Side-by-side tree and house damage in the May 2013 Moore, OK EF5 tornado

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Motivation

Our qualitative observations have suggested that the tree-focused DIs (#27 & 28) in the EF scale are flawed. Both impressions and objective data reveal that numerous aspects of the DoDs in DIs 27 & 28 need to be revised. As a first step toward such a revision, we have examined tree damage in the immediate vicinity of single-family homes, using the EF-scale rating of the home as a benchmark for comparison to tree damage. The immediate proximity suggests that both the trees and the homes should have experienced very similar winds.

Methods

We obtained pre- and post-tornado imagery of 34 single-family homes in Moore, OK, using Google Earth and Google Disaster Response. We obtained the assessed EF-scale damage to each home from the NWS Damage Assessment Toolkit. We considered any tree within 15 m of a single family home as a valid neighbor, and evaluated damage to all trees that could be identified in the imagery.

Both of these houses were rated EF2 damage. Based on current DoDs, trees should be uprooted. Instead, several show minor damage or defoliation, while one large tree is stubbed and debarked.

Figure 1: Pre-storm Google Earth view of a home on South Olde Bridge Road, Moore, OK

Figure 2: Post-storm image of the same home after the May 2013 tornado. House damage was rated EF1. Image from Google Disaster Response.

One example, showing the pre- and post-tornado aerial (nadir) imagery, along with an oblique photo from a newspaper helicopter (lower right).

Table 2. Number of trees assigned to each damage classification, grouped by corresponding level of damage to the nearby house, for 34 homes in Moore, OK. Note that damage categories are not mutually exclusive. Total number of trees = 62.

EF-scale Rating of House (n)	Trees	Intact, Standing	Defoliated	Branches Broken	Uprooted	Snapped	Stubbed	Debarked
EF1 (5)	8	7	3	2	1	0	0	0
EF2 (5)	6	5	4	3	1	0	1	1
EF3 (8)	22	12	7	5	3	7	1	5
EF4 (14)	22	11	15	0	4	7	3	4
EF5 (2)	4	4	2	0	0	0	3	4

Results

Table 1 summarizes tree damage for trees near the home shown at left. Notably, tree damage varies from EF0 to EF3 using current EF-scale DoDs.

Table 1. Damage classification for trees visible in preceding images. Damage categories are not mutually exclusive (e.g., a tree could be both stubbed and debarked). The "branches broken" classification includes damage to both small and large branches.

Tree	Intact, Standing	Defoliated	Branches Broken	Uprooted	Snapped	Stubbed	Debarked
1						X	
2						X	
3						X	
4						X	
5		X	X				
6					X		
7					X		
8	X						
9			X				
10				X			
11						X	

Table 2 presents the findings for the full dataset of 34 homes and 62 neighboring trees, organized by the EF-scale rating of the house damage. Notice that tree damage is spread widely, with little congruency with the damage level assessed for the house.

Conclusions

Tree damage is often inconsistent with nearby houses, but we suggest that a much larger dataset such as this could allow tree damage to be 'calibrated' against single-family home damage to improve the tree-focused DIs of the EF scale.

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