



United States
Department of
Agriculture

Forest Service

**Northeastern Forest
Experiment Station**

Research
Paper NE-519

1983



New Turf for Gypsy Moth; There's More at Risk Downrange

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Manuscript received for
publication 23 September 1982

Abstract

Data collected from 600 field plots in central Pennsylvania forests threatened by gypsy moth point to a greater potential for damage down-range. Though greater than in the Poconos, losses are not expected to be spectacular. Still, some forest landowners will suffer heavy tree mortality to the pest.

Most of the recent furor over gypsy moth has not been about what it has done to the forest resource but rather about the nuisance created by caterpillars around home and recreation sites. Control efforts have been concentrated in residential areas and parks; not in the woods. Forest stand losses to gypsy moth during the past decade have reinforced the general lack of public concern over the impact of the insect on our woodlands. For example, a recent survey by the Pennsylvania Bureau of Forestry (Quimby 1981) showed that, in forest stands sustaining defoliation of 60 percent or more, cumulative tree mortality over a 10-year period averaged 20 percent. Losses in timber value averaged \$16 per acre; less than \$2 per acre per year. Our study in the Pocono Mountain Region of northeastern Pennsylvania yielded similar results (Gansner and Herrick 1979). Cumulative mortality (trees 3 inches in dbh and larger) associated with an outbreak in the Poconos during the early 70's averaged 13 percent over a 5-year period. Hardly a good thinning. Losses in timber value averaged \$14 per acre; less than \$3 per acre per year.¹ These are not the kind of impacts that inspire widespread, massive control efforts.

¹ Conversion standards developed by Mendel et al. (1976) were used to estimate timber value. These value standards account for current average regional conversion costs and incorporate species, dbh, butt log grade, and merchantable height for each tree. For example, a 16-inch diameter red oak having butt log grade 2 with merchantable height of two logs and containing 180 board feet (International 1/4-inch rule) was valued at \$7.08.

This is not to say that defoliation has not taken its toll on the forest. No doubt, overall growth in timber volume and value would have been greater without gypsy moths. But, as the Pocono study showed, only a small percentage of infested stands suffer severe losses. Only 10 percent of the stands lost more than \$30 per acre. Many of the trees that died were small and of low grade. Oak species were hit hard and their stocking is down, but species less vulnerable to gypsy moth such as red maple, hickory, black gum, ash, and yellow-poplar make up a greater proportion of average stocking now. Before infestation most stands were fully stocked or overstocked. They still are. Significant losses in timber volume and value occurred during the early years of infestation but most of them were offset by growth in later years. Most stands have more volume and value now than they had before infestation (Gansner and Herrick 1982). As Powell and Barnard (1982) put it, the gypsy moth's "impact on our future timber supplies has not yet been demonstrated to be of major consequence."

There is, however, growing concern among forest landowners and managers that things could become more serious as the outbreak spreads south and west into forests where oak stocking is greater and timber quality is better. What actually occurs downrange will depend on a number of interrelated factors such as the frequency and intensity of attack, the vulnerability of host trees, the effectiveness of control programs, and the influence of natural phenomena like predators and weather. And since these factors are difficult to predict, there's no way we can forecast impacts of the pest accurately.

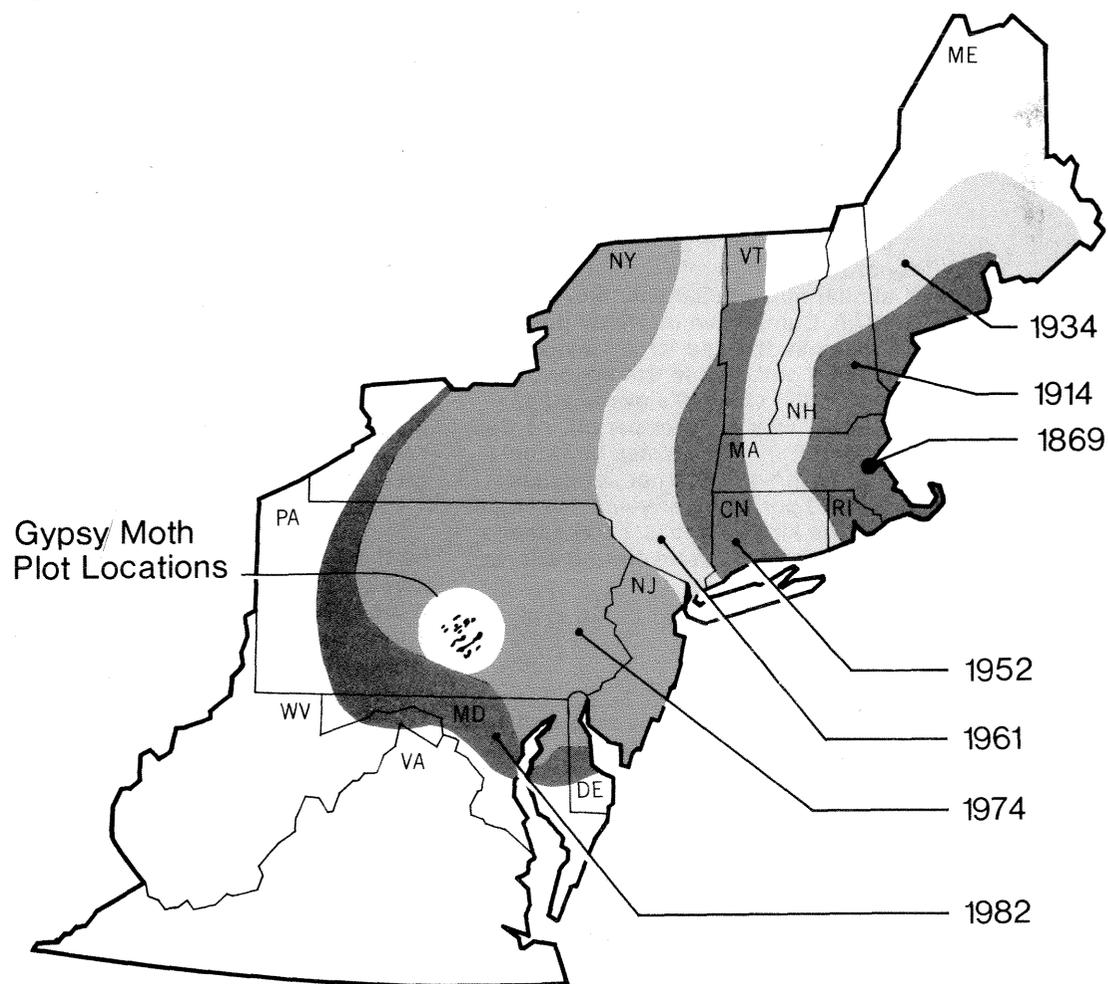
In an attempt to measure impacts downrange, some 600 field plots have been installed in central Pennsylvania in advance of gypsy moth infestations. They are located between State College and Harrisburg in the heart of Pennsylvania's oak country (Fig. 1). Most of these plots were not significantly defoliated until 1981, so it's too early to report any definitive results. However, we can compare some key characteristics of stand condition for threatened field plots in central Pennsylvania with the preoutbreak status of infested plots in the Pocono Mountain region to get a relative indication of what to expect:

	CENTRAL PA		POCONOS	
	Mean	Range	Mean	Range
Percent of basal area in oak	68	0-100	56	0-100
Percent of basal area in trees with poor crowns ²	11	0-89	8	0-69
Average dbh (inches)	7.4	3.8-13.4	7.0	4.7-10.8
Stand age (yr.)	72	15-175	68	25-105
Board foot volume per acre	5,500	0-28,200	4,100	0-23,100
Standing timber value per acre (\$)	159	1-1,525	132	20-840

² Crowns were classed as poor when 50 percent or more of the branches were dead (allowances permitted for non-self-pruning species); when foliage density,

size, or coloration was of subnormal quality; or when epicormic sprouting was heavy.

Figure 1. Spread of gypsy moth and location of central Pennsylvania plots.



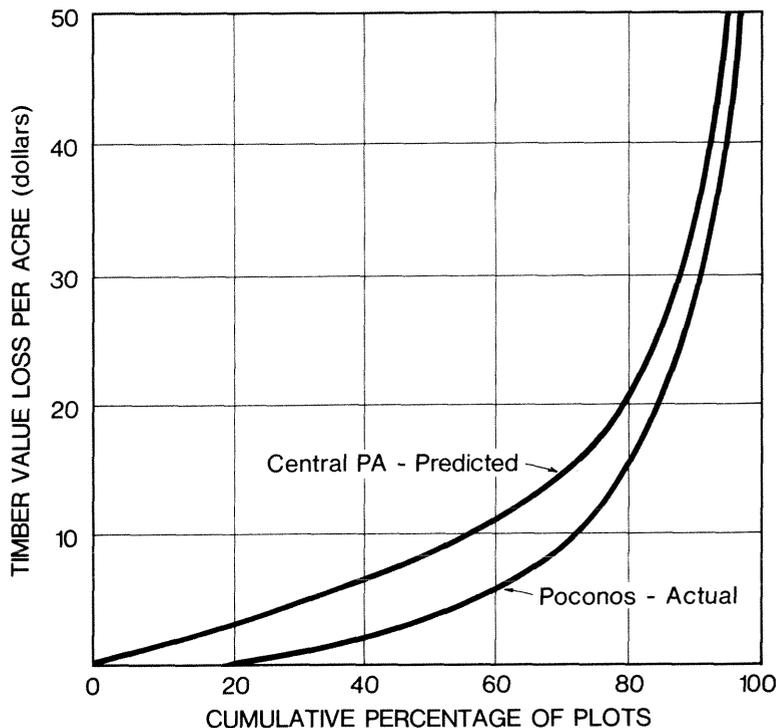
Oaks are a favorite food of the gypsy moth and there is more oak stocking downrange. On average, oaks account for 68 percent of the basal area in the central Pennsylvania plots. Oaks averaged only 56 percent of the basal area in the Pocono plots.

Tree vigor is a critical determinant of vulnerability to gypsy moth. Many trees that are old and in poor condition die after one heavy defoliation. Stand age and the proportion of stocking in trees with poor crowns are both greater in the central Pennsylvania plots than they were in the Pocono plots.

Timber is larger downrange. The average dbh of threatened stands in our central Pennsylvania study is 7.4 inches as opposed to 7.0 inches in the Poconos. Thirty percent of the central Pennsylvania stands average 8.0 inches dbh and larger. Only 18 percent of the Pocono stands were that big. There's more sawtimber volume downrange too, averaging 5,500 board feet per acre versus 4,100 board feet in the Poconos. And as you might expect, timber value is also greater. The value of standing timber in central Pennsylvania plots averages \$159 per acre, 20 percent more than in the Poconos. What this all adds up to is a greater potential for economic loss downrange.

Techniques for predicting forest stand losses to gypsy moth that include the use of easy-to-measure key stand characteristics have been developed from the Pocono data and are now being tested and refined. Typical of the models coming out of this effort is

Figure 2.—Comparison of predicted value losses in central Pennsylvania with actual losses in the Poconos, 1972-1976.



an equation for estimating losses in timber value for defoliated forest stands:

$$PVL = 0.49 + 1.02(PPC) + 0.02(PWO)$$

where

PVL = Percentage of timber value that will be lost

PPC = Percentage of live basal area in trees with poor crowns

PWO = Percentage of live basal area in trees of the white oak species group.

Only two of the many elements of stand condition analyzed as predictor variables were significant; they are in this equation. Their inclusion makes especially good sense because (1) trees with *poor*

crowns have lower vigor and are more likely to die after defoliation, and (2) *white oaks* are preferred food of gypsy moth and are usually attacked more severely than other tree species.

This equation was applied to the central Pennsylvania plots to estimate the potential hazard of impending gypsy moth attacks to timber value. Comparison of these value loss estimates with losses that actually occurred in the Poconos reinforces the inference that there is more at risk downrange (Fig. 2). The median loss for plots in the Poconos was \$4 per acre; that is, half the plots lost at least this much value. The median loss predicted for central Pennsylvania is twice that. Over 40 percent of the central Pennsylvania plots are predicted to lose more than \$10 per acre. Only 28 percent of the Pocono plots lost that much timber value.

Though losses are expected to be greater downrange, they aren't expected to be spectacular. Still, some forest landowners will suffer heavy tree mortality and will lose hundreds of dollars worth of timber to the pest (Fig. 3). These are the people that planners of cost-effective gypsy moth management programs have to be most concerned about. Operational decision-

making guides must be able to help us determine not only how much forest land to protect but also which stands. Field plots installed in advance of gypsy moth outbreaks will be used to monitor impacts of the insect as it spreads to new frontiers of forest vegetation. They will also provide data needed to improve techniques for predicting and evaluating damages.

Figure 3.—Most of the timber value in this stand was lost to gypsy moth.



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ODC 453-145.7 × 18.77 *Lymantria dispar* (L):652.54

Keywords: Risk rating, damage assessment, multiple regression analysis

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