





Justification for research

Management for white-tailed deer has become increasingly popular among private landowners

Most landowners concentrate on food plots

Overabundant deer herds can decimate understory

Previous research have evaluated silvicultural effects on understory in managed pine stands

Effects of fire and herbicides with and without canopy removal on available deer forage in upland hardwood stands has not been evaluated

Objectives

Determine effects of 6 silvicultural treatments on

- production of biomass
- production of species selected by deer

Compare production and use of 3 warm-season food plot plantings

Contrast forage availability and nutritional carrying capacity within silvicultural treatments and warm-season food plots



Study Area

Chuck Swan State Forest and Wildlife Management Area

24,000 acres

50 miles NE of Knoxville Ridge and Valley province

Precipitation 45-55 inches

Slope 10-20%

Deer density ~ 30 mi²



Site Description

4 mature mixed-hardwood stands

Overstory
white oak, black oak, chestnut oak, NRO, SRO, red maple, yellow poplar, blackgum, Am. beech

Midstory
sassafras, sourwood, flowering dogwood, pawpaw, hornbeam, Carolina buckthorn

4 fields paired with forest stands
food plot forages replicated in each field

Treatments

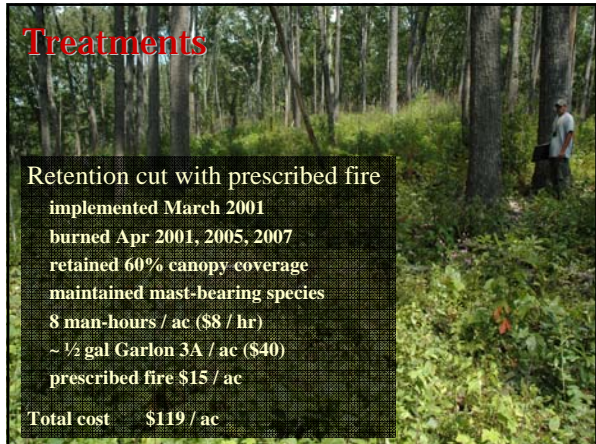
Shelterwood	Wildlife retention cut W/ herbicide	Shelterwood w/ fire	Control	Wildlife retention cut w/ fire	Prescribed fire only
Control	Shelterwood	Wildlife retention cut W/ herbicide and fire	Prescribed fire only	Shelterwood w/ fire	Wildlife retention cut w/ fire

each treatment replicated at each site
except for the retention cut with herbicide
and retention cut with herbicide and fire
Treatments are 2 acres each

Treatments

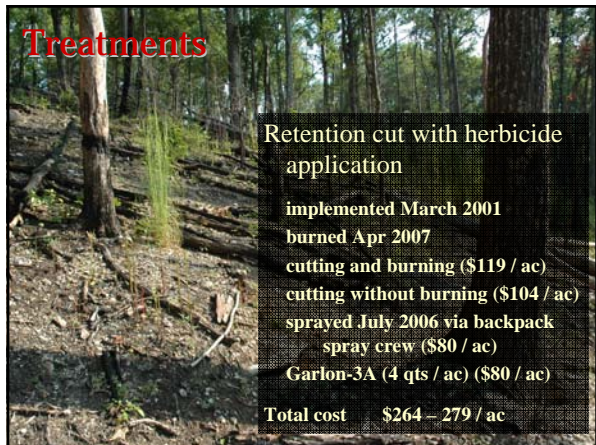
Fire
Apr 2001, 2005, 2007
strip-heading fire
low intensity
early growing season
6 – 18-inch flame height
\$15 / ac (TDF)

Treatments



Retention cut with prescribed fire
 implemented March 2001
 burned Apr 2001, 2005, 2007
 retained 60% canopy coverage
 maintained mast-bearing species
 8 man-hours / ac (\$8 / hr)
 ~ 1/2 gal Garlon 3A / ac (\$40)
 prescribed fire \$15 / ac
Total cost \$119 / ac

Treatments



Retention cut with herbicide application
 implemented March 2001
 burned Apr 2007
 cutting and burning (\$119 / ac)
 cutting without burning (\$104 / ac)
 sprayed July 2006 via backpack
 spray crew (\$80 / ac)
 Garlon-3A (4 qts / ac) (\$80 / ac)
Total cost \$264 – 279 / ac

Treatments



Shelterwood
 implemented March 2001
 retained 60% coverage
Total income ~ \$1,700 / ac

Treatments



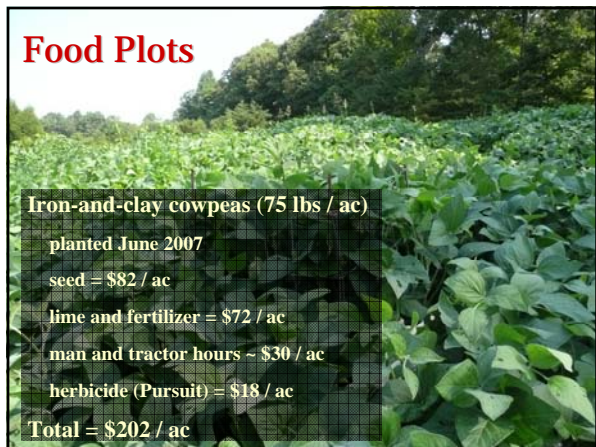
Shelterwood with prescribed fire
implemented 2001
burned Apr 2005
retained 60% canopy coverage
prescribed fire \$15 / ac (TDF)
Total income ~ \$1,700 / ac

Food Plots



Roundup Ready soybeans (80 lbs / ac)
planted June 2007
seed = \$102 / ac
lime and fertilizer = \$72 / ac
man and tractor hours ~ \$30 / ac
herbicide (glyphosate) = \$8 / ac
Total = \$212 / ac

Food Plots



Iron-and-clay cowpeas (75 lbs / ac)
planted June 2007
seed = \$82 / ac
lime and fertilizer = \$72 / ac
man and tractor hours ~ \$30 / ac
herbicide (Pursuit) = \$18 / ac
Total = \$202 / ac

Food Plots

Lablab (25 lbs / ac)

Planted June 2007

seed = \$75 / ac

lime and fertilizer = \$72 / ac

man and tractor hours ~ \$30 / ac

herbicide (Pursuit) = \$18 / ac

Total = \$195 / ac



Sampling

Selection transects

Sampled in August

1 transect in each treatment

300 feet, 3 sample plots

Per 75, 150, 225 feet

sampled 4 feet x 5 feet

≤4 feet high

Stem count by species

browsed stems tallied



Sampling

Woods sampling

Sampled July – September

3 4x4-foot exclusion cages

3 uncaged samples

≤4 ft high biomass sampling

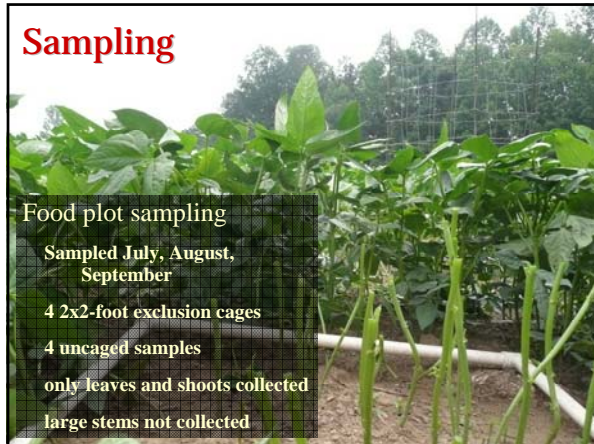
browse (leaves only)

herbaceous (whole plant)

excluding large stems



Sampling



Food plot sampling

Sampled July, August,
September

4 2x2-foot exclusion cages

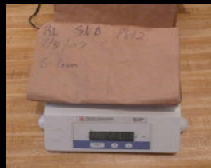
4 uncaged samples

only leaves and shoots collected

large stems not collected

Sampling

Samples bagged in paper sacks
Dried in walk-in air-flow dryer
Weighed after drying



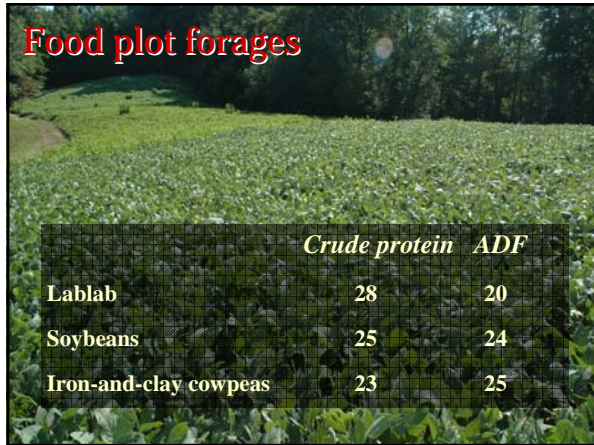
Data Analysis

RBD with replication within each stand
Blocked by stand
Fixed effects (woods) period, treatment, cage
Fixed effects (food plots) period, species, cage
Mixed model ANOVA using SAS 9.1
Square root transformation to correct non-normality
Selection index used to calculate species preference
No difference in forage availability by period or cage in
forested treatments

Selected species

	<i>Crude protein</i>	<i>ADF</i>
<i>Desmodium</i> spp.	16.95	32.53
<i>Nyssa sylvatica</i>	12.61	17.84
<i>Vitis</i> spp.	10.96	30.05
<i>Smilax</i> spp.	10.85	28.23
<i>Rubus</i> spp.	10.08	23.87
<i>Dioscorea villosa</i>	10.02	31.25
<i>Euonymus americana</i>	9.71	26.29
<i>Galium</i> spp.	8.55	31.75
<i>Cornus florida</i>	8.52	14.98

Food plot forages



	<i>Crude protein</i>	<i>ADF</i>
Lablab	28	20
Soybeans	25	24
Iron-and-clay cowpeas	23	25

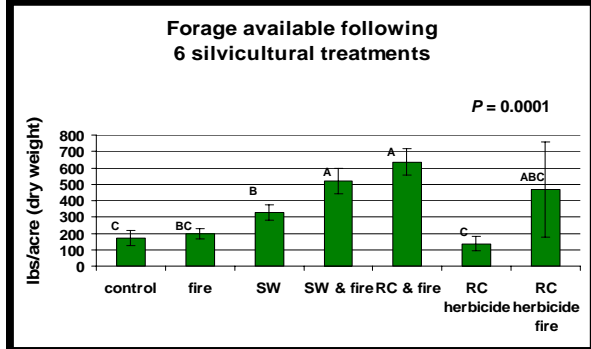
Nutritional carrying capacity

Selected species (pounds / acre, crude protein) used to calculate carrying capacity based on mixed diet of 12% CP (Edwards et al. 2004)

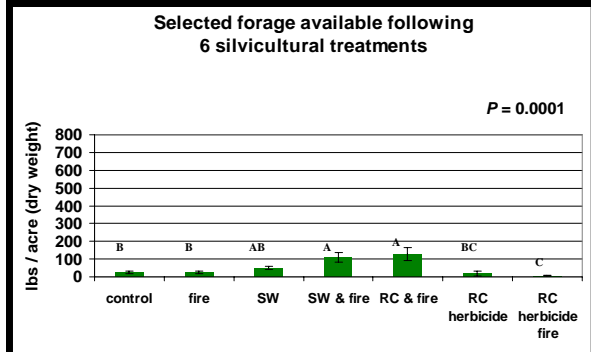
Assuming deer eat average of 3 pounds per day (dry wt)



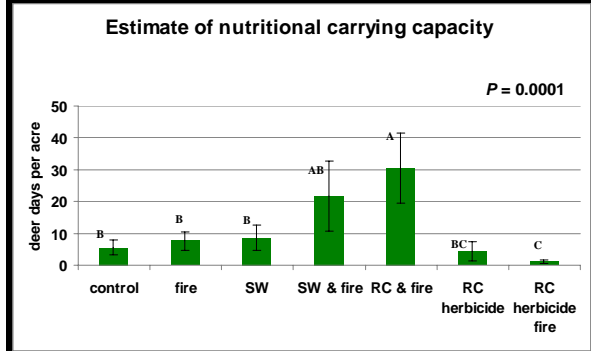
Forage availability



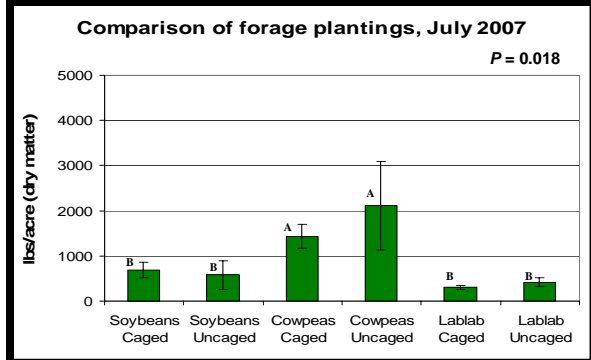
Forage availability



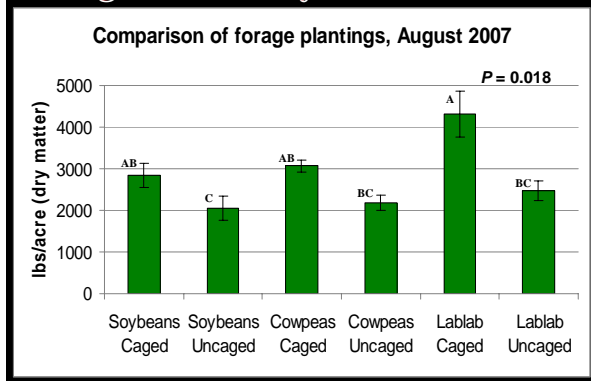
Forage availability



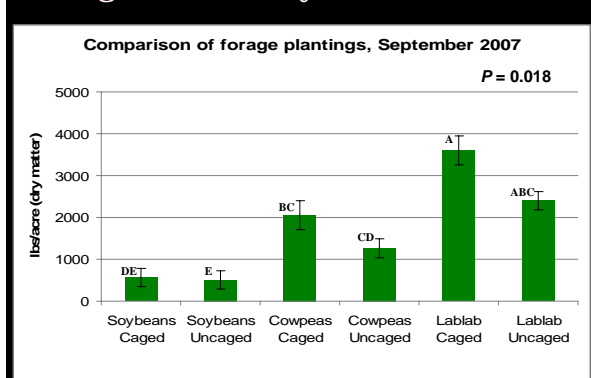
Forage availability



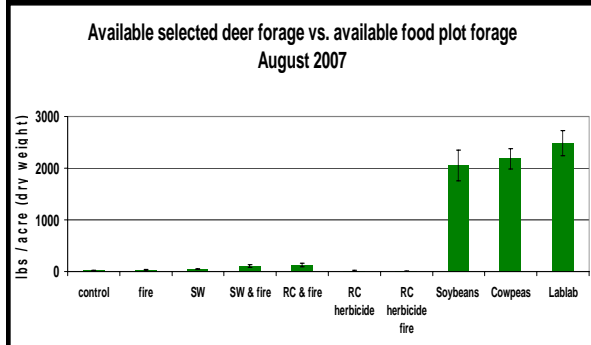
Forage availability



Forage availability



Forage availability



Cost analysis

Treatment	Cost
Prescribed fire	\$0.62 / lb
Shelterwood	--
Shelterwood w/ fire	--
Retention cut w/ fire	\$0.93 / lb
Retention cut w/ herbicide & fire	\$14.60 / lb \$41.24 / lb
Roundup Ready soybeans	\$0.10 / lb
Iron-and-clay cowpeas	\$0.09 / lb
Lablab	\$0.08 / lb

Comparative results

Mississippi	Tennessee
Controls 106 lbs / ac	Controls 25 lbs / ac
treated stands 387 lbs / ac	RC w/ fire 127 lbs / ac
Cowpeas 485 lbs / ac	Cowpeas 3072 lbs / ac

Management Implications

Reducing canopy coverage increases browse availability

Fire *can* be used in upland hardwoods to increase browse availability and enhance cover

Shelterwood harvests can provide economic incentives; species retained should favor oaks and other mast species

Warm-season forage plots can produce significant amounts of quality forage, far exceeding that available in mixed hardwood stands