Airborne Egg Detection & Removal System - Team Breadwinners
Clients: Cornell CALS Extension / E&J Gallo Winery / National Grape

1 Problem Statement

With few natural predators in the United States, the arrival of the spotted lanternfly in East Coast states has decimated crops in the region and left farmers and industries that rely on their produce in deep trouble. Insecticides, manual scraping, and even trap trees have been used to limit their spread, yet a study by NYU found that despite these measures the spotted lanternfly population increased by at least 10 times from 2014 to 2022. Current measures are costly and inefficient, and the insects multiply rapidly on their own. Our challenge is to find a way to locate and destroy egg masses on a wide scale that is efficient and easily deployable.

2 Importance

Vineyards, orchards, agricultural crops, and other forms of cultivated vegetation will suffer far less stress and long term damage. In addition, preventing hatching can stop thousands of lanternflies from emerging from a single egg mass, dramatically reducing population growth. The early removal of spotted lanternfly eggs reduces the need for pesticides or large scale treatments which can be more costly for small farmers, and fewer lanternflies prevent sticky honeydew buildup, curb harmful mold growth, and help preserve balanced local insect ecosystems.

3 Proposed Direction

We propose a drone based detection and removal system for the spotted lantern fly egg masses, designed to scale from a low cost detection system to fully autonomous intervention that can adapt to the variability of egg mass locations. The concepts below are presented as a series of minimal viable prototypes designed to build towards the final project.

Vehicle Mounted Detection Systems: Independent computer-vision camera modules installed on existing agricultural vehicles, trucks, or municipal fleets. Tests the camera, power, and computer vision systems of the final design.

Aerial Detection System: A drone equipped the aforementioned camera system, capable of detecting SLF egg masses on trees, posts, and other vertical surfaces. Tests if the computer vision camera system can be miniaturized and adapted to relatively fast moving aerial platforms.

Autonomous Removal Vehicles: Autonomous drones that are capable of identifying and mechanically/thermally removing SLF eggs on trees, posts, and other vertical surfaces. Final design, would incorporate the computer-vision detection system, as well as an in-house removal system.

4 Key Risks and Unknowns

Detection Accuracy: Eggs blend into bark and other surfaces, impeding visual detection. To combat this, we are going to test the prototype in various simulated weather conditions.

False Positives: Must avoid harming native insects minimizing impact on the broader ecosystem.

Surface Damage Risk: The removal must not harm bark, crops, and other surfaces. We would need to evaluate the best method for removal on sample bark, i.e mechanical vs thermal.

5 Client Questions

What is the time window for egg removal before hatching?
Defines the system speed requirements.

What cost per acre is acceptable for an early detection system?
Guides system complexity and pricing.

What regulatory or operational constraints exist for drone use in vineyards?
Determines the feasibility of and aerial solution.

6 Sources

Harrison, R. (2024, December 4). Spotted lanternflies in the US are living longer—and cities may be helping them spread. NYU. https://www.nyu.edu/about/news-publications/news/2024/december/spotted-lanterflies-urbanization.html