Assessing Storm Damaged Forest Stands

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Catastrophic - Severe mature pine stand damage SW GA & N FL

*Michael (making landfall at Mexico Beach on 10 Oct 2018) was the 1st Cat 5 hurricane to strike the contiguous United States since Andrew in 1992

Sept 1989 Hugo and Oct 2018 Michael major storm damage stand assessments

- Get most valuable wood salvaged first

Categories of damage (can be based on # of leave trees left or % damage)

Catastrophic - Severe = not enough quality trees standing and in good condition to thin back to an average of 75% damage (range of 50 to 100% damage) = salvage clearcut

Moderate = an average of 35% damage (range of 11 up to 50% damage) = often enough trees/acre to thin back to (salvage thin the broken and otherwise damaged trees), done after salvage clearcuts (1-2+ yrs after)

Light < = 10% damage = usually no salvage cut needed,

Minimal damage = no thinning needed

Main questions after a major storm event

- Are there enough trees/acre with little/no lean in good visible condition to carry to rotation?
- Does the landowner has sufficient access points into the stand?
- Major storm events show us how important stand access is
- Response to storm event goes back to landowner objectives, stand assessment, work needed, financial considerations, and time-line to do needed work

Catastrophic damaged stands post hurricane Michael – north of Panama City FL

Examples of catastrophic-severe damage

Lean trees - this large will <u>not</u> straighten

bottom line = not enough healthy trees to thin back to

Recommendation = a salvage clearcut (harvesting all trees)

Moderate damage (salvage thinning possible in most cases)

thinning can occur 1-2 yrs after major salvage operations are finished

125 to 200+ trees/acre in good condition to thin back to – visit this stand every 3-4 weeks and look for yellowing crowns (possible beetle activity)

Pine stand risk–example spring 2019 EF1 tornado–2 stands<100yd apart

Young thinned (4-5 yrs ago) loblolly pine stand –light –moderate damage

Mature (much older) mixed pine hardwood stand – severe damage

Generally younger (shorter) pine stands either unthinned or thinned >2 yrs ago have much less damage than older, taller, bigger crowns, more valuable stands

1 month (left photo) and 2 years (right photo) after a EF1 tornado (86-110 mph)– foreground catastrophic-severely damaged mature hardwood stand

Note right photo background is a planted, unthinned loblolly stand 25-35 ft tall with minimal damage

A predominantly hardwood stand with mostly severe damage

Not enough trees in good condition to thin back to = salvage clearcut if a logger can get to this stand (usually not) or allow to naturally regenerate

Stand assessment assistance

Having a reputable, local forestry consultant becomes very valuable after a major storm event – as they tend to know your forest stands are, their age and condition and with a phone call (or not phone call needed in some cases) will drive to these stands, assess the damage and give the landowner recommendations – they can contact local loggers and see who can get to the tracts first

- Other assistance: state foresters, Area Forestry Agents, Extension Foresters (these will usually not have the logger contacts that the forestry consultants will have)

Salvage clearcut estimates from hurricane Hugo (Category 4 - Sept 1989, SC)

- 16% of the catastrophic – severe damaged stands were salvage clearcut

- This means 5 acres in 6 of catastrophic – severe damaged stands were **not** salvaged

- There were many stands with 40 to 150 tons/acre of broken or leaning (in many cases in multiple directions) trees not salvaged and if site prepared would be very costly

Table 1. Timeline for timber to be salvaged to prevent degradation

Product	**Harvest window***	**Comments**
Pine and hardwood veneers	4 - 6 weeks	Blue stain prohibits use if left longer
Pine dimension lumber	3- 4 months	Should be kiln dried to prevent emergence of secondary pests
Pine posts	4 - 6 weeks	Blue stain will affect toughness and preservative treatment
Pine and hardwood pulp, fiberboard, particleboard and OSB	6 - 8 months	As wood begins to decay, pulping process will be affected. Storm damaged wood should be mixed with sound wood

*The harvest window can vary due to several factors including but not limited to: time of year of the storm event, temperatures, rainfall, humidity and winds after the storm event. Once the bark starts to fall off the trees, the window to salvage and get some value is usually considered past.

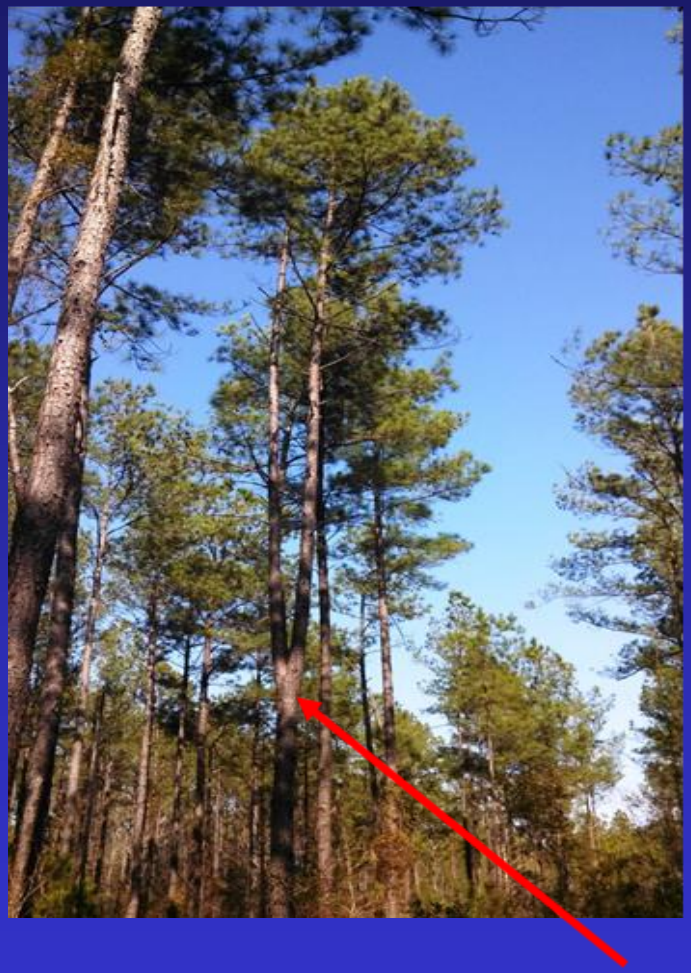
Table 2. Timeline for invasion of damaging insects and diseases

Species	**Year one**	**Year two**
Pine	Bark beetles, ambrosia beetles, sawyers, blue stain fungi, soft rot fungi	Decay fungi
Oak and Hickory	Wood borers, ambrosia beetles, sawyers, soft rot fungi	Sapwood decay fungi
Other hardwoods	Wood borers, ambrosia beetles, sawyers, soft rot fungi	Sapwood and heartwood decay fungi

Catastrophic-severe damaged stands factors after a major storm event

- Logger availability (and time it takes to cut each stand increases greatly due to lean and broken trees)
- Loggers tend to take broken, lean, and standing trees - good for landowner for artificial regeneration-site prep and planting nursery seedlings
- Harvest window time (1 – 12 months; refer to previous slide)
- Wood supply increases significantly but demand may be the same, plus logger time efficiency is slowed down so stumpage prices decline to $0.10 to $0.50 on the dollar.

What pines look like yrs after wind damage



Need at least 3 live branches for tree to live (but may grow slower than full crown)

Pine and hardwood damage after a major storm event

- Crowns act like sails on a sailboat; the larger the crown and the taller the tree (and crown) the more wind that crown will “catch”

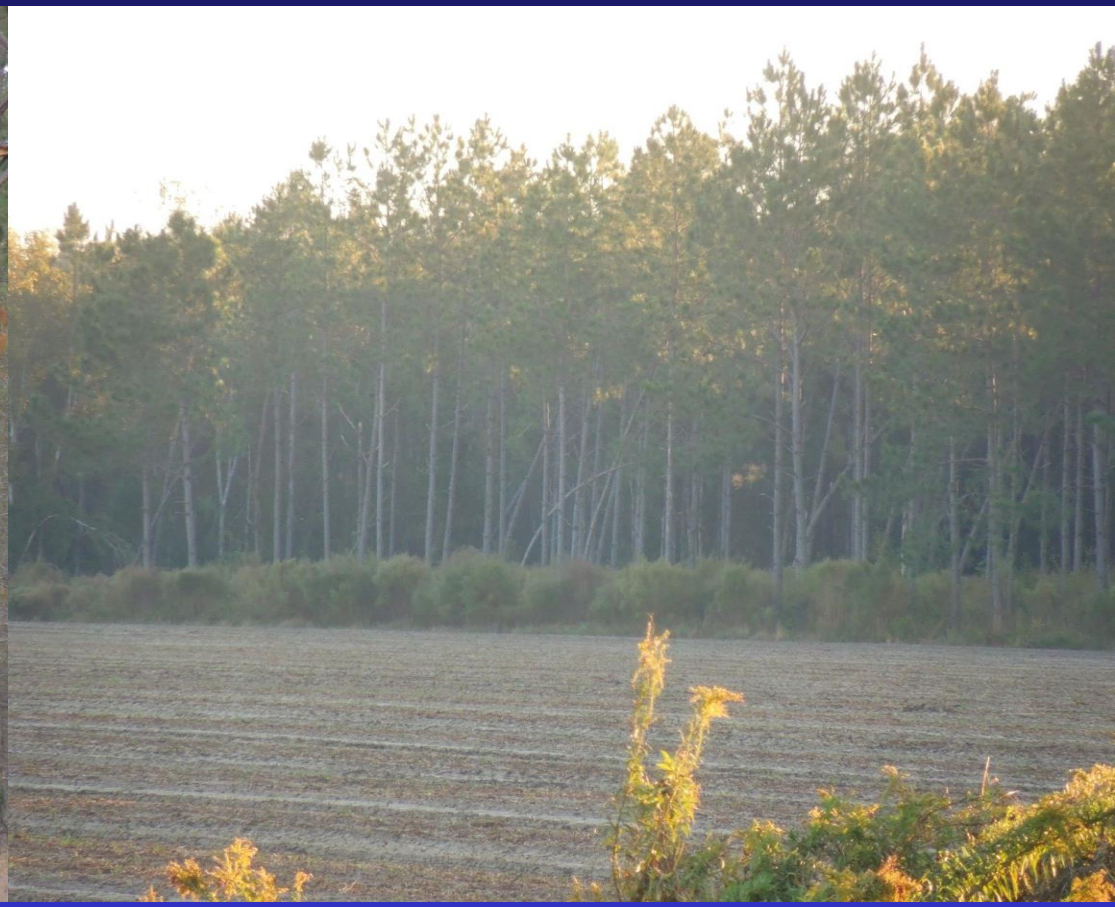
- When looking at a number of stands, one tends to notice that the smallest crowns and shortest trees tend to take a major storm event better than taller trees with large crowns

- The next section is on lean pines after a major storm event

Lean pines over 40 ft tall

- 40-90 ft tall pines with any lean: very few will straighten up after 1 – 2 yrs but will continue to live (stem sweep >3” per 16 ft will not make in to saw mill)

Lean pines over 40 ft tall



- L photo: 1 month after hurricane Matthew 50-60 ft tall loblolly with varying degrees of lean – most did not straightened up after 1-2 yrs
- Rt photo: 2YA hurricane Matthew (Rt photo) same slash stand – most still with lean but living

Lean pines 20-40 ft tall

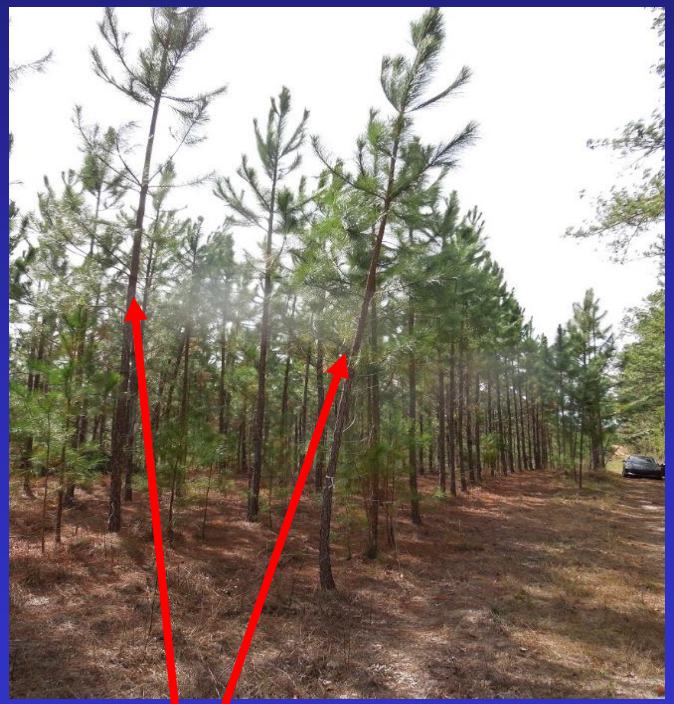
leaning < 30 degrees from vertical = most will straighten up

30-45 degree lean = some/most will straighten up

45-60 degree lean = some/most will NOT straighten up

> 60 degree lean = most will NOT straighten up

(shorter trees = greater chance of straightening up)



30-40 ft longleaf (left photo) did not straighten after 1 or 2 yrs. Many leaning longleaf died when over 45 deg and roots exposed .While 20 ft tall slash pine leaning <30 degrees straighten some after 2 yrs (right photo) → **Give these young stands 1-2 growing seasons**

Lean pines 5-20 ft tall

leaning < 30 degrees from vertical = most/all will straighten up

30-45 degree lean = most/all will straighten up

45-60 degree lean = some will straighten up

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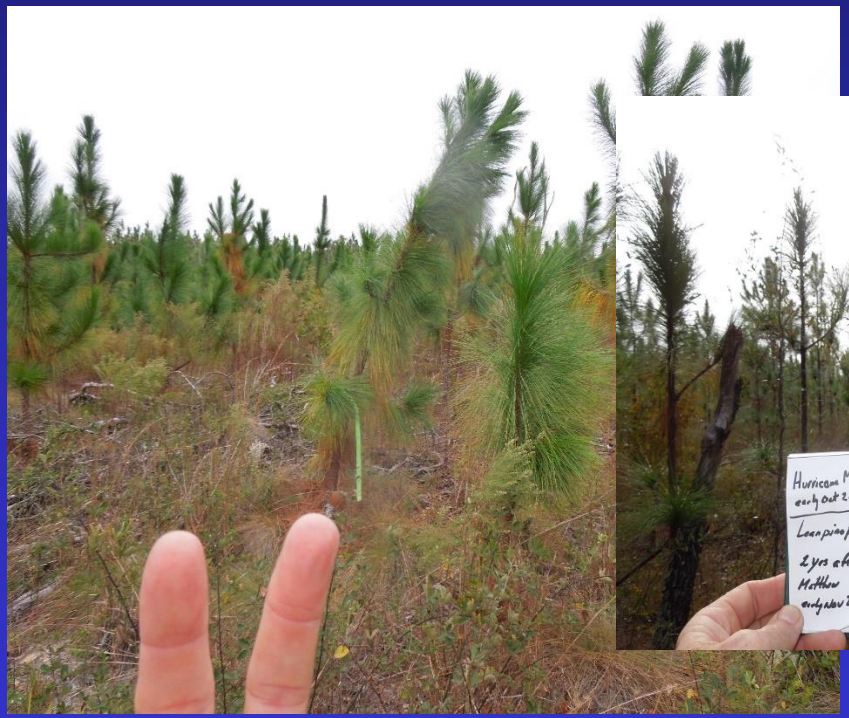

Longleaf (left photo) did straighten after 1 growing season (middle photo) while young slash pine (right photo) with 75-80 deg lean - shorter ones may straighten up – taller ones may not →

Give these young stands 1-2 growing **seasons**

Lean pines <5 ft tall → rules of thumb

leaning < 30-45 degrees from vertical = most/all will straighten up

45-60 degree lean = most/all will straighten up

60-80 degree lean = most will straighten up

(shorter trees = greater chance of straightening up)

1 yr old loblolly leaning >45- 60 deg that straightened back up after 1 yr (left photo).
Rt photo 1-yr old loblolly with hole at base from hurricane Matthew tree straightened up after 1 yr.
Give these young stands 1+ growing **season**

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Left photo: 1-yr old loblolly w/ 45 deg lean from vertical post Matthew (Nov 2016 photo) that straightened back up after 2 yrs Right photo: 2 yrs post Matthew in Effingham Co,

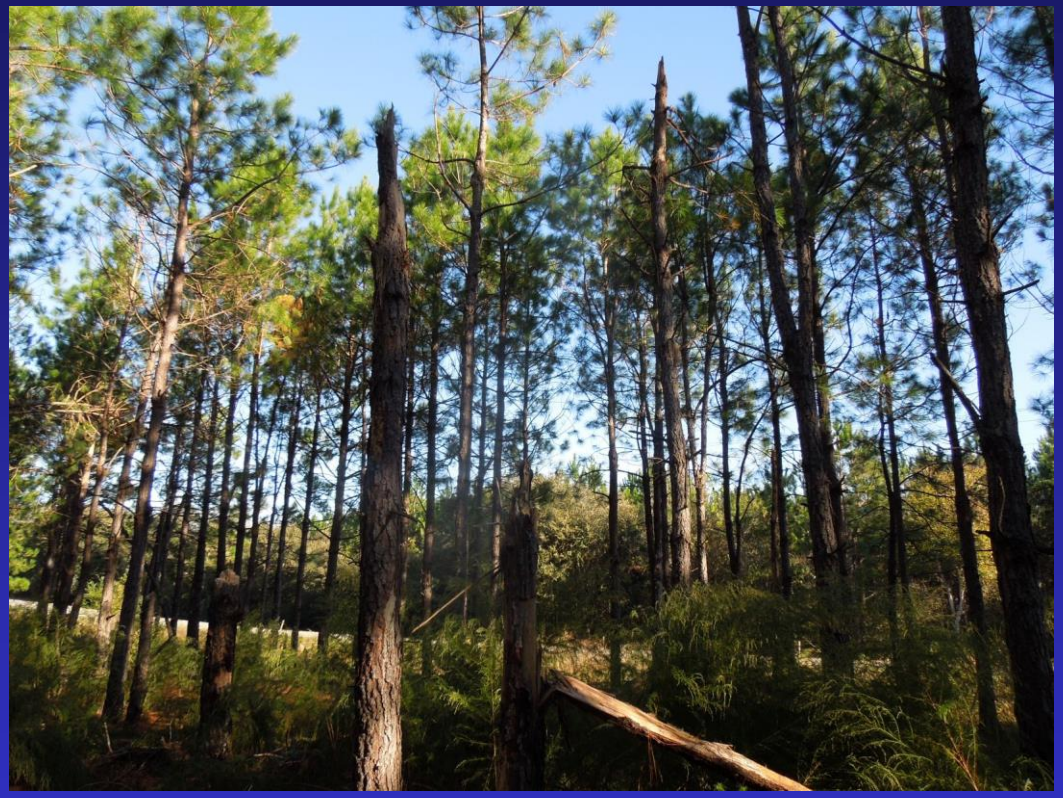
Uprooted large pines

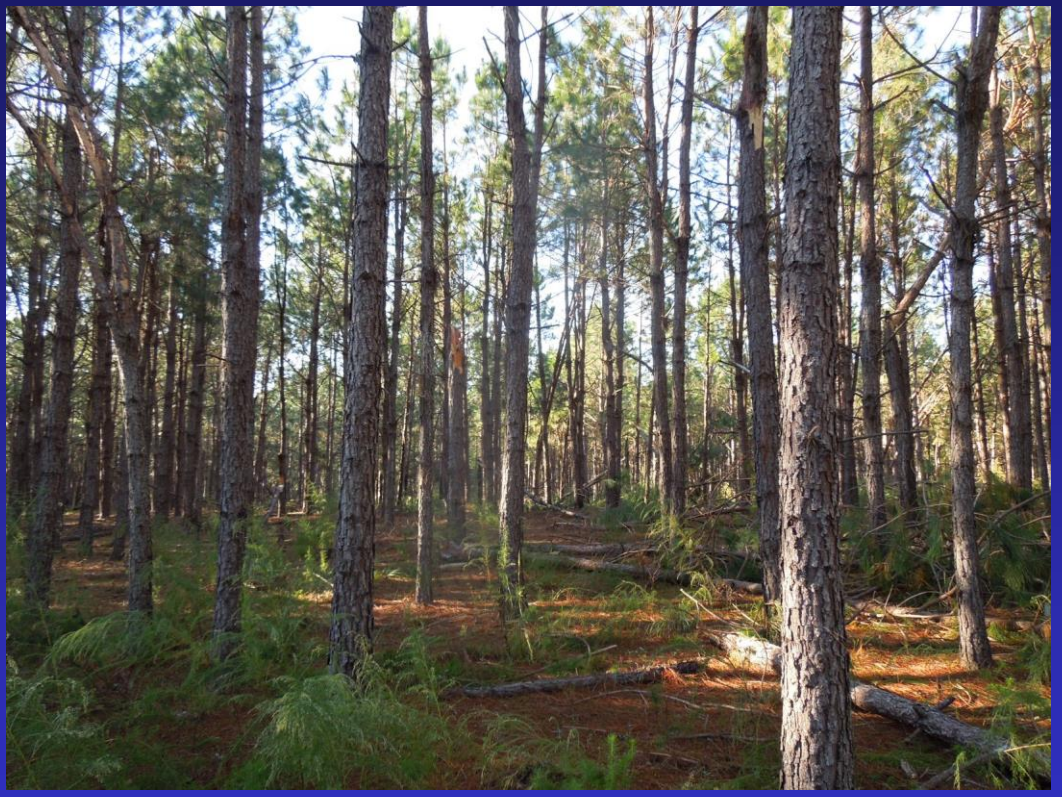
tops tended to stay green until spring (March-April) of following year

5-6 month salvage window for high value uprooted wood

Late Oct 2016 after Matthew Bulloch Co GA

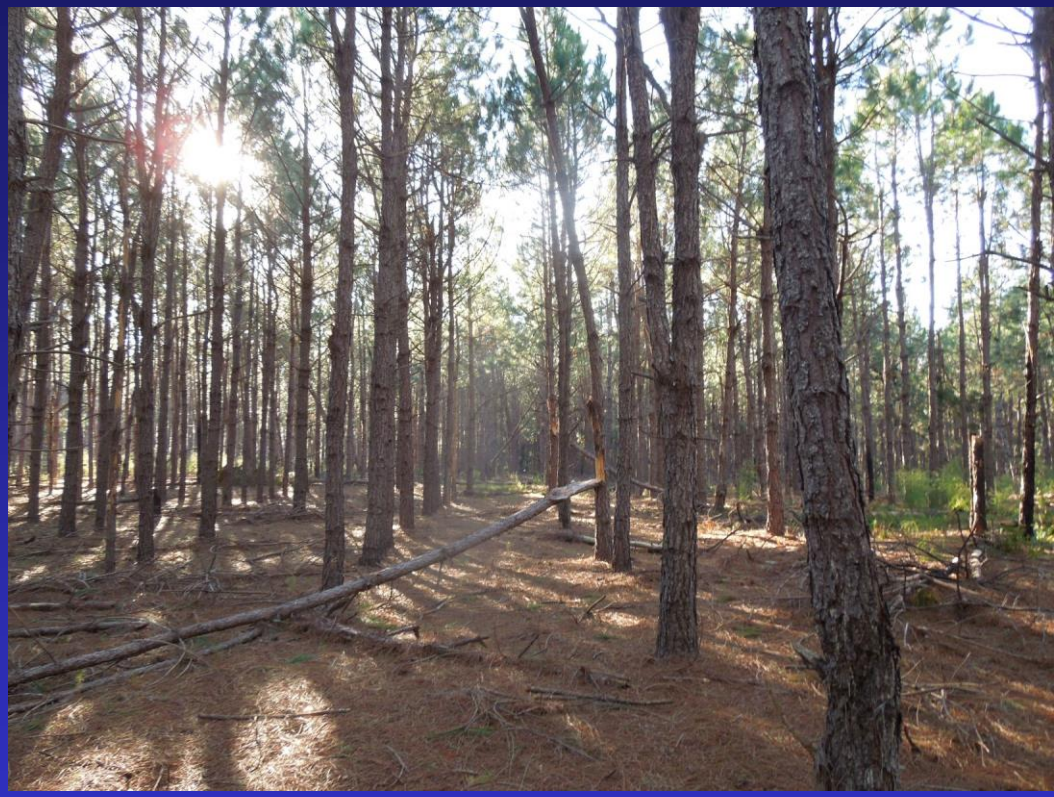
Stem quality issues and hurricanes or tornados





- 9 Nov 2018 – 1 month post hurricane Michael (76+ mph max winds in this area)
- Photos: a high basal area slash pine stand (W of Hwy 221 about 1 mile on Hwy 86 in Treutlen Co
- and poor stem quality → many cankered, forked and ramicorn branched trees
- Many trees broke at stem canker or fork → this stand is being clear cut as of early Dec 2018
- (most of stand is high and dry land in a very wet year so pulpwood prices in this area are high)

Stem quality issues and hurricanes or tornados



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Catastrophic-severe damaged, unsalvaged stands site prep and planting

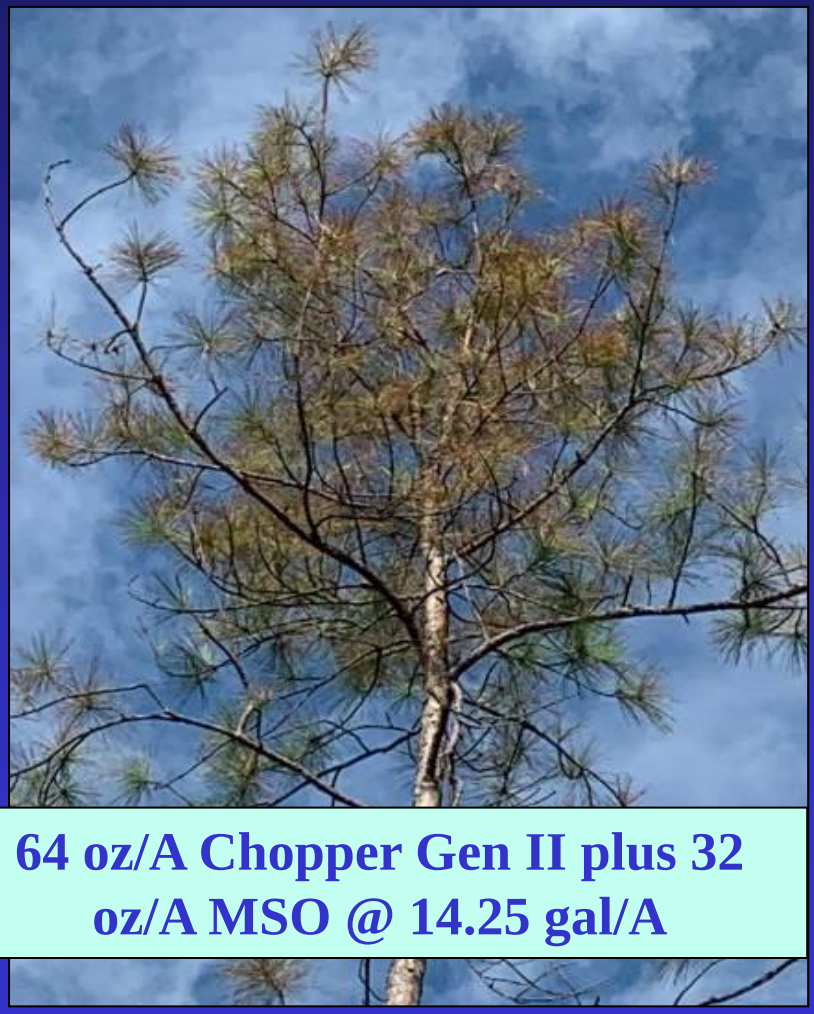
- Site prep options (upland sites - no bedding needed, low-moderate tons/ac woody material):

- (1) Aerially herbicide treat the stand, wait 2 months (for hebricides to work through plants)

- (2) sawhead or shear, rootrake, pile or windrow (operator care to minimize topsoil movement); pile tends to be better than windrow for site productivity sake

- (3) hand plant site

Different landowner objectives and stand conditions: 7-2019 aerial chemical app (photos late Aug 2019)



64 oz/A Chopper Gen II plus 32 oz/A MSO @ 14.25 gal/A

Late July 2019 Chopper+MSO aerial herbicide treatment - this site was mechanically prepared months after herbicide– sawhead cutting standing timber, rootraked, and windrowed (windrows 14 ft wide x 6 ft tall and 100 ft apart) – site hand planted @ 6x12'

Photos taken 23 Feb 2020 – NW Bailey Cemetery Rd. Clarksville FL

Large, high horsepower mulchers in N FL after hurricane Michael

These mulchers can do site prep in catastrophic-severe damaged stands – leaving smaller mulched debris in place (vs displacing debris in windrows which can reduce stand productivity)

V-blade on dozer to clear planting rows

Highway transport constraints w/ 10-12 ft V-blade ???

a wide (10-12 ft) V-blade gives 2 row option

Timber Management Objective Sites – high tons/ac woody debris

Mechanical Site Prep

- Much more expensive after hurricanes due to debris levels
- Debris management on high debris sites (>75-100+ tons/ac) D8's + anchor chaining to level debris
- Lesser debris site may involve v-blade shearing or sawheading, root raking & windrow or pile
- Poorly drained soils will usually require bedding (or use old beds?)

Site Prep Options

Use 2-3 Modified D8 dozers

1 ahead to clear paths for D8s & 2 to pull ship anchor chain


Post first v-blade shear pass

Additional steel plating installed over tracks

Pine natural regeneration

Needs

- Overstory cone producing pines:
- Loblolly 6-10 per acre
- Longleaf 30+ per acre
- Slash 15-25 per acre
- Can burn in September to prepare seed bed prior to bumper cone crop
- Or seed or seedlings in place in some cases

Pine natural regeneration

Stocking will be variable (300-3000+/ac), longer rotation, later thinning, genetics from site (not from seedlings brought into site), no chem site prep, much lower cost

Summary

- First 8 months post storm (Nov-June)–assess stands – salvage high value stands first, salvage rest if possible – clearcut stands consider regen option (natural vs site prep+planted)

- 8-12 months (June-Oct)– safely clean up, site prep (mech + chem in many cases) stands to be planted MAKE SURE you can get seedlings and planter lined up before hand –
- Look for reforestation cost share
- Yr 2 – if can not get sites prepped do so in yr two with seedlings and planter committed
- natural regen for some may be an option if seed in place or enough seed trees left

Summary

- Visit merchantable pine stands every 2-4 weeks that had light to moderate damage looking for insect damage evidence (mostly Ips or black turpentine beetle, possible So. Pine beetle)

- Visit younger pre-merchantable pine stands monthly to see if some of the lean trees have straightened up

- Determine casualty loss and establish a timber basis if one is not already established

Reforestation after a major storm event: summary for unsalvaged stands with varying degrees of debris/damage

- **Natural regeneration** of pine on smaller tracts may be the best option assuming seed or seedlings in place or enough seed trees to adequately stock tract
- Most **hardwood stands**' best option may be natural regeneration—check regularly for invasive plant establishment-disturbance perpetuates especially without active mgmt
- For **pine artificial regen** – case by case prescription based on debris level, landowner near- and long-term objectives, $/ac each can afford
- Try to line up the site prep (chem + mech, chem only, mech only then aerial release), order seedlings and have planting crew committed for that winter – basically same yr
- The "window" to get most/all the stands reforested that were catastrophic-severely damaged will take **4-5 yrs** due to the work needed vs seedling supply and contractor availability

Changes in coastal Gopher Tortoise borrow characteristics and density following hurricane events (Matthew; Oct 2016 and Irma; Sept 2017) in NE Florida: Implications for conservation planning

In: Global Ecology and Conservation 25 (2021) e01437

Barbara Blonder (Associate Professor-Natural Sciences), K.J. Liedtke, and S.E. Stephens

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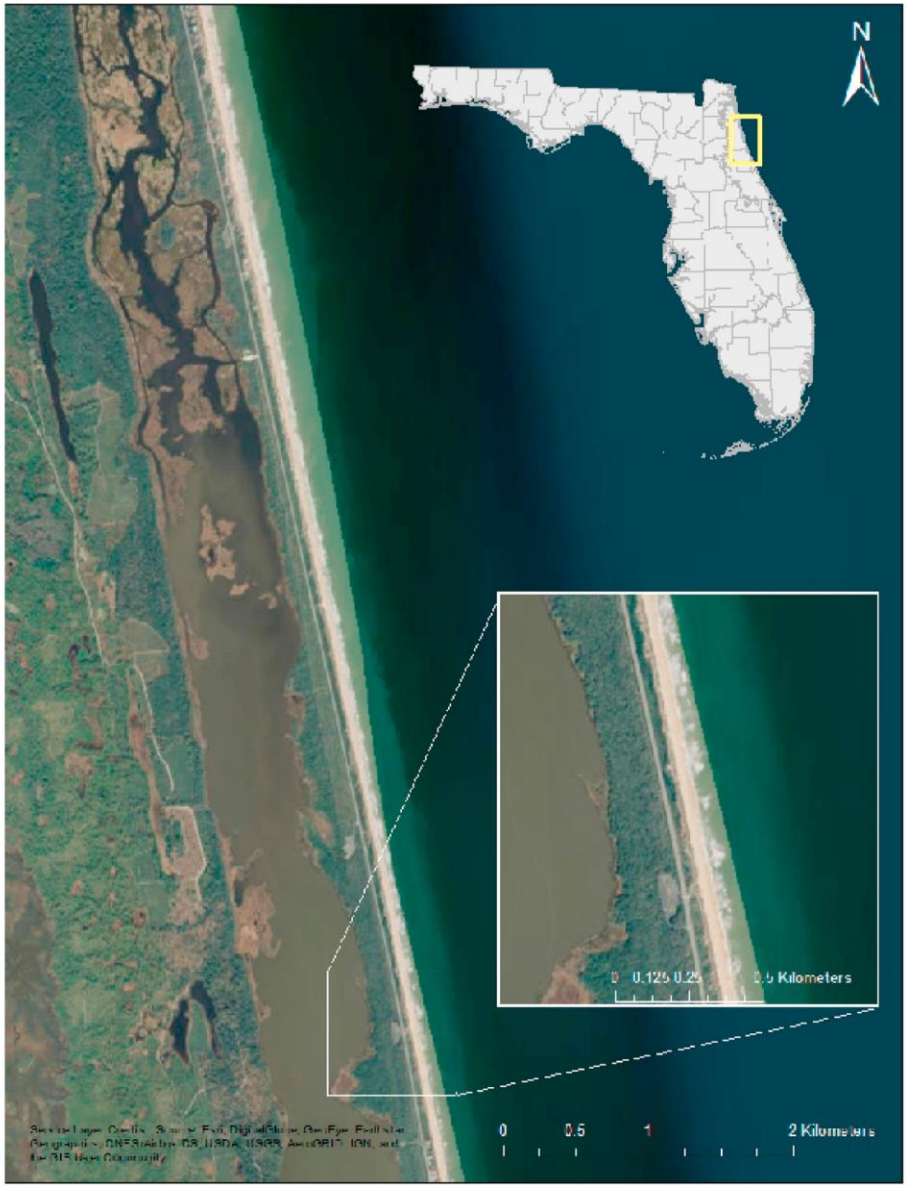

Fig. 1. Study area: GTMNERR northern component, Florida, USA (courtesy of SS Scott Eastman, GTMNERR).

Fig. 2. Vegetated dune swale pre-hurricane Matthew.

Fig. 3. Vegetated dune swale post-hurricanes Matthew and Irma, 2018.

3.3. *Mapped burrow location changes*

Locations of Gopher Tortoise burrows pre-hurricanes (2016) in the lower elevations of the study area are largely missing from the post hurricane maps (2017 and 2018), in which burrows are located landward and at higher dune elevations (Fig. 7).

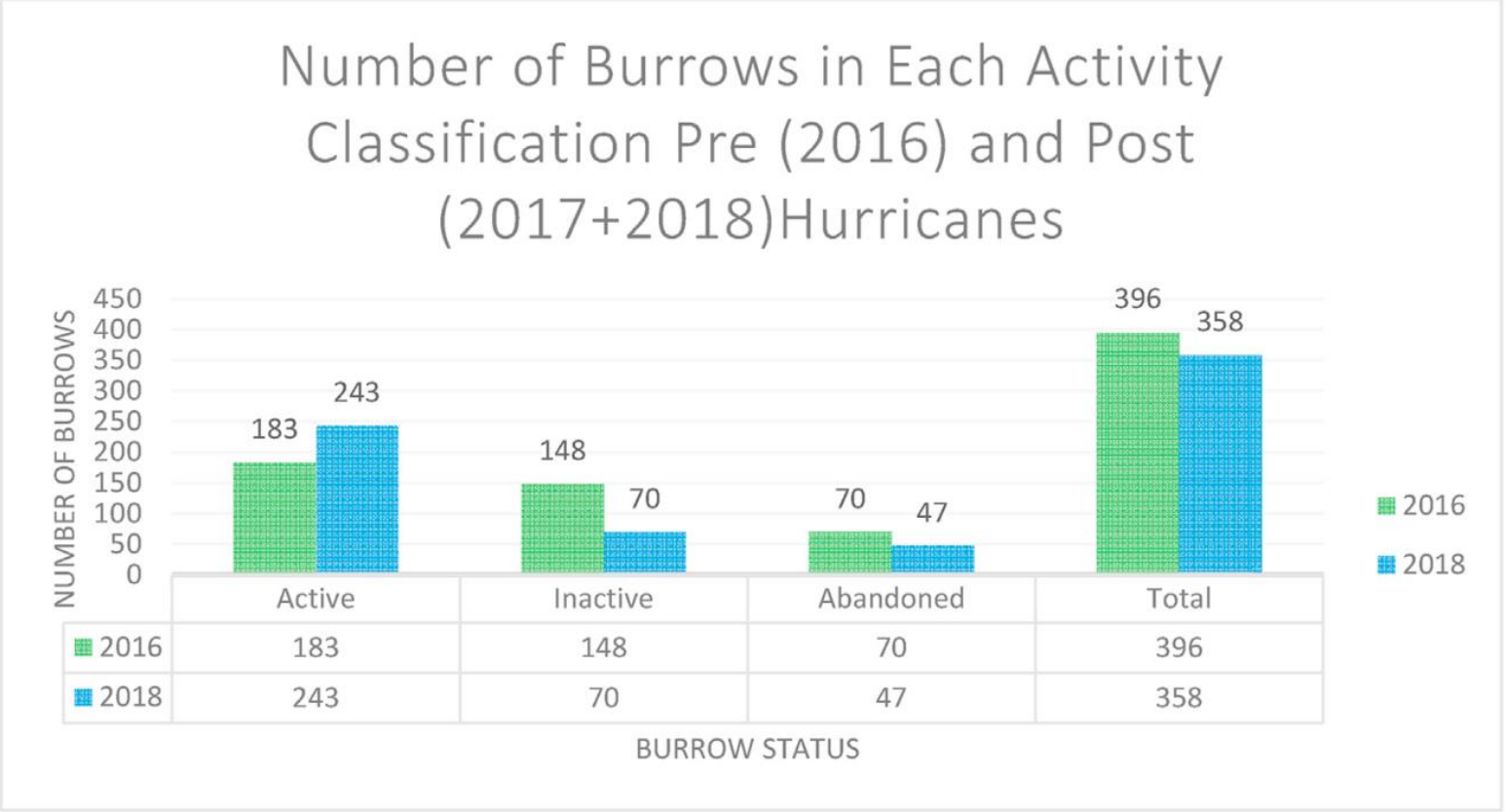

Fig. 4. Comparison of burrow abundance in each activity classification before and after hurricanes.

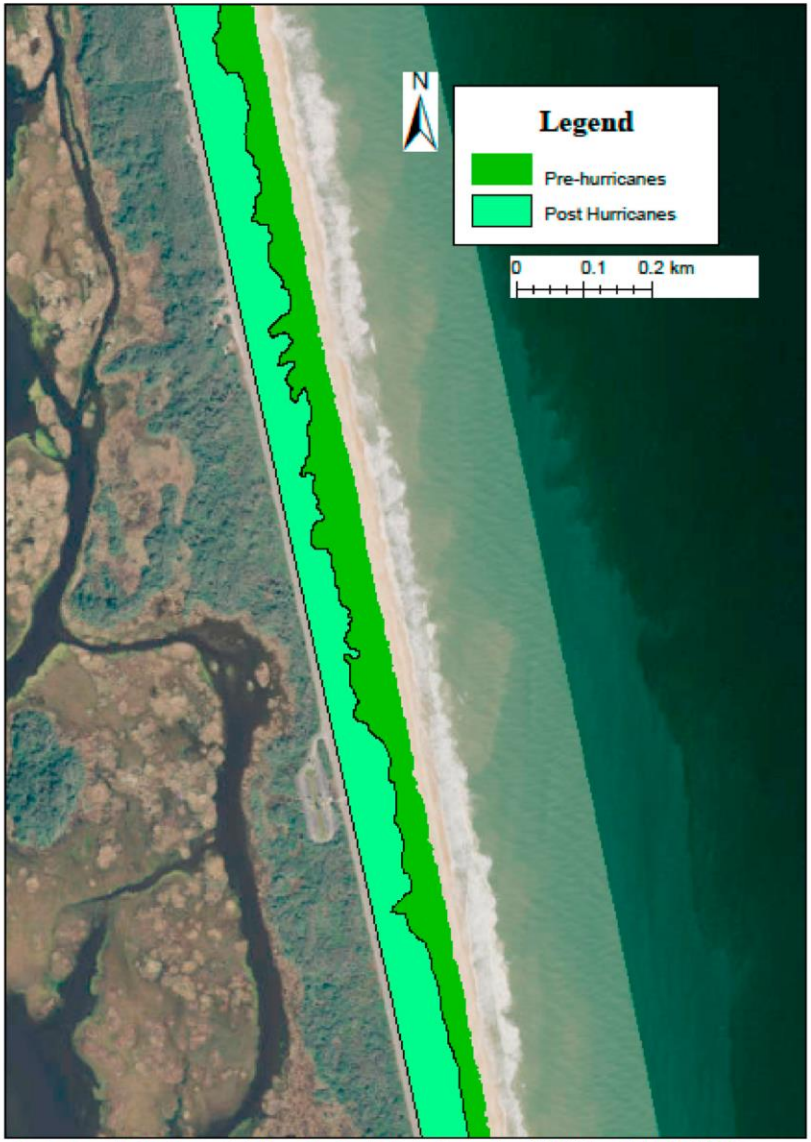

Fig. 5. Vegetative change map depicts hurricane-releted changes in vegetated area from pre-hurricane GIS imagery (January 2016) to post-hurricanes imagery (October 2017).

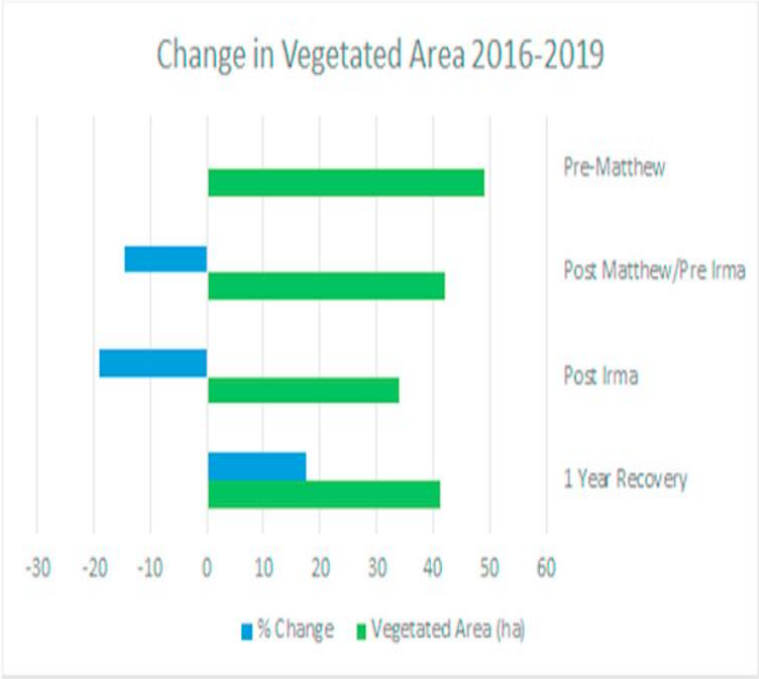

Fig. 6. Calculated changes in vegetated cover (ha.) on foredunes of coastal strand in study area.

Fig. 7. Map image showing pre and post-hurricane burrow locations within a segment of the sampled area. Burrow locations from 2016 are pre-hurricane locations.

Summary for Ecological Impacts from Major Storm Events

- Animals tend to move to new suitable habitat and away from storm damaged areas that are no longer (in the near-term) suitable habitat
- The same may be said for insects – moving to more suitable habitats
- Trees are sessile and can not move so time and management (or lack of management) will aid in forest recovery

Questions

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