TIMBER IMPACT ASSESSMENT

Hurricane Michael, October 10-11, 2018

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BACKGROUND

Hurricane Michael impacted multiple southern states from Florida to Virginia, and significant damage was seen in the panhandle of Florida and South Georgia. In Georgia, a large portion of forested, agricultural, and urban landscapes was impacted by the storm. Hurricane Michael made landfall near Mexico Beach, Florida as a category 4 hurricane on Wednesday, October 10, 2018 then moved across Georgia, South Carolina, North Carolina and Southeastern Virginia on October 11, 2018. Hurricane Michael was the strongest hurricane to hit Florida in 50 years. On October 10, 2018, Georgia experienced extreme winds (125-150 miles per hour) from Lake Seminole through Bainbridge, to north of Albany, while heavy rain and hurricane force winds were felt from Albany to near Dublin in the center of the state. Tropical storm winds and rain were experienced from central Georgia, through South Carolina and as far north as Virginia (*Figure 1*). Extreme flooding and rainfall accumulation were limited due to the rapid movement of the storm as it crossed the state. The Albany, Georgia weather station reported four inches of rain during the passing of the system.

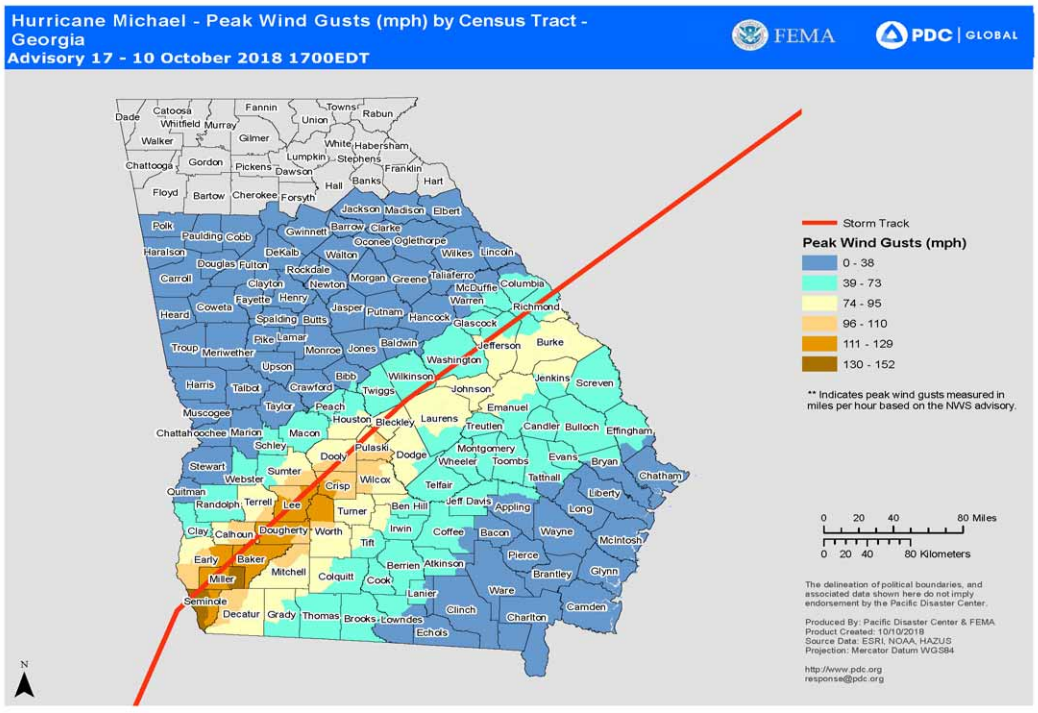

Figure 1, Georgia Disaster Declaration

Governor Nathan Deal declared a state of emergency on Tuesday, October 9, 2018 for 92 counties in Georgia. The counties under emergency declaration were: Appling, Atkinson, Bacon, Baker, Baldwin, Ben Hill, Berrien, Bibb, Bleckley, Brantley, Brooks, Bryan, Bulloch, Burke, Calhoun, Camden, Candler, Charlton, Chatham, Chattahoochee, Clay, Clinch, Coffee, Colquitt, Cook, Crawford, Crisp, Decatur, Dodge, Dooly, Dougherty, Early, Echols, Effingham, Emanuel, Evans, Glascock, Glynn, Grady, Hancock, Houston, Irwin, Jeff Davis, Jefferson, Jenkins, Johnson, Jones, Lanier, Laurens, Lee, Liberty, Long, Lowndes, Macon, Marion, McIntosh, Miller, Mitchell, Montgomery, Muscogee, Peach, Pierce, Pulaski, Quitman, Randolph, Richmond, Schley, Screven, Seminole, Stewart, Sumter, Talbot, Tattnall, Taylor, Telfair, Terrell, Thomas, Tift, Toombs, Treutlen, Turner, Twiggs, Upson, Ware, Warren, Washington, Wayne, Webster, Wheeler, Wilcox, Wilkinson and Worth counties. On October 12, 2018, 17 additional counties were added to expand the emergency declaration area: Butts, Clarke, Columbia, Elbert, Greene, Jasper, Lamar, Lincoln, McDuffie, Monroe, Morgan, Oconee, Oglethorpe, Putnam, Taliaferro and Wilkes.

Emergency Declarations issued by the State of Georgia:

https://gov.georgia.gov/sites/gov.georgia.gov/files/related_files/document/10.09.18.01.pdf

https://gov.georgia.gov/sites/gov.georgia.gov/files/related_files/document/10.10.18.02.pdf

On October 16, 2018, the Federal Emergency Management Agency (FEMA) released the Georgia Disaster Declaration emergency map (*Figure 2*). https://gis.fema.gov/maps/dec_4400.pdf

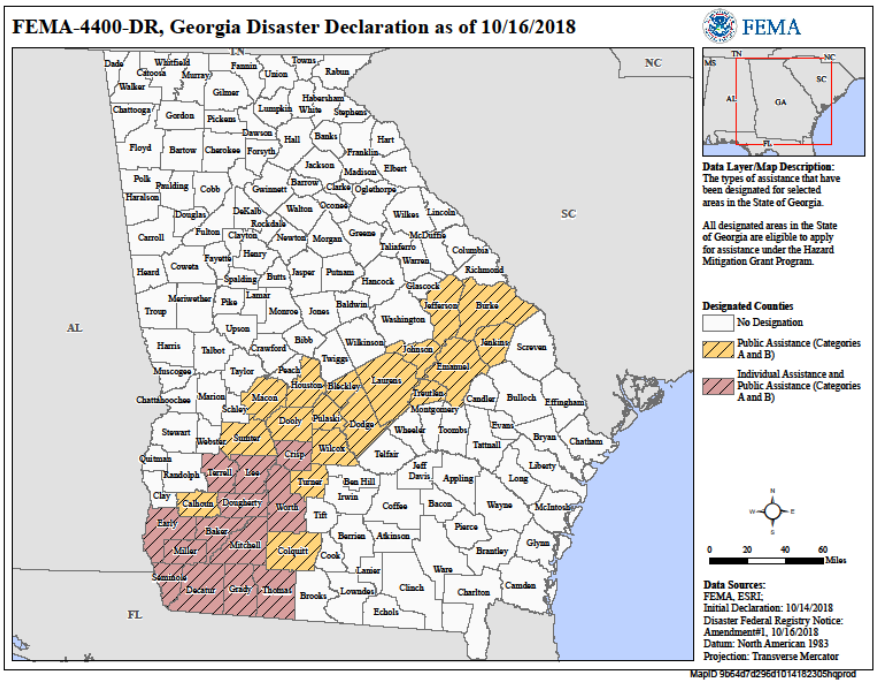

Figure 2, Georgia Disaster Declaration

The National Weather Service provided continuous predictions and updates to identify areas of risk and potential impact. These updates narrowed the expected areas for the Timber Impact Assessment. The Forest Health Management group began ground surveys near Bainbridge on Friday, October 12, 2018. Using the "Collector Application," field observations were taken from Lake Seminole to Dublin to determine the extent of damage to the overall forest. Approximately 4,500,000 acres were surveyed for damage.

Georgia Forestry Commission Air Operations began aerial reconnaissance on Thursday, October 11, 2018. Initial reports revealed severe damage from Southwest Georgia to Albany, and isolated damage was detected as far north as central Georgia. Widespread damage was observed in the extreme southwest corner of Georgia, and catastrophic to severe damage was seen in a multitude of timber stands in **Seminole**, **Decatur** and **Miller counties**. This damage will require complete harvesting and salvage operations of devastated stands (*Figure 3*).

Figure 3, Catastrophic damage in Seminole County

The goal of the Timber Impact Assessment survey is to determine the current overall damage to the forest in Georgia and to document widespread impacts to the region affected by hurricane conditions. This is not to say that damage was not or could not be found further outside the declared state of emergency area but the damage outside the disaster area was isolated and confined to localized impact.

OBSERVATIONS

A team of GFC foresters surveyed the zone determined to have endured the greatest timber impacts using field observations combined with a geospatial analysis and developed the map in Figure 6. Please note that damage was observed beyond this zone but was scattered and therefore not surveyed. The general overview of the Timber Impact Assessment revealed a weakening of the hurricane as it moved over land from Florida. Severe damage was found in Southwest Georgia and a progressive weakening was seen as hurricane force winds diminished to tropical storm categories resulting in more moderate damage. Well established pine plantations that were properly stocked, healthy and vigorously growing weathered the storm the best but even those stands were battered by the 100+ mph winds. The damages noted include the breakage of stems, tops and branches, as well as bent trees and some completely blown over. Trees with bends less than 45 degrees have a good chance of survival but should be removed at the next harvest.

Outside of the severe and catastrophically damaged areas, pine stands maintained at higher residual stand-densities showed less damage, with wind-bent trees leaning at less than 45 degrees common (*Figure 4*). **Managers and landowners are encouraged to monitor their stands for insect damage during the next year**. The stress placed on these trees could attract pine bark beetles or increase the likelihood of disease across the stands as these trees recover.

Figure 4, Light damage in Crisp County

The most severe timber damage in our rural forests was found in more recently thinned pine stands with lower stand-densities. There is less wind resistance in these stands and no neighboring trees to provide support to tree tops (*Figure 5*). These stands had not developed adequate individual root systems to anchor the trees, nor stems strong enough to withstand heavy winds.

Figure 5, Open thinned pine

TIMBER DAMAGE ASSESSMENT PURPOSE

This survey examined landscape-level impacts and classified them accordingly. The categories of damage are based upon field observations about:

- Frequency of damage within a county.
- Levels of damage within multiple timber types across the counties. Hardwood stands along low, wet areas, such as creeks and streams, received significant damage during the hurricane, as well as all classes of pine stands.

The "Collector Application" was used to gather field observations from Lake Seminole to Dublin. A three-mile square grid was established across the damage area for survey crews to determine the extent of damage. Each grid was assigned a damage intensity level and data was collected on species, product class, percent damage and county.

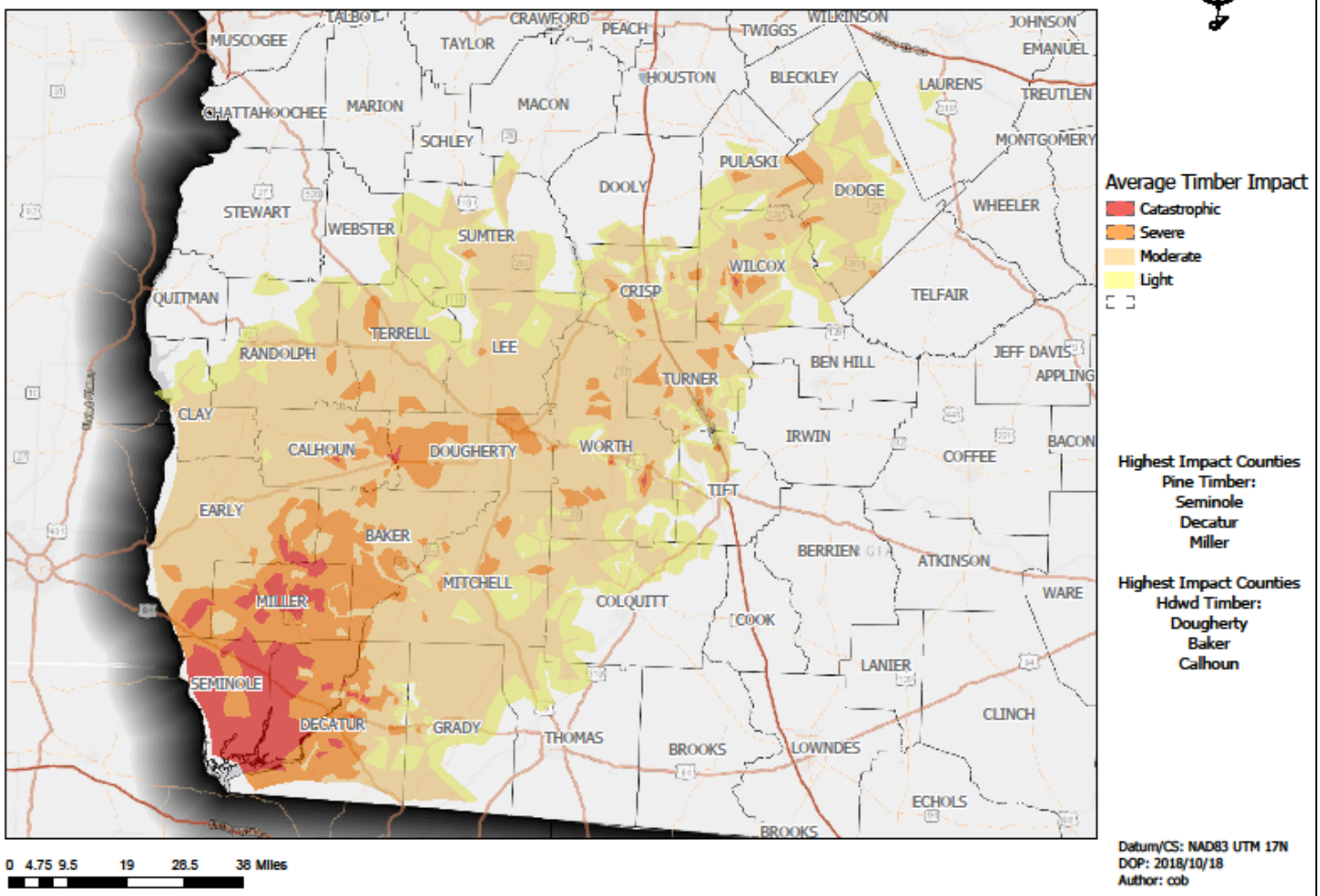

Figure 6, Timber Damage Assessment Map October 18, 2018

Damage levels:

Minimal damage – Scattered branches and limbs broken from trees, with little to no damage to the overall stand and scattered trees bent less than 45 degrees. No salvage operation will be necessary, and the stand should recover with no additional management requirements.

Light damage – Only branches and limbs broken from the tree, with minor damage to the overall stand and trees bent less than 45 degrees. No salvage operation will be necessary, and the stand should recover with no additional management requirements, though long term yields will likely be impacted.

Moderate damage – Branches and limbs broken from the trees with damage to the overall stand. More than 25 percent of stems broken and a salvage operation should be considered to minimize losses and remove trees that likely will not survive.

Severe damage – More than 30 percent of stems broken, tops broken out across the stand, limbs stripped, and trees bent more than 45 degrees. A salvage operation must be considered, and a clear-cut may be the prudent management decision.

Catastrophic damage – More than 50 percent of stems broken, multiple trees blown down across the stand, tops broken out across the stand, limbs stripped and trees bent more than 45 degrees. A salvage operation is considered unlikely and the stand may be considered a total loss.

Storm damage was detected in many timber types across Georgia and damage was seen in three-year-old pine stands to mature hardwood riparian areas. Most of the damage appeared to be wind related and landowners will need to be vigilant in the spring of 2019 for pine bark beetles. Wind damage may not become apparent until the following growing season. The areas with substantial damage may see issues with stem defects and sluggish growth rates.

Photo (*Figure 7*) – Twenty-year-old, heavily thinned, stand in Early County suffered over 50 percent wind-damage. Stand thinned within two years of Hurricane Michael.

Any salvage cut will involve removal of leaning and broken trees. This stand will require a salvage clear-cut and replanting.

Figure 7, Older thinned loblolly pine stand

Photo (*Figure 8*) – Twenty-year-old stand in Crisp County suffered moderate damage. A salvage thinning operation should be considered to minimize losses and remove trees that likely will not survive.

Figure 8, Moderate damage in well thinned pine stand

EXTENT OF DAMAGE

GFC foresters evaluated the counties noted on the previous map (*Figure 6*) and developed estimates of damage based upon a combination of this field work and a geospatial analysis of this region. Hardwood stands along low, wet areas, such as creeks and streams, received significant damage during the hurricane, as well as all classes of pine stands. Some pine and hardwood stands were completely broken, blown down and/or uprooted. There will be little chance of salvage in these devastated areas (*Figure 9*). Data for hurricane damage was gathered using the "Collector App," and the GFC Geographic Information System (GIS) team compiled the data that produced estimates of damage across the affected area.

Figure 9, Hardwood Damage

DAMAGE ESTIMATES

The Timber Damage Assessment survey showed that 2,368,226 acres of forestland were impacted by Hurricane Michael with 20,510,889 tons of pine and 17,178,721 tons of hardwood being damaged with an estimated value of $762,683,909. Forest Inventory Analysis (FIA) data was used to determine volumes and the percentage breakdown of pulpwood and sawtimber across the impacted area. The percentage breakdown was applied to the TimberMart-South Stumpage Price Report (*GA third quarter 2018*) to determine a stumpage price of $17.27 per ton for hardwood and $22.72 per ton for pine. See Tables 1 and 2 for a breakdown of the numbers.

Light Damage - Damage estimates from Hurricane Michael determined that 536,448 acres of light damage was detected across forested land in the survey area. This damage represents a loss of 1,538,320 tons of pine and 1,288,399 tons of hardwood with a value of $57,201,651. These figures were determined using a damage level of 10 percent of the volume on the lightly damaged acres. Forested stands in these areas should recover with no additional management requirements.

Moderate Damage - The majority of the damage surveyed in Hurricane Michael is considered to be moderate damage covering 1,456,210 acres of forestland from just south of Albany to Dublin. This damage represents a loss of 10,439,578 tons of pine and 8,743,532 tons of hardwood with a value of $388,188,010. These figures were determined using a damage level of 25 percent of the volume on the moderately damaged acres. This damage class would indicate heavier damage to the overall stands and that salvage operations should be considered. The assessment of this area revealed some additional damage in stands with uprooted trees and minor stem breakage, but the increase in wind-throw and stem breakage in older stands appeared minimal throughout this survey region. Landowners in this moderately damaged area are encouraged to use the services of a professional forester to assist in making informed decisions for the management of their individual stands.

Severe Damage - Severe damage was documented for 296,112 acres of forestland from south of Albany to near Bainbridge (*Figure 3*). This damage represents a loss of 6,368,484 tons of pine and 5,333,844 tons of hardwood with a value of $236,807,442. These figures were determined using a damage level of 75 percent of the volume on the severely damaged acres. These areas were severely damaged with some stands completely devastated. The majority of the timber was broken and wind-thrown. Salvage operations will need to begin immediately in these areas. Around 75 percent of the timber was damaged with broken stems, broken tops, stripped limbs and trees bent more than 45 degrees. A salvage operation must be considered and a clear-cut may be the prudent management decision. This timber can be used for pulpwood or fuel wood but any sawtimber in these areas may be so damaged that it will not be salvageable for such use.

Catastrophic Damage - Catastrophic damage was documented for 79,456 acres of forestland from south of Albany to Lake Seminole (*Figure 3*). This damage represents a loss of 2,164,507 tons of pine and 1,812,946 tons of hardwood with a value of $80,487,176. These figures were determined using a damage level of 95 percent of the volume on the catastrophically damaged acres. These areas were completely devastated and the majority of the timber was broken and wind-thrown. The majority of this timber could be considered a complete loss. Timber harvesters may not be willing to salvage areas that are damaged to this extent.

DAMAGE ESTIMATES

Table 1. Estimated forestland acres impacted according to the damage class.

Timber Damage Class	All Forestland Acres Impacted	Pine Acres Impacted	Hardwood Acres Impacted	Pine/Hdwd Mix Acres Impacted
Catastrophic – 95% of timber damaged per acre	79,456	38,933	33,372	7,151
Severe – 75% of timber damaged per acre	296,112	145,095	124,367	26,650
Moderate – 25% of timber damaged per acre	1,456,210	713,543	611,608	131,059
Light – 10% of timber damaged per acre	536,448	262,860	225,308	48,280
Total	**2,368,226**	**1,160,431**	**994,655**	**213,140**

Table 2. The estimated tons and value of timber impacted according to the damage class.

Timber Damage Class	Pine Timber Volumes	Pine Timber Value	Hardwood Timber Volumes	Hardwood Timber Value
Catastrophic – 95% of timber damaged per acre	2,164,507 tons	$49,177,599	1,812,946 tons	$31,309,577
Severe – 75% of timber damaged per acre	6,368,484 tons	$144,691,956	5,333,844 tons	$92,115,486
Moderate – 25% of timber damaged per acre	10,439,578 tons	$237,187,212	8,743,532 tons	$151,000,798
Light – 10% of timber damaged per acre	1,538,320 tons	$34,950,630	1,288,399 tons	$22,250,651
Total	**20,510,889 tons**	**$466,007,397**	**17,178,721 tons**	**$296,676,512**

The survey estimated that a total of 37,689,610 tons of timber valued at $762,683,909 was damaged or destroyed by Hurricane Michael.

RECOMMENDATIONS

With the damage inflicted by this hurricane, there will likely be three distinct categories by which landowners make their evaluations:

1) Light damage or losses that may not warrant a salvage operation. This could include merchantable stands (trees are large enough to sell), which don't have enough timber damage to warrant a commercial harvest, or pre-merchantable stands where there is a good chance it will recover over time.

2) Stands with severe or catastrophic damage mandating a salvage operation to recoup whatever value can be recovered from the stand. In most cases, this could include a complete harvest for widespread damage.

3) Stands with moderate damage in which landowners may need to decide between a partial or complete harvest based on damage levels. In these cases, landowners are encouraged to use the services of a professional forester to help make the best decision for the situation. Immediately following a storm, it may be difficult for landowners to accurately gauge how well a stand may recover, or to measure the amount of timber that could be allowed to remain for future growth and income.

Even though the report shows a very large amount of damaged timber over the area, it is possible that forestland owners can recover some of the value lost through prompt salvage harvests. It is recommended that landowners utilize registered consulting foresters to help with timber sales. Seeking independent advice is a sound way to reduce hasty judgments and ensure all available options are considered.

Landowners facing a complete harvest to salvage their damaged timber should consider reforesting the area. The Farm Service Agency (FSA) has a cost share program called the Emergency Forest Restoration Program (EFRP) that can assist with site preparation and planting costs. Apply at your local FSA office.

Special thanks to our GFC foresters who helped develop this Timber Damage Assessment: Mark McClure, Chris Barnes, Chuck Fore, Greg Klett, Paul McDaniel, Scott Griffin, Michael Torbett, Charles Bailey and Troy Clymer.

Stasia Kelly, Media Relations Specialist, worked diligently to assist with the production of this report.

These resources can help forest landowners learn more about options and considerations for situations in which trees have been damaged by severe weather:

TIMBERLAND SEVERE WEATHER DAMAGE

Assessing Hurricane and Tornado Storm Damaged Forest Stands:
https://bugwoodcloud.org/bugwood/productivity/pdfs/assessing_hurricane_and_tornado_damaged_forest_stands_Dec-2016_final.pdf

How to Evaluate and Manage Storm Damaged Forest Areas:
http://www.forestpests.org/storm/

Evaluation and Management of Storm Damage to Southern Yellow Pine:
http://www.ncforestservice.gov/Managing_your_forest/pdf/EvaluationMngt-StormDamageSYellowPines.pdf

TIMBER SALES

Selling Your Timber:
http://www.gatrees.org/forest-management/private-forest-management/timber-selling/

TAXES

Income Tax Deduction on Timber and Landscape Trees Loss from Casualty:
https://www.fs.fed.us/spf/coop/library/tax_deduction_loss_casualty.pdf

Tax Tips for Forest Landowners for the 2017 Tax Year:
https://timbertax.org/publications/fs/taxtips/Tax%20Tips%20for%20Forest%20Landowners%202017%20-%20F.pdf

National Timber Tax website (Master Index has good list of subject areas):
http://www.timbertax.org/