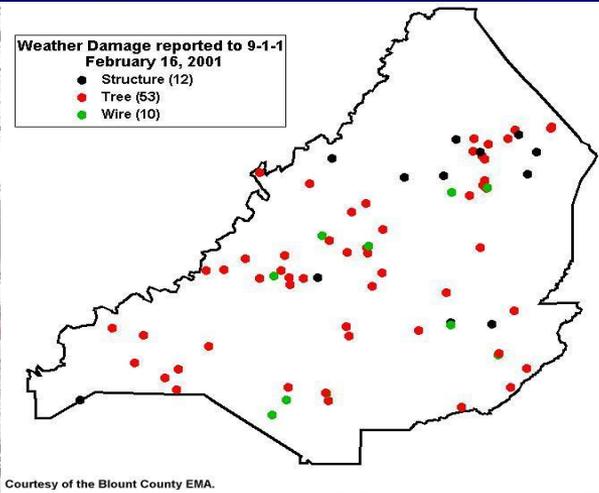


Storm Damage Assessment



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Adapted from a Presentation Developed by National Weather Service Grand Rapids, MI



Damage Assessment: NWS Perspective

We are interested in the science of an event

- What was damaged
- How widespread/how bad is it
- What caused it

Monetary and societal impacts are secondary (though **not** less important) concerns

Helping Each Other in the Storm Damage Assessment Process

- Storm damage info is **crucial** to NWS operations.
- **DURING** the storm, we use this information to compare it to what we see on radar, and make warning decisions for downstream counties.
- **AFTER** the storm, we use this information for warning verification and deciding what storms need follow up surveys.

Estimating Wind Speeds & Assessing Tree Damage



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Estimating Wind Speeds

Excerpts from the Beaufort Scale

Speed (MPH)	Effect on Land
13-17	Dust and loose paper raised. Small branches begin to move.
18-24	Branches of a moderate size move. Small trees begin to sway.
25-30	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
31-38	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
39-46	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
47-54	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
55-63	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.

Issues Related to Tree Damage

- It takes time to do a thorough survey for large events (may not be able to cover a large area in one day)
- Difficult to estimate the effect of so many variables.

Important Variables for Trees

Structural Integrity

- Insects
- Disease
- Prior trauma
 - lightning
 - fire
- Root system (shallow or deep?)

Important Variables for Trees

Exposure

- Protected from direction of wind
- Exposed / Isolated tree

Ground Condition

- Type / looseness of soil
- Wet or dry?

Important Variables for Trees

Tree Species

- Deciduous or evergreen?
- Fully leafed out (if deciduous)?
- Height / age
- Crown size
- Root system
- Brittleness of wood
- Bradford Pears?

Bottom Line on Trees

Get / pass on as much information from your source as possible, regarding a report of “trees down.”

- Whole tree, or just a branch or two
- One tree, or more than one in same area
- Healthy tree, or diseased/rotted tree
- Type of tree (especially if Bradford Pear)

Bottom Line on Trees

Using your report we will:

- Estimate a wind speed
- Determine the need of Warnings or Significant Weather Alerts (or maintenance of same).

Tornado vs “Straight-line” Wind



NWS BMX



Tornado vs “Straight-line” Wind

- Match up damage in space and time with radar data (gather eyewitness data on storm time)
- Make detailed plot of tree and debris fall
- Ask eyewitnesses: did rain/hail precede or accompany the storm? Most downbursts will occur at the time of heavy rain/hail.

Tornado Damage:

Damage is **convergent**: trees fall generally pointing inward towards the center of the damage path.

Microburst/Downburst (aka “straight-line winds”):

Damage is **divergent**: trees fall generally pointing away from the center of the damage path.

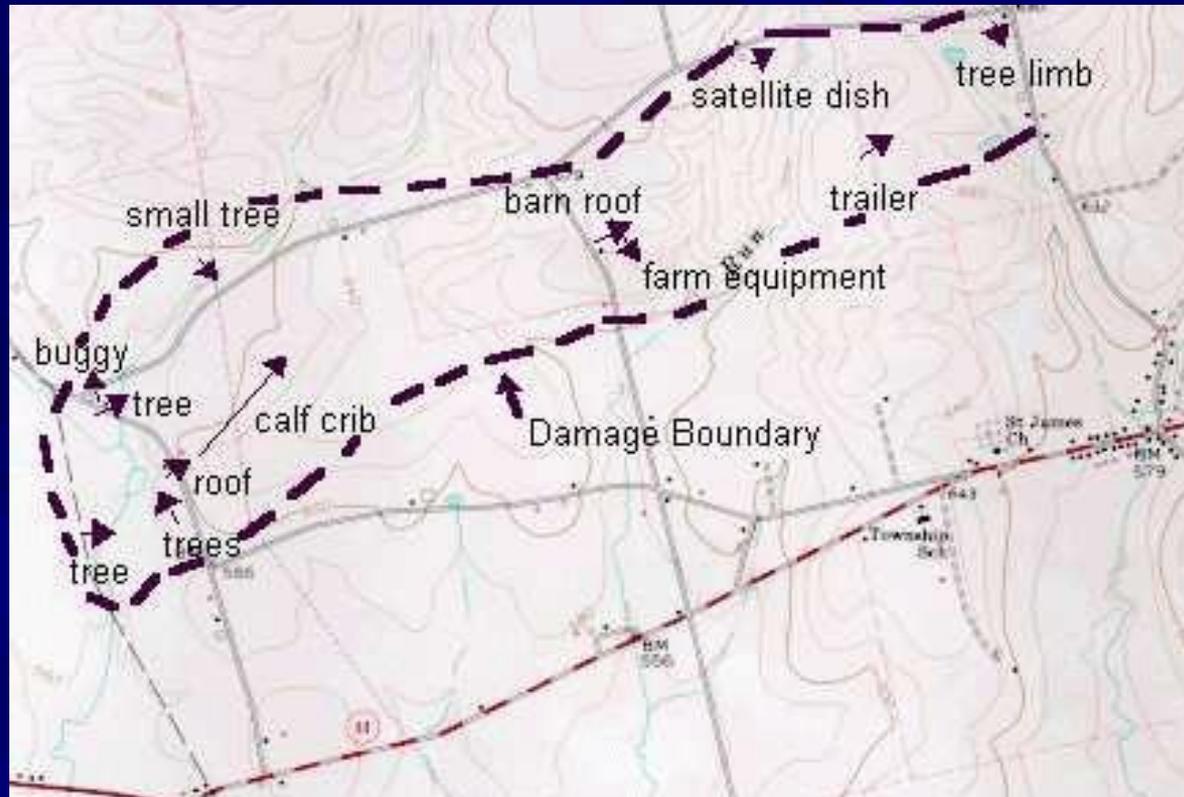


This is an example of a **convergent** tree fall pattern as seen from the air. A tornado moved from left to right across the field of view. Look for signs of this **crossing or “herringbone” pattern** in the downed trees to indicate tornado damage.

The **fan-shaped, divergent** tree fall pattern that is typical of a microburst, as seen from the air:



Complicating factor: tornado damage may be close to or within downburst damage.



If time allows, draw a detailed map of “damage vectors”. Include every downed tree, blown debris.

Be careful of “outliers”: trees may have been moved after the storm or forced to fall in a different direction.

Tornado vs. Straight Line Wind Caveats

- Snapped trees do not necessarily mean tornado
- Trees in different directions do not necessarily mean tornado – try to look for convergence (or pointing toward center of path) or divergence (pointing away from center of path).
- “It roared/sounded like a freight train/jet/etc...”



Finally, a subjective observation: Tornadoes seem more likely to do odd things such as impaling debris into walls or the ground, carrying debris for long distances and suspending debris aloft on power lines and trees. Also look for the “churn factor.”

Reporting Procedures

- During an event:

- Southern Linc / 800 mHz

- Unit # 181

- NWSChat

- Landline phone

- 1-888-835-1662

- Toll Free EMA Line; always answered

- 1-800-856-0758

- Toll Free Spotter Line; goes to answering machine, may be answered in critical situations

Reporting Procedures

- Follow-up (after an event):
 - Southern Linc / 800 mHz
 - Unit #181 (operations)
 - Unit #381 (WCM)
 - Landline phone
 - 1-888-835-1662 Toll Free EMA Line
 - 1-800-856-0758 Toll Free Spotter Line
 - Email
 - John.DeBlock@noaa.gov
 - SR-BMX.StormReports@noaa.gov

What to Report

■ What was it?

- All reputable, specific, reports of damage are important, even if they seem minor.
- Be as specific as possible:

Good:

“Several mature pine trees snapped 10’ up.”

“Mobile home shifted off its blocks, but still intact.”

“One side of a large closeout store collapsed.”

Not as good:

“Trees down” (More specific info is better)

“Building destroyed” (Destroyed how, and by what?)

“Roof damage” (Shingles? Whole roof? Caused by trees?)

What to Report

■ Where did it happen?

- Again, be as specific as possible.
- But remember, we don't know your county as well as you do.

Zero in on the location, if it is rural:

“Northeast part of the county, about 10 miles east of (town), on CR-xx.”

If a County Road, does it go by another name? (aids in searching Google Maps)

Reference a page number and coordinate box in *Alabama Atlas and Gazetteer*.

What to Report

- When did it happen?
 - Best approximation, if an exact time is not known.

Reporting Procedures

- Email digital photos of damage or survey maps to: SR-BMX.StormReports@noaa.gov.
- With trees, include both a close-up of the break point, and a wide-field photo to show perspective.



Questions?

$$\left(\nabla_p^2 + \frac{f_0^2}{\sigma} \frac{\partial^2}{\partial p^2} \right) \omega = \frac{f_0}{\sigma} \left[\underbrace{2 \left(\frac{\partial \vec{v}_g}{\partial p} \cdot \vec{\nabla}_p \zeta_g \right)}_A + \underbrace{\frac{\partial \vec{v}_g}{\partial p} \cdot \vec{\nabla}_p f}_B - \underbrace{2D^2 \frac{\partial \theta_D}{\partial p}}_C \right]$$

