Responses of Shrub Midstory and Herbaceous Layers to Managed Grazing And Fire in a Wisconsin Degraded Oak Woodland

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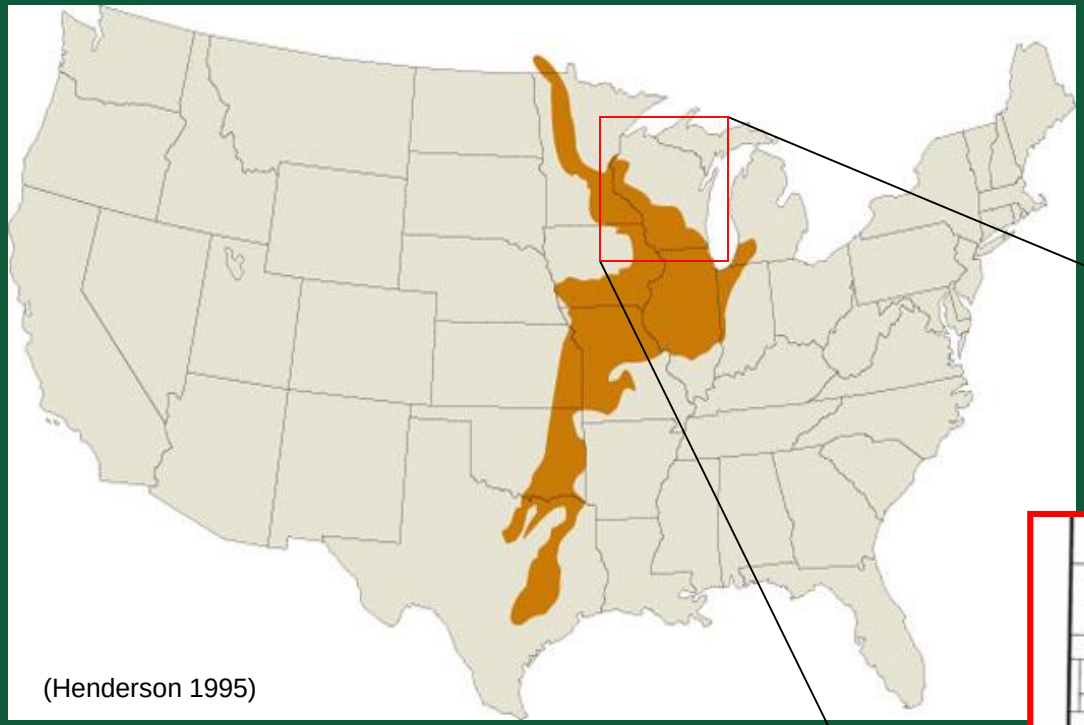
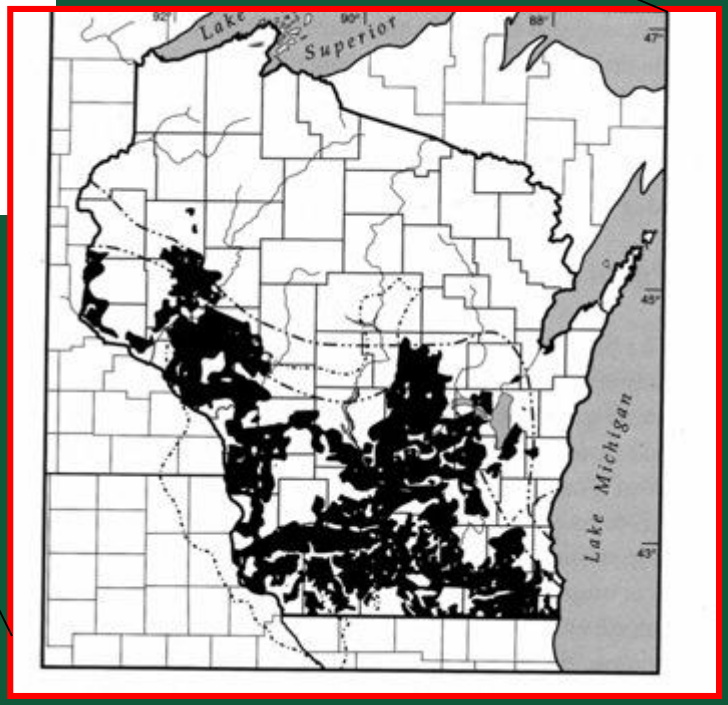
Upper Midwest Invasive Species 2014

Oak Savanna Status



(Henderson 1995)

- Original Midwest extent 12 million ha.
- By 1985 this was reduced to 2600 ha or .02%



(Cochrane and Iltis 2000)

- Wisconsin: In 1830, 2.2 million ha of oak opening; 2.1 million acres of prairie; 0.6 million ha of oak forest

Oak Savanna/Woodland

- Open canopy (10-80%)
- Transition zone
- Moderate-absent midstory
- Grass-sedge dominated ground layer (Curtis 1959, Taft 1997)

Premise

- Oak savanna is in significant decline.
- Hundreds to thousands of acres of degrading oak savanna still exist on private lands.
- Fire is not always successful at reducing shrubs and provides limited direct benefit to private landowners.
- Large acreages that have dense shrub cover may discourage recovery efforts, if fire and mechanical cutting are the only tools to do so.

Premise

- Continuous grazing is problematic in that it causes soil disruption in terms of erosion, compaction, fertility, etc. and often favors weedier species.

- In such situations, light grazing may have a two-way benefit--supporting livestock and providing a means to reduce shrub and sapling cover.
- This study's focus is on grazing as a conservation tool for shrub reduction, it is not an attempt to mimic natural grazing activity of the past.

Oak Savanna Management Strategies

- Prescribed Fire
- Mechanical
- Chemical
- Biological

- Timing
- Intensity
- Frequency
- Duration

Study Questions

1. What are the effects of cattle on shrub density and herb layer cover when rotationally grazed in overgrown oak woodlands of Wisconsin?

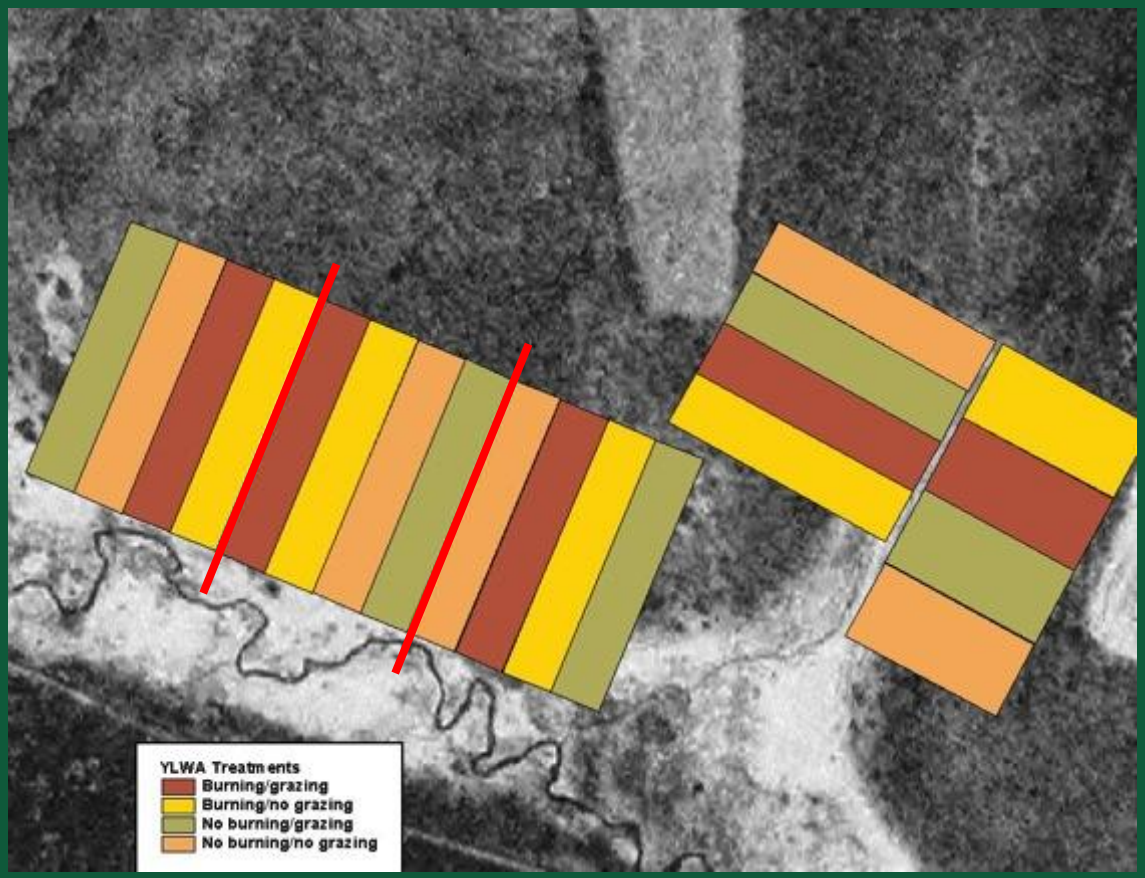
2. How does the response of vegetation to grazing compare with that of fire?

Yellowstone State Wildlife Area

- DNR managed land in Lafayette County
- Roughly 300 acres of degraded oak savanna present

Experimental Design

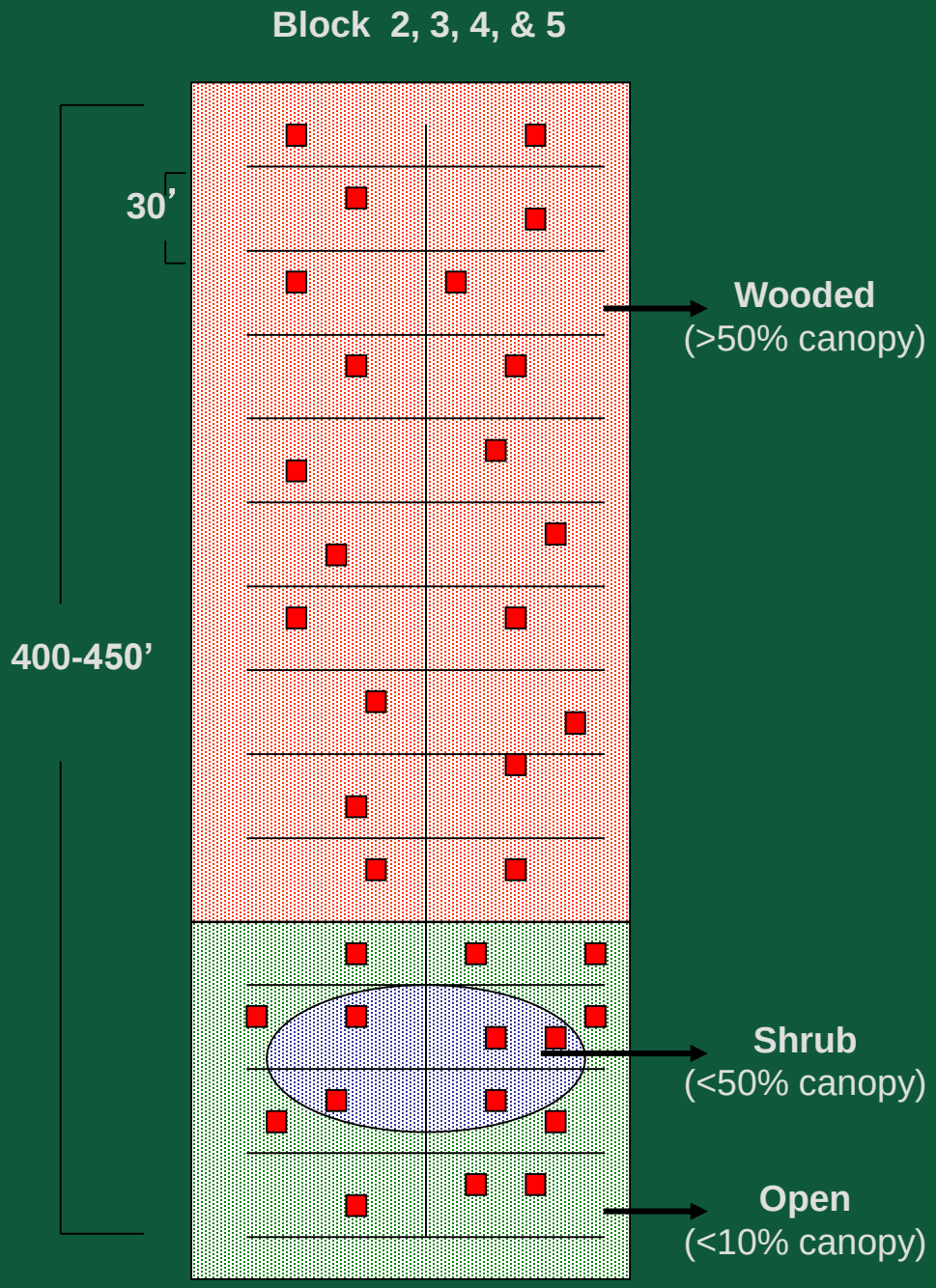
- Treatments
  - Control (C)
  - Annual spring burn (B)
  - Graze (G)
  - Burn and Graze (BG)
- 5 Blocks
- 4.5 - 9 A.U./ paddock
- Grazing cycles
- Data Collection:



- Shrub and sapling: density and height (.1 – 9” dbh) (5 sqm quad)
  Herbaceous: cover, individual sp. frequency (1 m^2 quad)
- Significance: P-value ≤ .05

Transect Layout

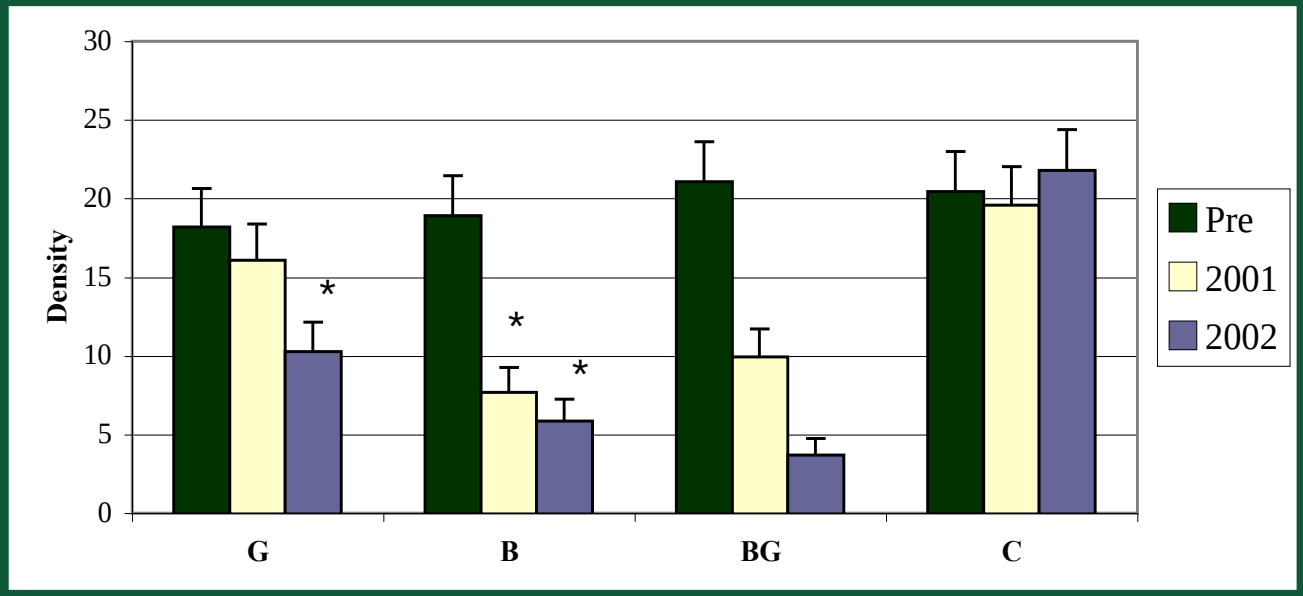
(YSWA)



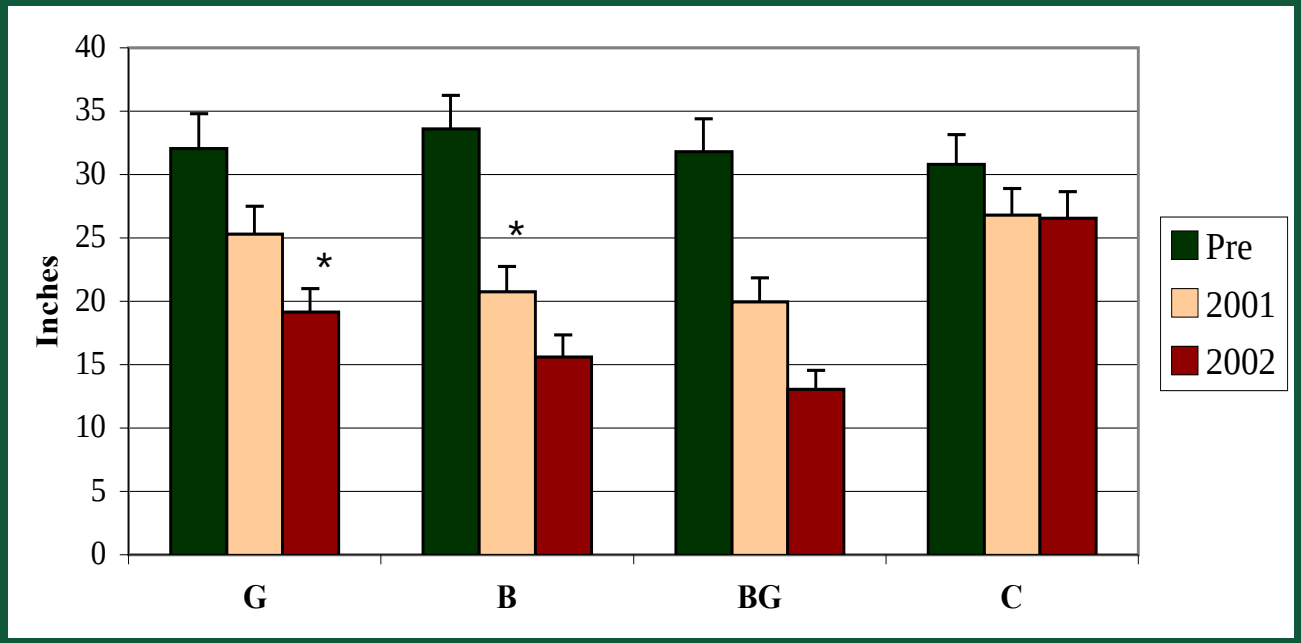

OBSERVATIONS
&
RESULTS

Woodland
All Species

Mean Shrub Density



Mean Shrub Height



* $p < .05$

Block 5: Tree Zone

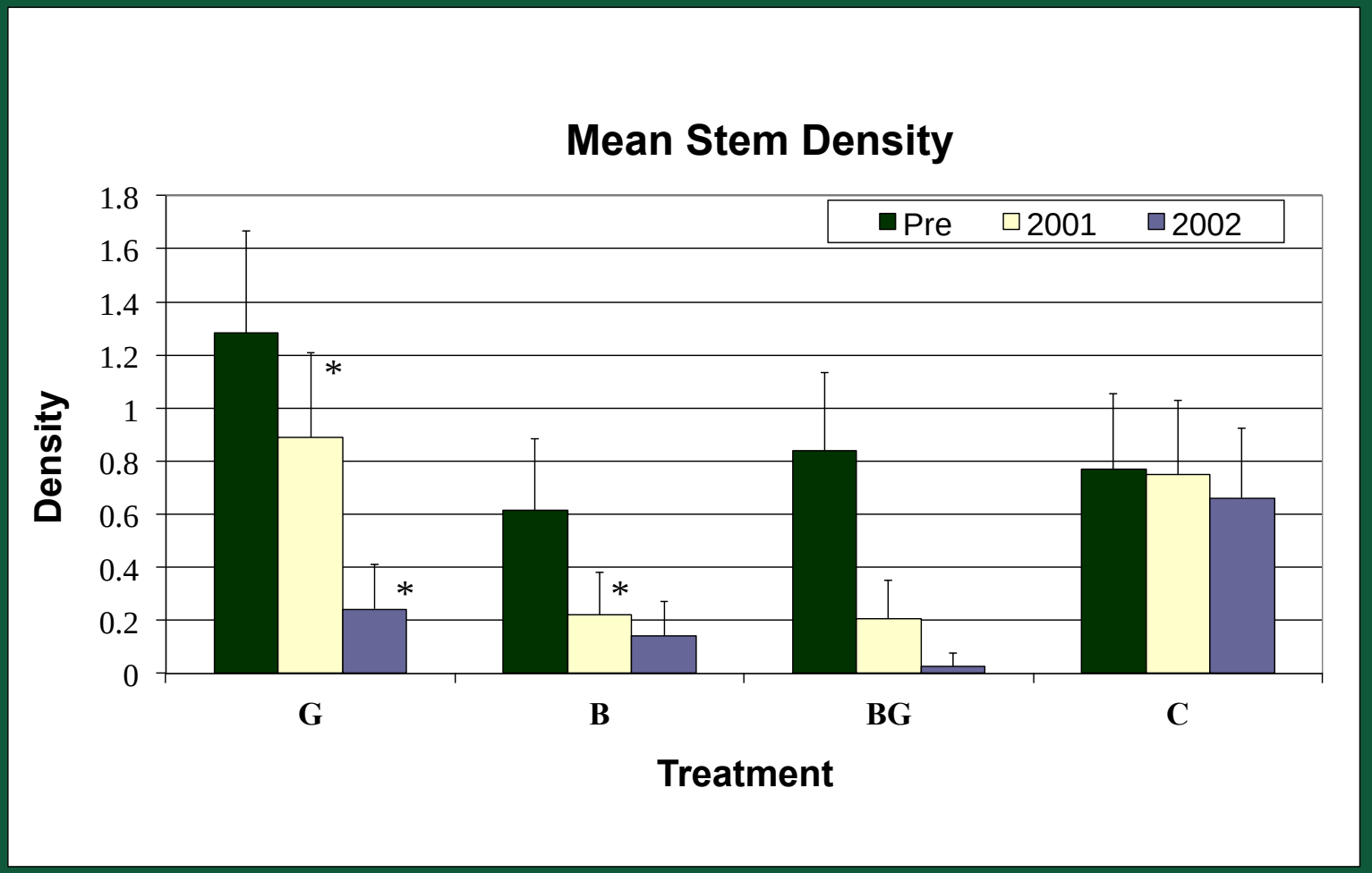
Control

Graze

Burn

Burn x Graze

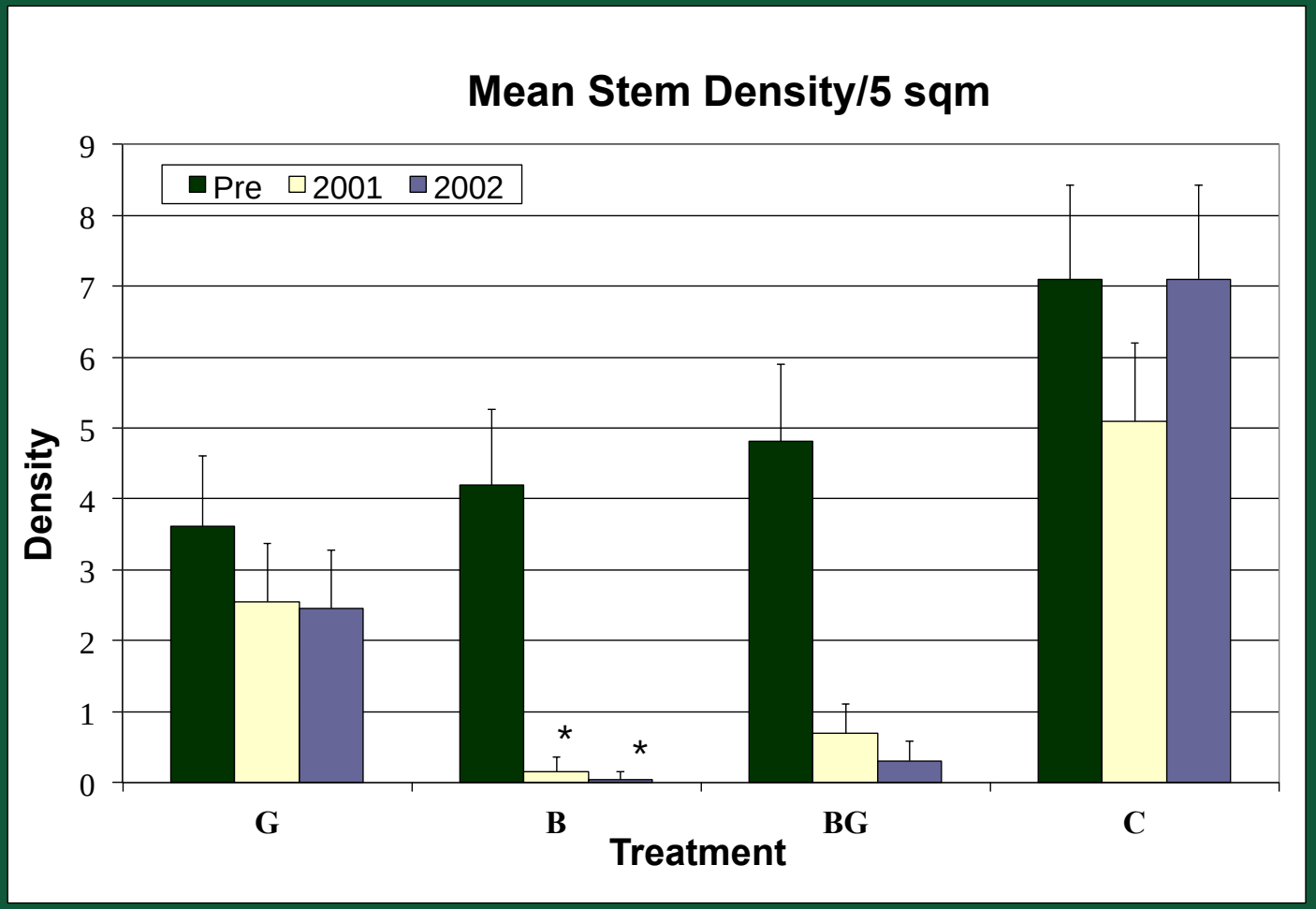
Woodland: *Corylus americana*



Pre = Before Treatment; 2001 = One Spring Burn and One Grazing Season; 2002 = Two Spring Burns and Two Grazing Seasons

B = Burn; BG = Burn x Graze;
C = Control;
G = Graze

Woodland: Gooseberry (*Ribes* spp.)



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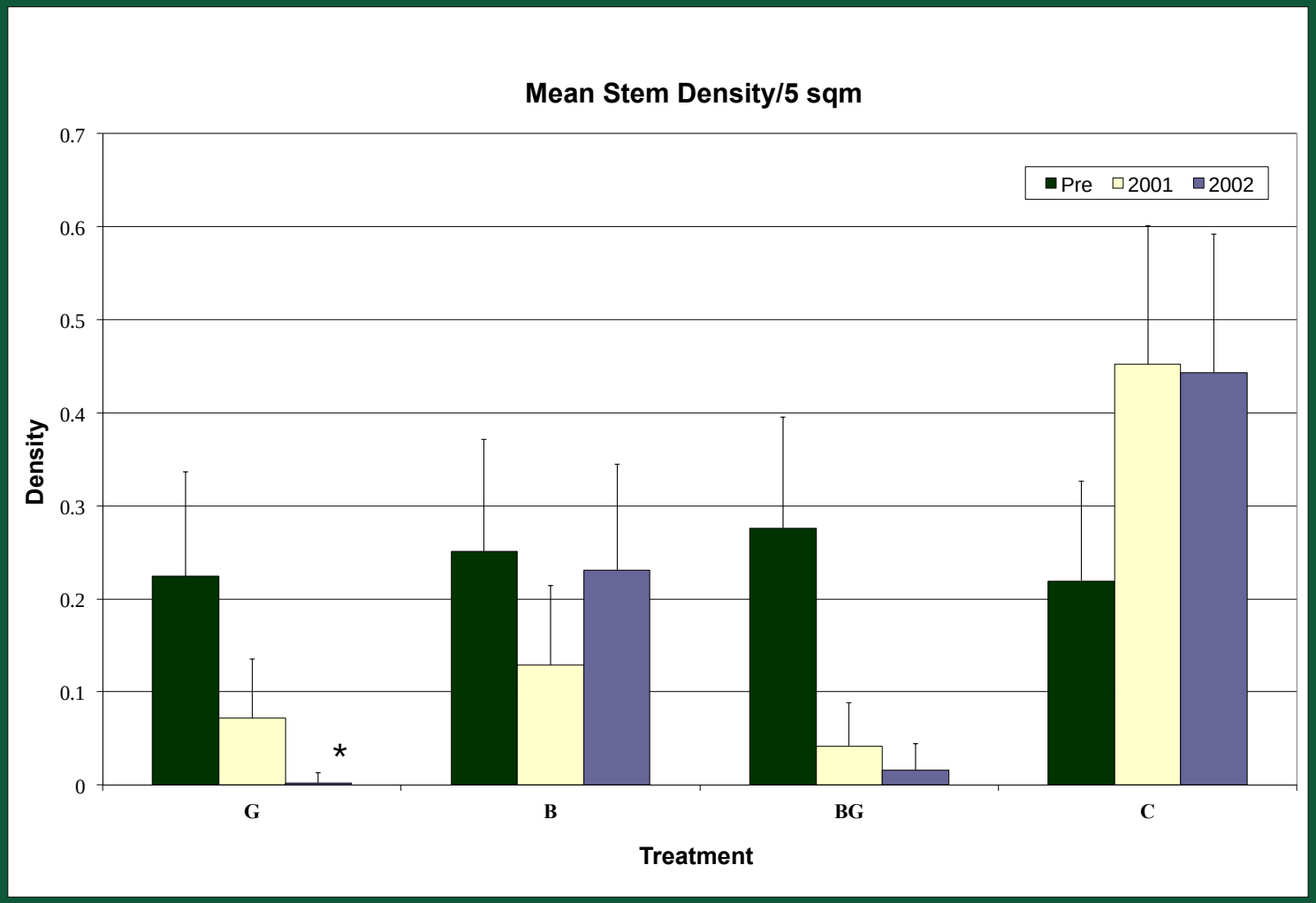
Woodland *Rubus* spp.



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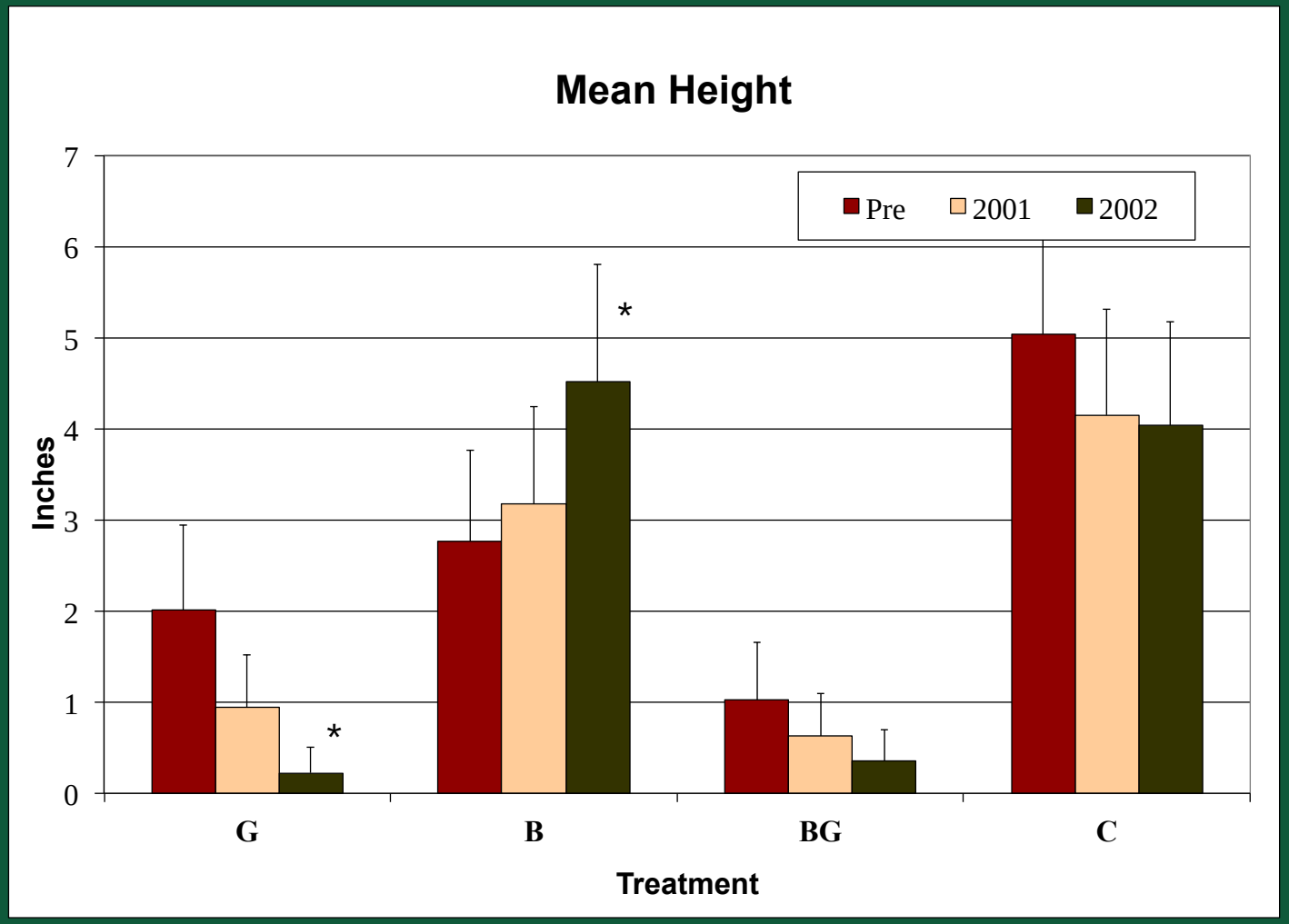

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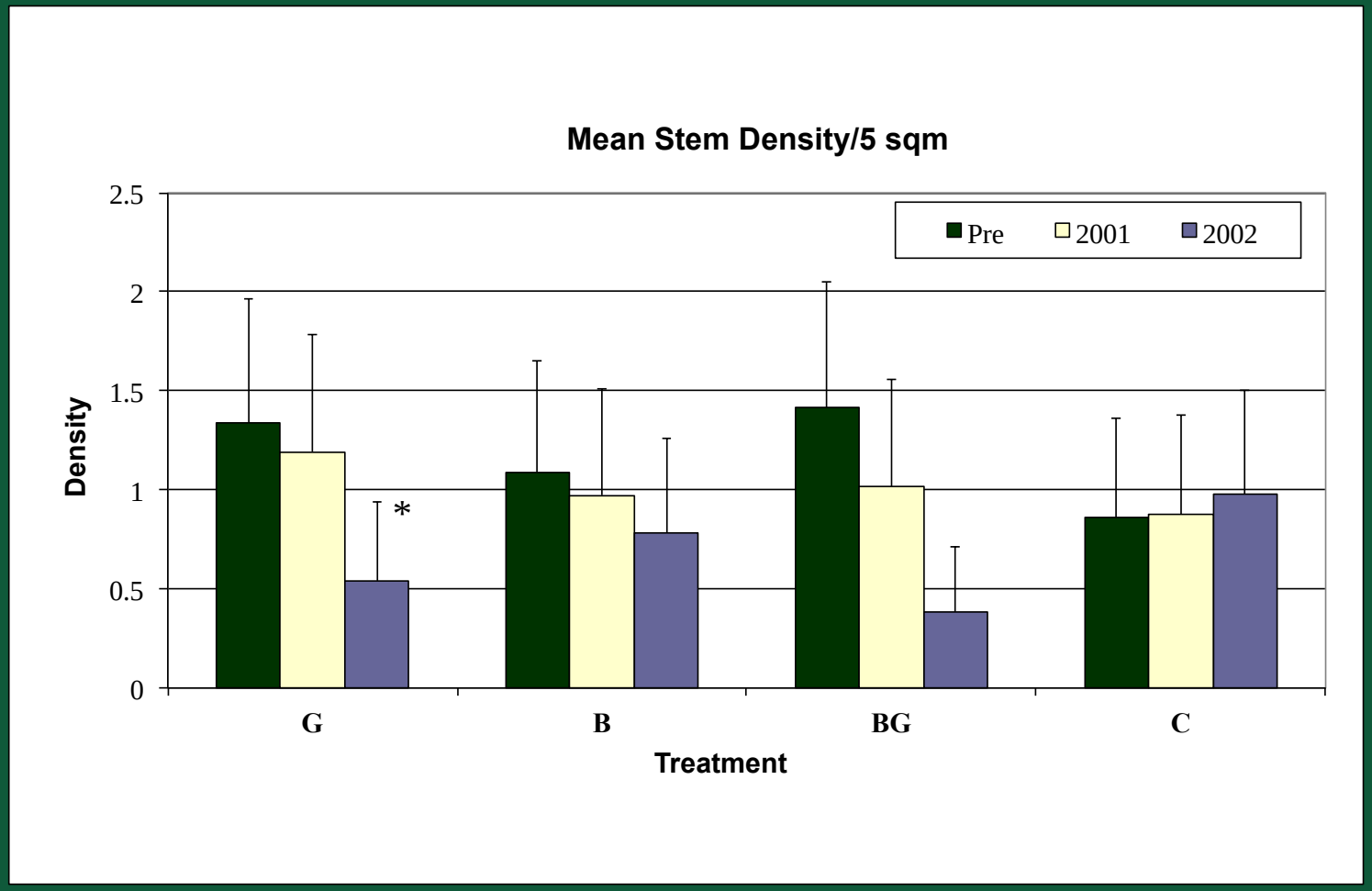
Woodland: Prickly Ash (*Zanthoxylum americanum*)



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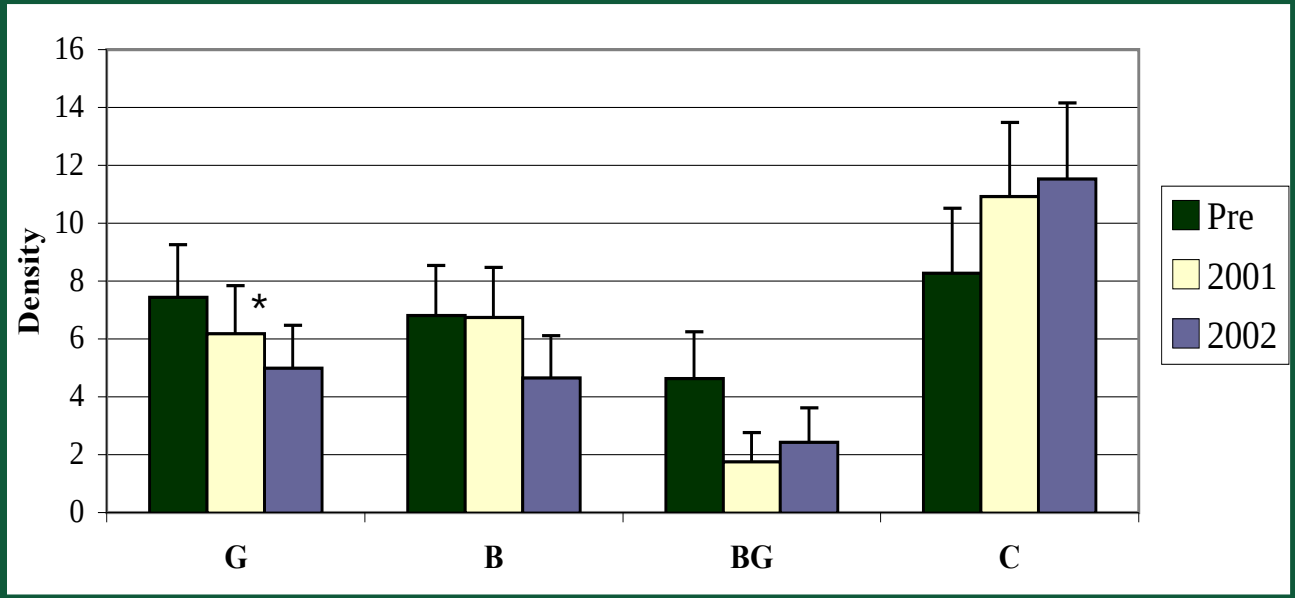
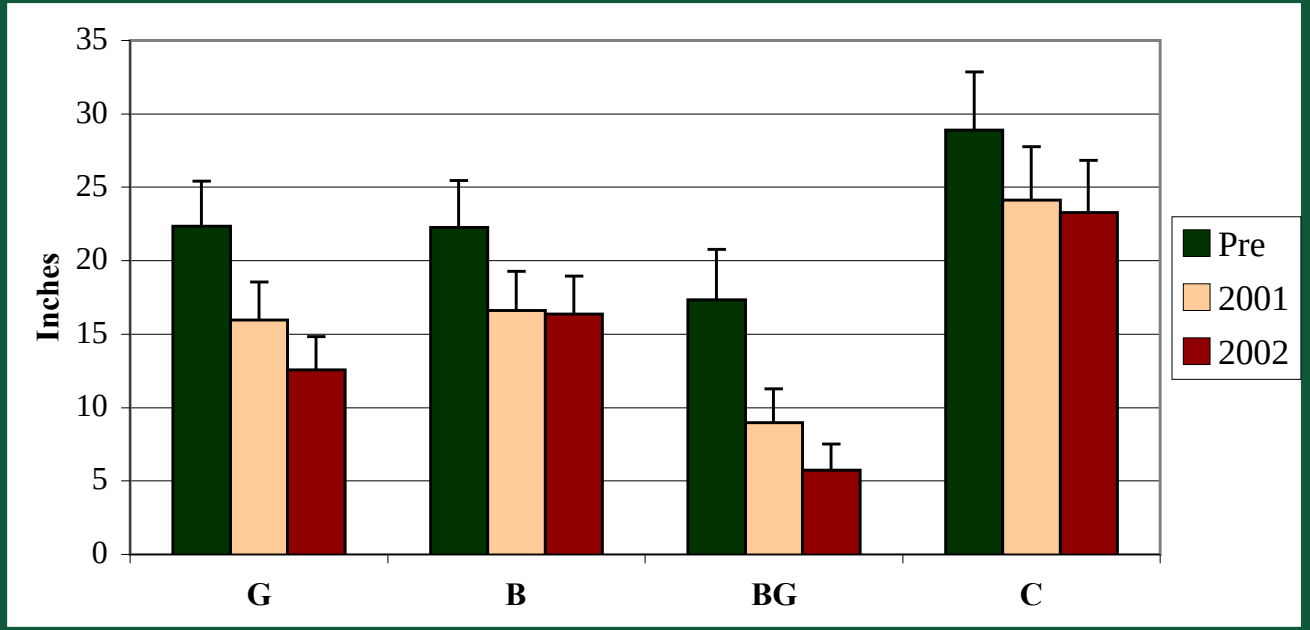
Prairie Openings

Stem Density



Average Stem Height



Prairie Openings

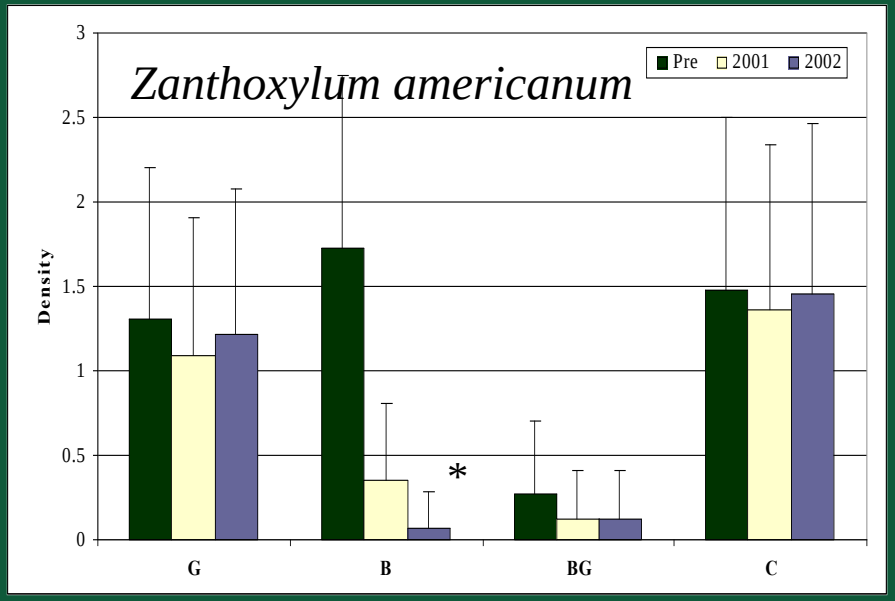
Control

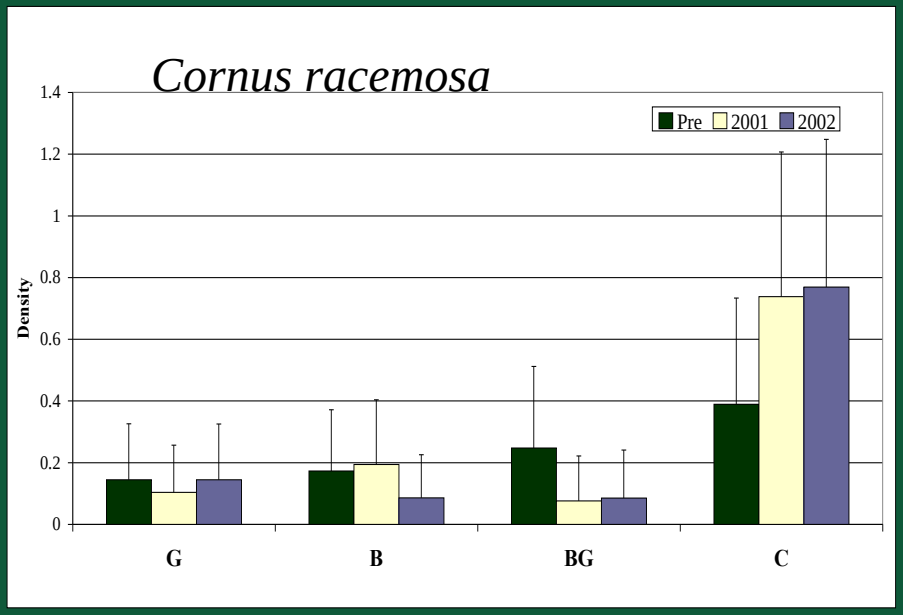
Graze

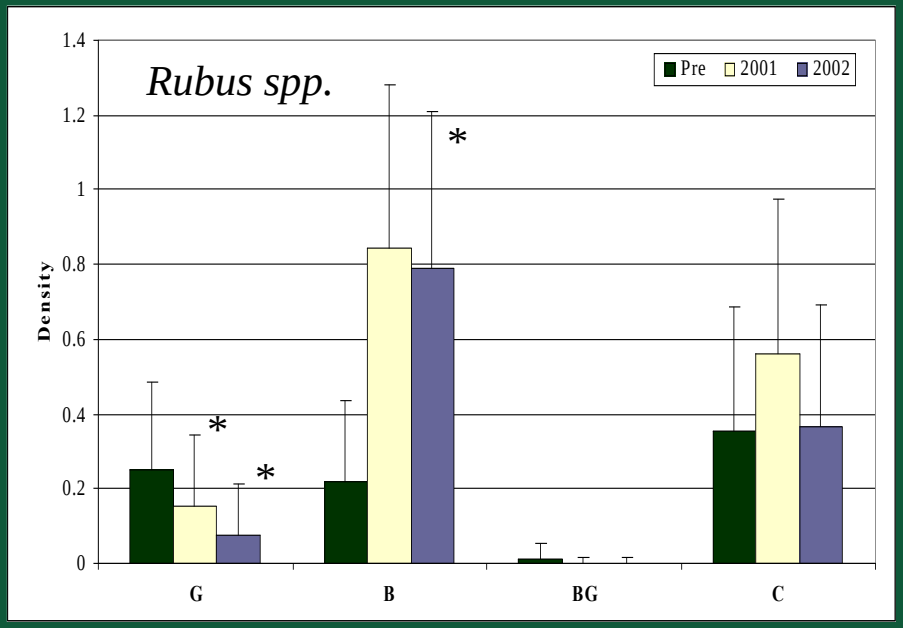
Burn

Burn and Graze

Open Zone: Mean Stem Densities (/5 sqm)







Herbaceous Recovery in the Woodland Zone

Control

Graze

Burn

Burn & Graze

Average Number of Native and Introduced Species Within the Summer Sampling Season Within Each Vegetative Zone.

Vegetative zone	Origin	Year	*Treatment* G	B	BG	C	*Effect* G	B	B x G
Wooded	Native	2001	5.03	6.91	6.53	5.94	∞	*∞	
		2002	5.76	6.36	6.69	5.76			
		s.e,	0.57	0.57	0.56	0.55			
	Introduced	2001	0.74	1.04	1.36	0.56	*i	*	
		2002	1.05	0.89	1.67	0.56			
		s.e,	0.25	0.25	0.25	0.24			
Open	Native	2001	8.49	9.18	7.73	9.25	*i*		
		2002	8.39	8.08	8.29	7.74			
		s.e,	1.70	1.70	1.75	1.75			
	Introduced	2001	3.86	4.45	3.36	3.91	^∞		
		2002	5.06	3.48	5.18	3.02			
		s.e,	0.49	0.49	0.54	0.55			

* = treatment main effect <.05, ^ = treatment main effect <.1, ∞ = treatment x year effect <.05, *i* = treatment x year effect <.1

Individual Species Frequency

Species increase:

Taraxicum officinale (dandelion) wooded **G**

Cirsium spp. (thistle) prairie **G**

Triflorum spp. (clover) prairie, thickets **GB**

Daucus carota (wild carrot) prairie **GB**

Poa spp. (bluegrass) thickets **GB**

Species decrease:

Achillea millifolium (yarrow) thickets **G**

Poa spp. (bluegrass) prairie **B**

Soil Bulk Density (g/cm^3)

Vegetative Zone	Depth	Year	Treatment G	Treatment B	Treatment BG	Treatment C	Effect G	Effect B	Effect G x B
Wooded	0-3"	2001	0.850	0.899	0.907	0.931	∞		
		2002	0.926	0.865	0.951	0.883			
		s.e.	0.030	0.030	0.029	0.028			
	3-6"	2001	1.205	1.201	1.192	1.255			
		2002	1.168	1.168	1.197	1.185			
		s.e.	0.041	0.042	0.039	0.040			
Open	0-3"	2001	0.992	1.080	1.038	1.018	∞	*	
		2002	1.010	1.023	1.050	0.942			
		s.e.	0.043	0.043	0.044	0.047			
	3-6"	2001	1.190	1.359	1.255	1.193		*	
		2002	1.147	1.270	1.361	1.186			
		s.e.	0.074	0.074	0.072	0.076			

* = treatment main effect <.05, ∞= treatment x year interaction <.05

Conclusions

1. MG may be an effective savanna/woodland and grassland management tool for reducing undesired large shrub concentrations.

2. Such concentrations result in the suppression of grasses and other fuels that carry fire, thus reducing its effectiveness for management.

3. Grazing is a supplement, however, and not a replacement for fire.

Conclusions

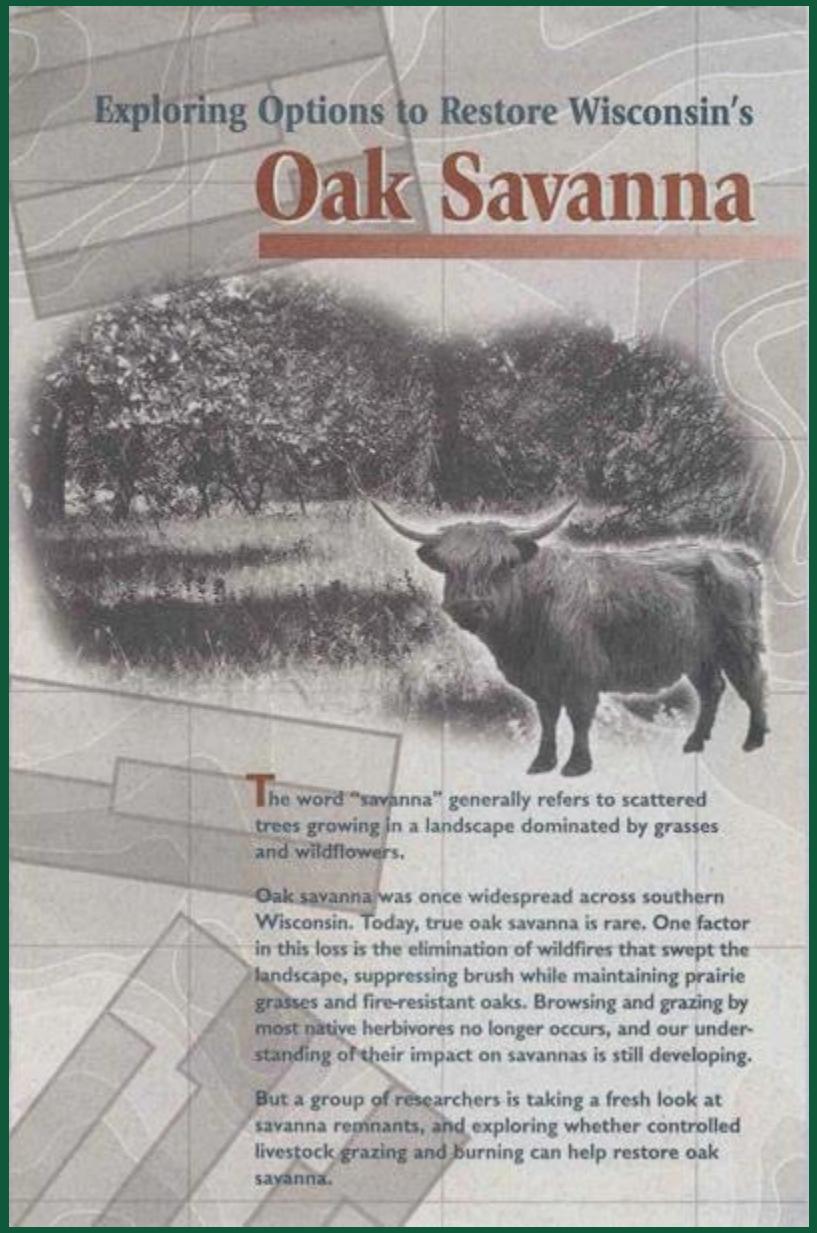
4. Both managed grazing and fire were effective at reducing shrub stem densities and heights for species that the other was not.
5. Scottish highland cattle, unlike fire, were able to enter shrub thickets, such as in the *Rubus* genera, and reduce stem numbers and heights quickly.
6. Grazing reduced stem numbers and biomass of *Rubus* spp., and to a lesser extent *Zanthoxylum americanum* and *Corylus americana*. Cattle tended to ignore *Cornus racemosa* and *Ribes* spp.

Conclusions

7. Neither fire not MG resulted in renewal of the savanna/woodland herbaceous layer. We suspect that this is a factor of shade created by saplings and canopy trees too large to be removed by fire or grazing alone.
8. When MG occurred with burning in the same year, a small component of undesirable species entered the prairie herbaceous layer.
9. The 25-day cycle for MG also constrained replenishment of prairie grass and forb biomass of which the long-term impact needs further study.
10. Soils remained uncompacted after 2 years of MG.

Participants

- University of Wisconsin-Madison: Departments of Landscape Architecture and Agronomy
- University of Wisconsin-Platteville
- UW-Extension
- Wisconsin DNR
- Livestock owners



Support provided by the University of Wisconsin Consortium Grants Program, Partnerships for Wildlife, EQIP, Wisconsin Department of Natural Resources, Lois Almon Grants, Zoological Society of Milwaukee and UW-Nelson Institute of Environmental Studies granting agencies for financial support.