

Restoring Woodlands and Savannahs in the Eastern US: Lessons Learned from a Decade of Research



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P. Keyser, A. Vander Yacht, C. Henderson,
and S. Barrioz

“A squirrel could travel from the Atlantic to the Mississippi without its feet ever touching the ground...”



...or not!!



In **1637**, Thomas Morton wrote that the Indians:
"are accustomed to set fire of the Country in all places where they come, and to **burne it twize, in the year**....so that hee that will see good tymer...(will not) finde them on upland grounds, but on the lower grounds, where the grounds are wett."

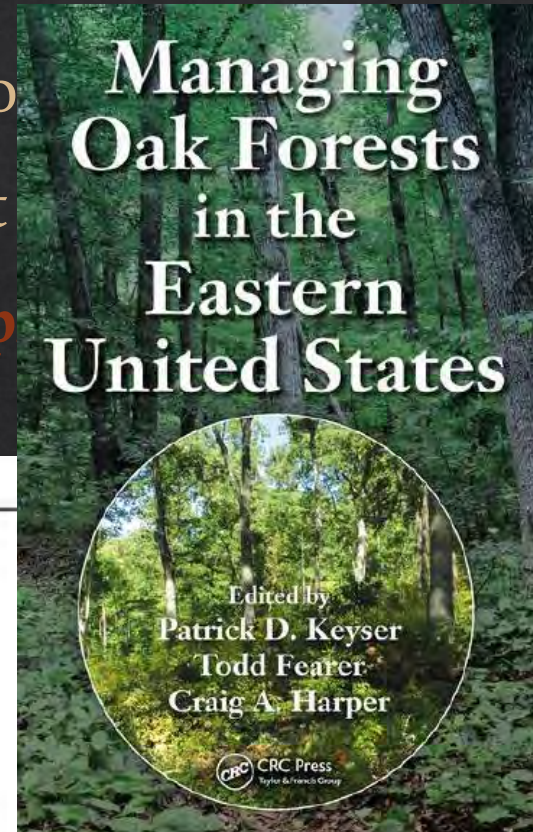
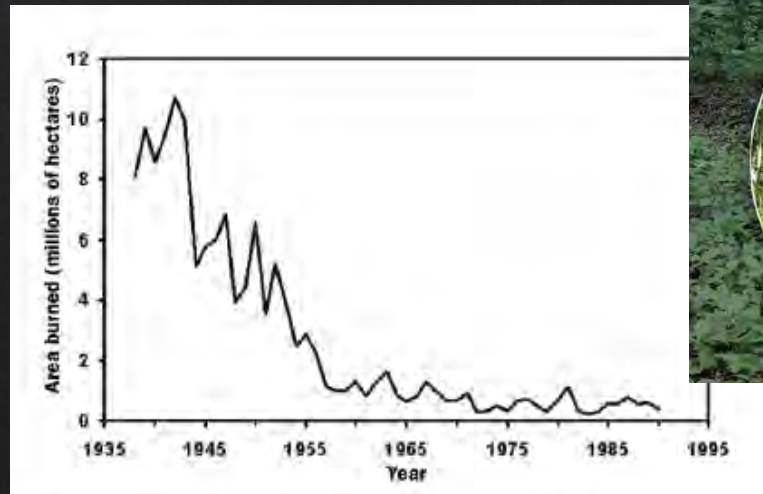
Andrew White, on an expedition along the Potomac River forest was: "not choked with an undergrowth of brush, but laid out in by hand in a manner **so open, that you could see a horse chariot in the midst of the trees.**"

"Concerning a road built through the Cumberland Mountains, Ramsey (1853:501) reported, "The top of the mountain being then **a vast upland prairie covered with a growth of native grasses, pastured over as far as the eye could see, with numerous herds of deer, elk, and buffalo**,....."



Disappearing Fires...

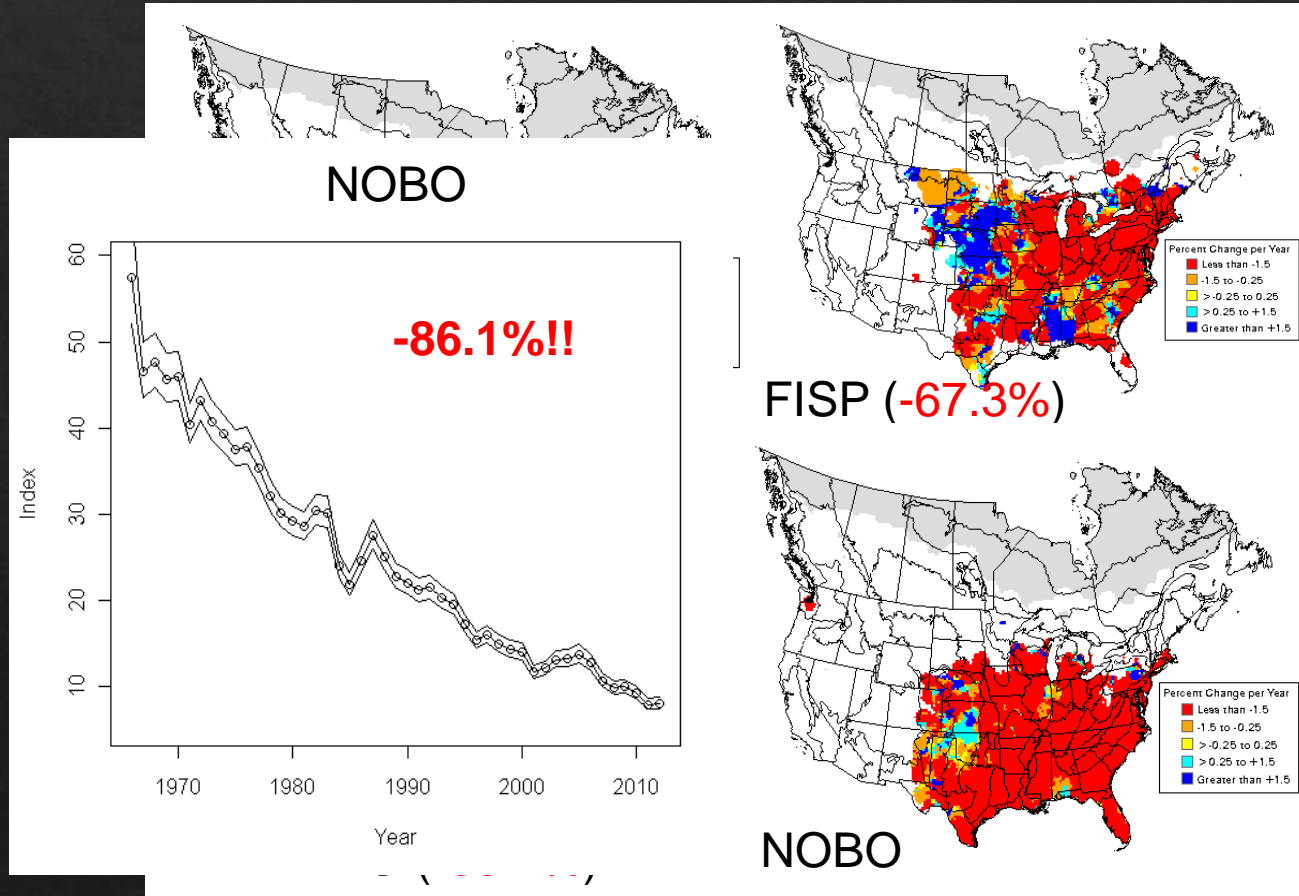
- Disturbance is normal for eastern oaks
- Fire has been a normal part of that
- **Fire-influenced components comp**



An Eastern Grassland without Disturbance



Declining Grassland Birds (1966-2012)



Cooperative Oak Ecosystem Restoration Project

A Management Experiment, 2008-2017

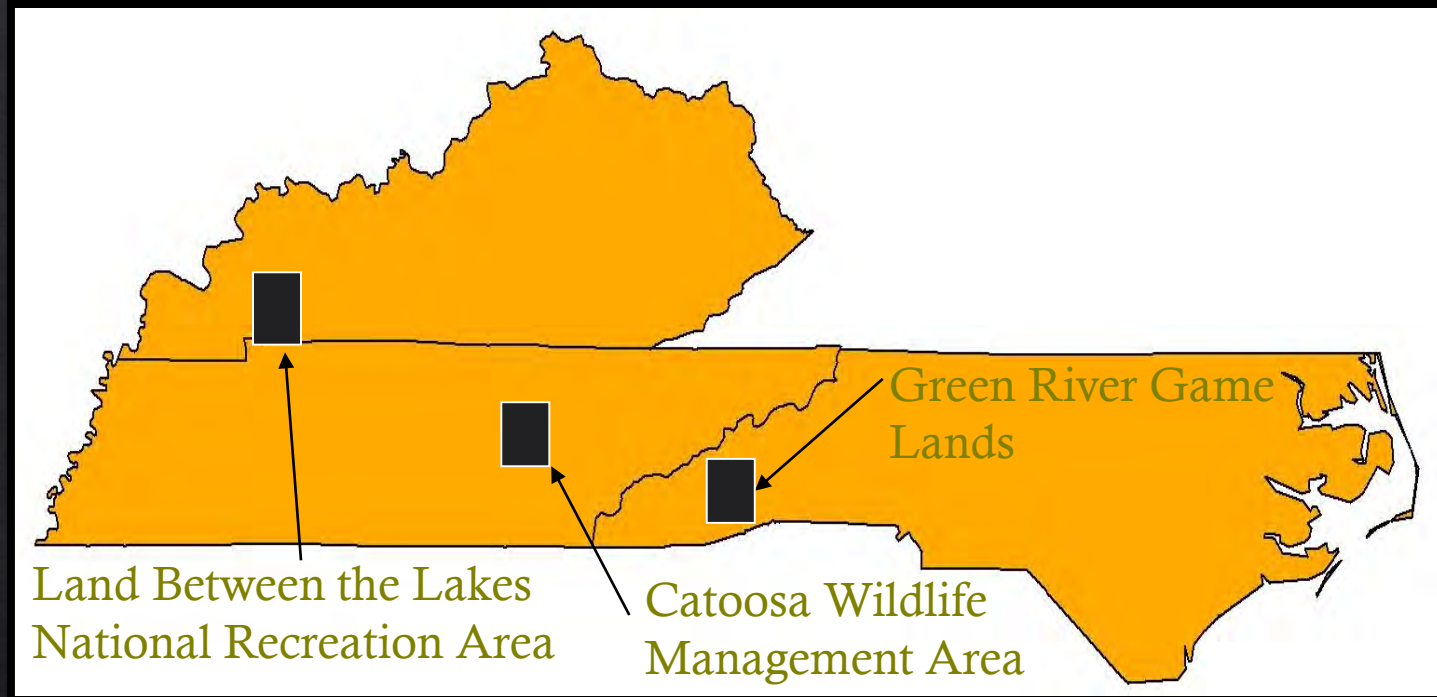
		Fire		
		None	Dormant Season	Growing Season
Canopy Reduction	None/ Minimal	IMPAIRED FOREST		FOREST/ WOODLAND
	Partial		MIXED/OAK FOREST	OAK WOODLAND
	Heavy		FOREST/ WOODLAND	OAK SAVANNAH

Acknowledgements

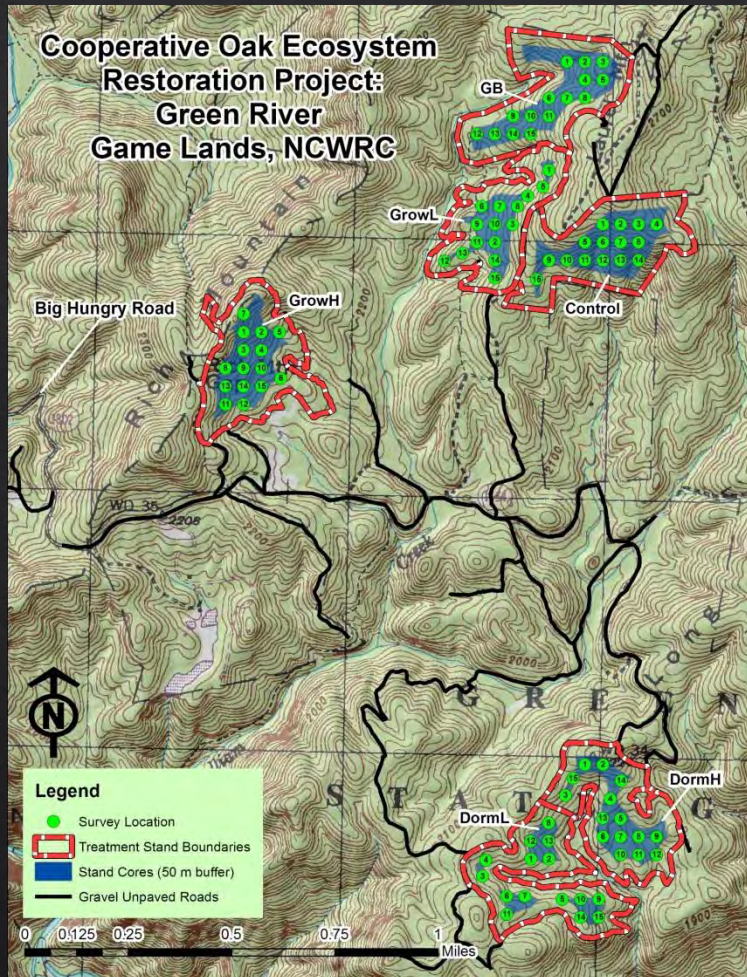
- ◆ National Wild Turkey Federation
- ◆ Quail Unlimited
- ◆ Joint Science Fire Program
- ◆ USFS (LBL and DBNF)
- ◆ USDA CSREES
- ◆ North Carolina WRC
- ◆ TWRA
- ◆ Seth Barrioz, Andy Vander Yacht, and Chrissy Henderson
- ◆ UT Forestry, Wildlife & Fisheries



COERP Study Sites



COERP Treatments



Six, 50-ac stands (CRD):

- growing-season only
- growing 60 & 30 BA
- dormant 60 & 30 BA
- control

Five reps total (across 3 sites)

Woody Responses – Canopy Reduction

- Canopy reduction shifted species in shrubby, seedling, and sapling strata to more shade-intolerant and more fire tolerant

	Control	Woodland	Savannah
Shrubs	Mtn Laurel		
Seedlings	Beech, W. Pine		
Saplings	Beech, W. Pine		

Vander Yacht et al. 2019. Forest Sci., 65:289-303.

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Woody Vegetation Responses - Fire

- Only modest differentiation between March and October burns
 - needed to look at Aug/Sept (original goal) – likely to be more effective...

	Control	Fall Burn	Spring Burn
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For Ecol. & Manage. 390:187-202

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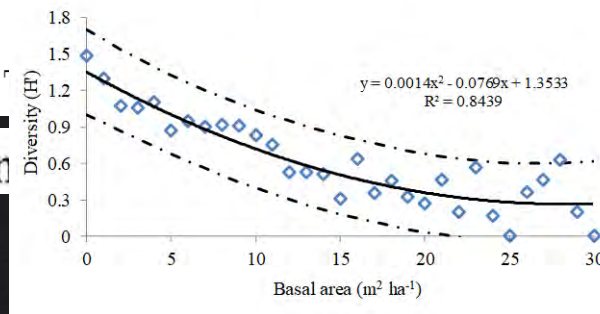
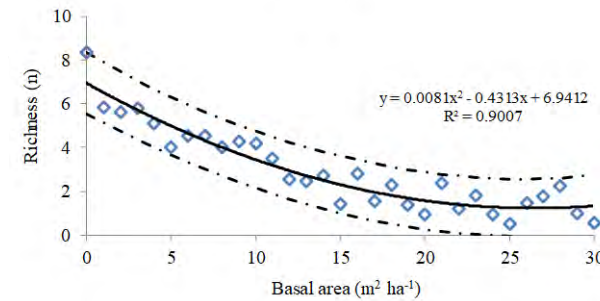
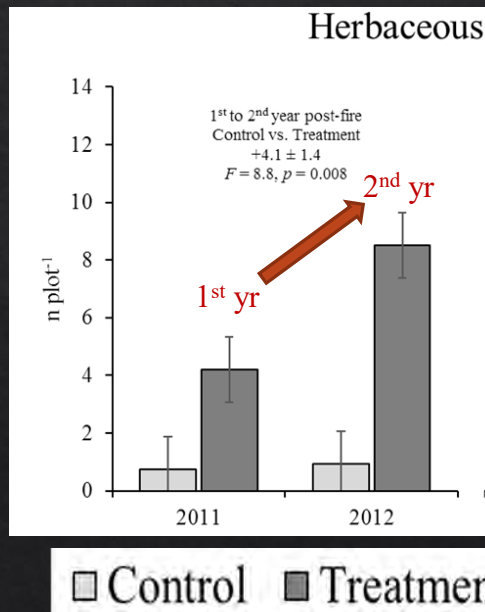
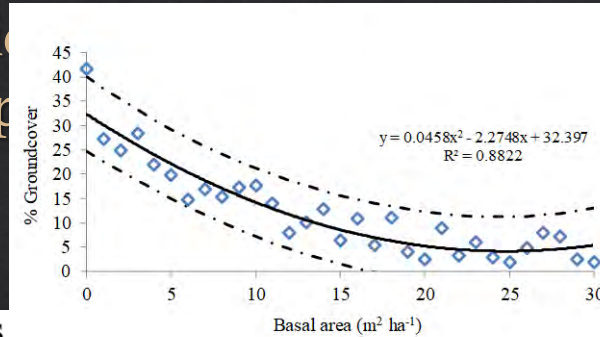
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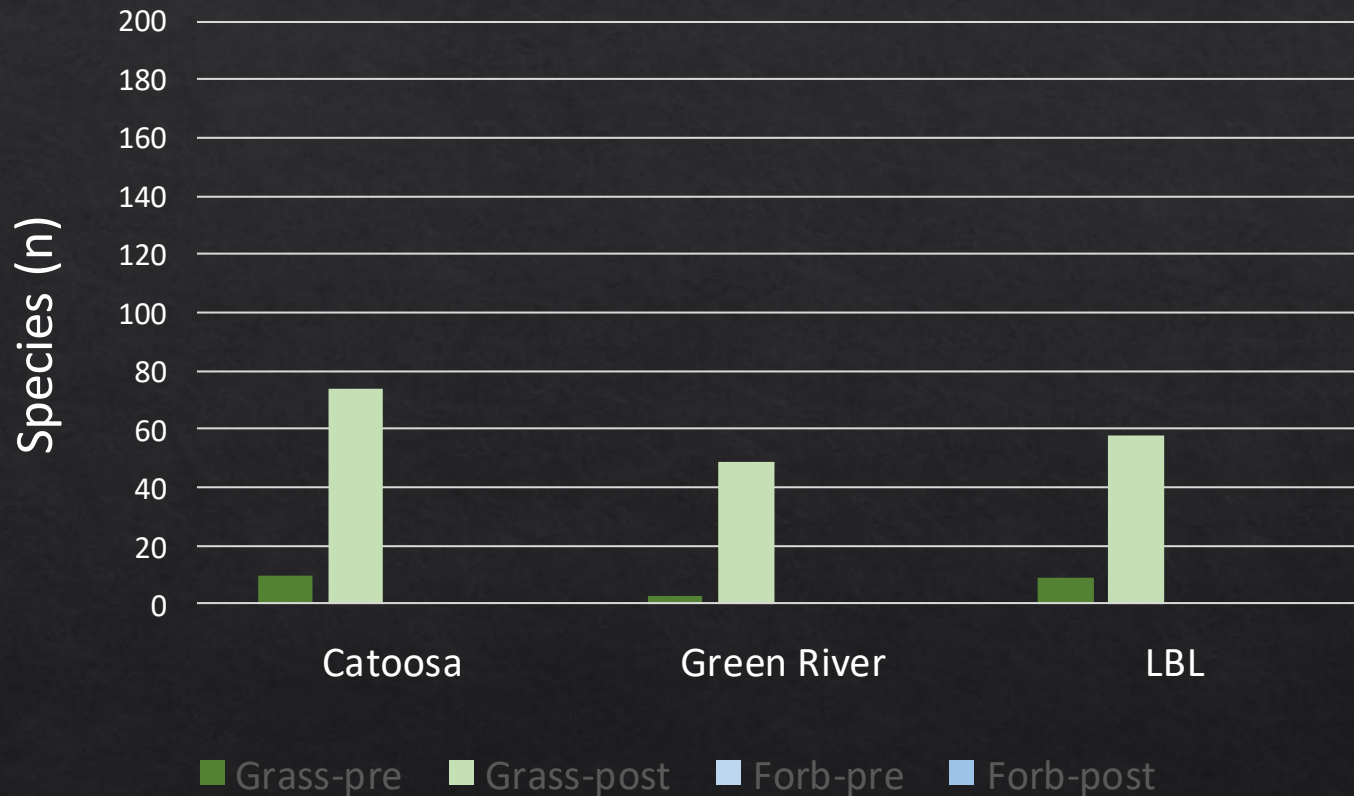
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Herbaceous Responses

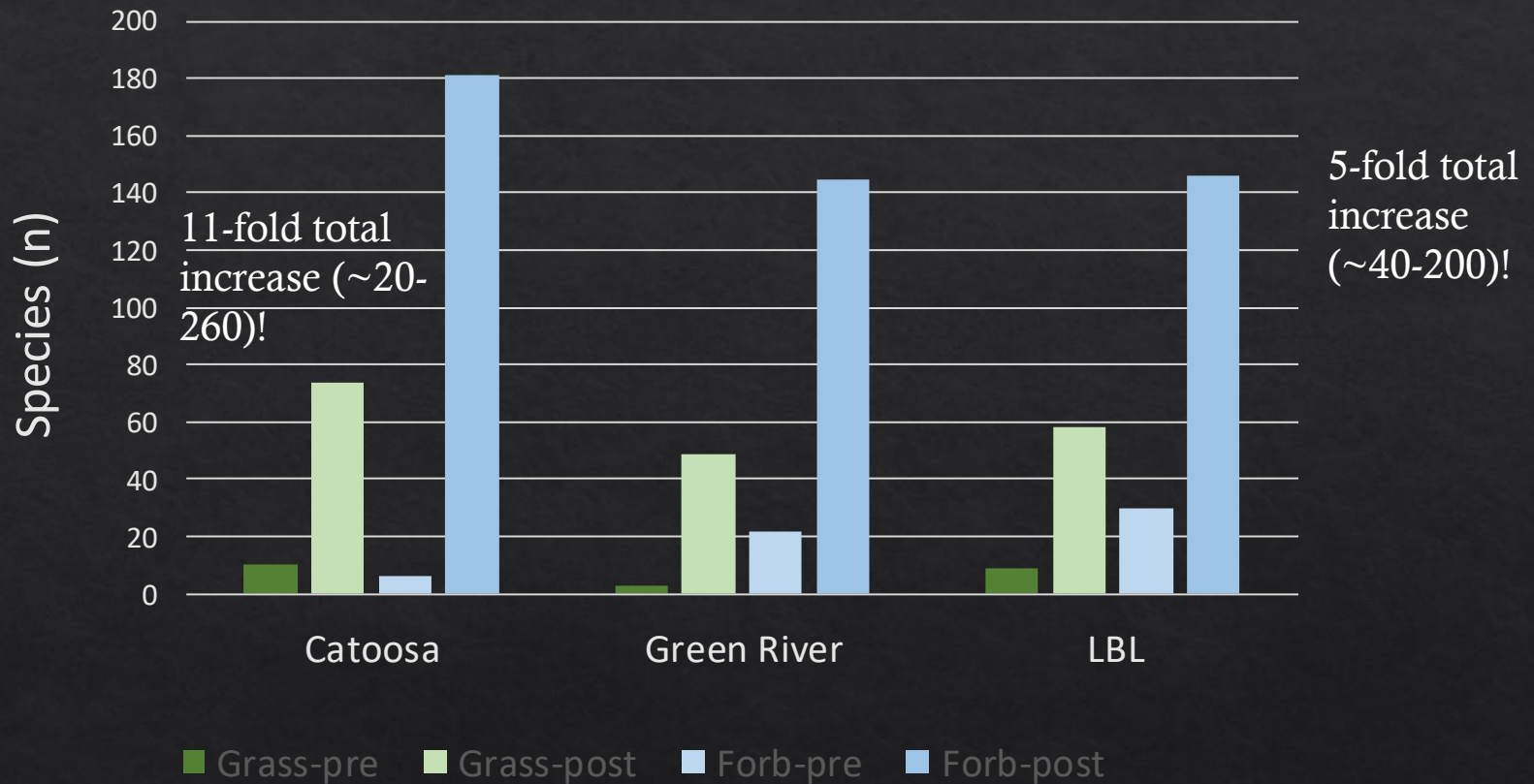
- Lagged (2-yr), but dramatic
- Greater light = greater response



Grass and Forb Richness



Grass and Forb Richness



Shortleaf and Bluestems

- When canopy cover $>65\%$, response of both was negligible
- Below 65% , response of both increased when:
 - vertical woody cover was low ($<49\%$)
 - woody groundcover was $<85\%$
- When these conditions were met:
 - Bluestem cover and density increased
 - Shortleaf root-collar diameter, stem density and height increased



Avian Occupancy vs. Basal Area

EARLY SUCC:

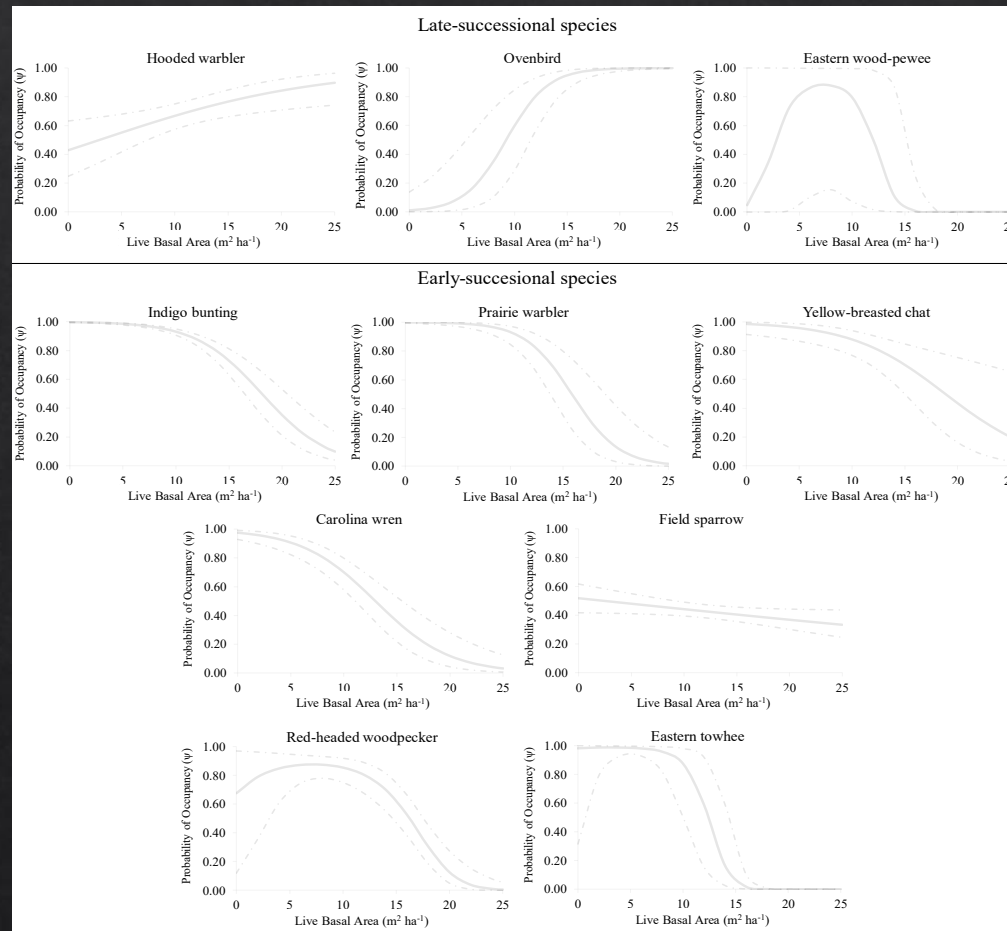
INBU+
 PRAW+
 YBCH+
 CAWR+
 FISP
 RHWO+
 EATO+

3 = no trend

LATE SUCC:

HOWA-
 OVEN-
 EAWP+/-

7 = no trend



Vander Yacht et al., 2016, J. Wildl. Manage. 80:1091-1105.

Occupancy vs. Herbaceous Ground Cover

EARLY SUCC:

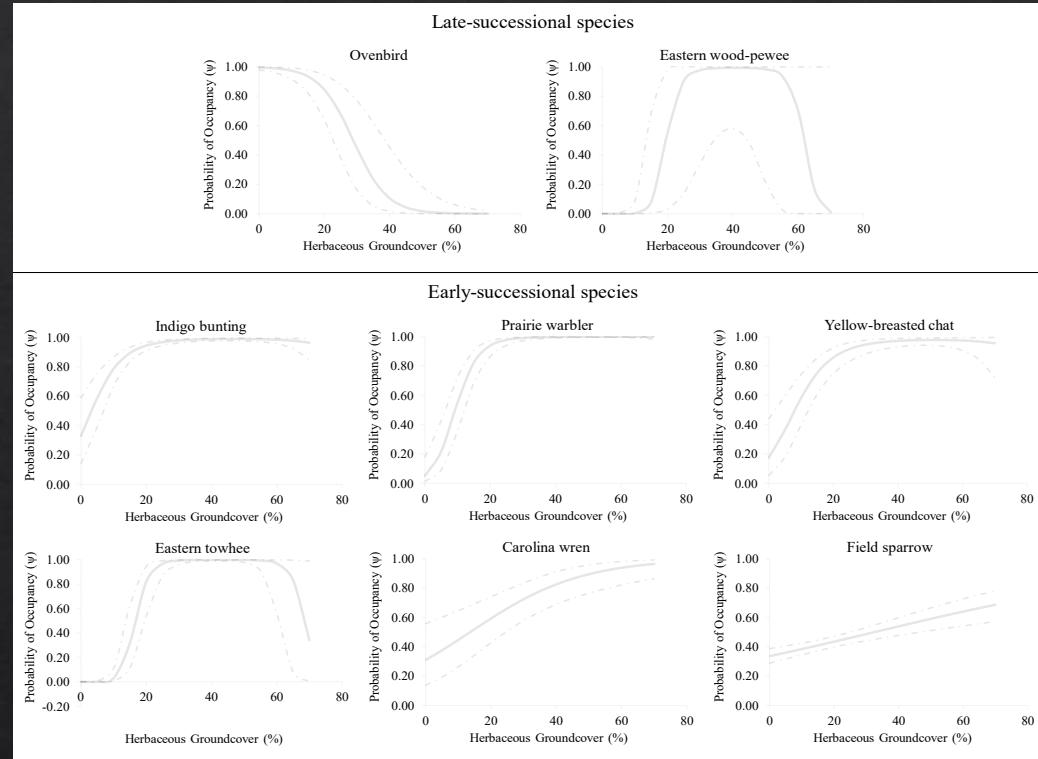
INBU+
 PRAW+
 YBCH+
 EATO+/-
 CAWR+
 FISP+

4 = no trend

LATE SUCC:

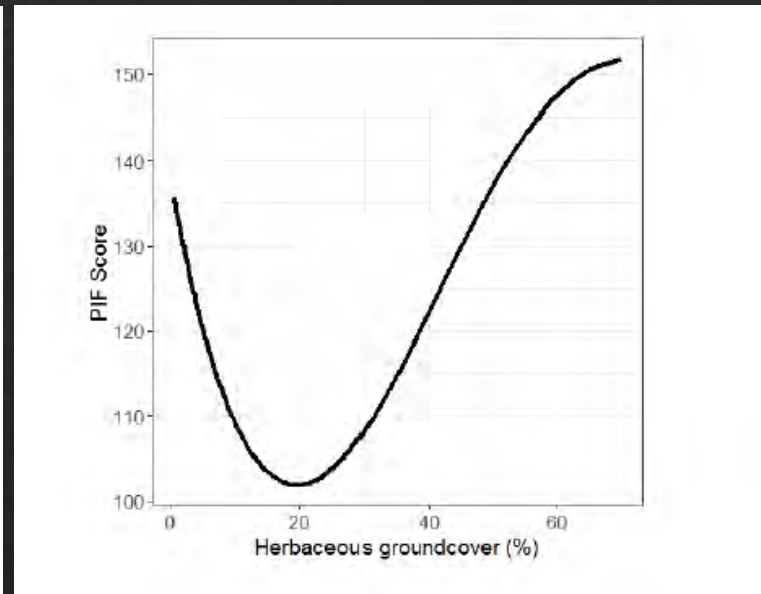
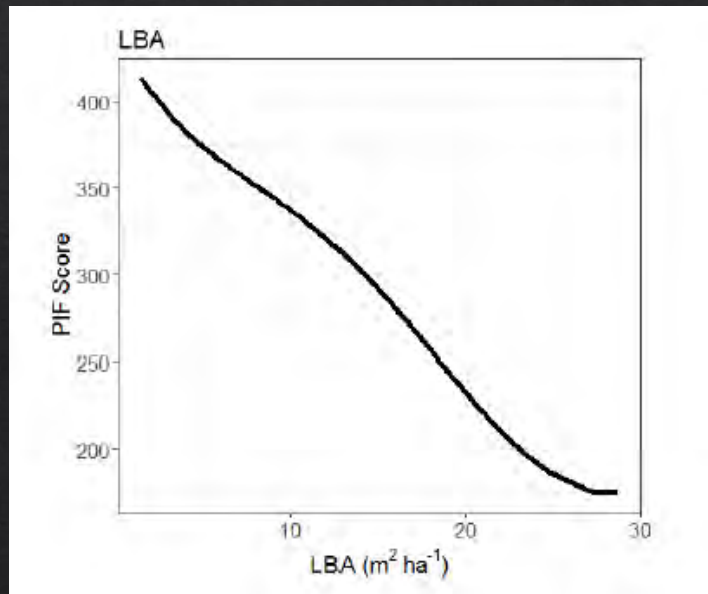
OVEN-
 EAWP+/-

8 = no trend



Vander Yacht et al., 2016, J. Wildl. Manage. 80:1091-1105.

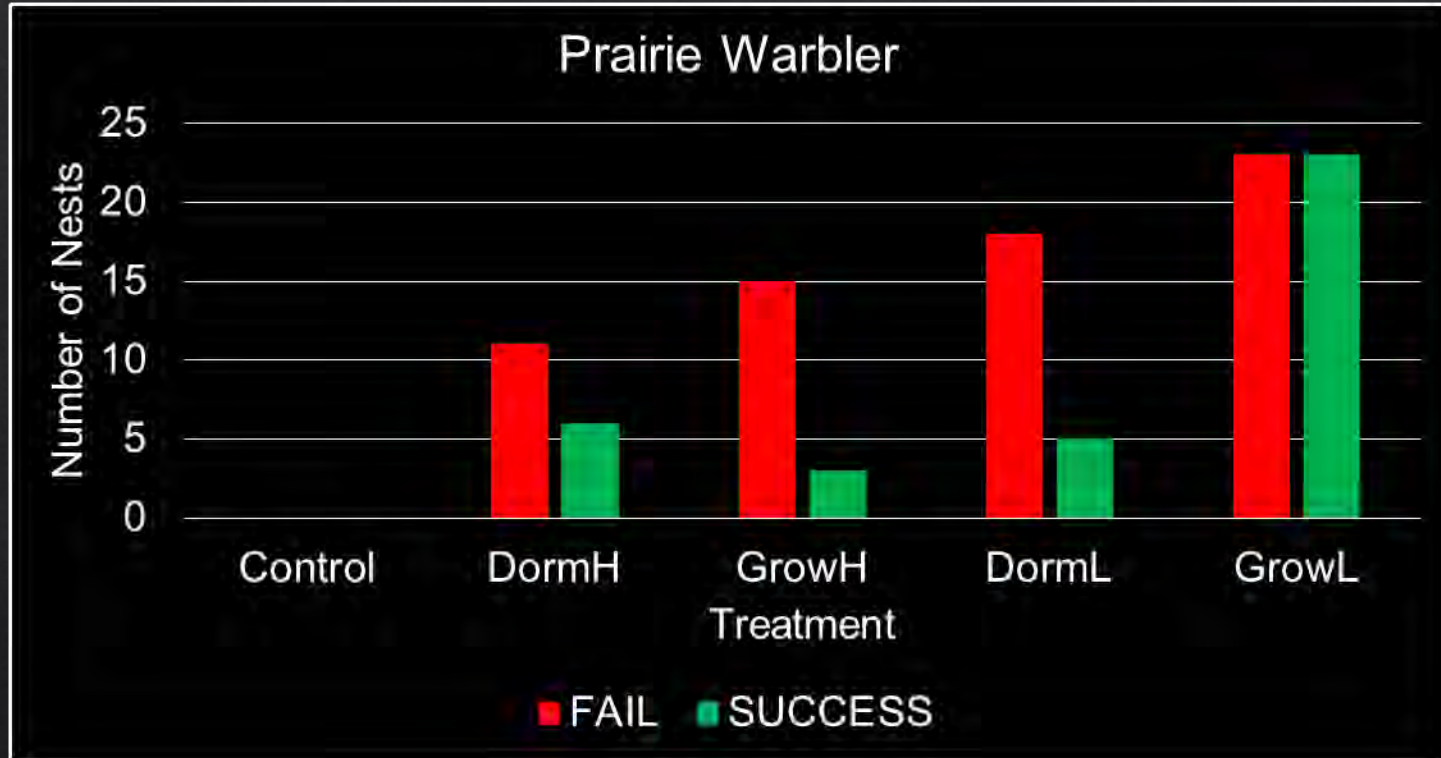
“Sweet Spots” for Avian Conservation?



Partners in Flight total Conservation Score
(all species combined)

- More high PIF score species among ES (e.g., PRAW vs. REVI)
- OVEN, SCTA driving low values at 20% herb cover

Nest Distribution and Fate by Treatment

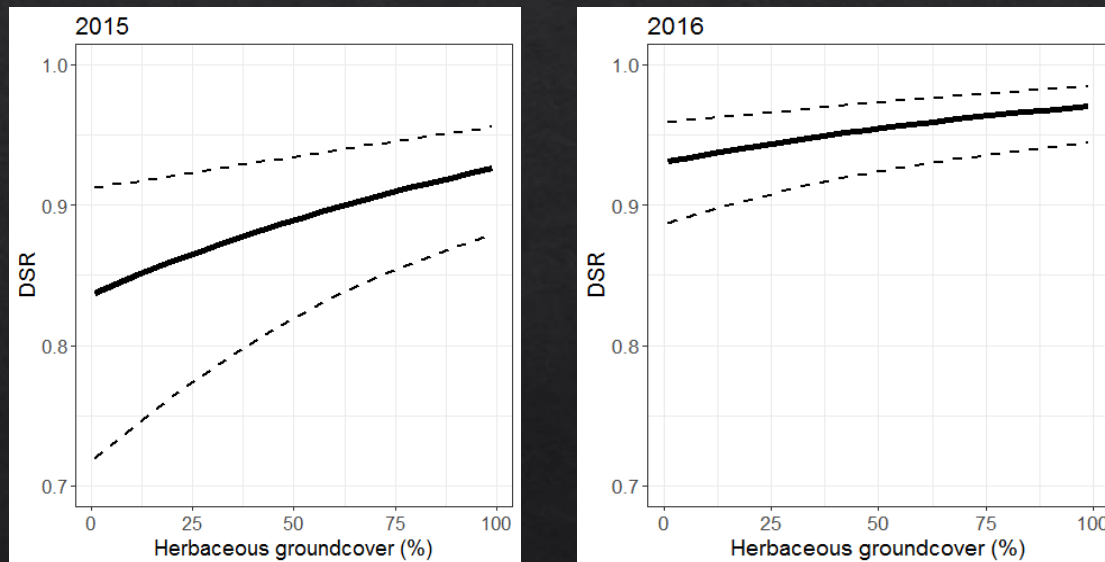


C. Henderson, MS Thesis, 2017, University of TN

Prairie Warbler Nest Survival

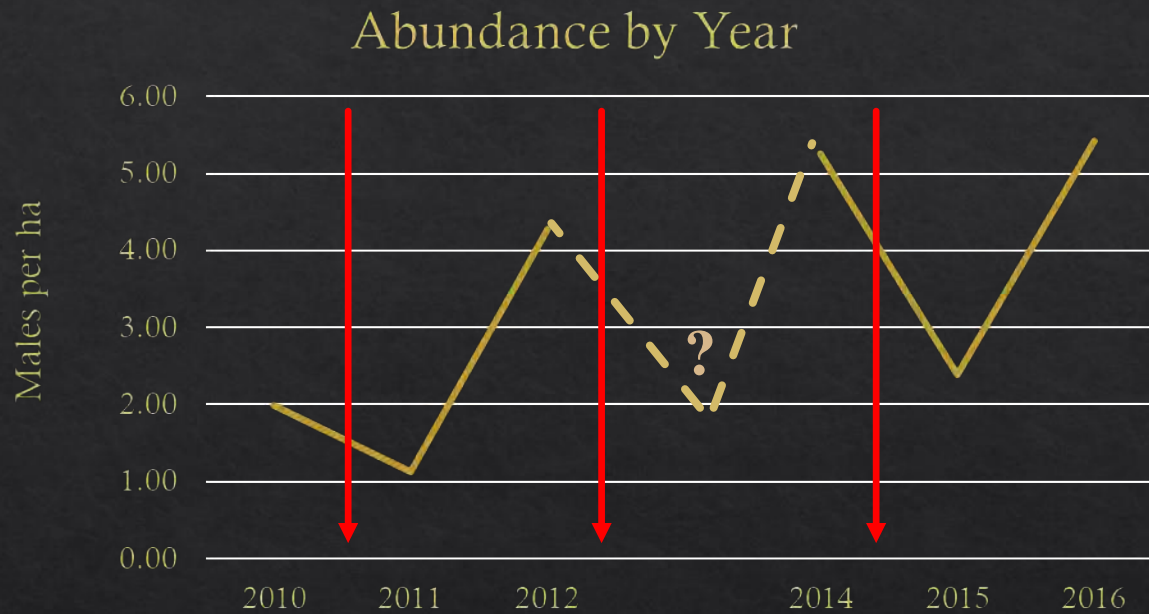
Period survival (24 days) = 20.7%; 2015 = 6.8%; 2016 = 32.5% (n = 105)

No relationship between survival and BA or midstory density, but...

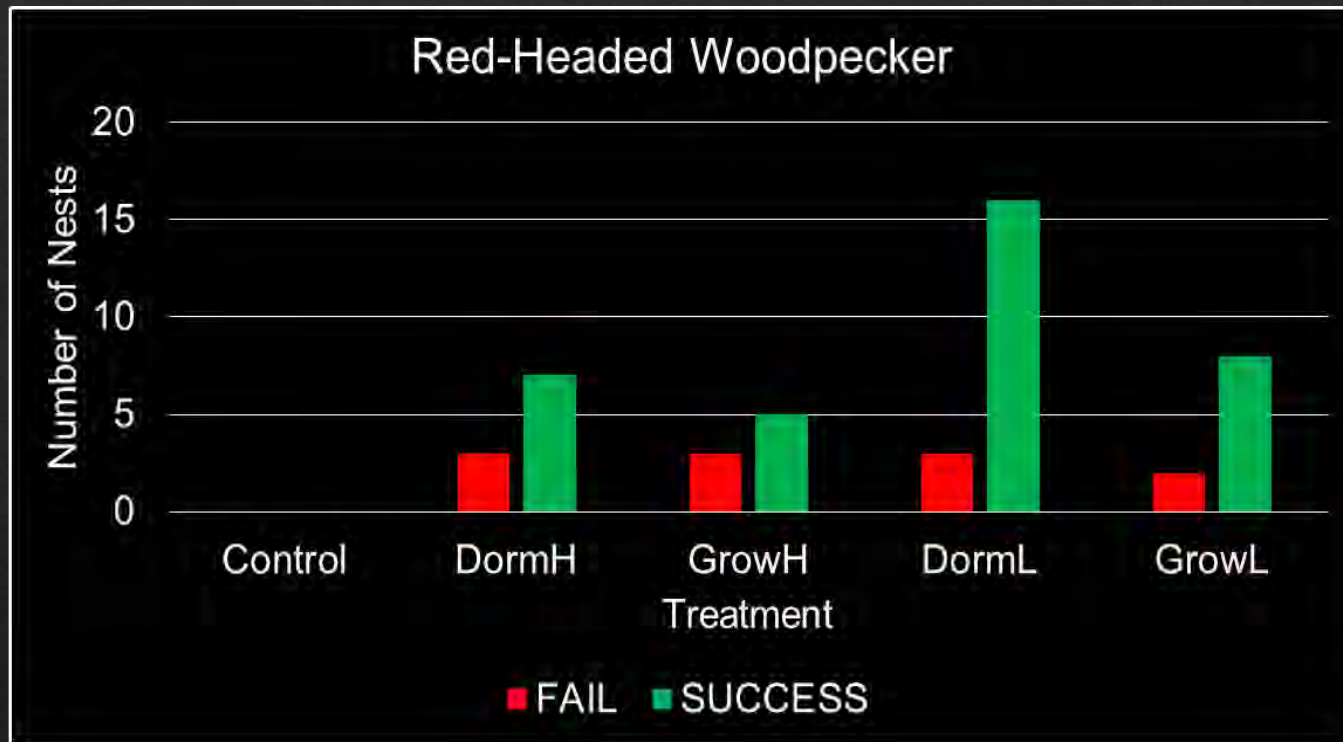


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Prairie Warbler Nest Survival vs. Fire



Nest Distribution and Fate by Treatment



C. Henderson, MS Thesis, 2017, University of TN

Red-headed Woodpecker Nest Survival

- Very high survival rates: 84.1% (n =47)
 - Did not vary by year (no apparent fire effect)
 - No stand-level covariates
 - Weak support for nest tree BA ('-') and DBH ('+'), but, 95% CI captured zero in both cases...



Lessons Learned

Woodland and Savannah Restoration:

- shifted woody seedlings and saplings from shade-tolerant, fire-intolerant species to more shade-intolerant and fire-tolerant species
- increased presence of shortleaf pine (restoration!)
- increased herbaceous cover, richness, & diversity
 - strongly influenced by BA

Lessons Learned

Woodland and Savannah Restoration:

- increased early succ'l. bird occupancy/abundance
 - strongly influenced by BA and herbaceous ground cover
- mature forest species generally persisted
 - even increased at some levels of disturbance
- Increased PRAW nesting on restoration sites (controls = 0 nests)
- Increased RHWO nesting on restoration sites (controls = 0 nests)

Conclusions

- Restores long-missing component of eastern forest ecosystems
- Provides additional benefits (e.g., plant richness from 16 to 255 species, many conservative/rare)
- Woodland/savannah restoration beneficial for wildlife conservation
 - game species as well (esp. quail, turkey)?
- Research should continue to document responses: through complete restoration as well as long-term impacts

Questions?

