Cerulean Warbler Response to Hardwood Forest Management

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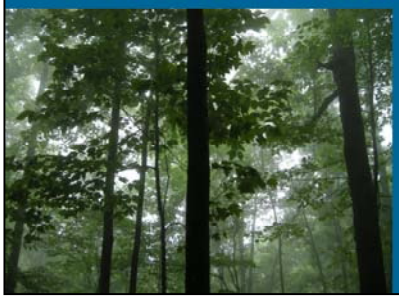
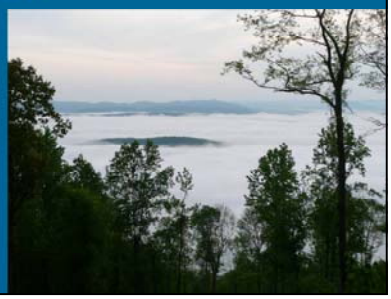
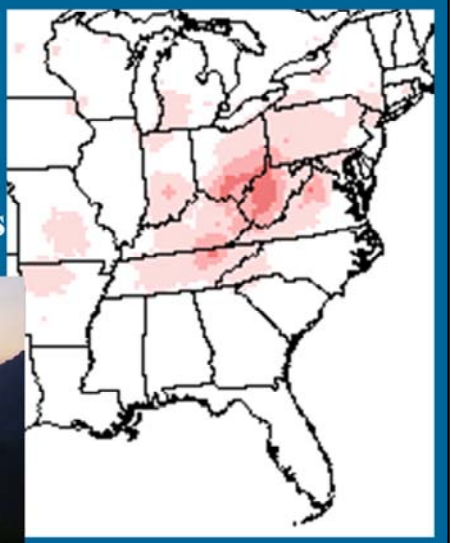




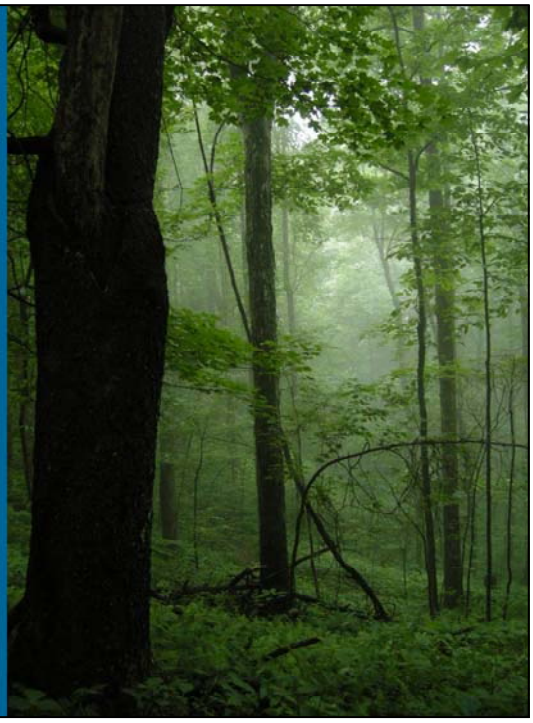
Cerulean Warbler Breeding Range

- Current population
  - ~250,000
- ~80% in central Appalachian Mountains



Appalachian Breeding Habitat

- mature deciduous forests (large, tall trees)
- steep, upper slopes and ridgetops
- north and east aspects
- canopy gaps / canopy heterogeneity – disturbance adapted?



Canopy Heterogeneity

- Characteristic of old growth
- But, most eastern forests are only 80-120 yrs

Creating Canopy Heterogeneity via Timber Harvest

Can we use timber harvesting to enhance/create habitat for Cerulean Warblers?

Mention that used operational silviculture; 3 common techniques used by timber industry

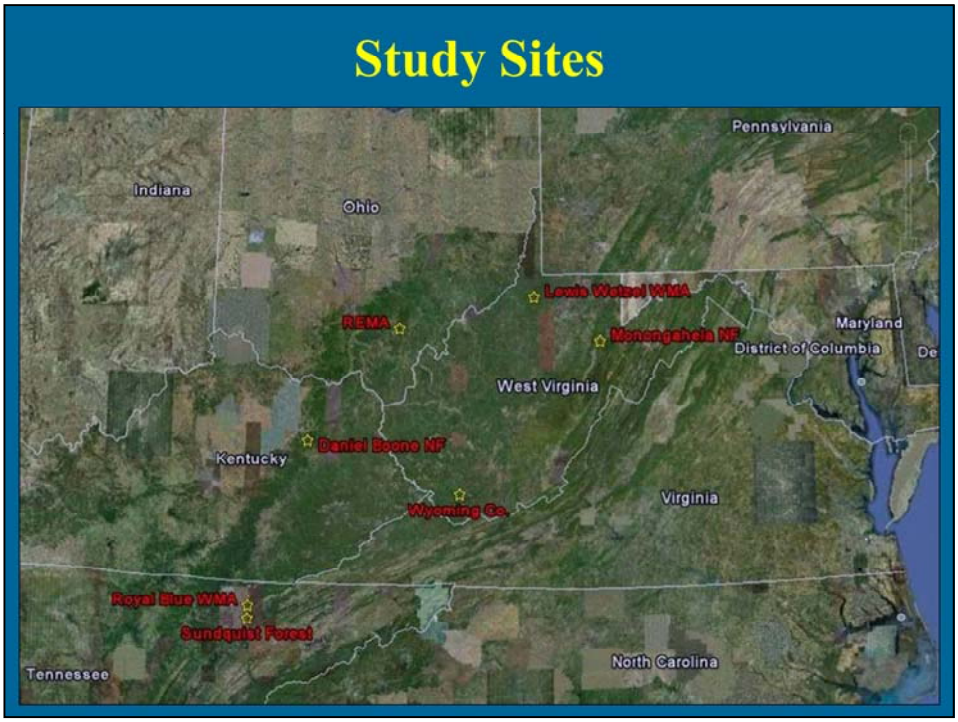
Study Question

How do ceruleans respond to various intensities of canopy disturbance via operational timber harvests?

Metrics:

- territory density
- reproductive success
- age structure
- body condition
- foraging
- nest-site and stand-level habitat covariates
- associated species response

So the question we asked in this study was:



We had 7 study sites across 4 states in the core of the CERW's range in the central Apps.

- 3 in WV, 2 in TN, 1 in OH, and 1 in KY

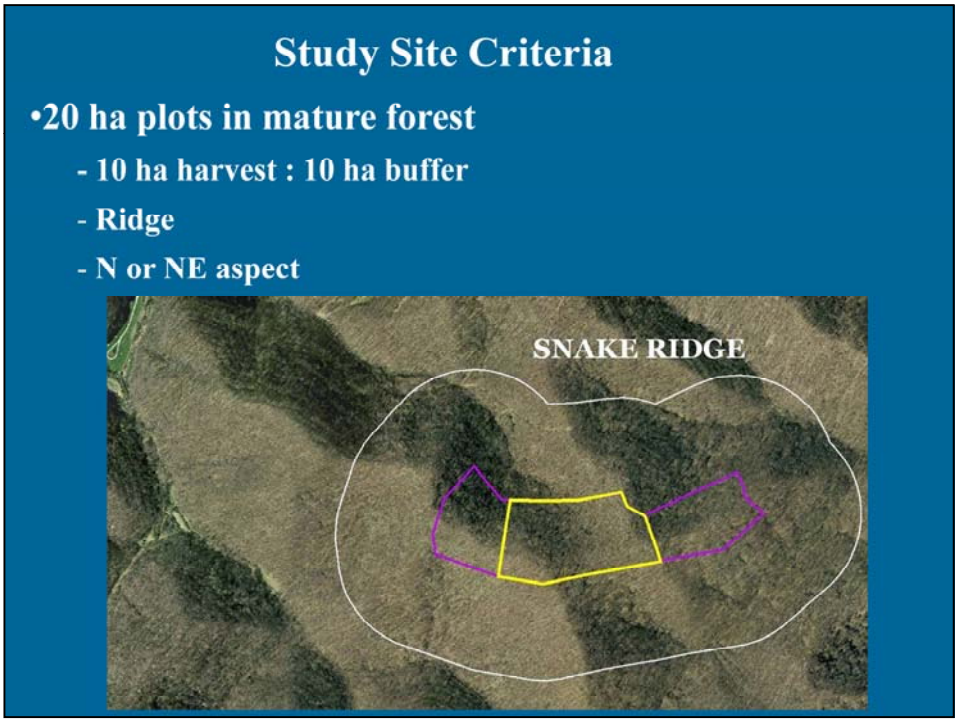
- we placed plots in areas with known occurrence of cerulean warbler and where timber harvest was logistically feasible (i.e. where we could find a landowner that would put in the harvests for free!).

Study Design

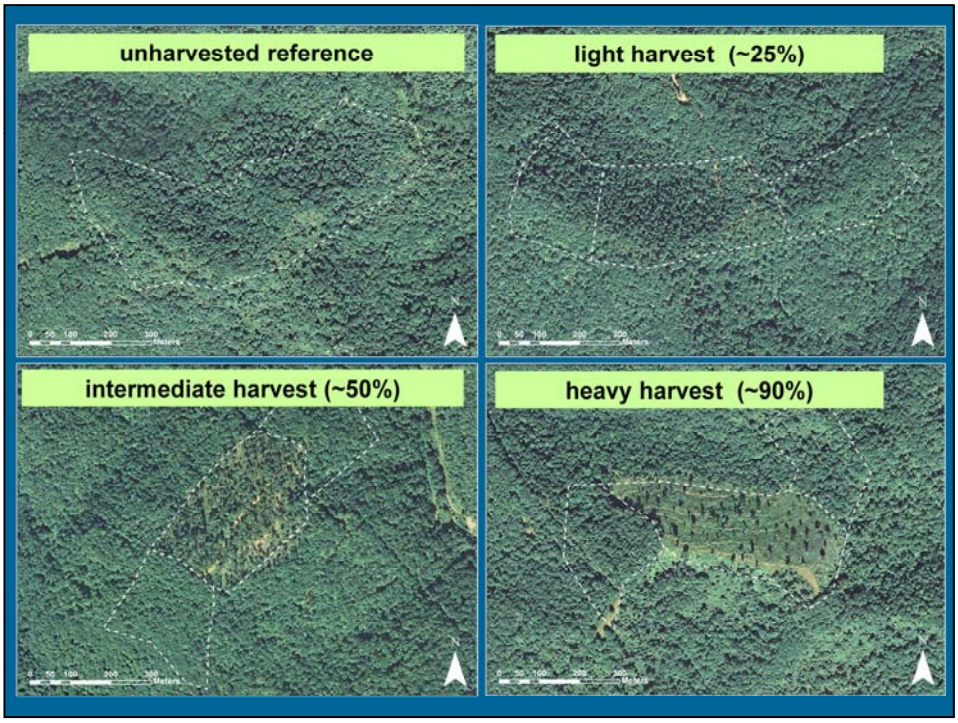
- Experimental approach (BACI)
- 4 treatments randomly applied at each site (n=7)

2 years pre-harvest (2005-06)

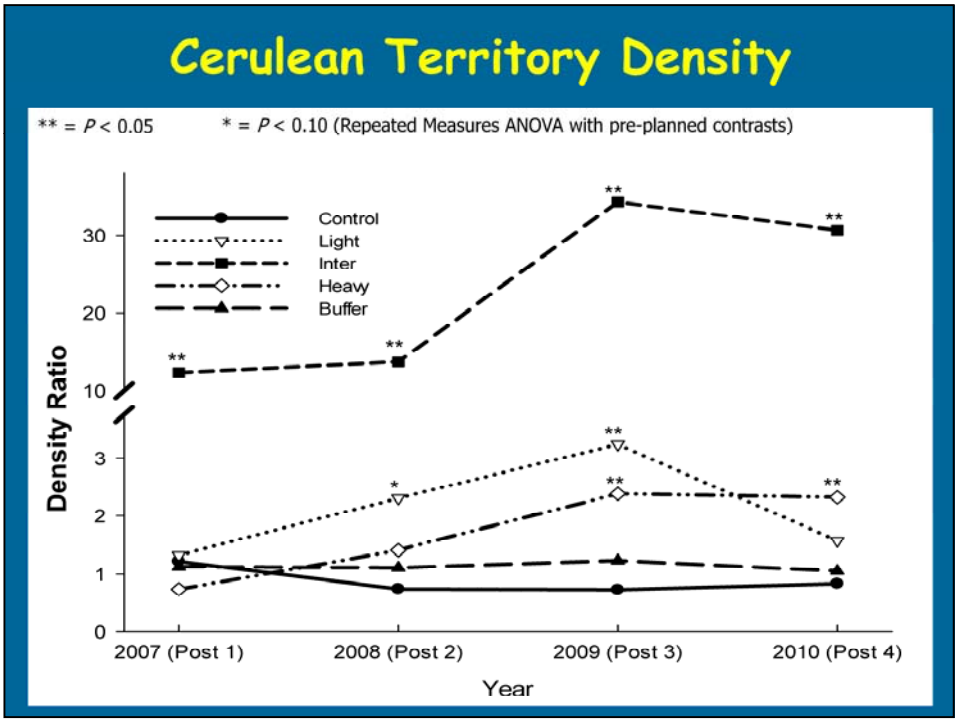
4 years post-harvest (2007-10)



This is one of the plots at LW; yellow is the part to be harvested; the purple at either end are the unharvested buffers to allow us to look at edge effects



Lewis Wetzel plots



- plotted change in density from pre- to post-harvest on the y-axis and post-harvest year on the x-axis

- unharvested controls and buffers did not change pre to post harvest and remained stable thru the 4 post-harvest years

- we had a year x treatment interaction so we analyzed the response separately for each year.

- in 2007, the first post-harvest year, density in intermediate harvest increased significantly more than the control

- In 2008, the intermediate remained greater and the light harvest increased marginally

- By 2009, all 3 harvests had increased significantly vs. the control

- in 2010, the intermediate and heavy treatments remained higher than unharvested but declined in the light harvest and was no longer different from the unharvested plots. Likely seeing canopy gaps starting to close.

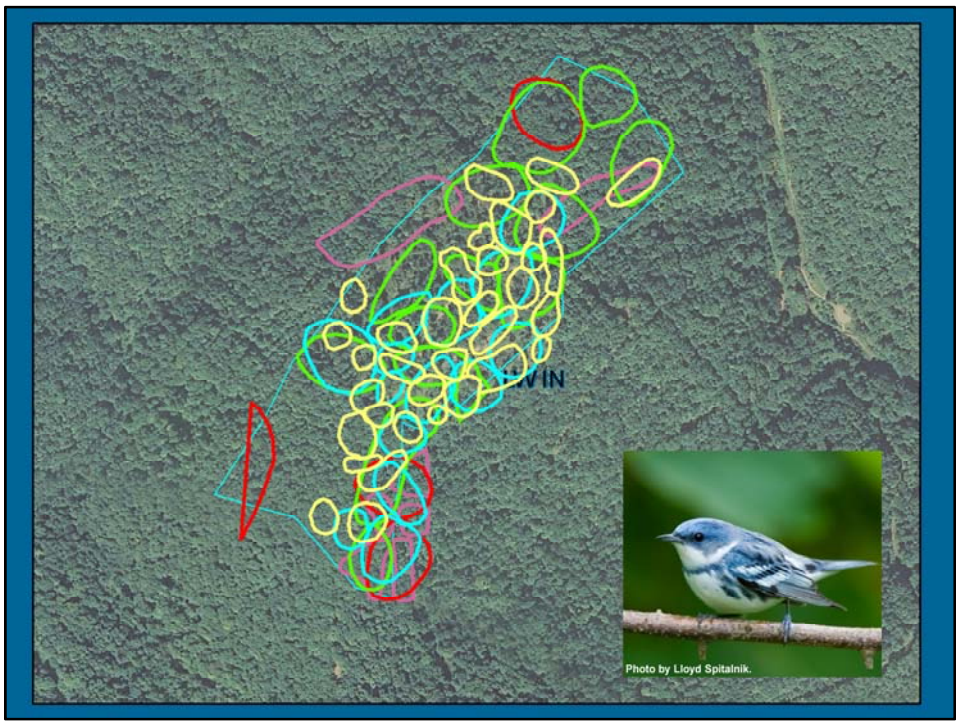
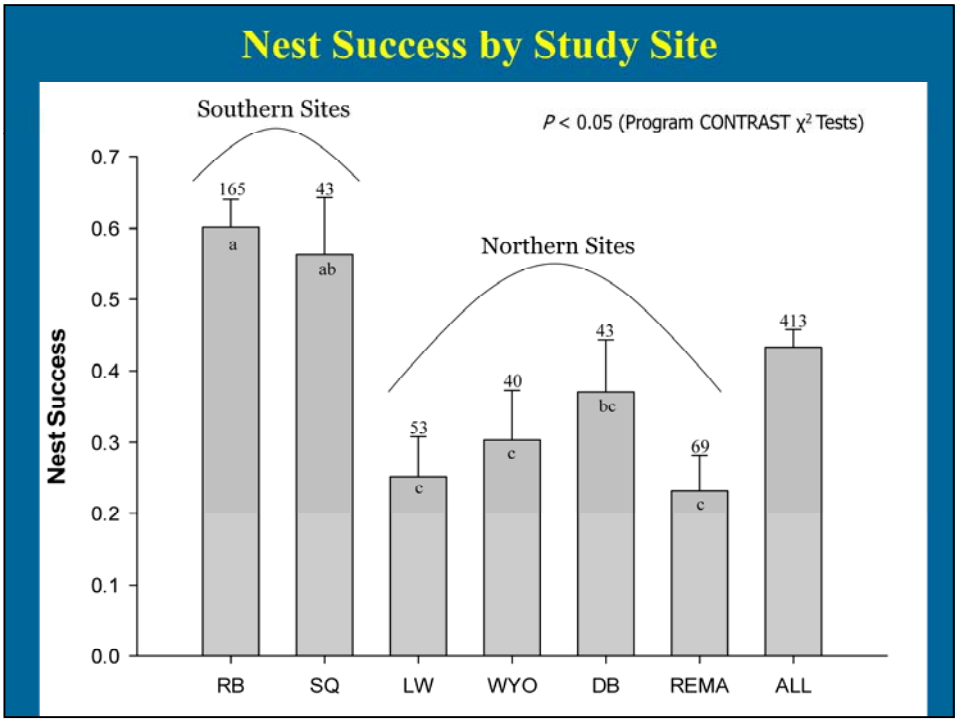


Photo by Lloyd Spitalnik.

- analyzed daily nest survival by comparing logistic exposure models in Program MARK.

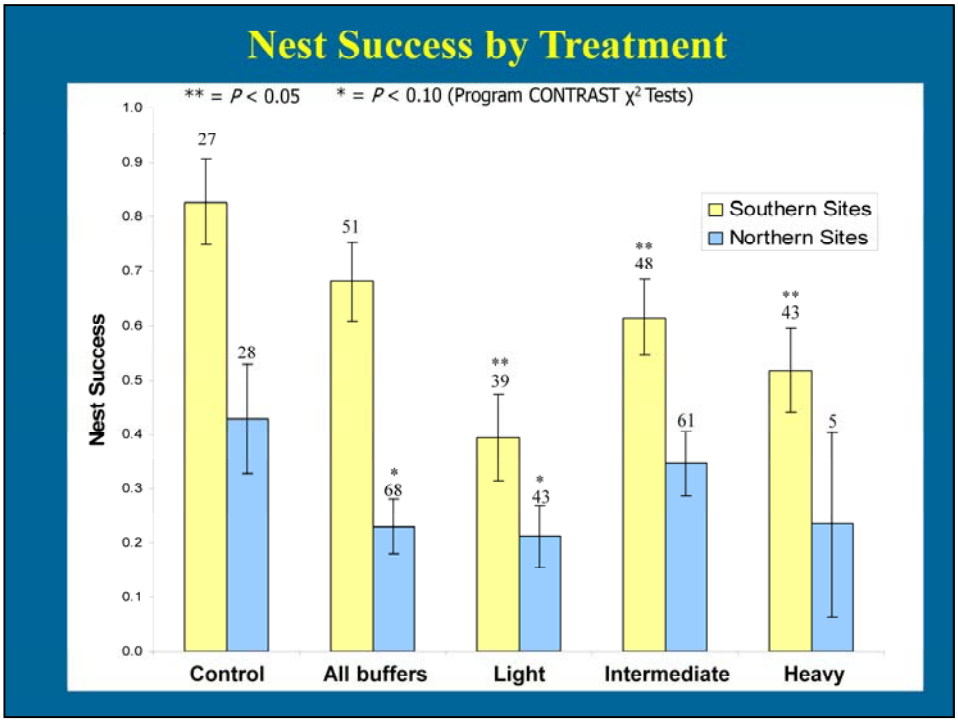
- best model incorporated site, year, and treatment, so all three of those factors were important in influencing whether a nest survived.



1st we examined nest success at each study site (# nests above each bar)

- the 2 southern sites (located in the Cumberland Mountains) had higher nest success than the northern sites.

- to look at treatment effect on nest success, pooled nests from each region.

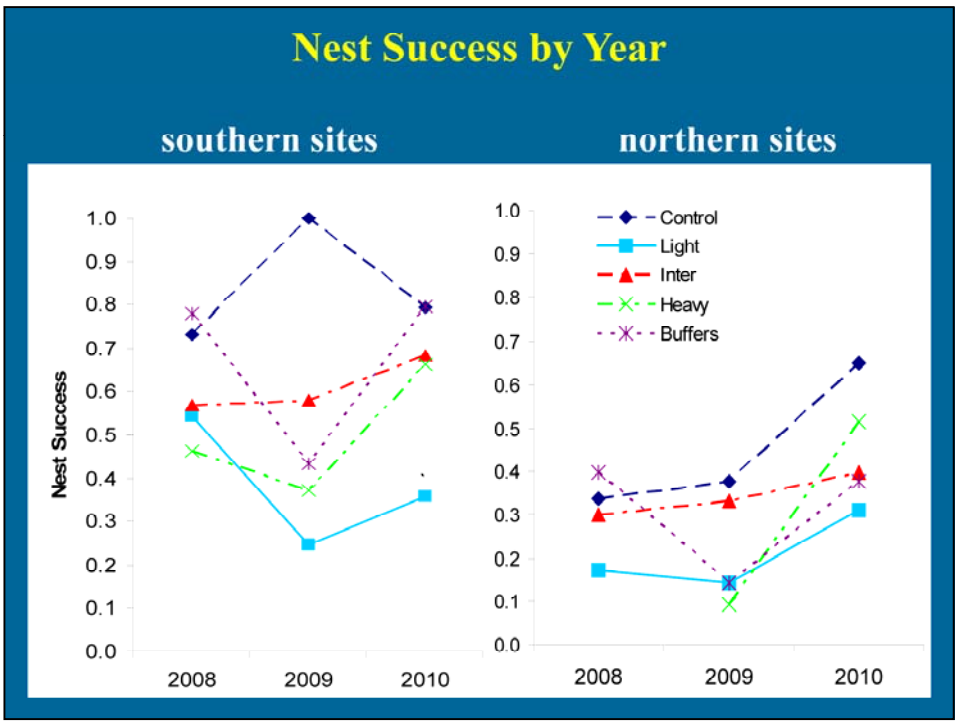


- southern sites, nest success was significantly higher on the unharvested controls and buffers than on any harvest

- northern sites, nest success was still highest on the controls but also on the intermediate harvest

- so these harvests are attracting cerw as we saw with the increased territory density, but nesting success on the light and heavy harvests in particular is reduced

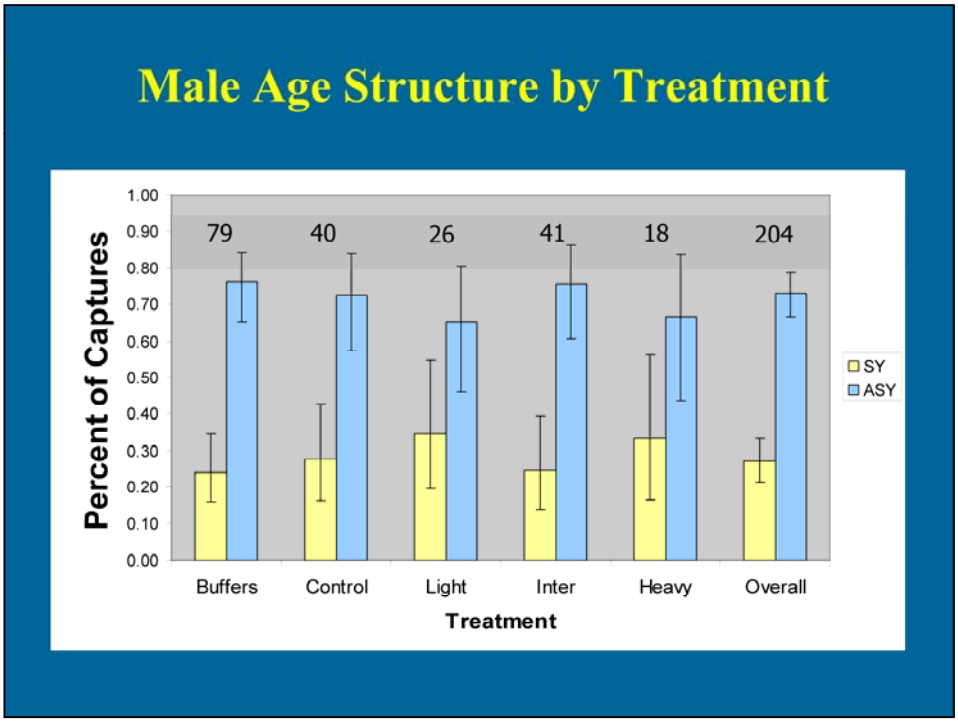
- it also is reduced on the intermediate harvest but perhaps the greater number of nesting individuals somewhat compensates for this. EG on northern sites had 61 nests on intermediate harvest compared to 28 on unharvested control



- Annually, nests on the unharvested control stands at southern and northern sites survived at a higher rate than nests in any of the harvests.

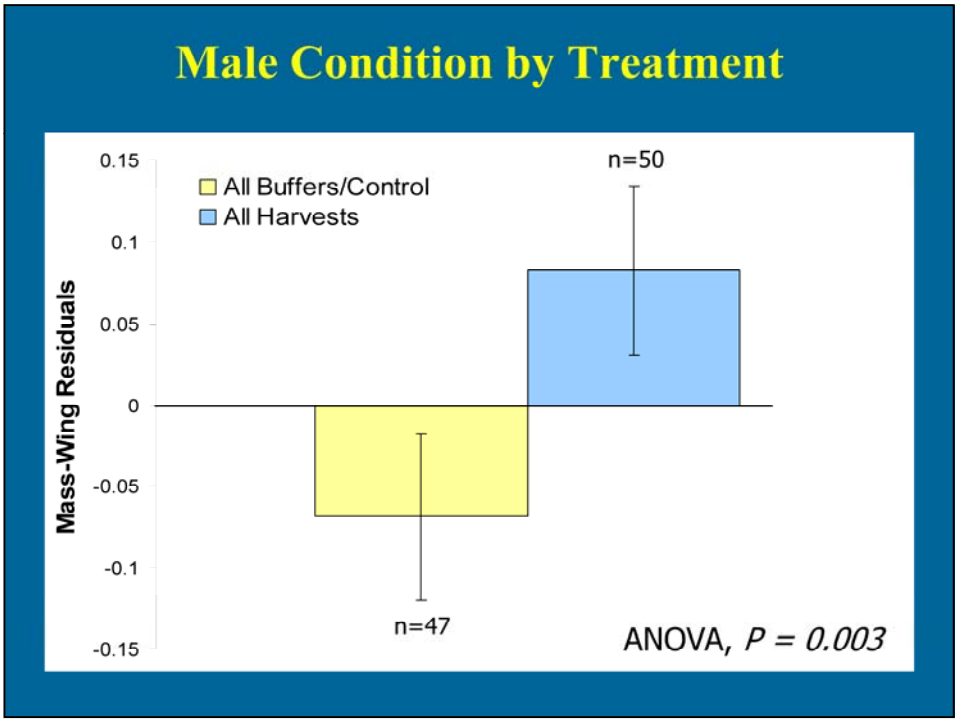
- Nest success rates in the intermediate harvest increased each year post-harvest suggesting habitat conditions improved over time.

- Similar pattern for the heavy harvests but sample size very low.



Switching now to male age structure; 204 males were captured and aged

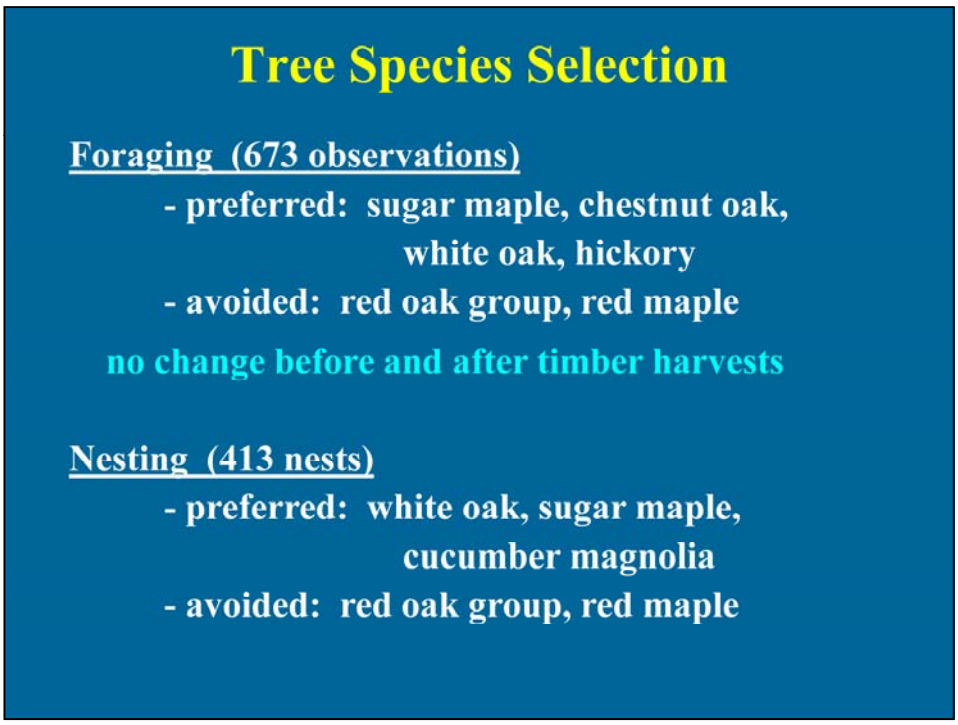
- combining all sites and years, found no statistical difference in age structure of the males inhabiting the various treatments



to examine male body condition, we had to combine harvests to get a large enough sample size for analyses

- the ave body condition index for males captured in unharvested buffers and controls was below zero indicating lower than avg. condition

- while males occupying harvests were in significantly better condition



tree spp listed in order of strength of preference/avoidance

foraging

- no change in tree spp selected for foraging before and after harvests
- but increased use of aerial foraging after harvests

nesting

- similar preference and avoidance patterns

Summary

- male ceruleans attracted to canopy disturbances in mature forest
  - increased abundance, territory density, body condition
  - no effect on male age structure
  - no effect on tree species selected for foraging

- intermediate harvests optimal (~10-22 m^2 /ha)
  - greatest increase in territory density
  - maintained over longest time period
  - nest success similar to unharvested at northern sites
  - greatest # of nests at northern sites

Relative abundance

Summary

- but at southern sites, all harvests had reduced nest success compared to unharvested areas
- and, nest success reduced in light and heavy harvests
- manage for preferred tree species
  - white oak and sugar maple preferred for foraging and nesting
  - red oak group and red maple avoided for both

What is next?

Acknowledgements

- Funding and collaborators:

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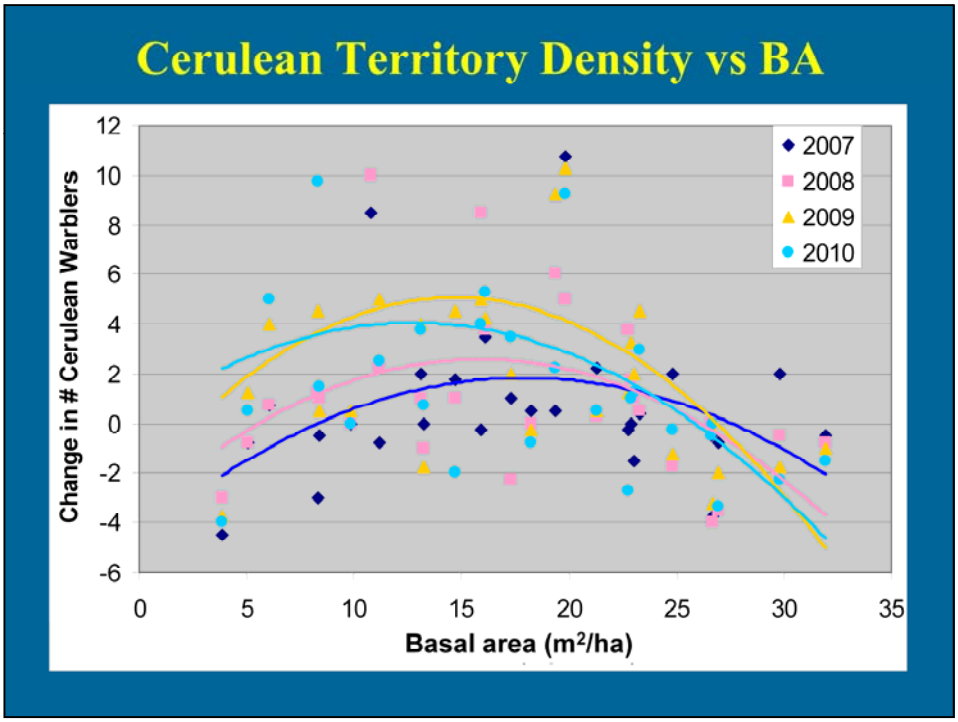
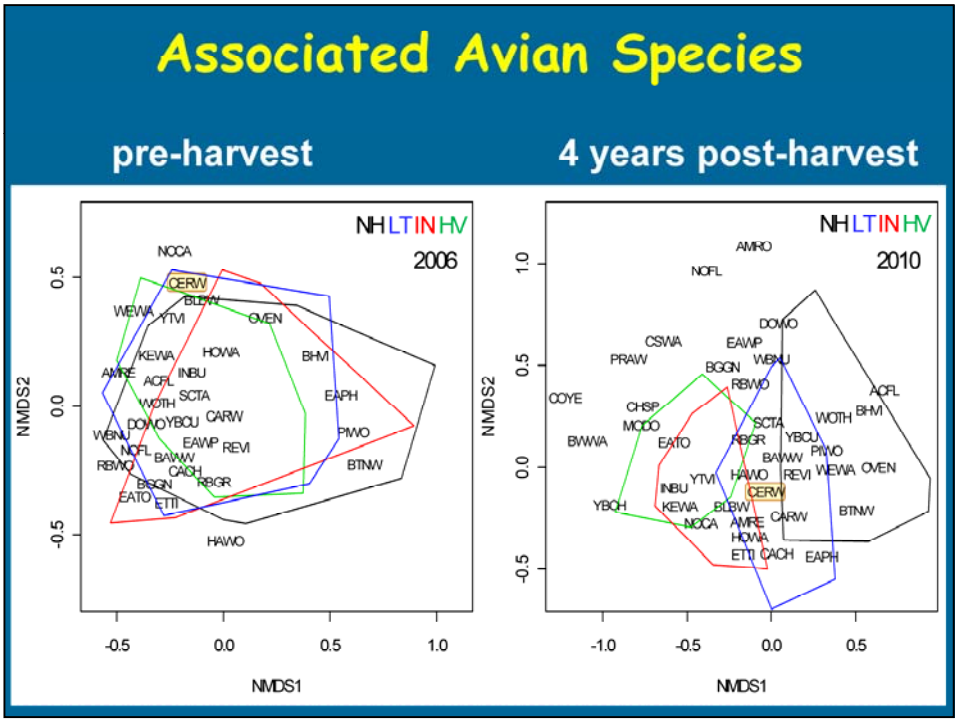


Because we had variable levels of residual basal area across the sites, we also looked at territory density relative to BA

- 1st thing to note; high variability in response with most sites increasing but some decreasing

- the sites that decreased were mainly the lowest and highest BA

- results similar to the treatment analysis in the previous slide, we generally saw greatest increases in territories at intermediate BA and the magnitude of the response increased over time



We also collected point count data to look at the overall avian community associated with the treatments

- in 2006, before harvest, all study plots had similar avian communities as shown by the overlap of all treatments
- in 2010, the 4th yr post-harvest, the intermediate and heavy harvests still had considerable overlap but were separated from the no harvest control [primarily due to considerable increase in early successional species
- notice that cerw fall in the center of the graph indicating that this species contributed little to the separation of the treatments