

## Atmospheric dispersion modelling for forest protection

Brian Richardson (on behalf of Tara Strand)



### What is atmospheric dispersion?

- Science of measuring and modelling the fate of particles (e.g. spray droplets, smoke particulates) and gases released into the atmosphere.



## Forest biosecurity atmospheric dispersion projects



- Aerial spray modelling.
- Mating disruption using insect pheromones.
- Modelling methyl bromide plume transport and spread near port facilities.
- Assessing the risk induced by wind reversal near obstacles.
- Disease spread modelling and epidemiology.

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## Aerial spray modelling

- AGDISP predicts fate of spray material released from aircraft.
- Needed to understand complex processes influencing spray deposition and drift.



Funded by USFS, Lincoln  
Ventures Ltd/MSI and B3

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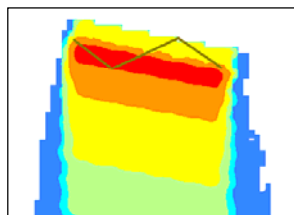
## Application of spray models in NZ



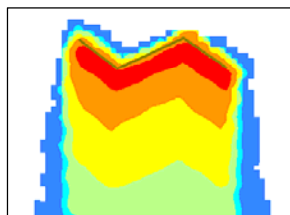
- Improving efficacy.
- Assessing environmental impacts.
- Defining buffer zones.
- Forensics – what went wrong (or right).
- Equipment selection.
- Training.
- Consent applications.
- Supporting license to operate e.g. FSC.



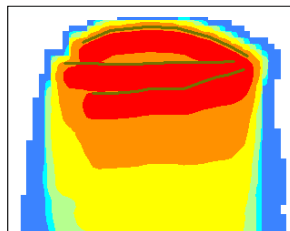
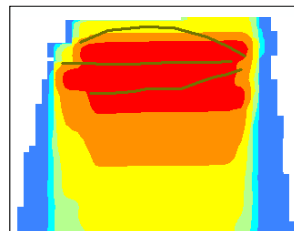
## AGDISP model development and improvement



Previous behaviour using straightened spraylines.



Improved behaviour using actual spraylines.



## Improving canopy models in AGDISP



Funded by Lincoln Ventures Ltd/MSI

- Spray coverage of plant canopies influences efficacy and cost effectiveness – especially true for protectant sprays e.g. Dothistroma.
- Models can help define optimal treatments.
- BUT Canopy component of existing model (AGDISP) needs improving.



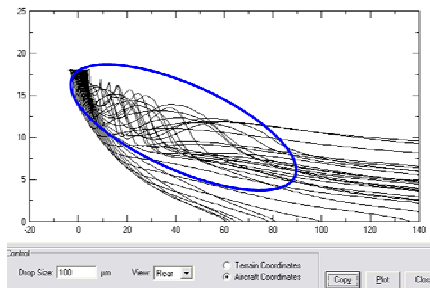
## Zespri Project: aircraft wake study



- Current work focused on kiwifruit canopy following Zespri request.
- How to maximise coverage of copper through canopy?
- Hypothesis: aircraft wake will disperse very fine droplets within the canopy:
  - Creates in-canopy turbulence.
  - Potential to enhance canopy penetration and foliage coverage.

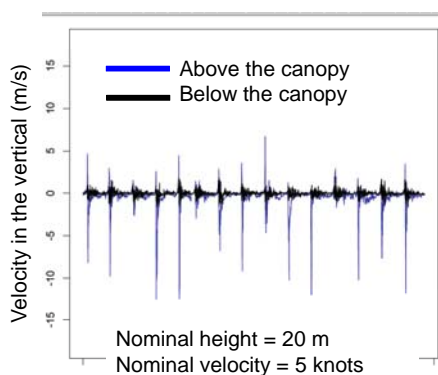


## Modelling canopy / aircraft wake interactions



- Pushes limits of current spray modelling techniques.
- Field study: effect of helicopter type, speed, height on downwash and canopy turbulence.
- Data collected will help to:
  - Improve AGDISP.
  - Provide specification for field trial to test hypothesis.

## Wake study: results to date



- Positive outlook: turbulence below the canopy strong enough to carry fine droplets throughout.
- Treatment specifications defined for field trial.

## Mating disruption for pest eradication?



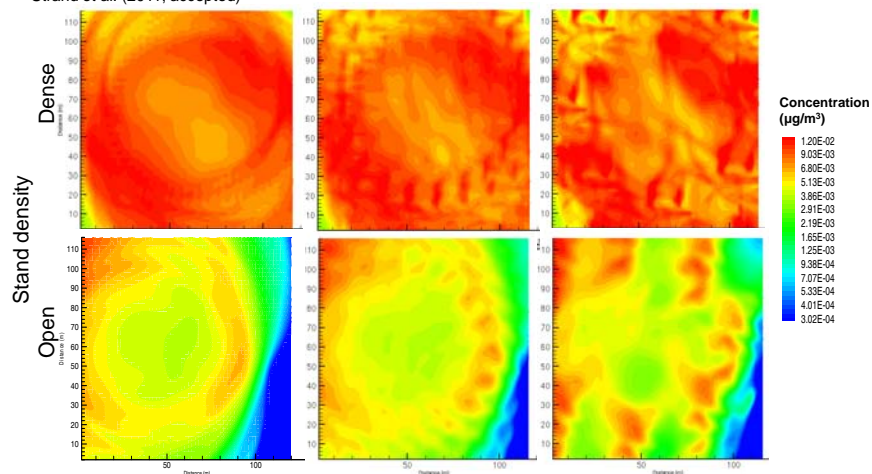
Funded USDA and B3

- Potential method for insect eradication.
- Using pheromones to confuse insects so males can't find females.
- Dispersion modelling used to:
  - Evaluate treatment efficacy.
  - Optimise cost effectiveness of pheromone application system i.e. pheromone 'bait' spacing and amount.



## Model results show potential for reducing cost of application – field trials to take place in USA this summer

Strand et al. (2011; accepted)



Spacing of anti-aggregation pheromone (MCH) bubble capsules

Close -----> Far

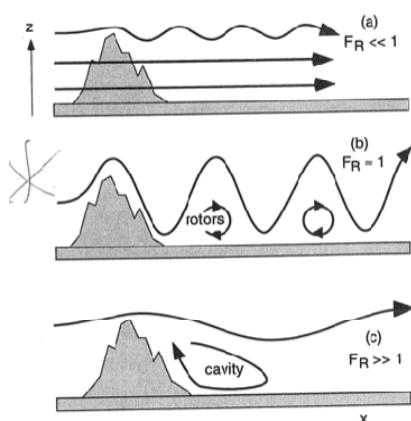


## Finding the right model of MeBr plume transport and dispersion



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## Risks from wind reversal



Air flow pattern is influenced by topography, wind speed and atmospheric stability

- Key issue for managing spray drift.
- Guidance needed to identify when it may occur and how to monitor over long boundaries.

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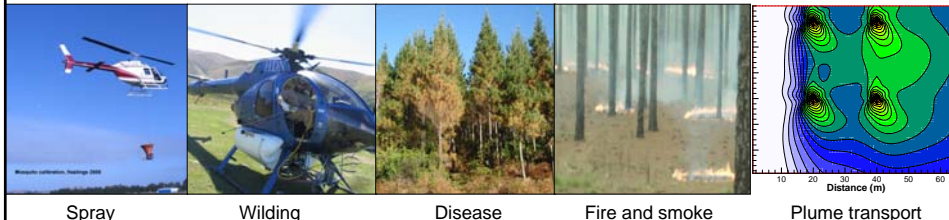
## Disease spread modelling and epidemiology



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## Summary

- Atmospheric dispersion modelling is being applied to improve decision making in many aspects of forest protection.





## Acknowledgements

### Funding:



**STIMBR**  
Stakeholders in Methyl Bromide  
Reduction



### Collaborators:

