

## If you spot a lantern fly...



Spotted lanternflies (*Lycorma delicatula*) are insects from Asia that are quickly spreading in North America and have a growing negative effect on agricultural production. Since their arrival to the USA about ten years ago, they have now spread to at least 16 states (PA, NY, NJ, MD, MI, OH, IN, WV, VA, NC, DE, CT, RI, MA, KY, TN). These insects are particularly dangerous for grapevines, which is becoming a major concern for many vineyards and wineries present in NY State. Spotted lanternflies feast on plant's sap and remove so much of it that the vine has far lower chances of surviving the cold temperatures. Even if a seriously affected vine survives, it is much less likely to produce any grapes next season. Quarantine measures in several states and [public eradication campaigns](#) have not proven successful in eliminating this threat. Most scientists expect the spread to continue until the lanternflies face off with some natural predators – either those already keeping the lanternfly population limited in Asian countries<sup>1</sup> or the native US birds and insects once they recognize the spotted lanternflies as suitable food. Either way, this process will take at least 5-10 years and for now the goal is to slow down the spread (e.g., through quarantine measures) and limit the immediate economic impact (e.g., by treating vines with insecticides).

**Your team is asked to select and address ONE of the following two challenge problems.**

**In addition to your detailed manuscript, please provide a one-page executive summary for the members of the [Integrated Pest Management Program](#). While highlighting your recommendations, please make sure to also address the limitations of your modeling approach and possible directions for future improvement.**

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<sup>1</sup> But these would have to be checked carefully before introducing them to the US to avoid harming the local/native insect species!



## Challenge 1: Limiting the spread in NY State

Spotted lanternflies (SLF) hatch from eggs & start their life as nymphs in April, become adults by late July, lay their eggs in September-November, and then die in December. Each female SLF usually lays at least one “eggmass” with about 35 eggs in it.

SLF can feed on more than 100 different plants (which makes it much easier for them to spread), but their all-time favorite is the so-called [“Tree of Heaven”](#) (*Ailanthus altissima*). If it is present in the vicinity, the lanternflies are known to lay about 7 times as many eggs as usual. Thus, removing these trees (present in Ithaca and, more broadly, in the Finger Lakes region) may be one of the most effective anti-SLF measures. But [some of the current guidelines](#) recommend using a “tree trap” approach; i.e., removing only small Trees of Heaven while treating the larger ones with a long lasting insecticide (dinotefuran) to kill the returning SLF.

SLF cannot fly too far on their own – the natural distance they can cover in one year is estimated to be between 4 and 10 miles only. But the spread becomes much faster when they lay the eggmass on shipping materials, railroad cars, or automobiles, which by April, when the eggs hatch, can be in a very different location. Thus, the quarantine measures are usually focused on finding and destroying the eggmasses before they have a chance to travel far.

**You need to model the SLF population spread in NY State and suggest the best strategy for slowing it down. Regular inspections of vehicles & railroad cars require resources (money, time, coordination with businesses and agencies, human efforts), which could be otherwise spent on other measures – e.g., on reducing the number of Trees of Heaven (TOH) or setting up “tree traps”. Suggest a strategy for balancing these efforts. Explain the predicted effect on the overall SLF population as well as the economic and environmental impact in the next five years.**



## Challenge 2: Saving the grapes and/or saving the vines?

Protecting a vineyard from SLF is primarily accomplished through using insecticides. Usually, this is not done in advance – partly because the effect of such chemicals is only temporary and partly to avoid the unnecessary costs/work & side effects. Instead, [it is currently recommended](#) to apply the chemicals only after observing some threshold number of SLFs:

- In the Spring: at least 15-20 nymphs per vine before you spray (one application should be enough).
- In August-September, when the adult SLF are migrating and many of them move to vineyards: at least 5-10 adult SLF per vine before you spray (repeated applications might be needed).

All insecticides have different effectiveness against the SLF, but also come with [different restrictions](#): on the maximum dose that can be used per year **and** on the Pre-Harvest Intervals (PHI) – i.e., the number of days that has to pass after the last application before you are allowed to harvest the grapes.

This presents a hard dilemma when the adult lanternflies arrive close to the harvest time. If you start using insecticides, you will likely have to harvest later than intended, which increases the potential incidence and severity of fungal diseases, resulting in reduced yield as well as reduced grape quality. On the other hand, if you decide to wait with the insecticide until after the harvest, you risk long-term damage to your vines due to SLF sap feeding.

**Suggest an optimal strategy for using insecticides throughout the season. Among other measures, this might involve changing the threshold of observed SLF (nymphs and adults) before you spray or, more generally, making that threshold depend on**

- **SLF migration patterns,**
- **the number of days remaining until the harvest,**
- **the chemicals already used up to that point, and/or**
- **the predicted weather (which influences the development of fungal diseases).**

**In addition to financial considerations, please also address a possible impact of your approach on other (beneficial) insects.**