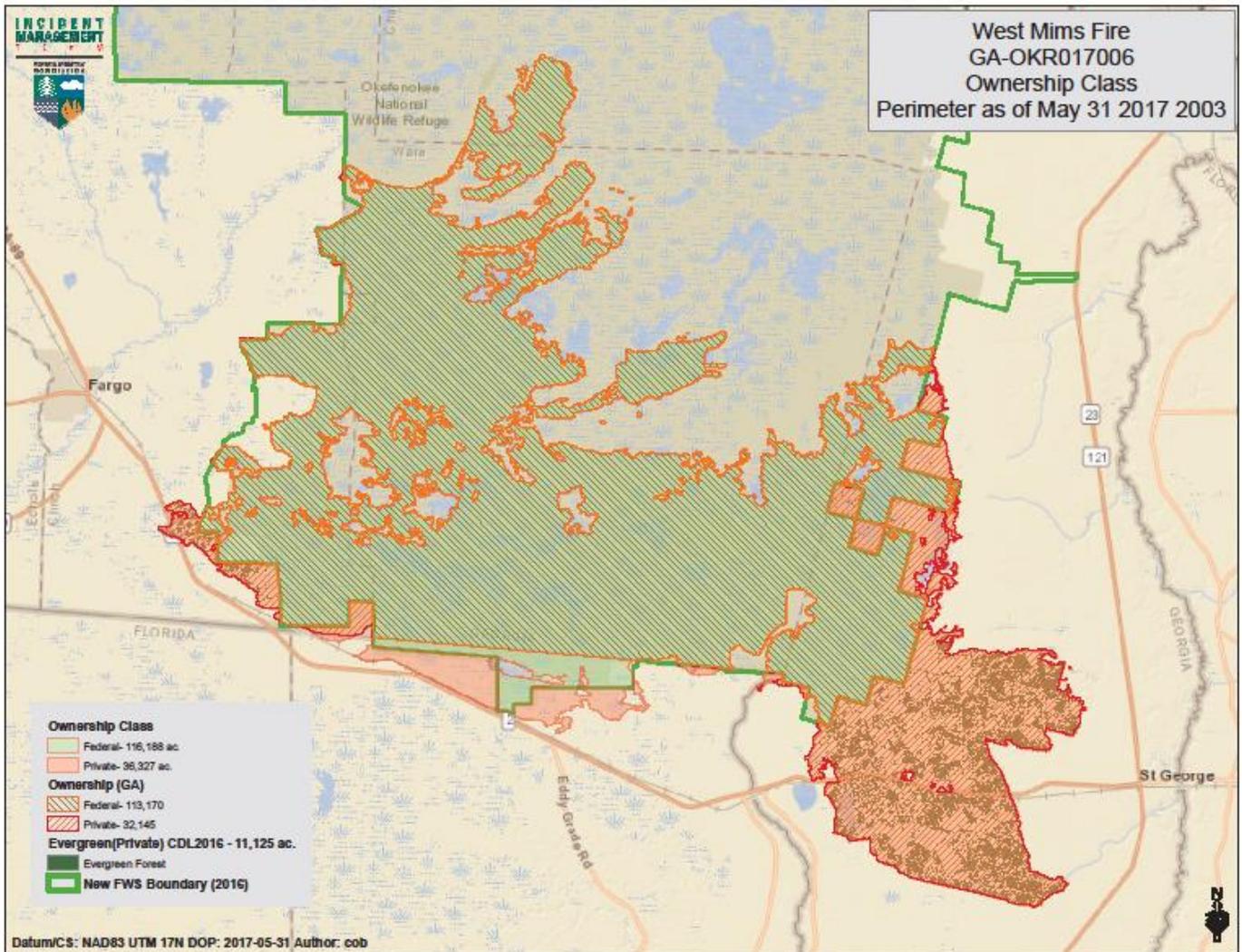




Wildfire Damage Assessment for the West Mims Fire

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Background: On April 6, 2017, a lightning-caused wildfire began approximately seven miles east of Fargo, Georgia and 2.5 miles northeast of the Eddy Fire Tower in the Okefenokee National Wildlife Refuge. The fire quickly spread across the Okefenokee Swamp National Wildlife Refuge and on May 5, 2017 the West Mims fire escaped the refuge, consuming approximately 32,000 acres of industry and privately owned forest. The effects of long term drought and extreme fire weather conditions resulted in limited control. As of May 31, 2017 the West Mims Fire has consumed 145,315 acres (113,170 acres of federally owned land and 32,145 acres on private and industrial property). Ware, Clinch, and Charlton Counties all have sections of this massive wildfire within their boundaries. Efforts continue to contain the fire within the swamp and suppress all remaining portions of the fire that are outside the refuge area.

The Georgia Forestry Commission conducted a timber impact assessment on private and industrial lands to determine fire severity and predict survival of the damaged stands. Based

upon previous research done in the 1960's, 1980's and 1990's on wildfires in Florida, stands were rated for damage and classified in one of three categories: **Light, Moderate, and Severe**. Although one might assume that pine bark beetles automatically play a decimating role following fires of this magnitude, this has not always been the case, as documented in the 1990's research (Hanula, Meeker, Barnard, et al). The 1980's research conducted by Dixon (et al) did indicate an increase in Ips Engraver Beetles for up to two growing seasons following an April wildfire. One certain fact is that catastrophic wildfires often coincide with long term drought, and both of these factors cause tree stress, decline of growth, and mortality. There are numerous factors to consider when assessing fire impact, and pine bark beetles are just one. Other stand factors observed are: *Root Damage, Basal Stem Damage, Stem Char and Severity, Crown Consumption and Scorch, Appearance and Damage of Growing Shoots (if present), and overall appearance of the stands*.

Survey Methods: In general, wildfire intensity is impacted by multiple factors, including time of day, daily weather patterns, and fuel composition. These variations result in a mosaic of burn patterns across the landscape. Variations in fire behavior are evident within each stand and from section to section. Survey efforts sought to classify each stand for its overall appearance and damage levels. It should be noted that this is not an exact science, but rather an overall indicator of forest health. In marginal areas, future weather patterns, particularly rainfall, will play a major role in tree survival throughout the remainder of the 2017 growing season.

Fires burned through most sampled areas two to six weeks prior to this survey. Evaluations were made primarily along travel corridors in an effort to get reliable samples and to make worthwhile observations and predictions. A great deal of timber salvage has begun, but it is only a small percentage of what needs to occur.

Timber Evaluation Protocol: Most observers evaluate the severity of a burn by looking at the canopy of the stand or tree. A thorough and more accurate evaluation is required using a systematic approach which forecasts potential insect and disease problems and associated tree mortality. This process begins with a check of the root system and litter layer, followed by examination of the bole for stem damage and char. Next the crown is inspected for crown consumption, scorch, and damage to shoot growth, and finally the overall appearance of the stand is evaluated. Any sign or symptom of insect presence must be noted. A post-fire evaluation guidelines form is available to document this process.

<http://www.gatrees.org/forest-management/forest-health/post-fire-timber-assessment/PostFireEvaluationGuidelines2Apr2011.pdf>

Post-Fire Evaluation Guidelines: Predicting Insect and Disease Problems and Associated Mortality...

Root Damage:

Most tree roots can be found in the top six inches of soil, with many roots positioned at the soil surface. As fire burns the litter and duff layer, tree roots are exposed and feeder roots are killed. When fire burns into the ground, organic material is removed, which produces a depression around the tree's base - "The Halo of Death."



Stem Damage and Char:

Stem char refers to the blackened portion of the stem that was exposed to direct flame. After needles drop and crown scorch can't be effectively measured, the stem char line remains as a permanent record indicating fire severity on the tree.

Stem damage is a good visual representation of the intensity and duration of the fire that burned around the tree stem. Complete charring on all sides of the stem or noticeable bark consumption are indicators of possible injury to the cambium layer. Normally, clear sap flowing between the bark plates is evidence of cambial damage, and it is highly attractive to insects. The higher the bark char, the greater the potential for mortality.



Crown Consumption and Scorch:

Crown scorch refers to needles that weren't directly burned in the fire, but were exposed to lethal temperatures during the fire. These needles will typically drop from the tree within 30 days of turning reddish – brown. Crown consumption indicates the portion of the crown/living needles that were directly burned off by the fire. Stands with excessive crown scorch or consumption should be considered for immediate harvest.



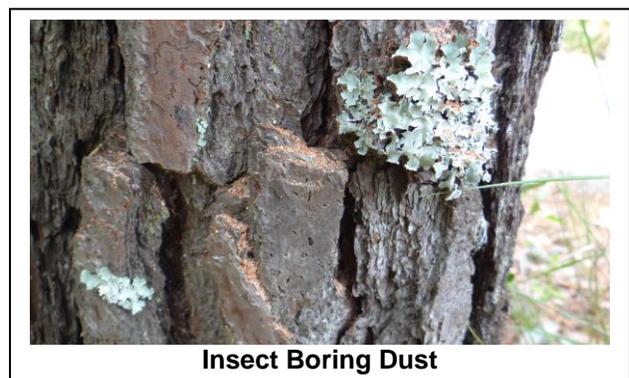
Terminal Bud Damage and Mortality:

Heat over 140 degrees for more than one minute, is lethal to most plant tissues. In the early spring to summer, candling terminal buds are highly susceptible to damage from excessive heat and are a key identification point in determining tree survival.

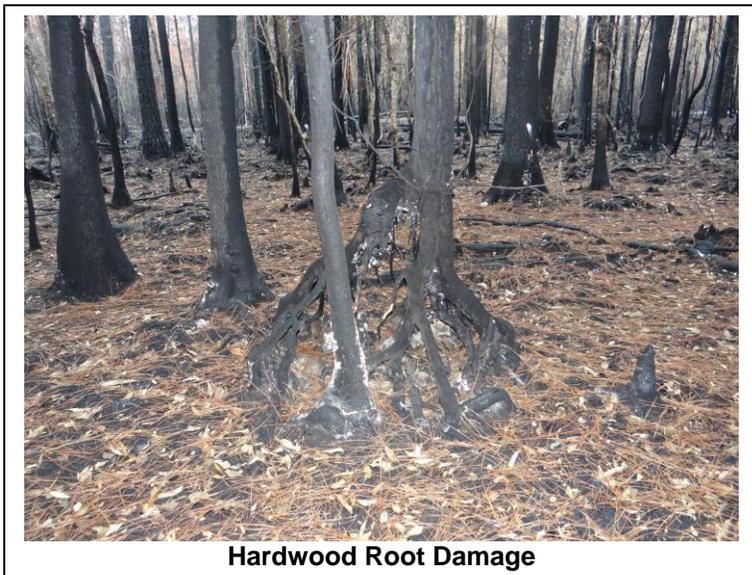
Crown scorch does not automatically indicate mortality of the tree. Surrounding needles can protect the terminal bud from severe scorch or consumption providing a chance for survival. Normally, a significant portion of green canopy will be noted at the top of the tree and the terminal bud will be straight and unburned. If the terminal bud is “shepherd’s crooked,” there is little to no chance for survival.



Insect Sign and Symptoms: Pine bark beetles and ambrosia beetles are attracted to stressed and fire-damaged stands. Any indication of boring dust or insect entry holes should be noted.



Hardwood Damage: Hardwoods also face serious damage from fire. Many southern hardwood species have thin bark and shallow root systems, making them more susceptible to fire damage and eventual death from direct exposure to flames and heat. Fire doesn't normally burn in the lower, wet areas where we find hardwood stands, but extended drought conditions have produced lower moisture levels and dry organic material that can be several inches to multiple feet deep. Hardwood stands with heavy fuel build-up around the bases of trees experienced long burn periods that may have damaged the stem bases and root systems. These damaged trees may experience more complications from root and fungal disease and insects.



Survey Findings:

Damage Estimates -	Severe	74%
	Moderate	8%
	Light	18%

Stands rated as “severe” had extreme damage and a significant portion of the trees are already dead or will likely not survive this growing season.

“Moderate” rated stands had significant damage, but a portion of the trees will likely survive this growing season. The resulting stand, however, may not be fully stocked and some landowners should liquidate these areas.

“Light” rated stands had relatively minor damage and a majority of the trees within these areas will survive. Some mortality has or will likely occur within these areas also, but will be relatively minor, with no management action required.

Overall: A mortality rate of approximately **75-80%** can be applied to this fire.

Product Class -	Pre-merchantable	33%
	Pulpwood	56%
	Chip-n-Saw	7%
	Sawtimber	2%
	Hardwood	2%

Almost all areas other than “hardwood drains” were pine plantations, so the above product classes refer to one of the pine species listed below, normally slash pine. The majority of the “pre-merchantable” stands evaluated were within two to three years of merchantable size. It is estimated more than half of the pre-merchantable stands contained trees with four inch diameters at breast height and were on the borderline of becoming pulpwood.

Species -	Loblolly Pine	22%
	Slash Pine	74%
	Longleaf Pine	1%
	Hardwood/Cypress	2%

No records were kept on land ownership, because it was almost impossible to determine on most tracts. A significant portion of this fire, however, is owned by forest industry.

Economic Timber Loss:

The timber impact assessment report for losses on private and industrial lands was used to determine economic impact at the present estimated value. This estimate of fair market value does not take into account losses of future harvests, nor destruction of pre-merchantable timber which was within two years of merchantable size. Using an overall mortality rate of **75%** across all product classes, the estimated loss on private and industrial lands is **\$38,187,291**.

Variation in Fire Damage: Within timber stands and across the landscape...



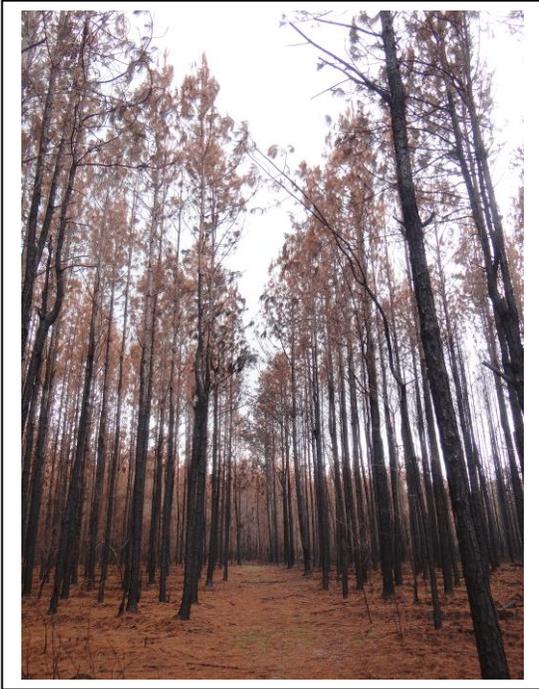
Severe fire activity and crown consumption can be seen in the black areas.



Browned needles indicate crown scorch and less severe damage.



Green canopy indicates the lowest levels of damage (Little to no basal stem or root damage occurred).



Stand at left – one month post burn. Stem char is approximately 50%, crown scorch is close to 100%. This stand would be rated as “severely” damaged and when all the needles fall, the potential for reburn exists.

Younger stands tended to suffer more severe damage if they were greater than three years old, (four year old stand at right)



Longleaf stands suffered minimal damage compared to loblolly or slash plantations of similar age.



Stands with heavy fuel build up around the base of trees (left) experienced long burn periods that may have damaged the stem bases. This has been indicated as a mortality factor in the past also.

Salvage harvest operations began immediately after the fire.



Post-Fire Evaluation Guidelines for Forecasting Potential Insect and Disease Problems and Associated Tree Mortality

Stand: _____

Date: _____

1. Average Basal Root Damage: (See Page 2)

- 0 -25% 26 – 50% >50
(Light) (Moderate) (Severe)

2. Average Stem Damage:

a. Relative Height of Stem Char

- 0 -25% 26 – 50% >50
(Light) (Moderate) (Severe)

3. Average Crown Damage:

a. Percent Crown Scorch

i. *Dormant Season* (October 1 – February 28)

- 0 -25% 26 – 50% >50
(Light) (Moderate) (Severe)

ii. *Growing Season* (March 1 – September 30)

- 0 -20% 21 – 50% >50
(Light) (Moderate) (Severe)

b. Terminal Bud Mortality (“Shepherd’s Crooked”)

- Absent Present
(Light) (Severe)

4. Sign and symptom of insect attacks (e.g., pitch tubes or boring dust from bark beetles, boring dust from Ambrosia beetles, oviposition pits or excelsior from wood borers, etc.)

- Absent Present
(Uncertain) (Severe)

5. Note that the effects of multiple damages are somewhat additive.

For example: Moderate Crown Scorch + Moderate Stem Char + Moderate Basal/Root Damage, likely equal a severe probability of insect infestation and tree mortality.

Overall Rating: _____ Survey Conducted By: _____

Post-Fire Evaluation Guidelines for Forecasting Potential Insect and Disease Problems and Associated Tree Mortality

Fire Damage Rating Matrix for Basal and Root Portion of Trees			
	DAMAGE		
Indicator	Light	Moderate	Severe
Lower Bole	Bark partially charred, a side or plate only	Bark completely charred, all sides plates and fissures	Bark completely charred and noticeable consumed
Ground Substrate	Litter charred to partially consumed, remains recognizable; upper duff burned to partially consumed	Litter mostly to entirely consumed; duff partially consumed, feeder roots burned in duff layer	Litter and duff entirely consumed, leaving ash or exposed mineral soil, and crater effects around roots
Roots	Concealed, not evident	Slightly exposed and charring, particularly on one side or at the tree base, feeder roots burned in duff layer	Abundant exposure and charring to partial or complete consumption

Notes:

Adapted from: James R. Meeker, USDA Forest Service