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Southeastern Forest
Experiment Station

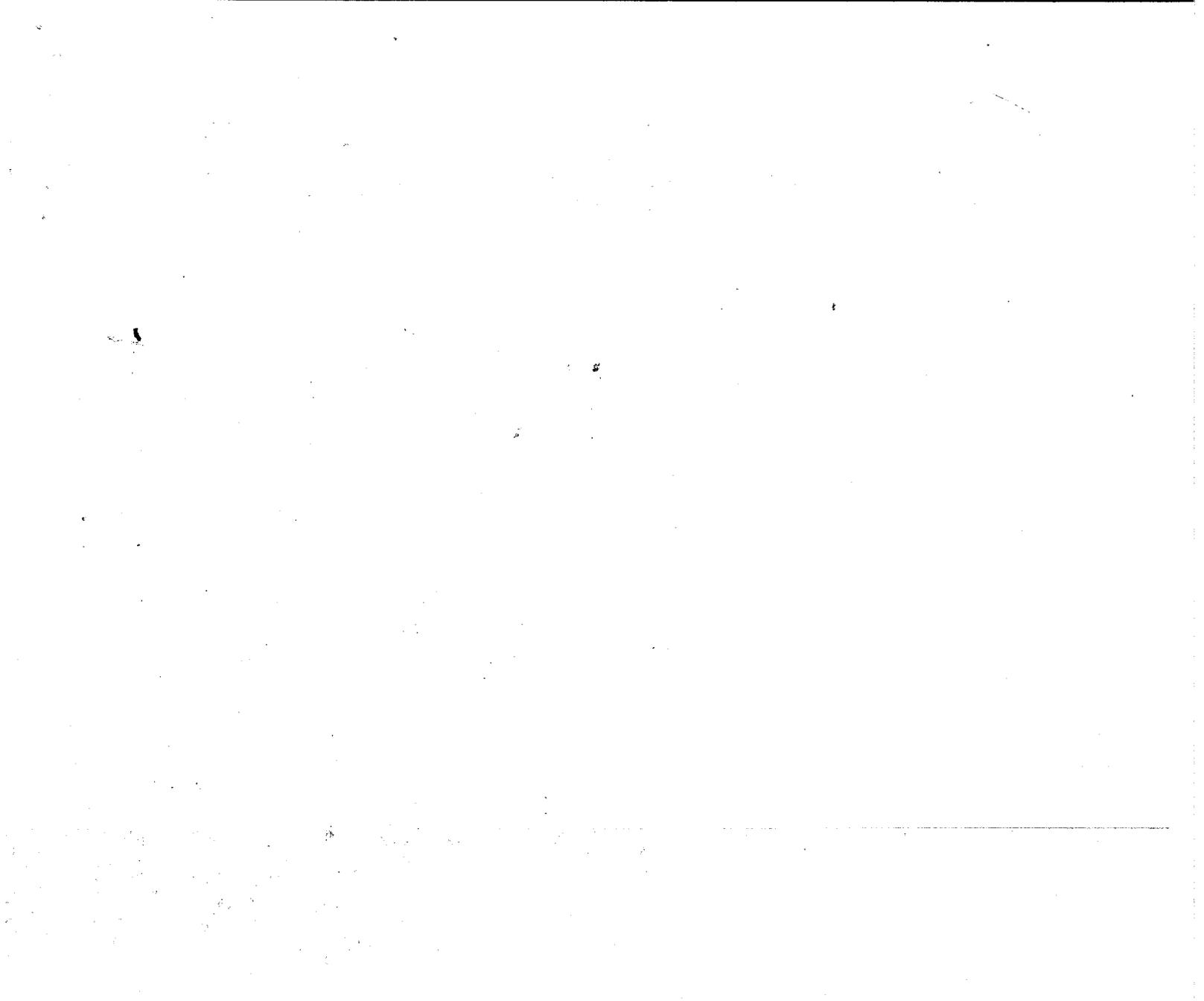
General Technical
Report SE-49

Photos for Estimating Residue Loadings Before and After Burning in Southern Appalachian Mixed Pine – Hardwood Clearcuts

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**Photos for Estimating Residue Loadings
Before and After Burning in Southern Appalachian
Mixed Pine – Hardwood Clearcuts**

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ABSTRACT. — Paired photographs show fuel conditions before and after burning in recently clearcut stands of mixed pine-hardwoods in the Southern Appalachians. Comparison with the photos permits fast assessment of fuel loading and probable burning success. Information with each photo includes measured weights, volumes, and other residue data, information about the timber stand and harvest, and weather conditions at time of broadcast burn ignition.

KEYWORDS: Fuel loading, broadcast burning, site preparation.

Summer broadcast burning is being used increasingly for site preparation after clearcutting of mixed pine – hardwood stands in the Southern Appalachians (Phillips and Abercrombie 1987). This trend away from intensive mechanical site preparation to properly timed prescribed burns has increased the need to accurately quantify residue loadings – the weights of dead branches, tops, and unmerchantable logs that remain on the ground after logging. Residue loading and arrangement affect fire behavior, fire intensity, and smoke dispersal.

Land managers, therefore, must estimate residue loadings to effectively prescribe site preparation burns. No existing fuel models describe residues in harvested pine – hardwood mixtures in the Southern Appalachians. The planar-intersect sampling method (Brown 1974) provides accurate estimates, but it is

time consuming and expensive to apply over large areas. The photo series presented here permits rapid estimation of residue loadings and probable reductions after broadcast burnings.

About the Photos

Photographs are paired to show conditions before and after burning. The examples were chosen to represent the range in residue after clearcutting on the Sumter National Forest in the Southern Appalachians. Included with each photo taken before burning are: measured residue quantities by fuel size class, average depth of fuel, ground area covered, and harvest information. With each photo taken after burning is information on the ignition technique and weather conditions at time of ignition.

This photo series is closely tied to the site preparation technique discussed by Abercrombie and Sims (1986) for establishing pine – hardwood mixtures in the Southern Appalachians. Briefly, the technique involves spring chainsaw felling of unmerchantable stems left after harvesting. After residues cure for at least 1 month, a high-intensity broadcast burn is ignited in middle to late summer to reduce residue loads and prepare the site for regeneration.

Burning is done under moist conditions, usually 2 to 3 days after a heavy rain. Photos after burning, therefore, represent results to be expected from fires under these conditions. High moisture contents of duff and soil at the time of burning ensure that a sufficient organic layer will remain to protect the site from erosion (Van Lear and Danielovich 1988). Approximately two-thirds of the weight of fine fuels (< 3.0 in) are consumed in burns of this type (Sanders and Van Lear 1987). In addition to reducing hardwood sprout vigor, the fire makes planting of the site easier and improves subsequent seedling survival rates (Phillips and Abercrombie 1987).

Residue Loadings

Weights of residues shown in the photos were measured in the manner suggested by Sanders (1987). The planar-intersect technique was applied as described by Brown (1974). Specific gravities for calculating loadings were taken from Anderson's (1978) values for southern and southeastern forest types. Information about timber stands, harvesting, and site preparation was obtained from timber sale records in the Ranger District Office.

The major species present on the areas before cutting were:

<u>Common name</u>	<u>Scientific name</u>
Blackgum	<i>Nyssa sylvatica</i> Marsh.
Flowering dogwood	<i>Cornus florida</i> L.
Hickory	<i>Carya</i> Nutt.
Mountain-laurel	<i>Kalmia latifolia</i> L.
Oak	
Black	<i>Quercus velutina</i> Lam.
Blackjack	<i>marilandica</i> Muenchh.
Chestnut	<i>prinus</i> L.
Northern red	<i>rubra</i> L.
Post	<i>stellata</i> Wangenh.
Scarlet	<i>coccinea</i> Muenchh.
Southern red	<i>falcata</i> Michx.
White	<i>alba</i> L.
Pine	
Eastern white	<i>Pinus strobus</i> L.
Loblolly	<i>taeda</i> L.
Shortleaf	<i>echinata</i> Mill.
Virginia	<i>virginiana</i> Mill.
Red maple	<i>Acer rubrum</i> L.
Rosebay rhododendron	<i>Rhododendron maximum</i> L.
Sourwood	<i>Oxydendrum arboreum</i> (L.) DC.
Yellow-poplar	<i>Liriodendron tulipifera</i> L.

Using the Photos

The photo series enables land managers to roughly estimate the following characteristics of woody residue:

(1) weight (tons/acre) of various residue size classes, (2) average residue depth (in), and (3) percentage of ground area covered by woody residue. Photo pairs are arranged in order of increasing weight of woody residues. To estimate residue loadings in harvested clearcuts, compare timber volumes and stand information listed in area cutting plans with those listed in the photo series. Then select one or more photographs with similar fuel conditions. By identifying differences between photos and existing conditions, and by considering the factors that cause the differences, a reasonable estimate of woody residue loading can be made. Forest floor material, live fuels, and the proportion of sound and rotted residue are difficult to quantify in photographs. Values for these characteristics must be determined from independent sampling or observations.

Maxwell and Ward (1979) list three steps for using a photo series to inventory an area's woody residue:

1. Observe woody residue characteristics, such as weight, depth, and ground coverage by walking through the residue complex or by viewing the area from an elevated position to observe residue continuity and distribution.

2. Select a photo that nearly matches, or photos that bracket, these observations.

3. Adjust the values shown for a photo that nearly matches conditions or interpolate between values for photos that bracket existing conditions.

These steps should be repeated for each residue characteristic desired. If residue loadings in the measurement area have zones of obvious differences, individual estimates may be made for each zone. These values should then be weighted and cumulated for a more comprehensive estimate of residue loading of the entire area.

For planning purposes, the approximate reduction occurring after broadcast burning can be estimated for a measurement area by comparing the residue loadings before and after burning in the photo series. The amounts of residues shown after burning in the photos are considered acceptable for hand planting on the Sumter National Forest when the objective is to establish a mixed pine-hardwood stand. Amounts considered acceptable elsewhere in the Southern Appalachians may vary, depending on site preparation objectives.

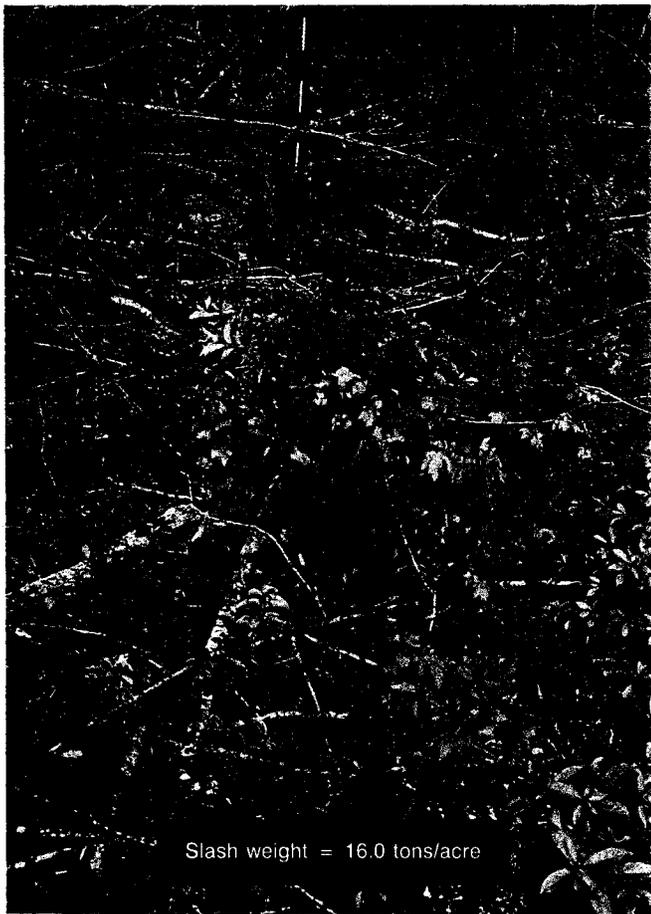
Acknowledgments

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Literature Cited

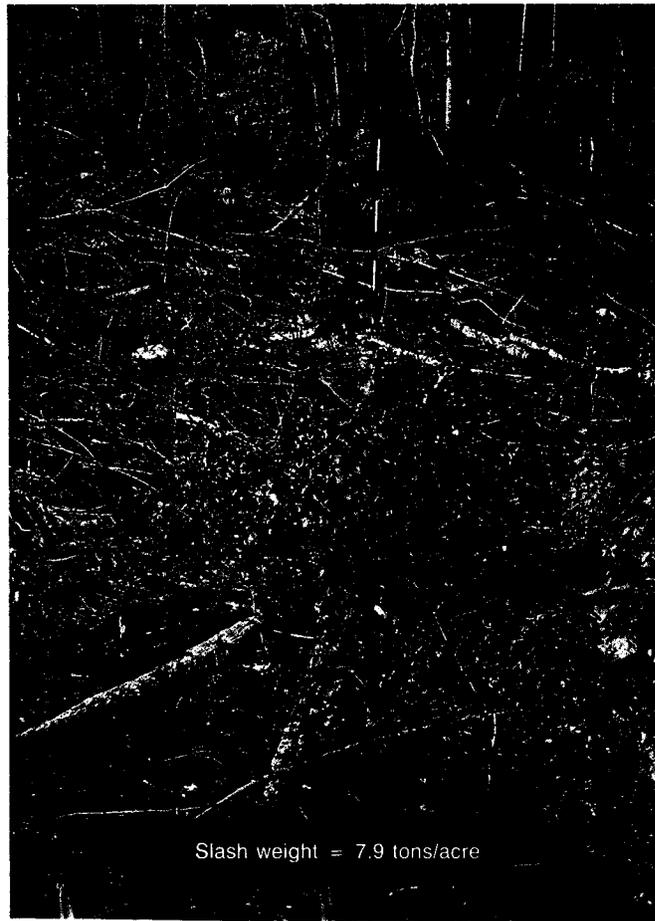
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Slash weight = 16.0 tons/acre

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Slash weight = 7.9 tons/acre

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				91
Branches:			20.1	
0.0-0.25	1.1	51.3		
0.25-1.0	2.7	125.3		
1.0-3.0	4.8	264.9		
3.0+	6.7	427.0		
Foliage	<u>0.7</u>			
Subtotal	<u>16.0</u>	868.5		
Live fuels ^a	0.2			5-25
Litter	4.2		1.4	
Duff	<u>11.9</u>		2.4	
Subtotal	<u>16.3</u>			
Grand total fuel loading	32.3			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 9, July 1986

Stand information: 125-year-old shortleaf pine with
numerous hardwoods

Site index: 61

Sawtimber (M fbm/acre): 3.0 pine, 0.5 hardwood

Cordwood (100 ft³/acre): 2.1 pine, 4.3 hardwood

Method of harvest: Chainsaw, feller-buncher, skidder

Period of harvest: December 1985 - January 1986

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				35
Branches:			3.5	
0.0-0.25	0.1	5.0		
0.25-1.0	0.7	31.9		
1.0-3.0	2.2	119.4		
3.0+	4.9	269.6		
Foliage	<u>0.0</u>			
Subtotal	<u>7.9</u>	425.9		
Live fuels ^a	0.0			0-5
Litter	0.0		0.0	
Duff	<u>3.2</u>		0.9	
Subtotal	<u>3.2</u>			
Grand total fuel loading	11.1			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 9, October 1986

Date of burn: 9/15/86

Days since last rain: 3 (0.15 in)

Ignition technique: Helitorch (Bell 206B-II)

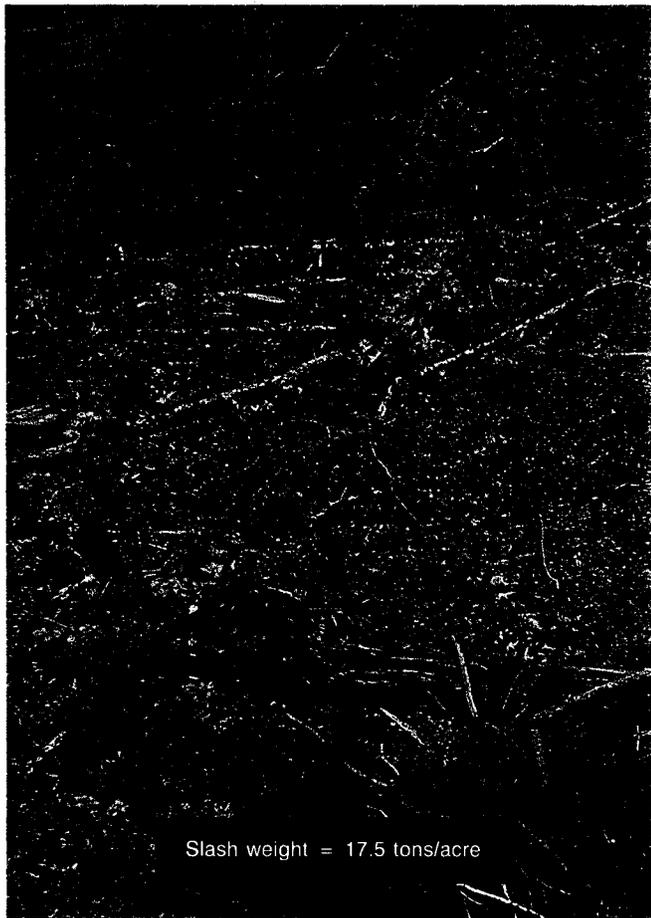
Period of ignition: 1300-1320

Temperature: 78 °F

Relative humidity: 42 percent

Windspeed: 0-5 mi/h

Cloud cover: 0 percent



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Fuel	Weight	Volume	Depth	Coverage
	<u>tons/acre</u>	<u>ft³/acre</u>	<u>inch</u>	<u>percent</u>
Slash:				76
Branches:			17.2	
0.0-0.25	0.7	34.3		
0.25-1.0	1.8	81.0		
1.0-3.0	7.9	434.8		
3.0+	6.9	567.7		
Foliage	<u>0.2</u>	<u> </u>		
Subtotal	<u>17.5</u>	1,117.8		
Live fuels ^a	0.2			5-25
Litter	7.0		1.8	
Duff	<u>14.9</u>		3.5	
Subtotal	<u>22.1</u>			
Grand total fuel loading	39.6			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 9, July 1986

Stand information: 125-year-old shortleaf pine with
numerous hardwoods

Site index: 61

Sawtimber (M fbm/acre): 3.0 pine, 0.5 hardwood

Cordwood (100 ft³/acre): 2.1 pine, 4.3 hardwood

Method of harvest: Chainsaw, feller-buncher, skidder

Period of harvest: December 1985 - January 1986

Fuel	Weight	Volume	Depth	Coverage
	<u>tons/acre</u>	<u>ft³/acre</u>	<u>inch</u>	<u>percent</u>
Slash:				7
Branches:			0.5	
0.0-0.25	0.0	0.8		
0.25-1.0	0.2	7.7		
1.0-3.0	1.8	98.9		
3.0+	2.6	226.9		
Foliage	<u>0.0</u>	<u> </u>		
Subtotal	<u>4.6</u>	334.3		
Live fuels ^a	0.0			0-5
Litter	0.0		0.0	
Duff	<u>11.6</u>		0.7	
Subtotal	<u>11.6</u>			
Grand total fuel loading	16.2			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 9, November 1986

Date of burn: 9/15/86

Days since last rain: 3 (0.15 in)

Ignition technique: Helitorch (Bell 206B-II)

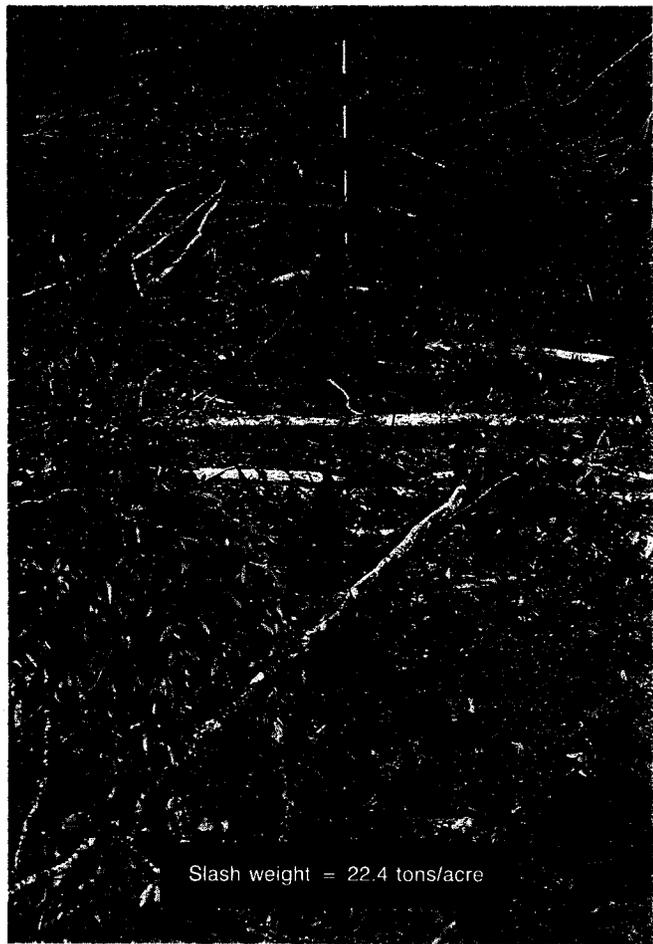
Period of ignition: 1300-1320

Temperature: 78 °F

Relative humidity: 42 percent

Windspeed: 0-5 mi/h

Cloud cover: 0 percent



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Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				91
Branches:			22.4	
0.0-0.25	0.6	28.6		
0.25-1.0	1.9	86.8		
1.0-3.0	5.2	288.3		
3.0+	14.4	793.4		
Foliage	0.3			
Subtotal	<u>22.4</u>	1,197.1		
Live fuels ^a	0.2			0-5
Litter	3.3		1.6	
Duff	<u>10.8</u>		1.8	
Subtotal	<u>14.3</u>			
Grand total fuel loading	36.7			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 16, July 1986

Stand information: 90-year-old shortleaf pine with
numerous hardwoods

Site index: 81

Sawtimber (M fbm/acre): 6.6 pine, 0.9 hardwood

Cordwood (100 ft³/acre): 2.5 pine, 3.1 hardwood

Method of harvest: Chainsaw, feller-buncher, skidder

Period of harvest: December 1985 - January 1986

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				26
Branches:			1.7	
0.0-0.25	0.1	3.9		
0.25-1.0	0.7	31.0		
1.0-3.0	1.2	64.6		
3.0+	6.2	339.9		
Foliage	0.0			
Subtotal	<u>8.2</u>	439.4		
Live fuels ^a	0.0			0-5
Litter	0.2		0.2	
Duff	<u>7.6</u>		0.6	
Subtotal	<u>7.8</u>			
Grand total fuel loading	16.0			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 16, October 1986

Date of burn: 9/15/86

Days since last rain: 3 (0.15 in)

Ignition technique: Helitorch (Bell 206B-II)

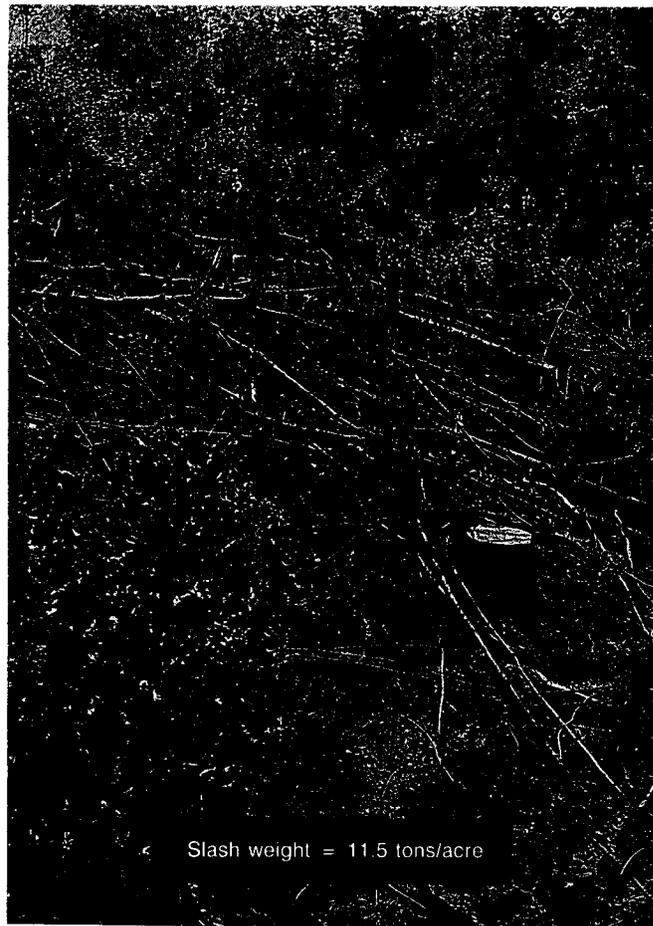
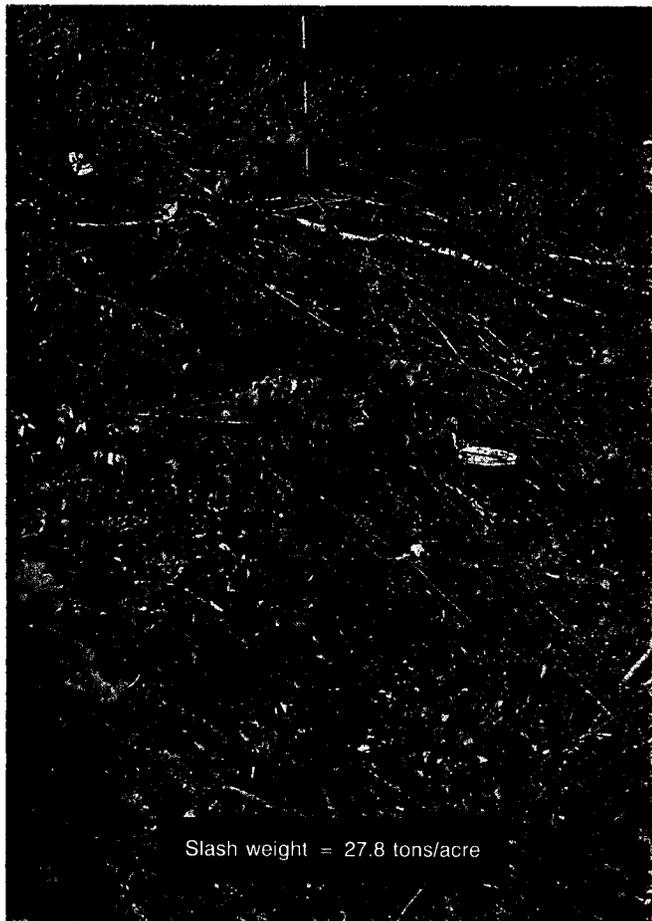
Period of ignition: 1500-1520

Temperature: 84 °F

Relative humidity: 40 percent

Windspeed: 0-5 mi/h

Cloud cover: 0 percent



Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				83
Branches:			21.1	
0.0-0.25	0.7	33.9		
0.25-1.0	2.5	116.2		
1.0-3.0	10.5	581.7		
3.0+	13.6	751.1		
Foliage	<u>0.5</u>			
Subtotal	<u>27.8</u>	1,482.9		
Live fuels ^a	0.2			5-25
Litter	4.3		2.9	
Duff	<u>13.5</u>		1.9	
Subtotal	<u>18.0</u>			
Grand total fuel loading	45.8			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 16, July 1986
Stand information: 90-year-old shortleaf pine with
numerous hardwoods
Site index: 81
Sawtimber (M fbm/acre): 6.6 pine, 0.9 hardwood
Cordwood (100 ft³/acre): 2.5 pine, 3.1 hardwood
Method of harvest: Chainsaw, feller-buncher, skidder
Period of harvest: June 1985 - December 1985

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				28
Branches:			1.8	
0.0-0.25	0.1	5.1		
0.25-1.0	0.8	37.2		
1.0-3.0	2.2	122.0		
3.0+	8.4	463.4		
Foliage	<u>0.0</u>			
Subtotal	<u>11.5</u>	627.7		
Live fuels ^a	0.0			0-5
Litter	0.0		0.0	
Duff	<u>6.3</u>		1.9	
Subtotal	<u>6.3</u>			
Grand total fuel loading	17.8			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 16, October 1986
Date of burn: 9/15/86
Days since last rain: 3 (0.15 in)
Ignition technique: Helitorch (Bell 206B-II)
Period of ignition: 1500-1520
Temperature: 84 °F
Relative humidity: 40 percent
Windspeed: 0-5 mi/h
Cloud cover: 0 percent



Slash weight = 31.2 tons/acre

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Slash weight = 16.8 tons/acre

Fuel	Weight	Volume	Depth	Coverage
	<u>tons/acre</u>	<u>ft³/acre</u>	<u>inch</u>	<u>percent</u>
Slash:				96
Branches:			22.3	
0.0-0.25	1.0	43.6		
0.25-1.0	5.8	263.5		
1.0-3.0	6.8	373.5		
3.0+	17.0	956.7		
Foliage	<u>0.6</u>			
Subtotal	<u>31.2</u>	1,637.3		
Live fuels ^a	0.2			5-25
Litter	10.0		1.8	
Duff	<u>18.0</u>		1.6	
Subtotal	<u>28.2</u>			
Grand total fuel loading	59.4			

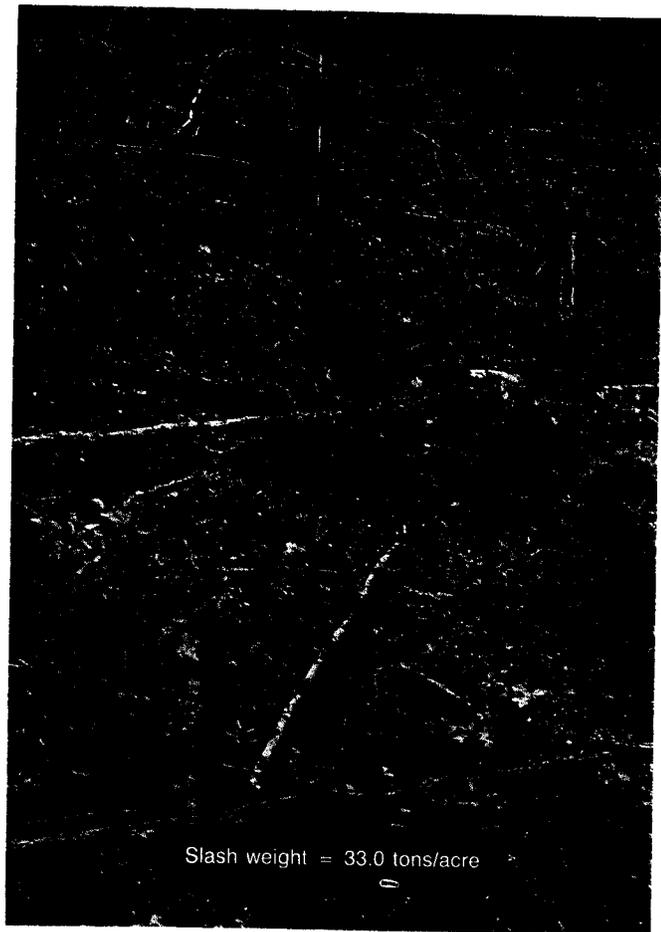
^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 30, stand 35, July 1986
Stand information: 89-year-old hardwoods with short-
leaf, Virginia, and white pine
Site index: 73
Sawtimber (M fbm/acre): 1.9 pine, 0.45 white pine,
1.6 hardwood
Cordwood (100 ft³/acre): 3.3 pine, 4.0 hardwood
Method of harvest: Chainsaw, feller-buncher, skidder
Period of harvest: October 1985 - June 1986

Fuel	Weight	Volume	Depth	Coverage
	<u>tons/acre</u>	<u>ft³/acre</u>	<u>inch</u>	<u>percent</u>
Slash:				33
Branches:			3.9	
0.0-0.25	0.0	0.6		
0.25-1.0	0.6	26.6		
1.0-3.0	2.8	156.2		
3.0+	13.4	738.7		
Foliage	<u>0.0</u>			
Subtotal	<u>16.8</u>	922.1		
Live fuels ^a	0.0			0-5
Litter	0.0		0.0	
Duff	<u>6.2</u>		2.3	
Subtotal	<u>6.2</u>			
Grand total fuel loading	23.0			

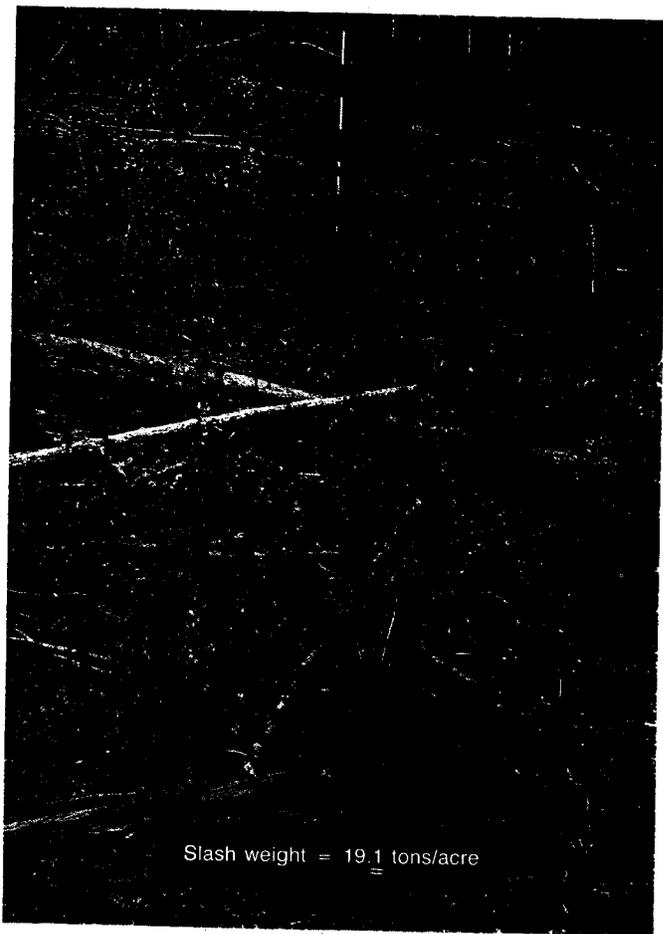
^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 30, stand 35, November 1986
Date of burn: 9/22/86
Days since last rain: 3 (0.24 in)
Ignition technique: Helitorch (Bell 206B-II)
Period of ignition: 1215-1230
Temperature: 83 °F
Relative humidity: 52 percent
Windspeed: 0-5 mi/h
Cloud cover: 0 percent



Slash weight = 33.0 tons/acre

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Slash weight = 19.1 tons/acre

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				89
Branches:			11.2	
0.0-0.25	0.7	30.8		
0.25-1.0	2.1	97.9		
1.0-3.0	6.6	365.6		
3.0+	23.5	1,321.5		
Foliage	<u>0.1</u>			
Subtotal	<u>33.0</u>	1,815.8		
Live fuels ^a	0.2			5-25
Litter	6.3		1.8	
Duff	<u>20.7</u>		1.1	
Subtotal	<u>27.2</u>			
Grand total fuel loading	60.2			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 16, July 1986

Stand information: 90-year-old shortleaf pine with
numerous hardwoods

Site index: 81

Sawtimber (M fbm/acre): 6.6 pine, 0.9 hardwood

Cordwood (100 ft³/acre): 2.5 pine, 3.1 hardwood

Method of harvest: Chainsaw, feller-buncher, skidder

Period of harvest: June 1985 - December 1985

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				63
Branches:			4.5	
0.0-0.25	0.1	6.0		
0.25-1.0	1.3	60.1		
1.0-3.0	4.0	221.8		
3.0+	13.7	761.0		
Foliage	<u>0.0</u>			
Subtotal	<u>19.1</u>	1,048.9		
Live fuels ^a	0.0			0-5
Litter	0.4		0.5	
Duff	<u>7.2</u>		1.1	
Subtotal	<u>7.6</u>			
Grand total fuel loading	26.7			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 16, October 1986

Date of burn: 9/15/86

Days since last rain: 3 (0.15 in)

Ignition technique: Helitorch (Bell 206B-II)

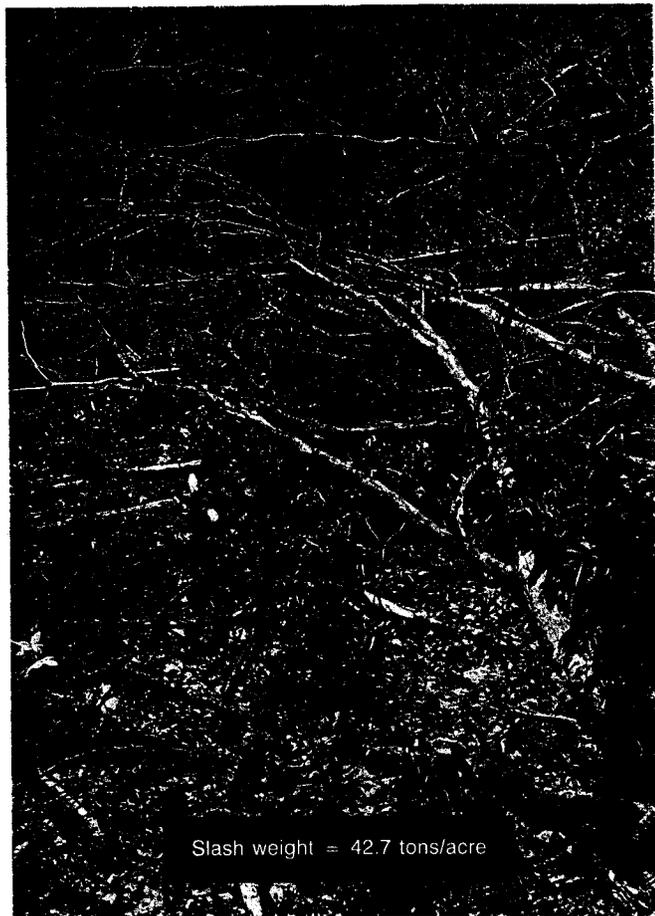
Period of ignition: 1500-1520

Temperature: 84 °F

Relative humidity: 40 percent

Windspeed: 0-5 mi/h

Cloud cover: 0 percent



18



Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				91
Branches:			30.0	
0.0-0.25	0.8	38.4		
0.25-1.0	3.7	170.1		
1.0-3.0	11.9	656.0		
3.0+	26.0	1,522.9		
Foliage	0.3			
Subtotal	<u>42.7</u>	2,387.4		
Live fuels ^a	0.4			5-25
Litter	6.4		1.8	
Duff	9.5		3.7	
Subtotal	<u>16.3</u>			
Grand total fuel loading	59.0			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 9, July 1986

Stand information: 125-year-old shortleaf pine with
numerous hardwoods

Site index: 61

Sawtimber (M fbm/acre): 3.0 pine, 0.5 hardwood

Cordwood (100 ft³/acre): 2.1 pine, 4.3 hardwood

Method of harvest: Chainsaw, feller-buncher, skidder

Period of harvest: December 1985 - January 1986

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				28
Branches:			4.4	
0.0-0.25	0.1	6.7		
0.25-1.0	0.8	35.7		
1.0-3.0	4.3	237.5		
3.0+	9.8	559.8		
Foliage	0.0			
Subtotal	<u>15.0</u>	839.7		
Live fuels ^a	0.0			0-5
Litter	0.0		0.0	
Duff	2.7		1.6	
Subtotal	<u>0.0</u>			
Grand total fuel loading	17.7			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 67, stand 9, October 1986

Date of burn: 9/15/86

Days since last rain: 3 (0.15 in)

Ignition technique: Helitorch (Bell 206B-II)

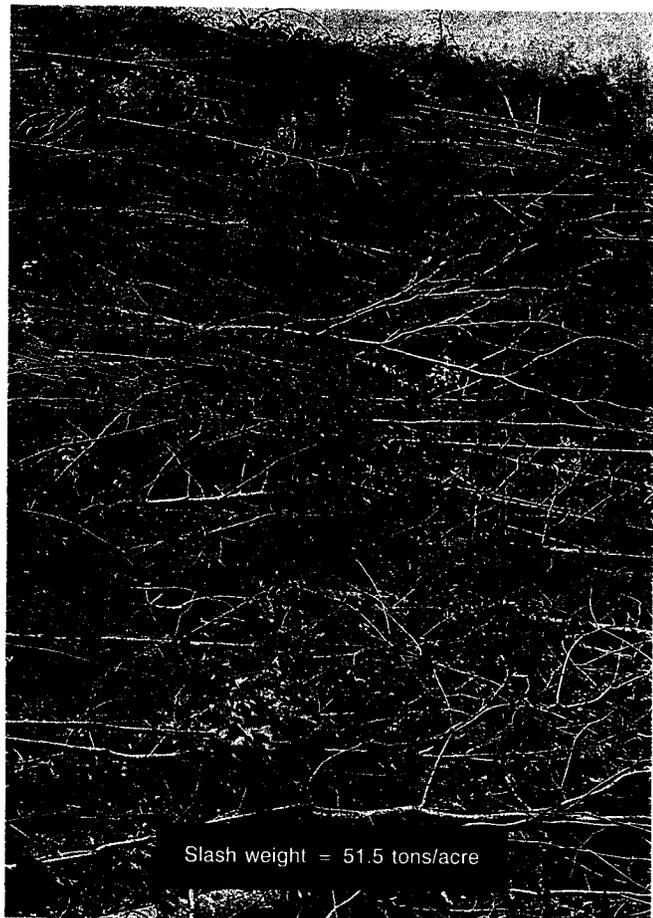
Period of ignition: 1300-1320

Temperature: 78 °F

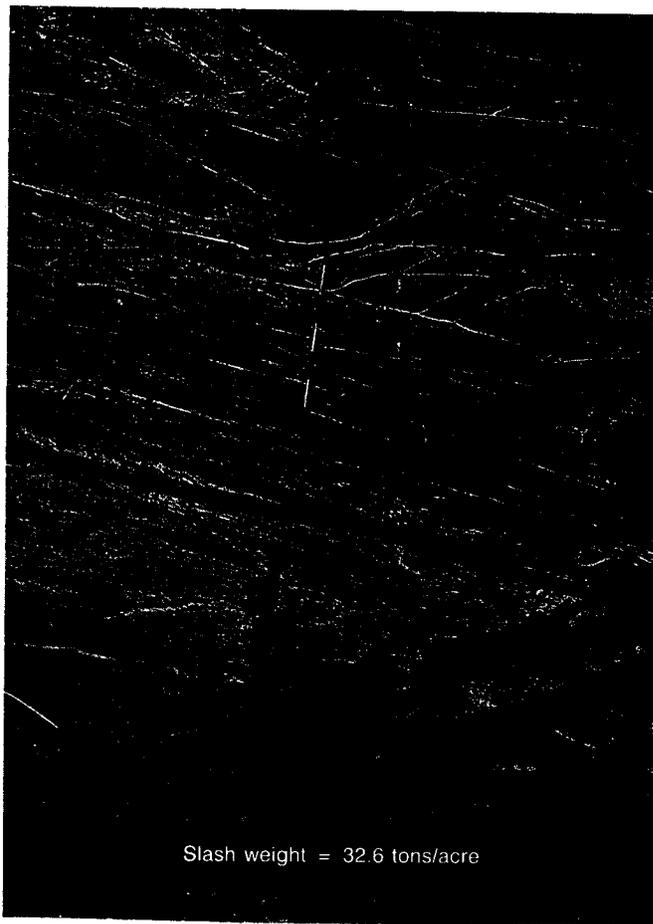
Relative humidity: 42 percent

Windspeed: 0-5 mi/h

Cloud cover: 0 percent



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Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				100
Branches:			31.9	
0.0-0.25	1.9	87.0		
0.25-1.0	6.1	280.6		
1.0-3.0	13.5	746.7		
3.0+	28.6	1,610.0		
Foliage	1.4			
Subtotal	<u>51.5</u>	2,724.3		
Live fuels ^a	0.1			0-5
Litter	7.0		1.8	
Duff	<u>8.8</u>		3.5	
Subtotal	<u>15.9</u>			
Grand total fuel loading	67.4			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 30, stand 35, July 1986

Stand information: 89-year-old hardwoods with short-
leaf, Virginia, and white pine

Site index: 73

Sawtimber (M fbm/acre): 1.9 pine, 0.45 white pine,
1.6 hardwood

Cordwood (100 ft³/acre): 3.3 pine, 4.0 hardwood

Method of harvest: Chainsaw, feller-buncher, skidder

Period of harvest: December 1985 - January 1986

Fuel	Weight	Volume	Depth	Coverage
	tons/acre	ft ³ /acre	inch	percent
Slash:				56
Branches:			7.3	
0.0-0.25	0.0	0.9		
0.25-1.0	0.7	30.3		
1.0-3.0	7.0	386.8		
3.0+	24.9	1,390.3		
Foliage	0.0			
Subtotal	<u>32.6</u>	1,808.3		
Live fuels ^a	0.0			0-5
Litter	0.0		0.0	
Duff	<u>4.2</u>		2.3	
Subtotal	<u>4.2</u>			
Grand total fuel loading	36.8			

^aIncludes sprouts, grasses, vines, and weeds.

Location and date: Andrew Pickens R.D., Sumter N.F.,
comp. 30, stand 35, November 1986

Date of burn: 9/22/86

Days since last rain: 3 (0.24 in)

Ignition technique: Helitorch (Bell 206B-II)

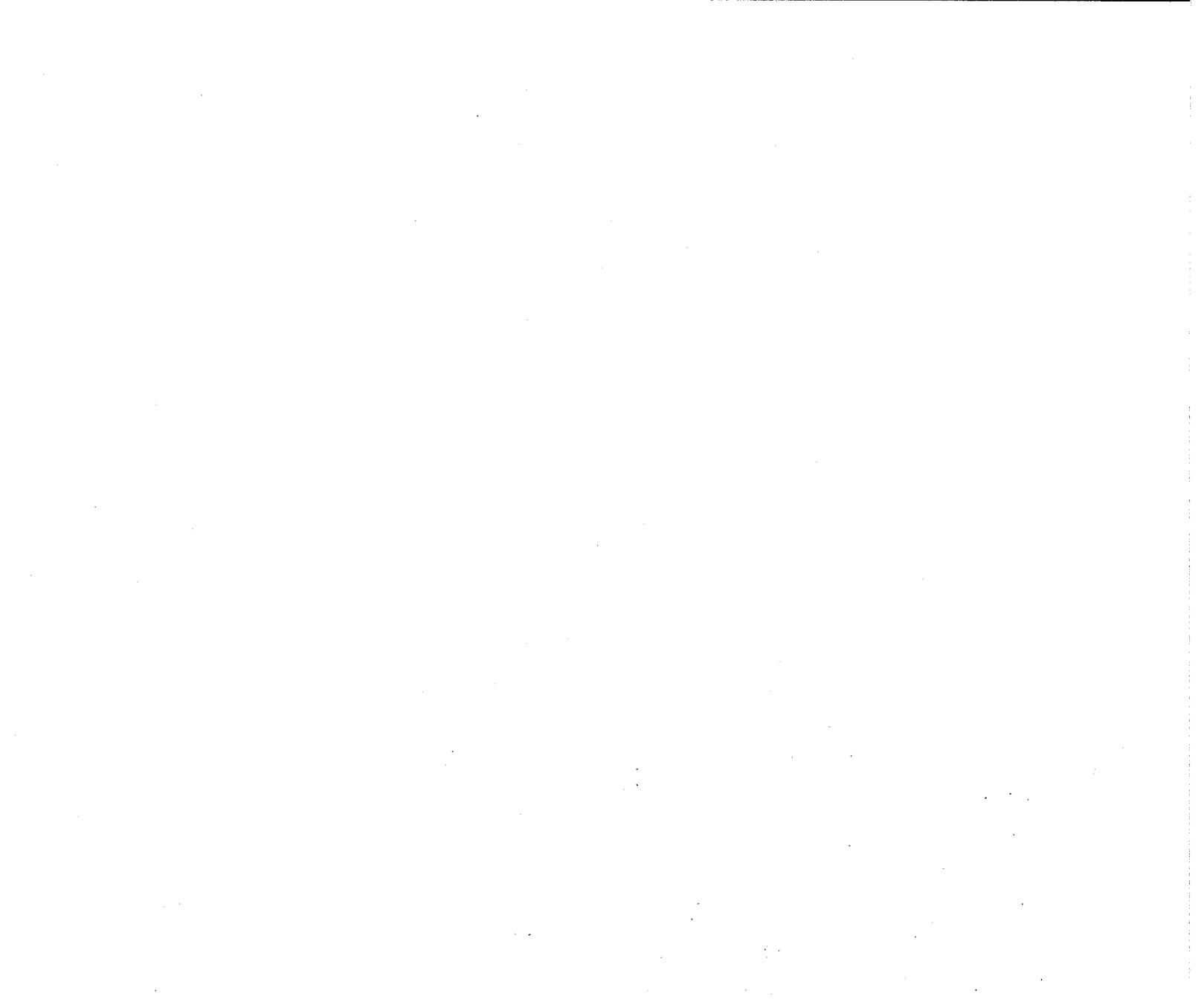
Period of ignition: 1215-1230

Temperature: 83 °F

Relative humidity: 52 percent

Windspeed: 0-5 mi/h

Cloud cover: 0 percent



Sanders, Bradford M.; Van Lear, David H.

Photos for estimating residue loadings before and after burning in Southern Appalachian mixed pine – hardwood clearcuts. Gen. Tech. Rep. SE-49. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1988. 21pp.

Paired photographs show fuel conditions before and after burning in recently clearcut stands of mixed pine – hardwoods in the Southern Appalachians. Comparison with the photos permits fast assessment of fuel loading and probable burning success. Information with each photo includes measured weights, volumes, and other residue data, information about the timber stand and harvest, and weather conditions at time of broadcast burn ignition.

Keywords: Fuel loading, broadcast burning, site preparation.



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