MODELING GYPSY MOTH-RELATED TREE MORTALITY UNDER DIFFERENT OUTBREAK SCENARIOS IN INTERIOR HIGHLANDS FORESTS

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Abstract—A simulation was conducted to determine how growth of forests in the Interior Highlands would change under attack by the gypsy moth (*Lymantria dispar* L.). Simulations were conducted for three different outbreak intensities using the Gypsy Moth Stand-Damage Model. Forest Inventory and Analysis (FIA) inventory data were used as input for the simulation. An ecological approach was taken for the simulation runs by stratifying the FIA data by ecological subsection, to better understand how outbreak effects might differ by subsection. Results show significantly greater percentage losses in stem density in the southern part of the Interior Highlands under both the moderate and heavy outbreak scenarios. The percent decline in basal area is nearly doubled in all susceptibility classes between the moderate and heavy defoliation scenarios. This is the first detailed examination of the damage that will inevitably occur when, at some unforeseen point within the next 100 years, gypsy moth becomes established in the Interior Highlands.

RESEARCH SUMMARY

The purpose of this study is to quantify the gypsy moth-related mortality and subsequent mortality-induced growth losses that might be expected in these highly susceptible forests in the event of gypsy moth outbreaks in the forests of the Interior Highlands. The Gypsy Moth Stand Damage Model (Colbert and Racin 2001) was used to simulate these losses using the "canned" scenarios that have been built into the model. Three outbreak scenarios were considered—moderate, heavy, and none. The length of the simulation was set at 20 years since that period of time is long enough to simulate changes but not so long that simulations would be unreliable. Output from the model was averaged for each simulation, weighted by forested acres expansion factors, by each subsection and susceptibility class. These averages were then used to calculate percentage losses for each scenario by dividing the moderate or heavy outbreak result by the baseline result.

Inventory plot data were obtained from the Eastwide forest survey database and FIA plots were stratified within the Interior Highlands by ecological section and subsection. The sheer number of forest survey plots and the plot-by-plot processing required to translate plot data into the model dictated that a subset of forest survey plots be sampled for inclusion in the model. Within each ecological subsection, plots were placed in a gypsy moth susceptibility class based on percent of basal area in gypsy moth preferred species. The initial random sample of forest survey plots was conducted to include a minimum of three plots per subsection (without replacement) in each of the four susceptibility classes. If this was less than a 1 percent sample of the forested area of a subsection/susceptibility class combination, additional plots were sampled to bring the sample percentage up to 1 percent.

No significant differences were observed by section for basal area loss under either the moderate or heavy defoliation scenarios. Basal area declined over time; percent basal area decline varied from 34.9 to 40.1 percent under the moderate defoliation scenario, and from 74.6 to 81.3 percent under the heavy defoliation scenario. Conversely, changes in stem density were significant by section. When plots were stratified by susceptibility, the opposite effect was seen. Under both moderate and heavy outbreak scenarios, significant differences in percent basal area loss were observed by susceptibility class. Immune plots had a smaller percent loss than highly susceptible plots. Under the moderate outbreak scenario, percent basal area loss varied from 25.6 in immune plots to 48.2 percent in highly susceptible plots. Under the heavy outbreak scenario, the trend was the same but more pronounced; basal area decline varied from 64.0 percent in immune plots to 88.1 percent in highly susceptible plots. There were no significant differences in percent change in stem density by susceptibility class under either the moderate or heavy outbreak scenarios. The heavy outbreak scenario often caused a reduction in the susceptibility class due to the large amount of mortality in susceptible species. In these results, the immune species group has significantly lower percent declines than the other groups, which suggests they will become more dominant at the end of the scenario.

LITERATURE CITED

Colbert, J.J.; Racin, George. 2001. How to use the stand-damage model. Version 2.0. Gen. Tech. Rep. NE-281. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 79 p. [Computer program].

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