

DISTRIBUTION AND EXTENT OF TREE MORTALITY
IN NORTH CENTRAL HARDWOOD FORESTS

J. Michael Vasievich, Sharon L. Hobrla, and Mark H. Hansen¹

Abstract: Forest inventory data shows that biophysical agents and human causes account for annual losses of more than a half-billion ft³ of timber in North Central hardwood forests. This paper reports on an analysis of forest inventory data to determine the extent and distribution of tree mortality in four forest types—Aspen-Birch, Elm-Ash-Cottonwood, Maple-Beech-Birch and Oak-Hickory. Eight states were included—Michigan, Minnesota, Wisconsin, Indiana, Illinois, Iowa, Missouri, and Kansas. Plot and tree measurement records were examined to characterize tree mortality; estimate the area affected by occurrences of higher-than-average mortality; to evaluate the proportion of timber lost to various causal agents and to explain differences in mortality due to location and stand conditions.

Results show that 1% of growing stock volume and 25% of growing stock gross growth are lost each year to all natural and human causes. Mortality was highest for the Aspen-Birch forest type which averaged 30% of growth (14.1 ft³/ac/yr) and lowest for Oak-Hickory which averaged 22% of growth (6.5 ft³/ac/yr). Estimates of the frequency of large losses show that Aspen-Birch had the greatest chance, 8.9%, of having annual mortality exceed 40 cubic feet annually and Oak-Hickory had the lowest chance at 1.4%. Curves are presented that describe the chance of exceeding a certain level of mortality for each forest type and state. Analysis of plot data showed that annual mortality was statistically related to site index, stand age, basal area stocking, and growing stock percent. Models produced adjusted R-square values of 0.36 to 0.91 for all but one model. Basal area stocking was significant and positive in almost all models. Stand age was significant and positive in more than half of the models. Cause of death determinations are highly subjective, so most mortality was classified as other or unknown. In cases where cause of death was determined, disease was generally the most common agent cited. Other major causes of mortality included fire, weather, suppression, insects, and logging. These results provide information to compare mortality with growth and inventory for different hardwood types across the study region.

¹ The authors are Project Leader and Statistician, respectively, Forest Economics Research, USDA Forest Service, North Central Forest Experiment Station (NCFES), 1407 S. Harrison Road, East Lansing, MI 48823 and Research Forester, NCFES, 1992 Folwell Avenue, St. Paul, MN 55108. We would like to acknowledge assistance provided by Pat Miles, NCFES, St. Paul, MN and support for this work by Frank Thompson and Steve Shifley, Central Hardwoods Ecosystem Management Project, NCFES, Columbia, MO.