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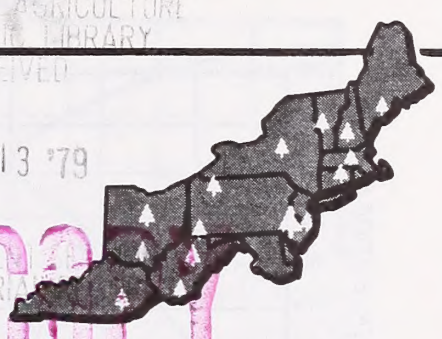
Northeastern Forest Experiment Station



FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE, 370 REED ROAD, BROOMALL, PA. 19008

FOREST STAND LOSSES TO GYPSY MOTH IN THE POCONOS

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Abstract. A Study of forest stand losses associated with the gypsy moth outbreak of the early 1970's in the Pocono Mountain Region of northeastern Pennsylvania, showed that while most of the stands incurred little or no loss, a few suffered heavy damage.

How much damage to trees and forests of a region will result from a gypsy moth outbreak? The answer depends on a number of interrelated factors such as the frequency and intensity of attack, the susceptibility and vulnerability of host trees, the size and effectiveness of insect control programs, and weather.

Since most of these factors are themselves difficult to predict, it is little wonder that we are unable to accurately forecast impacts of the pest. But, we can turn to recent experiences for some indication of what to expect. One is the outbreak that occurred during the early 1970's in the Pocono Mountains of northeastern Pennsylvania. Field-plot data have given us measures of tree and timber losses associated with that infestation.

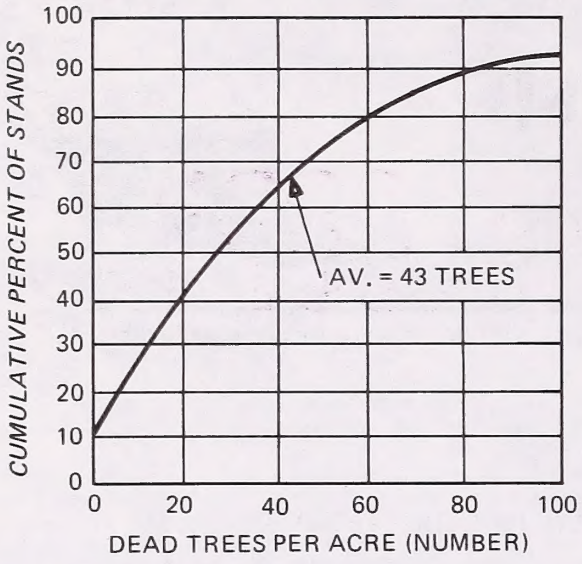
BACKGROUND

Forest stand losses were measured on 143 1/10-acre plots in Pike and Monroe Counties, Pennsylvania. This area was on the frontier of gypsy moth infestations in the early 1970's. The plots were established in 1971 in newly infested forest stands. Stand losses for trees 3 inches in diameter at breast height (dbh) and larger were measured each year for 5 years. The stands were not sprayed to control the gypsy moth during the study period.

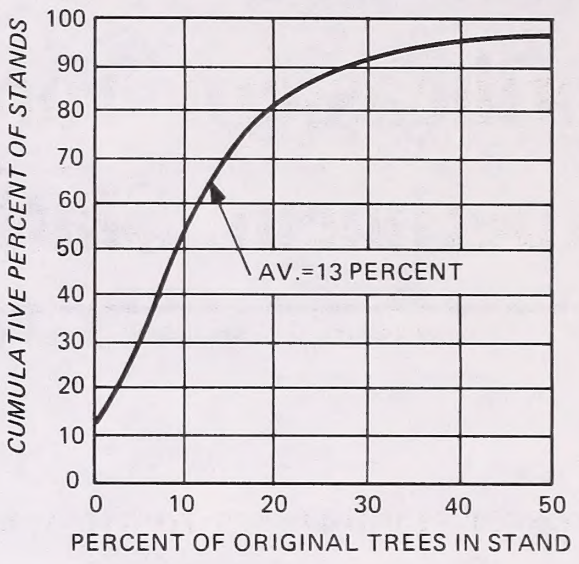
Severity and frequency of gypsy moth attacks varied from plot to plot. In general, the study area had moderate to heavy defoliation from 1971 through 1973. Insect populations all but collapsed in 1974 and 1975, and then built up again in 1976. Tree mortality reflected this pattern of infestation. Four-fifths

Figures 1a-4b.—Forest losses in gypsy moth infested stands in the Poconos, 1972-1976.

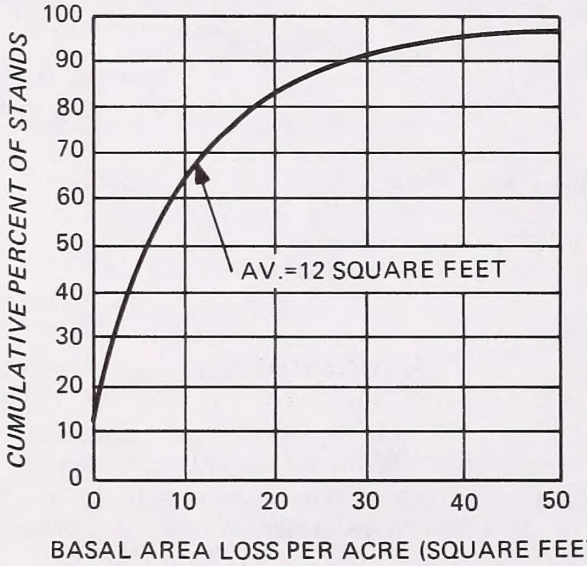
1a



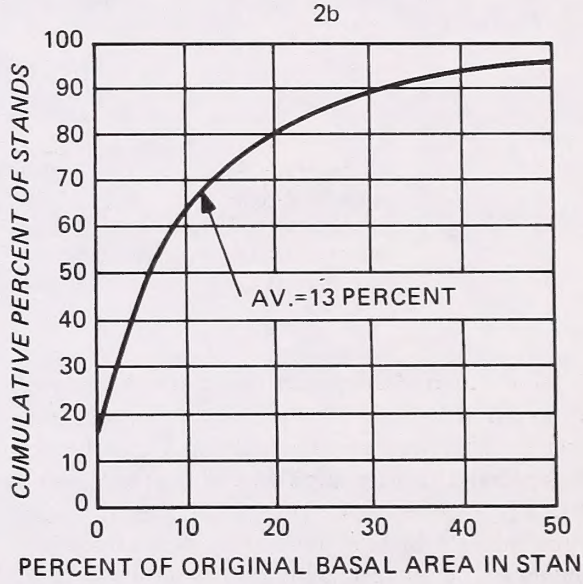
1b



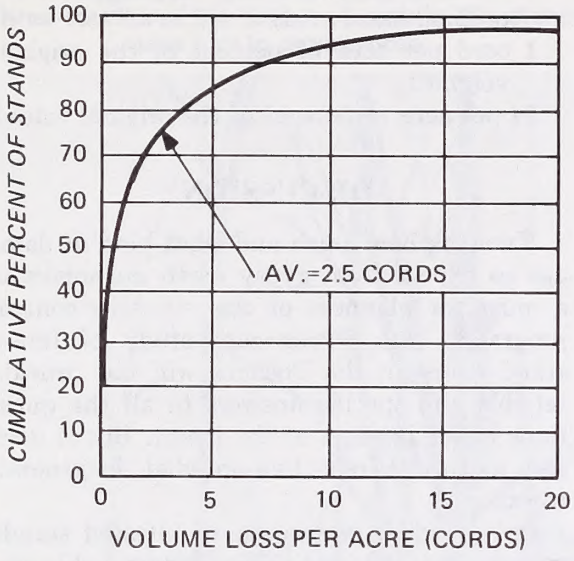
2a



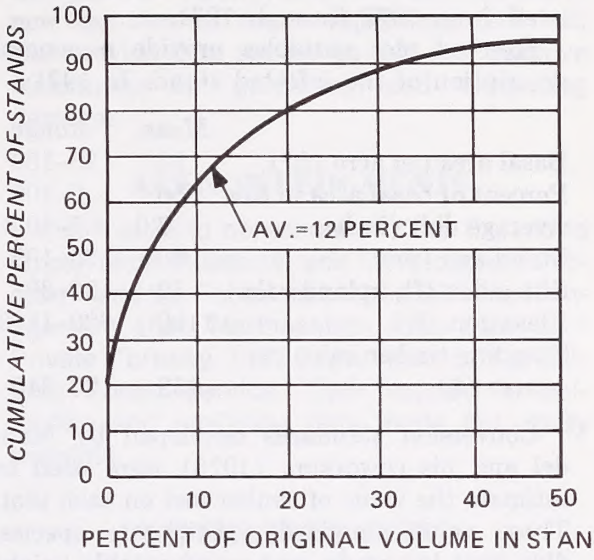
2b



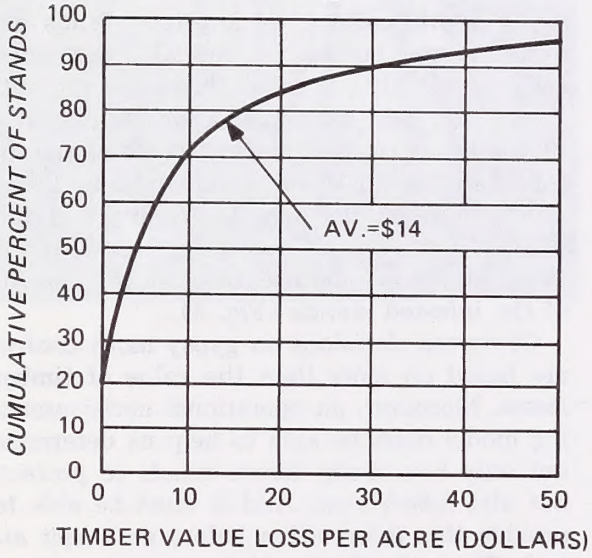
3a


CUMULATIVE PERCENT OF STANDS
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
AV.=2.5 CORDS
VOLUME LOSS PER ACRE (CORDS)

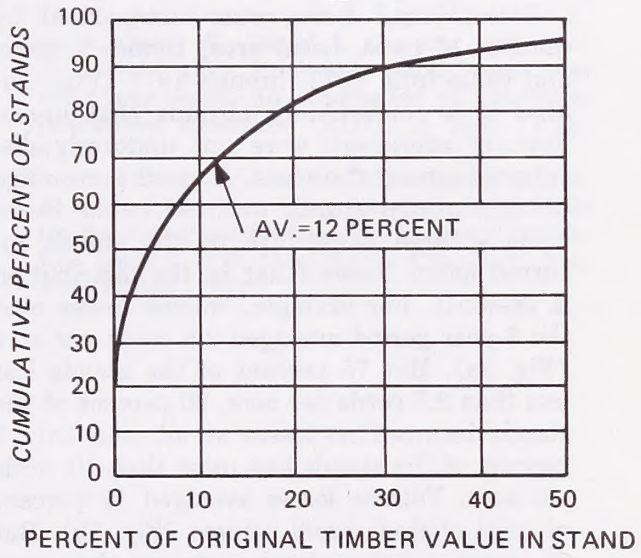
3b


CUMULATIVE PERCENT OF STANDS
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
AV.=12 PERCENT
PERCENT OF ORIGINAL VOLUME IN STAND

4a


CUMULATIVE PERCENT OF STANDS
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
AV.=$14
TIMBER VALUE LOSS PER ACRE (DOLLARS)

4b


CUMULATIVE PERCENT OF STANDS
100
90
80
70
60
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40
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10
0
0
10
20
30
40
50
AV.=12 PERCENT
PERCENT OF ORIGINAL TIMBER VALUE IN STAND

of the losses recorded through 1976 accumulated from 1972 through 1974.

Selected plot variables provide a general description of the infested stands in 1971:

	Mean	*Range*
Basal area per acre (ft^2)	95	35–180
Percent of basal area in oak	56	0–100
Average dbh (inch)	7.0	4.7–10.8
Stand age (yr)	68	25–105
Site index (ft, upland oaks)	59	30–80
Elevation (ft)	1190	620–1560
Standing timber value per acre ($)	132	20–840

Conversion standards developed by Mendel and his coworkers (1976) were used to estimate the value of timber lost on each plot. These value standards incorporate species, dbh, butt log grade, and merchantable height for each tree.

RESULTS

Forest stand losses were summarized by number of trees, basal area, timber volume, and value from 1972 through 1976 (Figs. 1a-4b). It is immediately obvious that losses, however expressed, were not uniformly distributed among the plots. A small percentage of the infested stands incurred major losses while a large percentage of the stands incurred minor losses (that is, the distribution is skewed). For example, volume losses over the 5-year period averaged 2.5 cords per acre (Fig. 3a). But 75 percent of the stands lost less than 2.5 cords per acre, 20 percent of the stands incurred no losses at all, and only 5 percent of the stands lost more than 10 cords per acre. Volume losses averaged 12 percent of total original stand volume (Fig. 3b). But 65 percent of the stands lost less than one-tenth of their volume and only 5 percent of the stands lost more than one-half of their volume.

The frequency distributions of stand losses are highly skewed. In a skewed distribution, the median (the value that divides the range of values into two equal parts) helps describe the "typical situation." Medians for the 5-year stand losses are:

30 trees per acre (10 percent of the original stand of trees)

6 ft^2 of basal area per acre (7 percent of the original basal area)

1 cord per acre (4 percent of the original volume)

$4 per acre (4 percent of the original value)

DISCUSSION

Knowing how much and what kind of damage to expect from gypsy moth outbreaks is a must for planners of cost-effective control programs. One 5-year case study of forest stand losses in the Poconos will not provide reliable and specific answers to all the questions about impacts of the insect. But it does give us fresh perspective on what, in general, to expect.

Only a small percentage of infested stands suffered major losses. This finding holds important implications for people whose job is to make cost-effective decisions about control. Suppose, for example, that effective gypsy moth control in infested stands required three successive annual treatments, each costing $10 per acre—that is, a total outlay of $30 per acre. Our analysis indicates that without treatment, 90 percent of the infested stands would suffer timber value losses of less than $30 per acre. So, from the standpoint of timber value saved, the cost of treatment would be justified on only 10 percent of the infested stands (Fig. 5).

Of course, decisions on gypsy moth control are based on more than the value of timber losses. Moreover, an operational decisionmaking model must be able to help us determine not only how many forest stands to protect, but also *which ones*. And it must be able to provide this information before an insect attack. From the Pocono data, techniques have been developed for predicting forest stand losses attributed to the gypsy moth (Gansner et al. 1978; Herrick et al. 1979). They can be used to estimate losses from easy-to-measure key characteristics of stand condition. We are working with the Northeastern Area State and Private Forestry's Forest Insect and Disease Management staff to install a system of field plots in Pennsylvania and adjacent states in advance of gypsy moth outbreaks. These plots will be used to monitor

Figure 5.—One of the big losers. Three-fourths of the timber volume in this stand was lost to gypsy moth.

the impacts of the insects as they spread to new frontiers of forest vegetation, and will also provide data needed to test and improve techniques for predicting and evaluating damages.

ACKNOWLEDGMENTS

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