PennState Extension

Guide to Spongy Moth Egg Mass Surveying

Systematically survey egg masses of Lymantria dispar, or spongy moth (formerly "gypsy moth"), in fall and winter to assess the risk of damage next spring and decide whether aerially spraying control agents is worthwhile.

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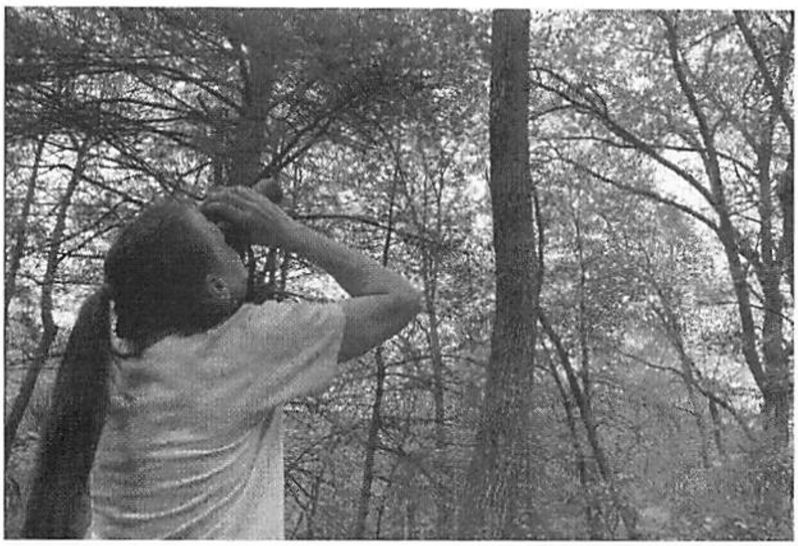


A forester counts egg masses through binoculars in an oak forest.

Lymantria dispar, commonly known as spongy moth (formerly "gypsy moth(https://extension.psu.edu/gypsy-moth)") is an insect that can cause significant damage to trees when populations are high(https://extension.psu.edu/preparing-for-high-spongy-moth-densities). During those times, the population and impact are not equally distributed across the state or region. It is important to keep an eye on the damage and evidence of insect activity that occurs locally in your forest. Some landowners who are concerned about very high populations may choose to pursue contracts with aerial spray applicators who are hired to spray control agents – for example, Btk (*Bacillus thuringiensis* subsp. *kurstaki*) and tebufenozide, known by the brand name "Mimic®," – across forest parcels in the spring to minimize damage from this insect. You can find more information about aerial spray contractors on the PA DCNR Bureau of Forestry Division of Forest Health webpage on *L. dispar* (https://www.dcnr.pa.gov/Conservation/ForestsAndTrees/InsectsAndDiseases/GypsyMoth/Pages/default.aspx).

(https://extension.psu.edu/media/wysiwyg//extensions/catalog_product/bc57848153864448a90f46e3463ab339/h/e/helicopterapplication_resized-jp_1.jpg)

Aerial spray programs may not be worthwhile where *L. dispar* populations and the level of damage are moderate to low. Deciding when conditions warrant the consideration of an aerial spray intervention can be tricky – how much is too much? This article discusses the threshold conditions when an aerial spray action might be beneficial to a forest parcel and how to assess those conditions in a systematic way. These protocols are used by the PA DCNR Bureau of Forestry Division of Forest Health, but they are relevant and usable for all forest landowners and managers in the region.

Estimating next year's potential *L. dispar* population in your area is done by focusing on the insect's egg masses, from which next year's caterpillars will hatch. The key number that helps you make decisions about control options for next year is the number of egg masses per acre that you find in your forest in the fall, after this year's insects have finished egg laying. To determine the density of egg masses in a given parcel of forestland, you will need to visit a few locations in your forest where you will spot and count egg masses using a standard survey method. You can conduct an accurate survey anytime between late summer and early spring.

Read on or watch a video of the step-by-step process:

Step 1: Choosing Where and How Much to Survey

Depending on the size of your forest, you may need to sample more or less intensively to get an accurate average egg mass density that is representative of the whole area. Most private forest landowners own less than 40 acres of land. For those folks, sample a minimum of two survey plots across the parcel. Larger parcels of forestland will need more sampling. A 40 to 70-acre parcel should have a minimum of 3 plots. A 70 to 200-acre parcel should have 4. For even larger parcels, add a minimum of one more survey plot for every additional 100 acres. You should err on the side of taking more survey plots than the minimum if you discover widely variable conditions, if your egg mass densities are close to decision-point thresholds, or if you suspect that *L. dispar* is likely to blow into your forest from a neighboring area.

Tract Size (acres)	Minimum # of Sample Plots
< 40	2
40-70	3
70-199	4
200-299	5
300-399	6
400-499	7
500-699	8
700-899	9
900-1099	10
1100-1500	11
1500-2000	12
> 2000	13 or more

(https://extension.psu.edu/media/wysiwyg//extensions/catalog_product/cb10c7952e224edfb959e6191f5a66f3/t/r/tractsizeplotintensity_resized-pn.png)

When choosing spots to conduct your survey, try to distribute the plots throughout the tract and select locations that seem representative of the typical conditions in the area. For this survey procedure, instead of choosing a truly random location, it is best to center the plot on a tree that is a favorable host for *L. dispar*, like a mature oak. If oaks are not present, choose a black cherry, American beech, or aspen. You should also try to conduct your survey on a clear day when the sun is high in the sky so that you will be better able to see egg masses high in the forest canopy.

Use the buddy system when surveying. A partner is beneficial both for safety as well as to provide a second pair of eyes to help find egg masses.

Step 2: Survey the Plot

From the "center" tree you choose, you should search for and count all visible egg masses within a circular plot with a radius of 18.6 feet. This plot size is one-fortieth of an acre.

It's easiest to start by counting the egg masses located on your center tree. You'll want to search for egg masses from the very bottom of the trunk all the way up into the canopy of the tree. Egg masses tend to be laid in sheltered locations like the undersides of branches but can be found anywhere in a tree. You'll need a pair of binoculars to see high into the canopy. When counting egg masses on a tree, be careful not to count the same egg mass more than once. It helps to scan the tree systematically – top to bottom or bottom to top – through your binoculars. For large trees, you may need to choose more than two vantage points to see all around the stem. Small to medium trees will usually only require examination from two opposed vantage points.

Survey other trees within the plot in the same way. The center of a tree should fall within the 18.6 foot radius to be included in the survey. Foresters often use a measuring tape called a logger tape for this, but you might find it easier to bring a length of rope that you measure in advance at 18.6 feet.

You should also look down and try to count egg masses that have been laid on objects on the ground, such as fallen branches and rocks. Sometimes you might need to move objects or leaf litter so that these surfaces can be seen. Snow can hide these egg masses if you choose to survey in winter.

At this point, you should have a total number of egg masses that you counted within a one-fortieth acre plot. To convert this observation to an estimate of egg masses per acre, you just need to scale up the measurement. 40 of your survey plots approximates one acre in size, so you need to multiply your count in the plot by 40. For example, if you found 25 egg masses on a one fortieth acre plot, you would calculate that:

25 egg masses per 1/40 acre x 40 = 1,000 egg masses per acre.

This is your total egg mass density measurement for this survey plot.

Step 3: Calculate and Subtract the Ratio of Old Egg Masses

L. dispar populations rise and fall in cycles. Egg masses from prior years may persist on trees even though they are spent, and no new insects will hatch out of them. These should not be included in your final egg mass density counts.

Up close, it's easy to see which egg masses are new and which egg masses are from prior years. New egg masses feel hard and full when you press on them. They are usually darker in color and appear less ragged than old egg masses, which tend to feel soft and spongy.

However, these differences are hard to see in high locations or through binoculars. Therefore, we'll use an estimate from a small, up-close area of what proportion of visible egg masses are "old" and adjust our total counts based on that ratio.

For example, let's say you arrive at a survey location where you start by counting all egg masses on the bottom three feet of a tree trunk. You count 10 egg masses but find that two of them are powdery and fragile, evidencing that they are from last year and should not be included in the count. At this spot, you would calculate the proportion of old egg masses this way:

(2 old egg masses / 10 total egg masses) x 100% = 20% old egg masses.

In this scenario, you would assume that 20% of the total egg masses you count are from a prior year and should eventually be subtracted from your total. Only the corresponding 80% are new egg masses worthy of counting.

Let's take our prior example. We counted a total egg mass density of 1,000 egg masses per acre. If 20% of these are assumed to be old egg masses, our true density of new egg masses is actually only 80% of the total we counted, or 800 egg masses per acre.

This density measurement, which incorporates the plot count, plot size, and new-to-old egg mass ratio, gives you a final, accurate number that you can use to make decisions.

Step 4: Making Decisions from Survey Data

At the end of your survey, you should have egg mass density estimates for a number of survey locations in your forest. Consider the average and the spread of these numbers and compare them to the threshold densities used by many forest managers to help decide when conditions warrant aerial spray control. Be aware, these "spray thresholds" are helpful in framing your decision about when a spray application might be beneficial but are not hard-and-fast rules; also consider your level of risk acceptance and other factors.

Data from the US Forest Service (https://www.researchgate.net/publication/267999457_Gypsy_Moth_Egg_Mass_Sampling_for_Decision-Making_A_Users%27_Guide) show a clear relationship between the density of egg masses and increasing damage to trees, measured by defoliation. We can use this information when we decide what level of damage we hope to prevent and what corresponding egg mass density triggers the need for treatment.

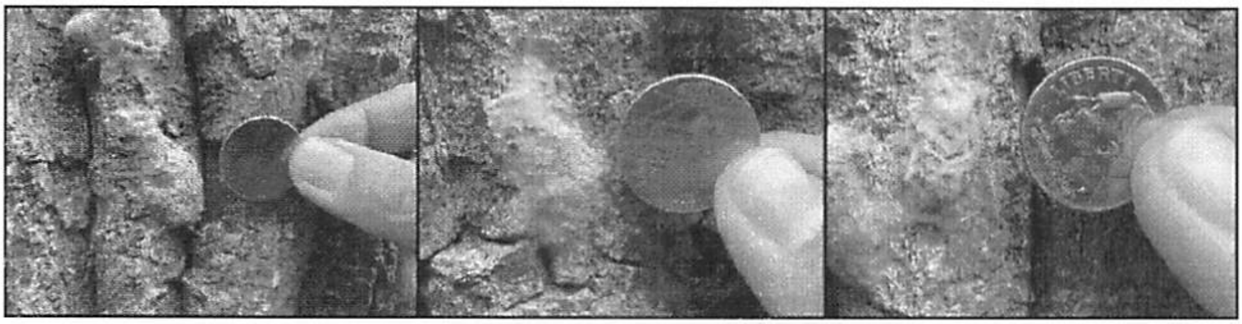
If your goal is to prevent noticeable defoliation, around 30%, treatment should be considered when you count between 500 and 750 egg masses per acre. If you hope to prevent loss of tree growth, which occurs above 40% defoliation, the threshold for treatment might be 700 to 900 egg masses per acre. If mortality, or the death of trees, is the main concern, consider a threshold of 1000 to 1400 egg masses per acre. You should err on the lower side of these ranges or define your own lower density threshold value if your forest contains a lot of oaks, if the stand has experienced significant stress or a harvest in the last five years, if unusually high-value or specimen trees are involved, or if you are very risk-averse.

Egg Mass Density Threshold (per acre)	Anticipated Damage
500-750	noticeable defoliation (30%)
700-900	growth loss (40% defoliation)
1000-1400	mortality

(https://extension.psu.edu/media/wysiwyg//extensions/catalog_product/8719ae2ab2634aecbbf63fdc9cd00989/e/m/emdensityanddamagetable_resized-pn.png)

Some managers commonly use 250 egg masses per acre as a treatment threshold, but damage resulting from this density tends to be low and may not be worth the expense of treatment in larger forests. However, it might be appropriate for high visibility public use areas like parks.

If your estimates are close to thresholds but borderline, you might choose to conduct additional sampling to improve confidence in your estimate. Additionally, you might consider the typical size of the egg masses you observe; smaller egg masses contain fewer eggs and may reflect a declining population. You can also look for evidence of natural controls and predators like *Ooencyrtus*, a small wasp that parasitizes *L. dispar* eggs.



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Regardless of whether you opt to pursue an aerial spray program on your land, you should monitor conditions in your forest to track the damage and recovery of your trees. *L. dispar* populations rise and fall; management of this insect in forests focuses on understanding, tracking, and mitigating stress at key moments in time.

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