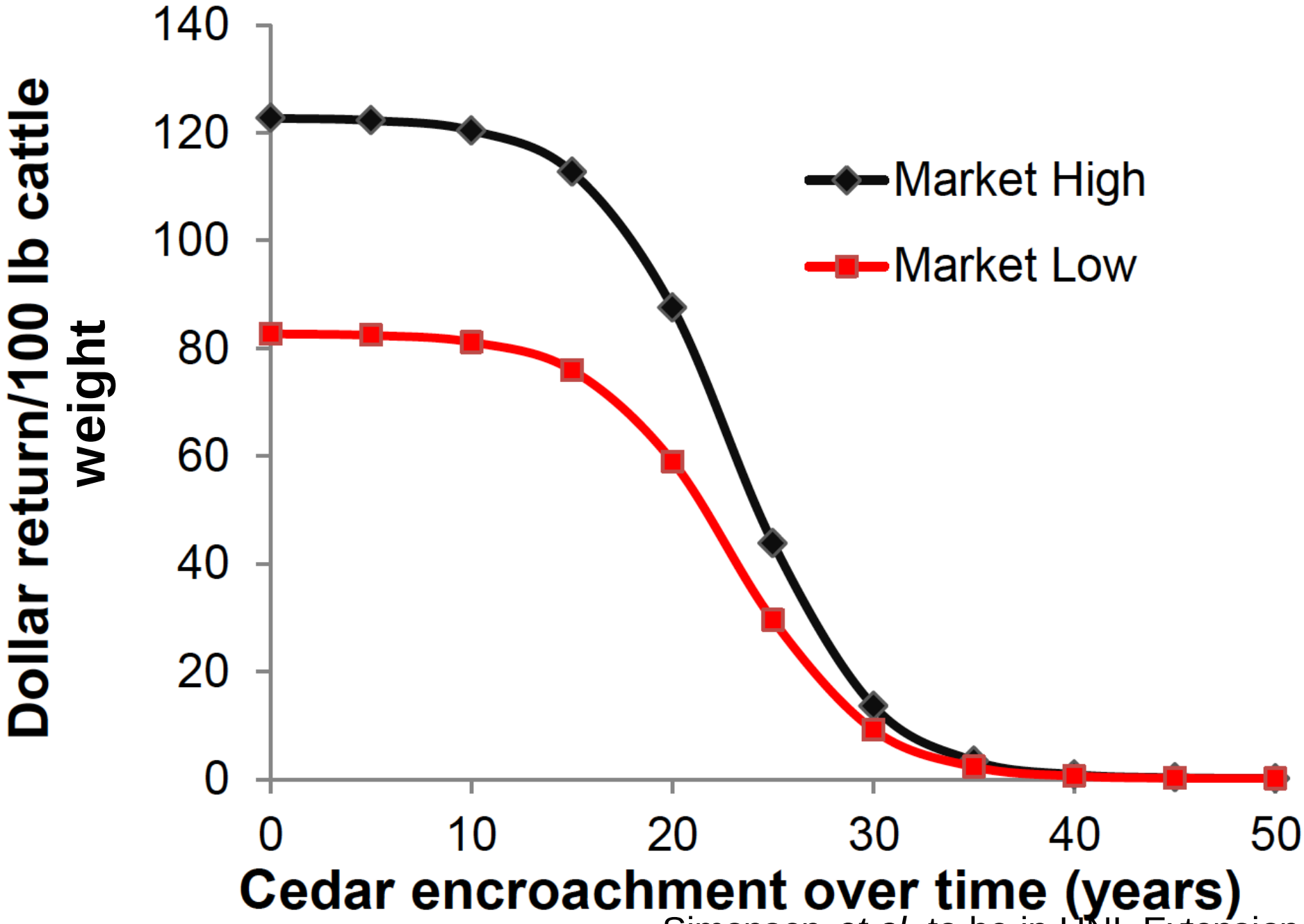

Simonsen *et al.* to be in UNL Extension

"So why can't we use mechanical clearing to get out of this mess?"

NE NRCS cost share information

Techniques used for cedar control	Management strategies		Total number of acres implemented	Total cost of implementation	Average number of projects/year	Average acres/project	Average cost/acre
	Proactive	Reactive					
Cutting/mechanical removal		X	138,869	$7,948,116.09	285	51.80	$53.81
Prescribed burning	X*	X*	96,328	$699,824.41	47	197.21	$7.34
Herbicide application		X	Minimal to none	Minimal to none	Minimal to none	Minimal to none	Minimal to none
Haying	X		Minimal to none	Minimal to none	Minimal to none	Minimal to none	Minimal to none
High density goat grazing	X		Minimal to none	Minimal to none	Minimal to none	Minimal to none	Minimal to none

Simonsen et al. *UNL Extension* (in review)

Restoration recommendations in juniper-encroached rangelands:

Restoration… requires extensive brush control, reseeding and grazing management (USDA, NRCS 2012).

But the brush management experiment has played out in the southern Great Plains...

USDA NRCS Conservation Expenditures

Management action	# ESDs (%) featuring management action as driver of state transition	Annual conservation expenditures (% of total expenditures)†	Annual land area treated in ha (% of total area)†
Grazing	268 (79%)	$9,364,843 (24%)	6,536,543 (67%)
Brush management	209 (61%)	$25,450,791 (66%)	1,590,489 (3%)
Fire	235 (69%)	$417,781 (1%)	123,957 (1%)
Reseeding natives	131 (39%)	$2,752,753 (7%)	103,976 (1%)

Twidwell et al. (2013) *Ecosphere*

"But we can't burn the Sandhills..."

Sandhills resilience to an extreme wildfire and drought event (current graduate research project)

Fairfield Creek Fire Threatens North-Central Nebraska Residents

Lightning Sparks Nebraska Wildfire Amid Drought

Nebraska wildfires rage as dry heat scorches central U.S

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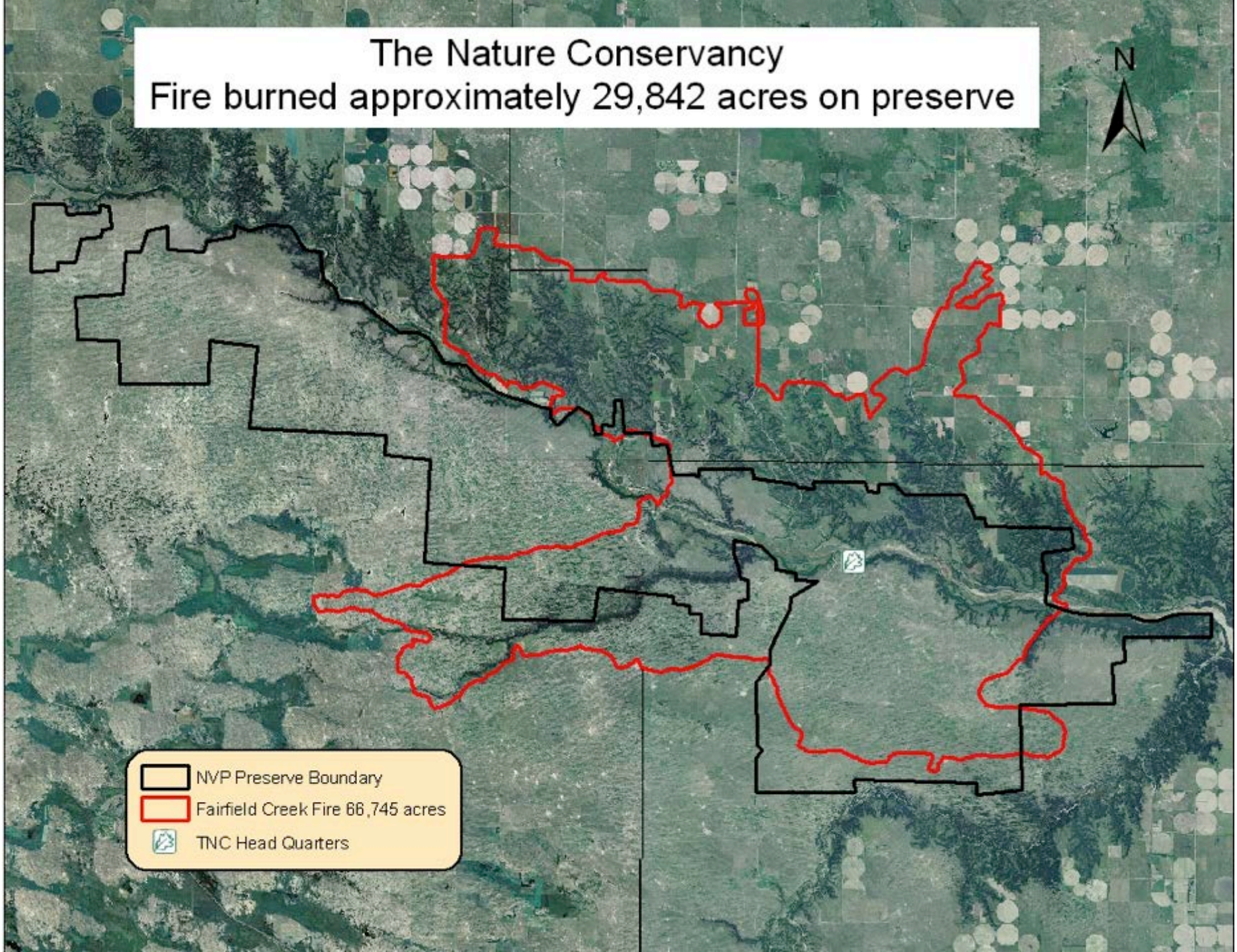
Top 10 Nebraska news stories of 2012

December 24, 2012 10:00 pm • By The Associated Press

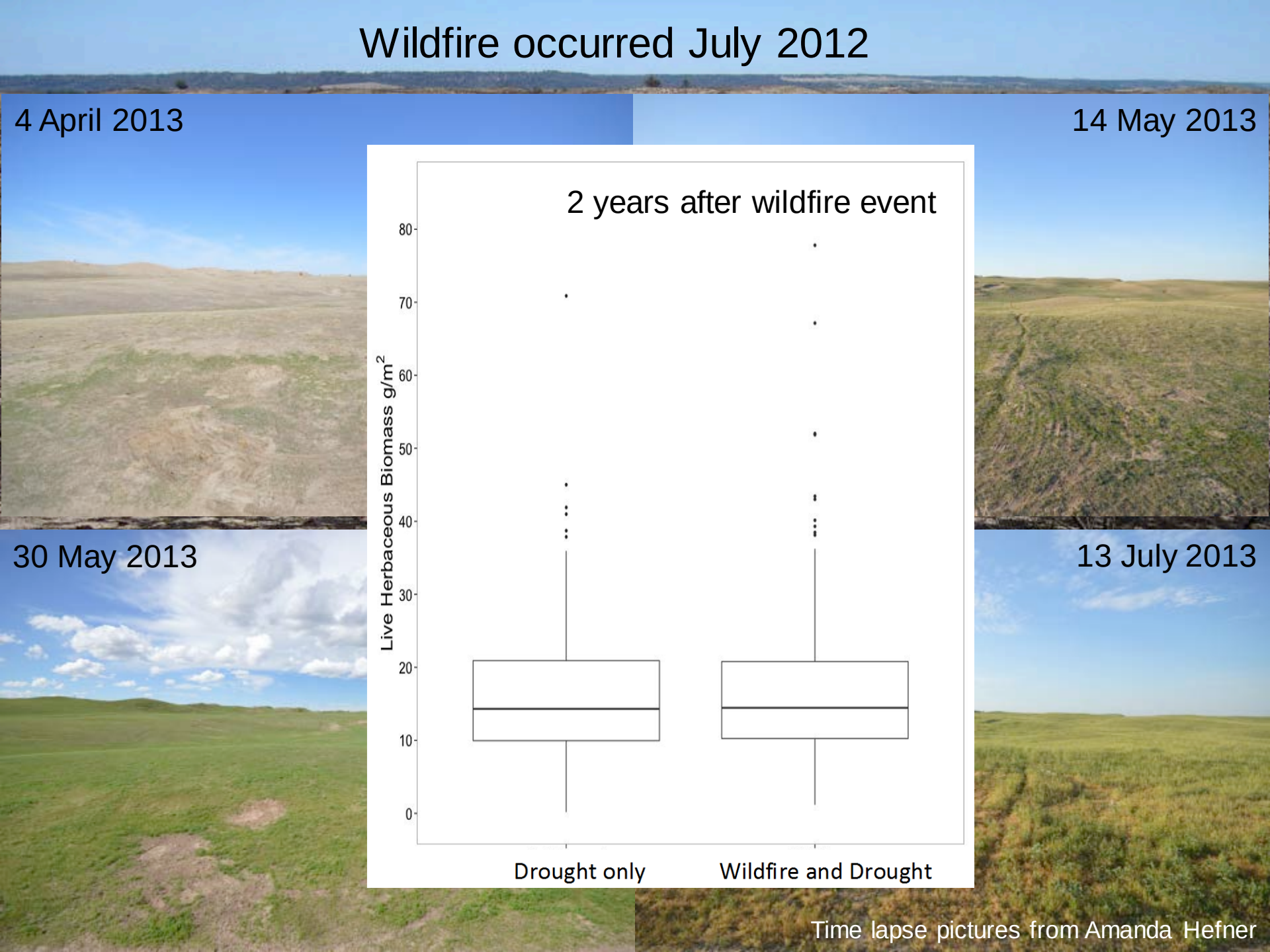
The top 10 Nebraska stories of 2012, as voted upon by Associated Press newspaper and broadcast members:

1. DROUGHT: Farmers, ranchers and residents of some cities struggled through the worst drought in decades, renewing concerns over water usage.

2. WILDFIRES: Firefighters throughout Nebraska stayed busy all summer battling wildfires driven by drought conditions and high winds.


The Nature Conservancy
Fire burned approximately 29,842 acres on preserve
N
NVP Preserve Boundary
Fairfield Creek Fire 66,745 acres
TNC Head Quarters

Wildfire occurred July 2012



Time lapse pictures from Amanda Hefner

The Sandhills:
More resilient to fire than previously believed

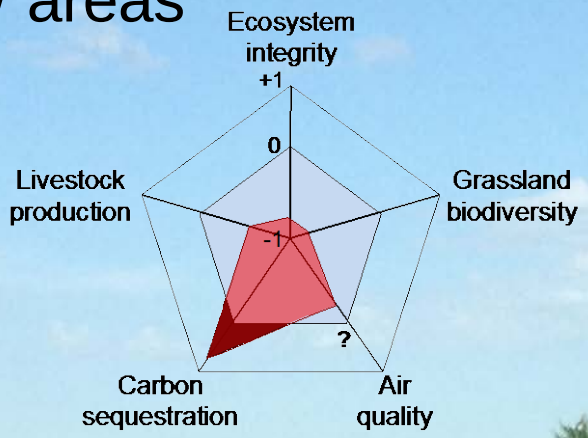
“But I like to plant cedar as windbreaks...”

Juniper invasions - one of the greatest threats to rangeland resources in the Great Plains

State	Mean annual distribution of Eastern redcedar seedlings	Year when distribution started	Justification	
			Wildlife habitat	Windbreak/ erosion control
Nebraska	850,000	1926	X	X
South Dakota	500,000	1959	X	X
North Dakota	200,000	n.a.		X
Kansas	115,000	1958	X	X
Iowa	100,000	1982	X	X
Missouri	100,000	1949	X	X
Minnesota	98,000	1961	X	X
Oklahoma	85,000	1948		X
Texas	23,500	1982		X
Total	**2,071,500**			

Data from Ganguli et al. 2008

Windbreaks serve as a novel seed source for dispersal and establishment of Eastern redcedar into new areas



The Challenge for Nebraska

- No state has successfully reacted to juniper invasions and restored expansive grasslands.
- The scale of invasion exceeds the scale of modern-day management.
- The cost of reacting to invasions prohibits broad-scale success with mechanical removal.
- Can we change from a culture facilitating cedar invasions to one that prevents it?
- We are not managing to prevent one of the biggest threats to Nebraska's rangelands.

The Opportunity for Nebraska?

- Much of the state is at the earlier stages of cedar invasions.
- Cedar invasions can be easily controlled compared to other invasive species.
- Potential for a uniform, consistent approach among all agencies and a constant message to NE stakeholders.
- The Nebraska Sandhills are an iconic ecosystem deserving of protection.