EFFECT OF SIMULATED ICE STORM DAMAGE ON LOBLOLLY PINE TREE AND STAND GROWTH

Rodney E. Will, Thomas Hennessey, Thomas Lynch, Robert Heinemann, Randal Holeman, and Dennis Wilson

Ice damage to loblolly pine plantations is a recurrent problem in eastern Oklahoma and western Arkansas with significant ice events occurring recently in 1995, twice in 2000, and in 2007. Following ice damage, forest owners need to decide to clear-cut and replant, thin or partial cut to rehabilitate, or take no action. A quantitative assessment of tree and stand growth in response to varying levels of ice induced crown damage is currently lacking that would allow informed decisions regarding stand termination or continuance.

In March 2008, six previously undamaged, mid-rotation stands (average age 16) were located that included two each that were unthinned, thinned, and thinned and pruned (pre and post thinning target densities of 450 and 115 trees per acre). Thinning (combination row thinning and thinning from below) and pruning (to approximately 20 feet) were completed less than a year before imposing simulated ice damage. Stands were divided into sub-stands that were randomly assigned to have 0, 25, 50, 75, or 100% percent of trees in the stand damaged. Ice damage for individual trees was simulated by shooting out up to 50% of the top portion of the live crown length. Both before treatment and two growing seasons post-treatment, height, dbh, and crown height were measured (Table 1). Live crown loss due to simulated ice damage was measured for each damaged tree at time of treatment.

To account for differences in initial tree size, data analyses focused on the relative basal area growth of individual trees [(BA 2010 – BA 2008)/BA 2008] and fraction loss of live crown ratio due to treatment [(LCR pre treatment – LCR post treatment) / LCR pre treatment]. We plan to conduct final measurements after six years that will include taper so that we can calculate changes in stem form and volume.

Tree growth decreased with fraction of live crown ratio removed (average R^2 for relationship between relative basal area growth and fraction of live crown ratio removed was 0.17) (Figure 1). Relative basal area growth was greater for thinned stands than for nonthinned stands, but the slope of the relationship between relative basal area and fraction of live crown ratio lost did not differ among stands (Figure 1). The regression relationships predicted a 57, 43, and 31% decrease in relative basal area growth with a 40% reduction in live crown ratio for the nonthinned, thinned, and thinned and pruned stands respectively.

Stand-level relative basal area growth decreased as percentage of trees receiving damage within stands increased. Average relative basal area growth was 0.288, 0.291, 0.272, 0.264, and 0.265 for the 0, 25, 50, 75, and 100% of damage within sub-stands. However, these reductions were less than predicted from the regression equations. Growth of undamaged trees did not increase as the percent of trees damaged within sub-stands increased.

Results indicate that even though basal area growth is reduced by crown damage, the stand-level reduction is not as large as might otherwise be anticipated from moderate and variable damage (ranging from 0 to 50% loss of live crown).

We thank Weyerhaeuser Co. and the personnel at the Kiamichi Tree Farm for providing the stands to work in and their willingness to postpone normal silvicultural operations and to allow us to damage trees. We thank Keith Anderson, and Greg Campbell for assistance with data collection and treatment installation.

Rodney E. Will, Associate Professor, Department of Natural Resource Ecology and Management, Oklahoma State University, Stillwater, OK, 74078
Thomas Hennessey, Professor, Department of Natural Resource Ecology and Management
Thomas Lynch, Professor, Department of Natural Resource Ecology and Management
Robert Heinemann, Senior Superintendent, Kiamichi Forest Research Station, Idabel, OK, 74745
Randal Holeman, Research Specialist, Kiamichi Forest Research Station
Dennis Wilson, Research Specialist, Kiamichi Forest Research Station

Table 1—Mean diameter at breast height (DBH), height (HT), and live crown ratio (LCR) for the no thin/no prune (NT/NP), thinned (Thin), and thinned and pruned (Thin-Prune) stands for damaged and undamaged trees measured in 2008 and 2010. PreT and PostT refer to the pre- and post-treatment measurements for trees that were damaged. Each mean represents two stands.

		DBH (in)		Ht (ft)			LCR		
		2008	2010	2008	2008	2010	2008	2008	2010
	Tree condition			PreT	PostT		PreT	PostT	
NT/NP	Undamaged	7.28	7.83	42.2	NA	49.4	0.497	NA	0.467
	Damaged	7.26	7.70	42.3	34.4	44.7	0.521	0.410	0.446
Thin	Undamaged	7.65	9.03	38.3	NA	42.5	0.563	NA	0.529
	Damaged	7.44	8.55	38.2	29.8	38.5	0.553	0.427	0.491
Thin-Prune	Undamaged	7.89	9.15	40.5	NA	44.4	0.523	NA	0.512
	Damaged	7.97	9.14	40.7	33.5	41.5	0.522	0.417	0.485

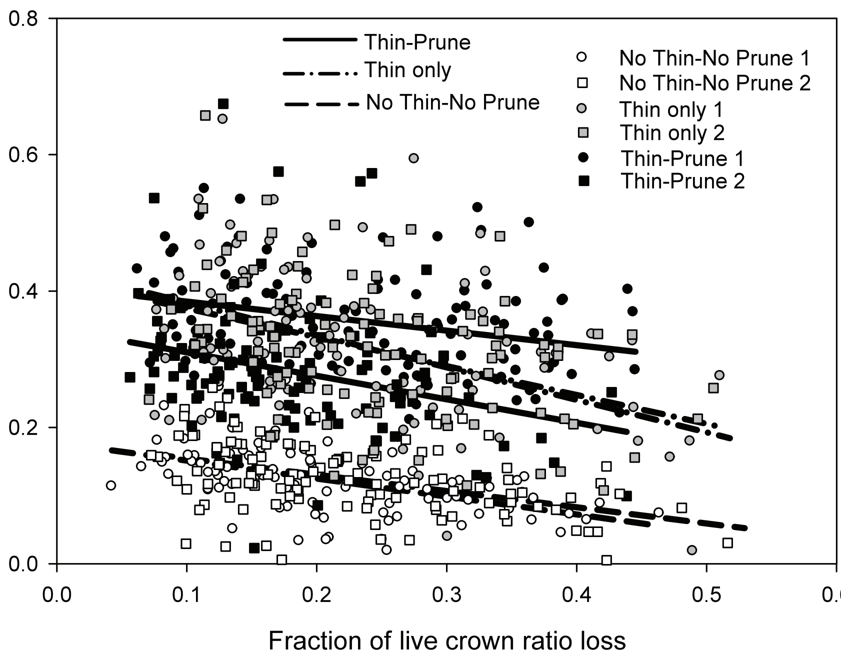

Figure 1—Relationship between relative basal area growth and fraction of live crown ratio removed for damaged trees in nonthinned, thinned, and thinned and pruned stands.