Title: Patterns of forest tree mortality in a mixed-hardwood forest following a native insect outbreak in the New Jersey Highlands

Abstract: In 2015-2016, many chestnut oak trees (Quercus montana) were defoliated during an unusual outbreak of oak leafroller insects (Archips semiferanus) in the New Jersey Highlands. The purpose of this study was to document the degree of forest canopy disturbance caused by mortality of chestnut oaks following the outbreak. In the autumn of 2020, a survey was conducted of all canopy and subcanopy trees that had died since 2015 in a 33.4-hectare study area within one forest tract at Apshawa Preserve, West Milford, NJ. Results of the survey revealed 544 dead chestnut oaks and 264 dead trees of other species, most of which were other oak species that died due to other natural causes. The estimated combined canopy area of all dead chestnut oaks was 56,963 m2, which represents a substantial portion (11.8 %) of the forest area surveyed. The scale of disturbance is remarkable, given that the estimated total canopy area of all other dead trees suggested an approximate background mortality rate of only 0.9 % canopy disturbance per year. Furthermore, the spatial distribution of the dead trees in the survey was statistically significantly clustered, implying that forest processes triggered by newly created canopy openings may be particularly accelerated in some areas of the forest. Interestingly, the dead trees in this survey do not appear to be spatially correlated with a previous survey of tree mortality following a spree of severe storms in 2011-2012. Therefore, only a relatively small area of the forest went without impact from either the oak leafroller insect outbreak or the major severe weather events of the past decade.