EVALUATING NEW TECHNOLOGY FOR BIOSECURITY SURVEILLANCE

Custom light trap designed for this research

SHINING A LIGHT ON INVERTEBRATE BIOSECURITY

Light trapping is a long-standing method for trapping flying invertebrates. The light traps used for this project were designed by an interdisciplinary team of product design, software engineering, and electrical engineering students, in association with the Wireless Research Centre at the University of Canterbury. The custom traps use high-power UV LED lights, solar power charging, and can be controlled through the internet, meaning researchers can assess the functioning of the traps and audit the trapping remotely.

AT A GLANCE

Biosecurity surveillance helps prevent the establishment of, control, and eradication of unwanted and damaging organisms in Aotearoa New Zealand. Existing surveillance either relies on the public to call in potential threat or is conducted through programmes focused on a particular species, group, or pathway of entry.

We investigated innovative technology that could be used to detect a broader range of unwanted organisms within a single programme.

LIGHT TRAPPING TRIALS

The research team completed two summer sampling trials. The first was conducted in the summer of 2021-2022. Traps were set up at 15 sites across the Port of Tauranga and monitored for three weeks. The second trial was conducted for three weeks in the summer of 2023-2024 in Tauranga and Lyttleton, where ten traps were set up at each respective port and ten traps were set up at transitional facilities. This design will allow the research team to investigate the biosecurity risk at ports, compared to transitional facility risks, where shipping containers are generally emptied.

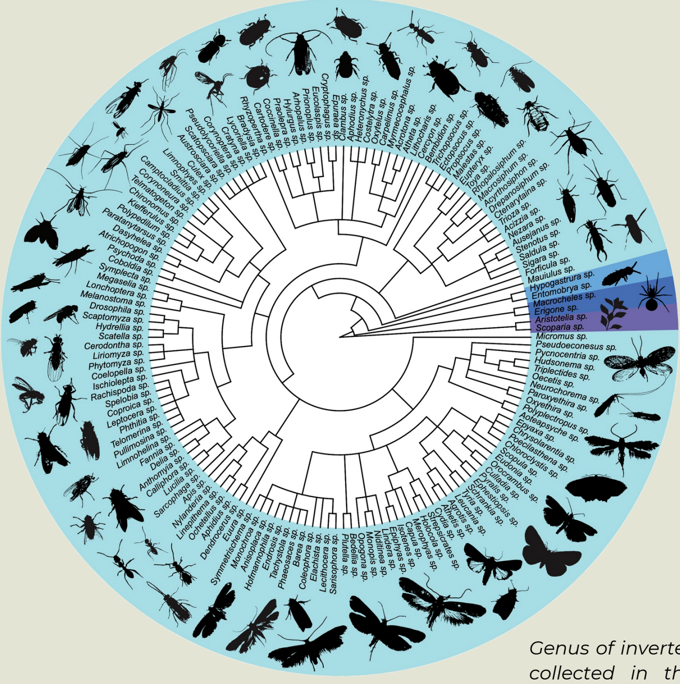
The organisms caught in the traps were collected, and the team conducted high throughput sequencing to identify invertebrate species in each sample. Five primer sets were used to target different gene regions of the samples collected.

PRELIMINARY RESULTS

Results from the first summer trial show that traps at the port collected approximately 1,500 arthropod taxa, representing approximately 20% of known orders from New Zealand. This means that, light trapping has a wider reach than current species-specific surveillance methods.

NEXT STEPS

The research team are preparing a cost-benefit analysis of a light trapping network for Biosecurity NZ. BioHeritage work has shown that UV light traps would make a valuable component of a future advanced biosecurity network that also includes eDNA sampling of air and water and computer vision approaches to monitoring plant health.

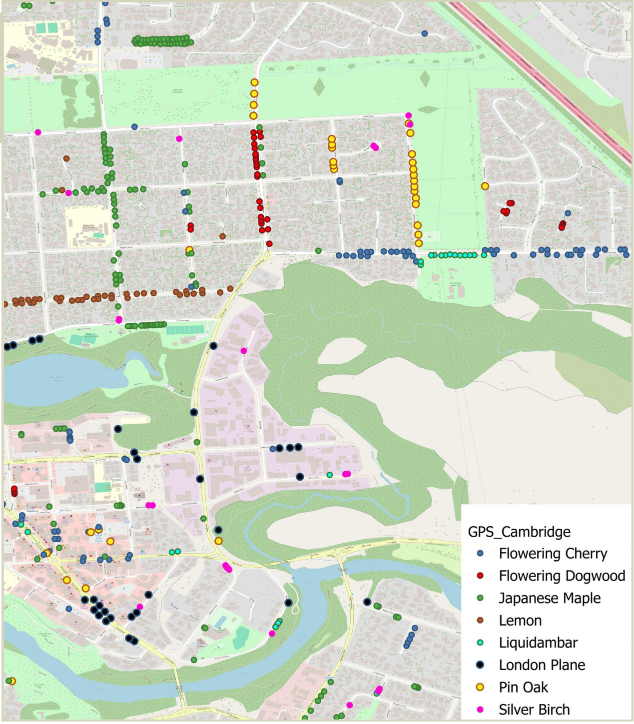


Genus of invertebrates collected in the first light trapping trial

NEW ZEALAND'S BIOLOGICAL HERITAGE
Ngā Koiora Tuku Iho
National Science Challenges

ROUTINE IMAGING OF TREE HEALTH

Biosecurity assessment of trees can be time-consuming and needs to be undertaken routinely for proper management. This research project was a preliminary investigation of the use of high-resolution imagery to monitor tree health. The aim is to develop a monitoring programme using cameras mounted on the top of rubbish trucks to image street trees and use machine learning models to track changes in tree health.

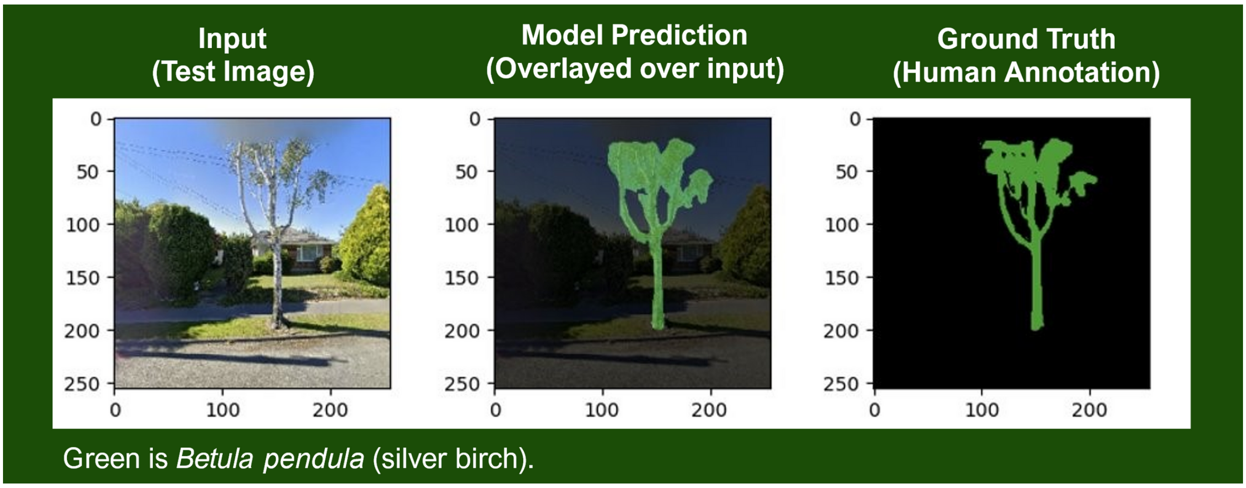


Map interface of the imaging system

BUILDING AN IMAGE LIBRARY

Researchers from the University of Canterbury and University of Waikato developed an automated imaging system mounted onto vehicles at the height of rubbish trucks to capture streetscape photos of trees.

These streetscape photos were used to develop and train a model that can detect, segment out the trees, and identify the tree species within each image. Now, the team is testing the model on images different to those it was trained on to assess its performance.



Performance of the model segmentation on a test image (Good)

NEXT STEPS

After evaluating the model and segmenting the test images for trees, the segmented images will be used to develop a machine learning process to look for disease symptoms. The machine learning process will be trained to look for known disease symptoms (currently being trialled with Dutch Elm Disease), and to identify unknown symptoms that could indicate disease. For both objectives, the plan is to look for anomalies within the dataset. Focusing on anomalies can indicate whether a tree has become an outlier because at first it looked healthy, but now looks unhealthy. This information can be used to inform inspection effort in existing surveillance programmes (e.g. Biosecurity NZ's High-Risk Site Surveillance programme).

The research team is looking for funding to continue to progress the machine learning model, and are evaluating the potential of developing a national machine learning image resource for New Zealand - a strategic resource that could be useful across many domains.


Test van camera setup used for preliminary investigation

Key words:
Biosecurity, surveillance, technology, trapping, invertebrates, imaging, trees, monitoring

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