Pathogen Dispersion Monitoring

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Funded by:

Foliar Pathology Lab 2019

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FRAME networks

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Revolution Crop Consultants — Amy Peetz

Funding

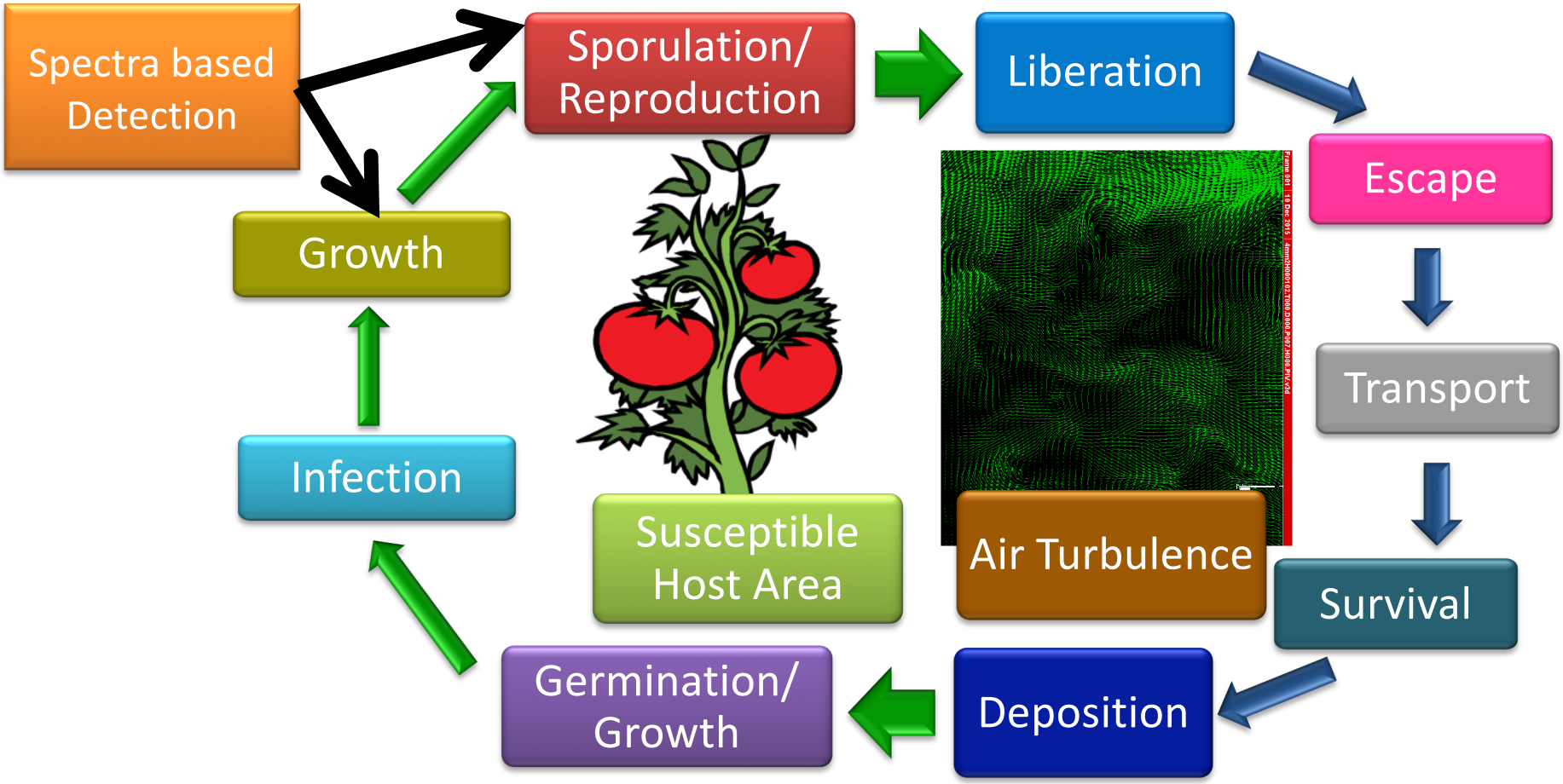
USDA-ARS, Washington Grape Growers Association, Oregon Wine Board, American Vineyard Foundation, Erath Family Foundation Northwest Center for Small Fruit Research USDA-NIFA-SCRI

American Vineyard Foundation · Oregon Wine · Washington State Wine · NIFA

USDA ARS · UC Davis University of California · UC CE · University of Georgia · Washington State University · FRAME networks

Funded by: NIFA · The University of Utah · Michigan State · The Ohio State University · Oregon State University

Pathogen Monitoring



Pathogen Life Cycle

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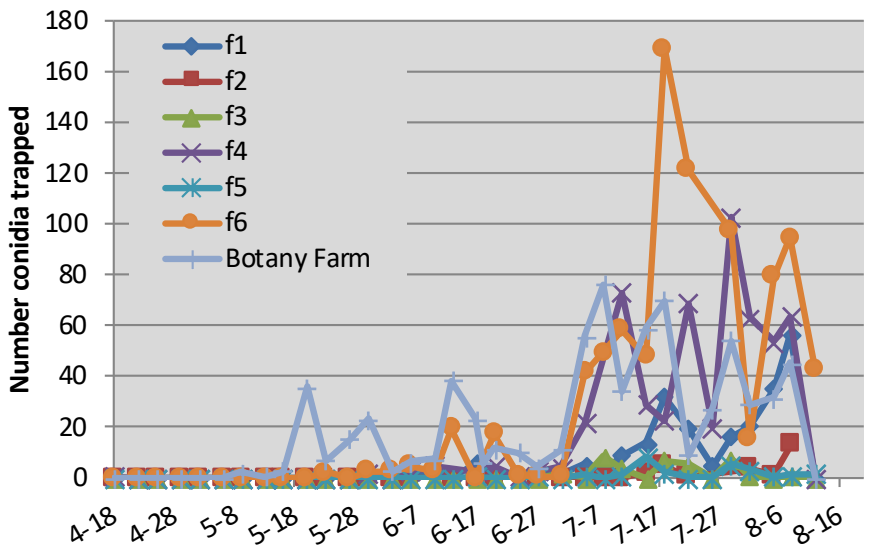
Inoculum Detection as a Decision Aid

Lindsey Thiessen

- An average 2.3 in fungicide applications were saved when initiating fungicide program based on detection
- An additional 1.9 applications were saved when adjusting application interval
- Level of disease control not significantly different between treatments
- Commercially available



Thiessen et al, Plant Pathology 65:235-249; Plant Disease 101:1246-1252; PeerJ 6:e4639

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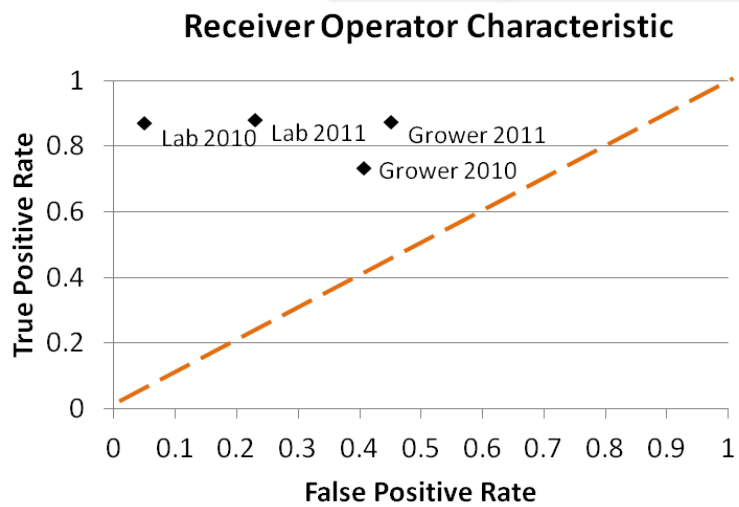
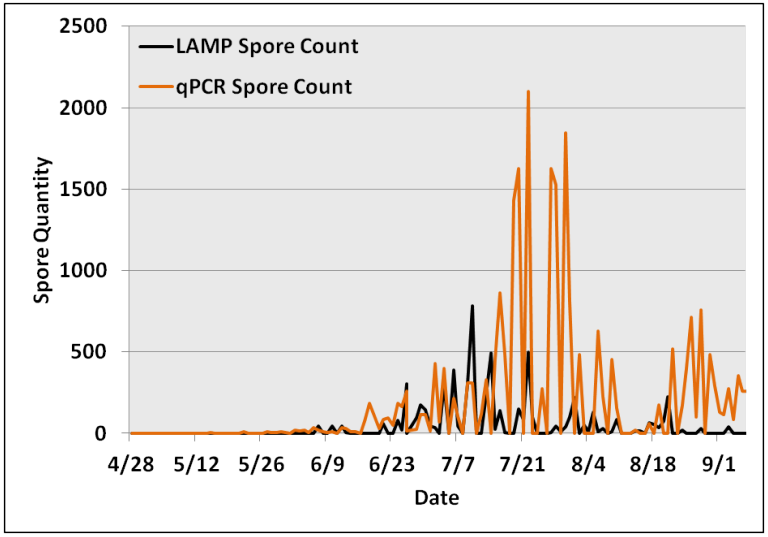
LAMP Inoculum Detection

Lindsey Thiessen

- **2010-2011 Turbidity LAMP**
  - Spray program initiated upon detection
    - Saved on average 2.5 early season sprays
  - Lab performance is comparable to quantitative PCR
  - Grower performance less accurate but still suitable for early season detection
- **Quantitative LAMP**
  - Semi quantitative
  - More susceptible to inhibitors





Thiessen et al, Plant Disease 101:1246-1252; PeerJ 6:e4639

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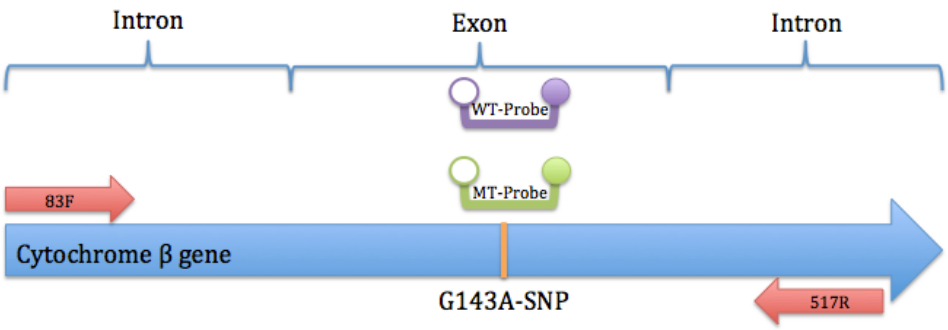
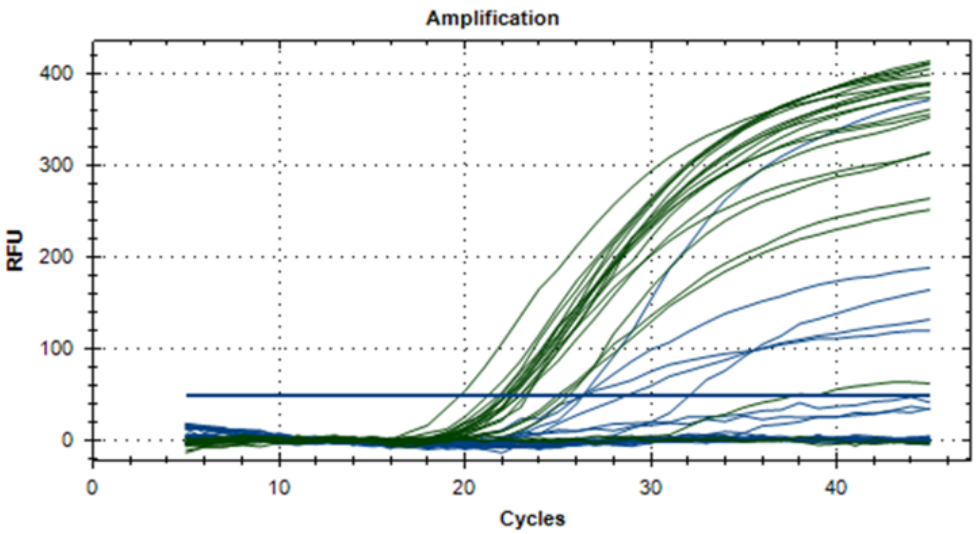
Molecular Detection of QoI Resistance

- Single nucleotide mutation (G143A)
- Developed TaqMan qPCR competitive Assay.
- Sensitive to a single spore
- 100% agreement with bioassay





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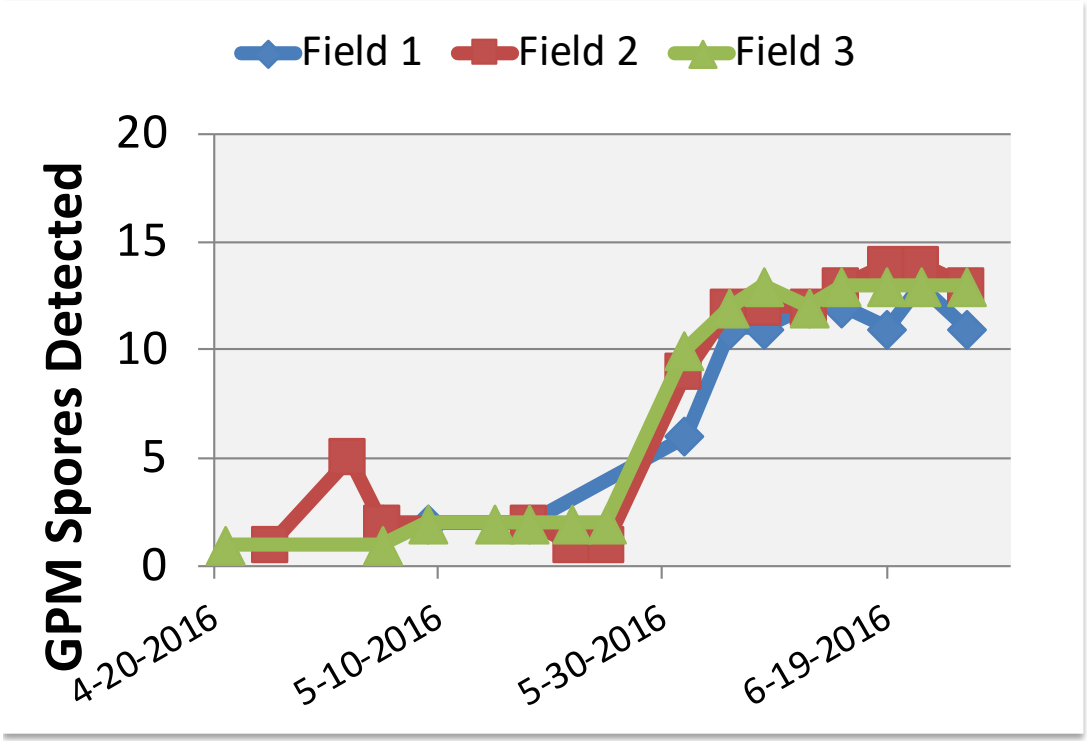
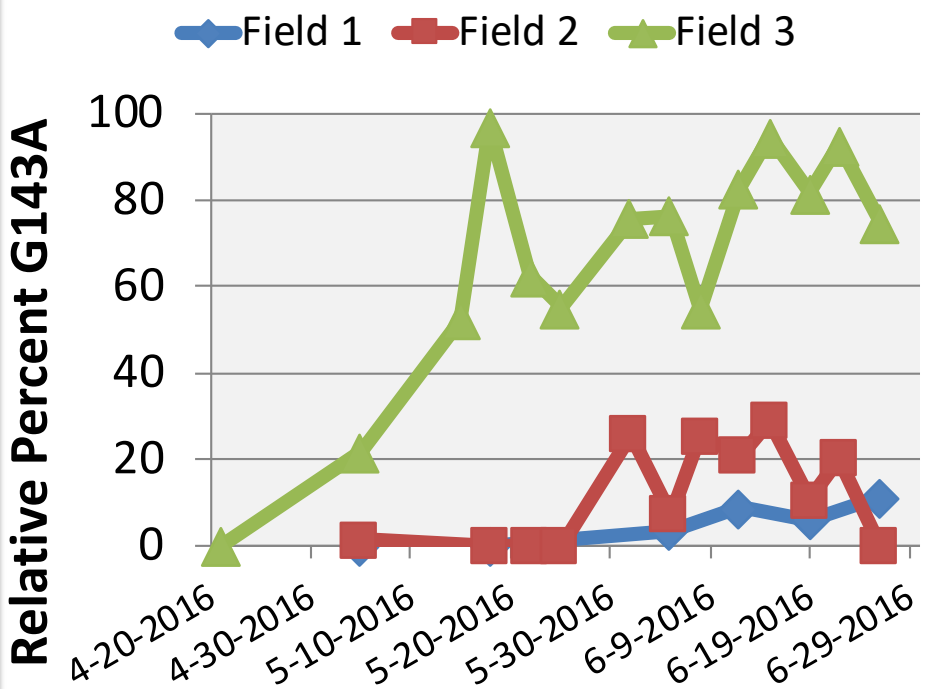
2016 QoI Field Resistance Monitoring





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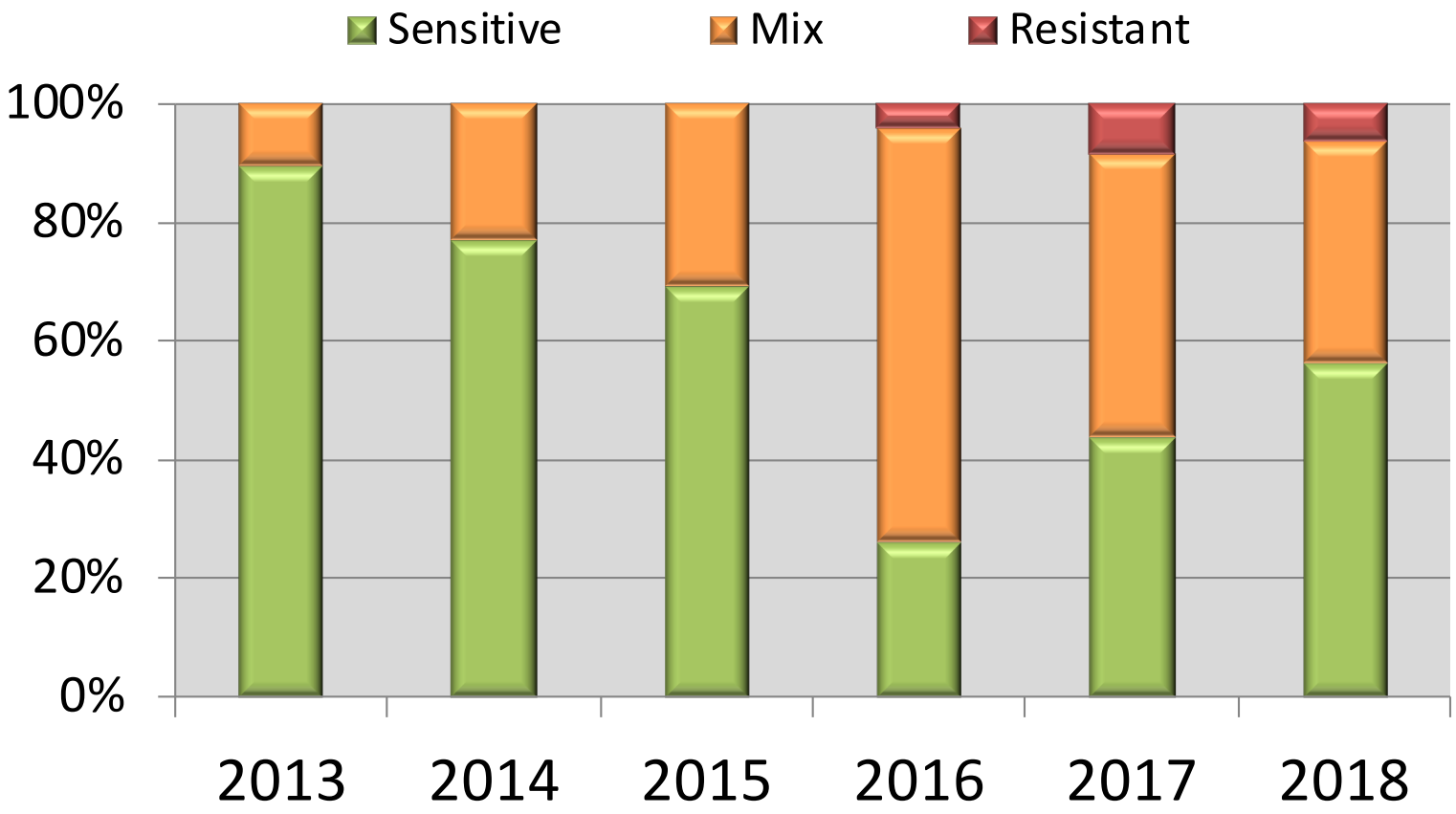
Allele frequency in Oregon Vineyard Air Samples



Summary of samples from 9 vineyards that used QoIs prior to 2017

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Sampling Field Crew Gloves

Sarah Lowder
230-P1

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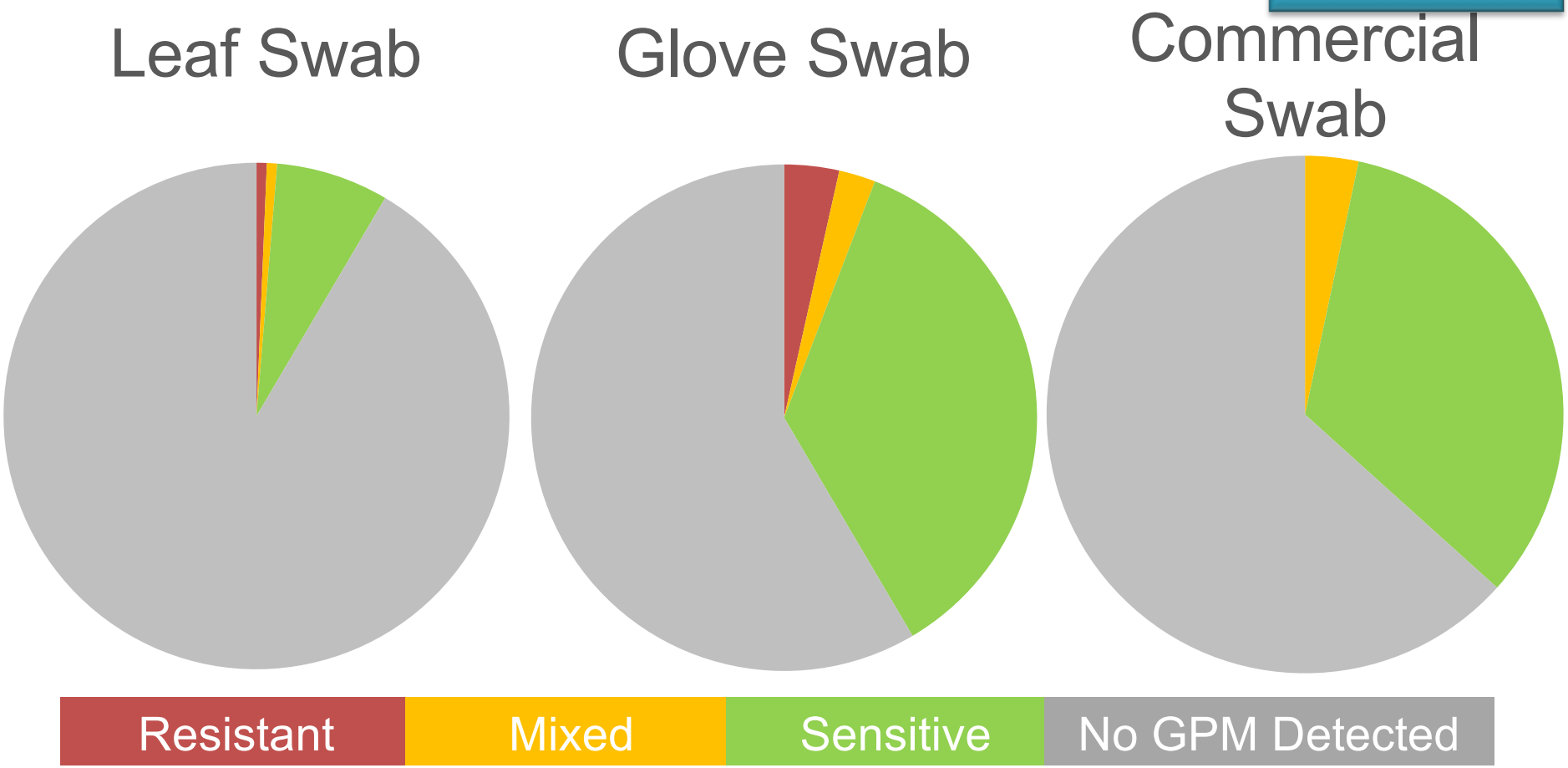
Are workers suitable?

Sarah Lowder



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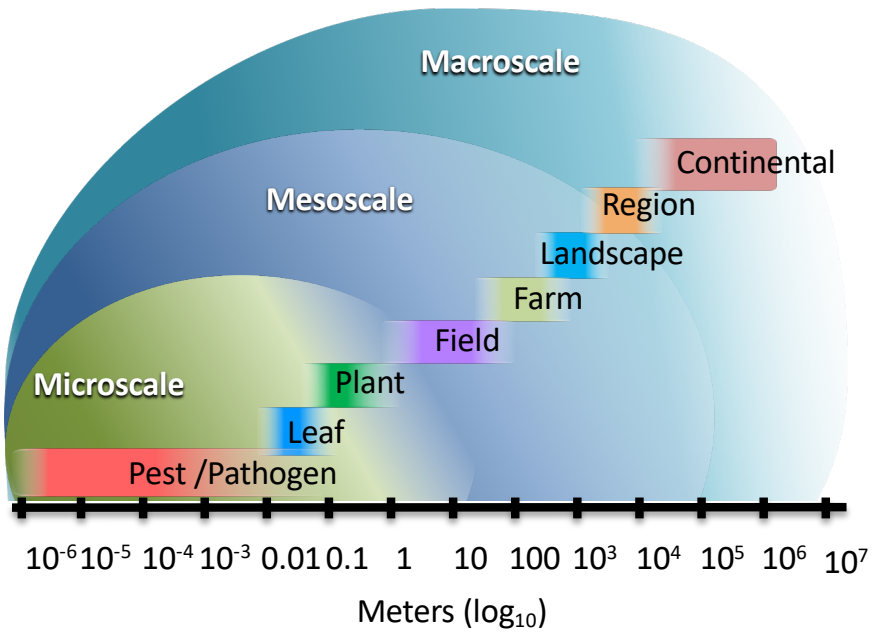
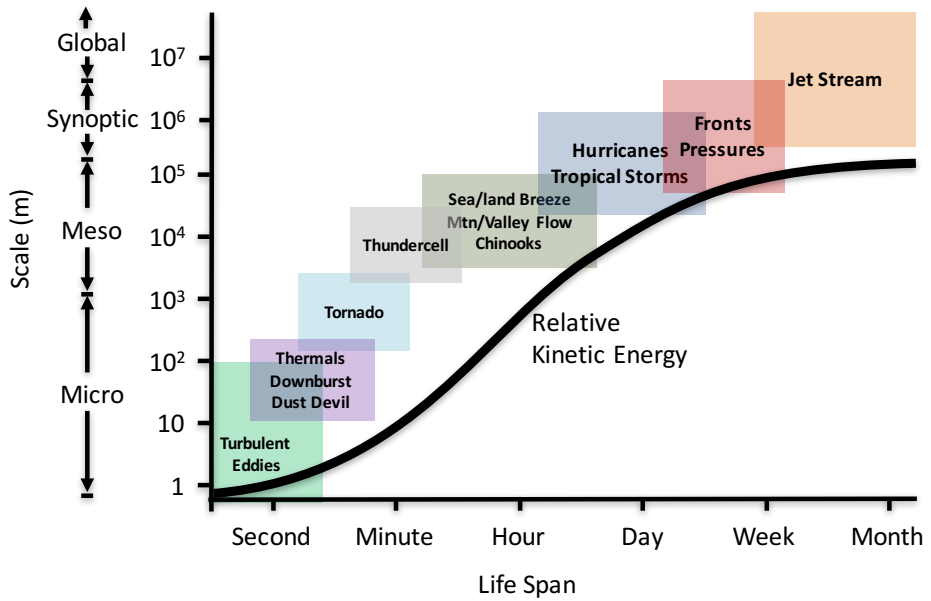
Scales of Pest Dispersion

- **Multiple spatial and temporal scales must be considered.**





Adapted from Laing and Evans, 2011

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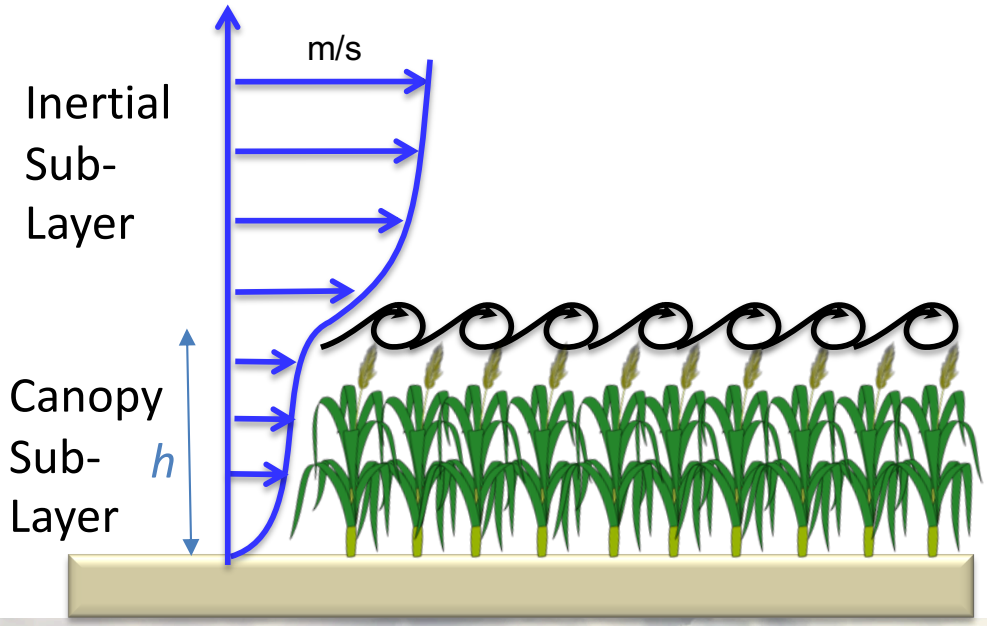
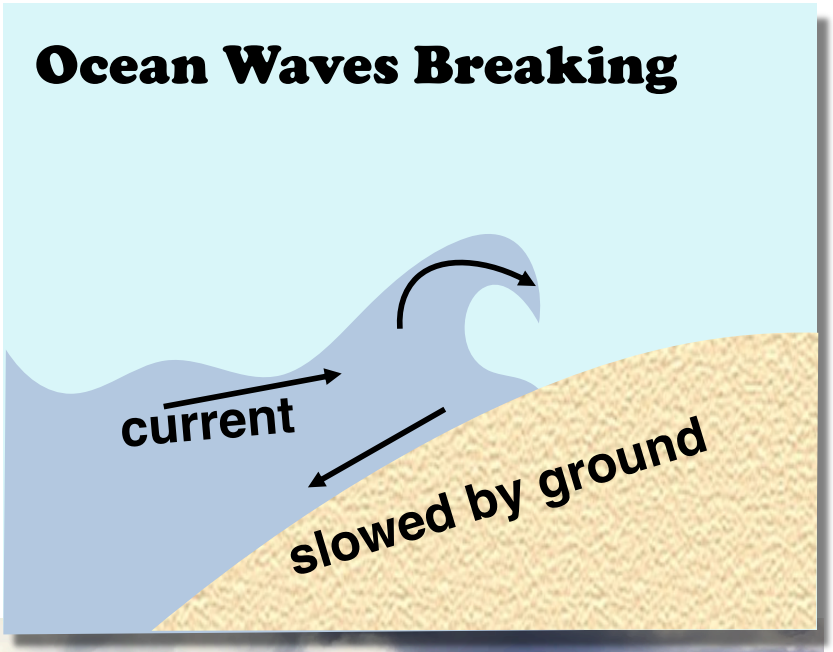
Turbulent Structure Formation





Vortices will Create Tension that Interacts with Surface Topology

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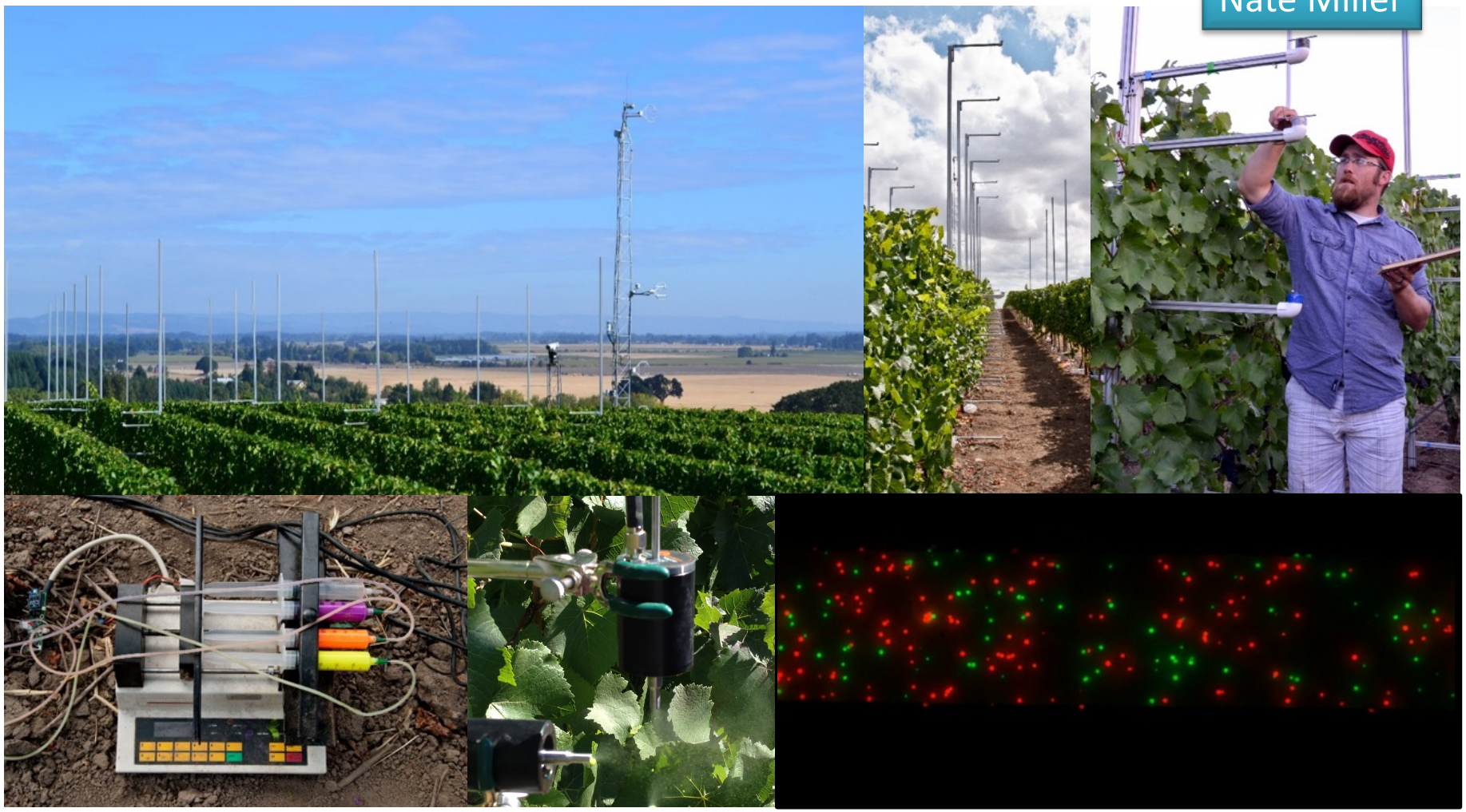
Crops have Structure

Some more so than Others

Pathogen dispersion

Nate Miller



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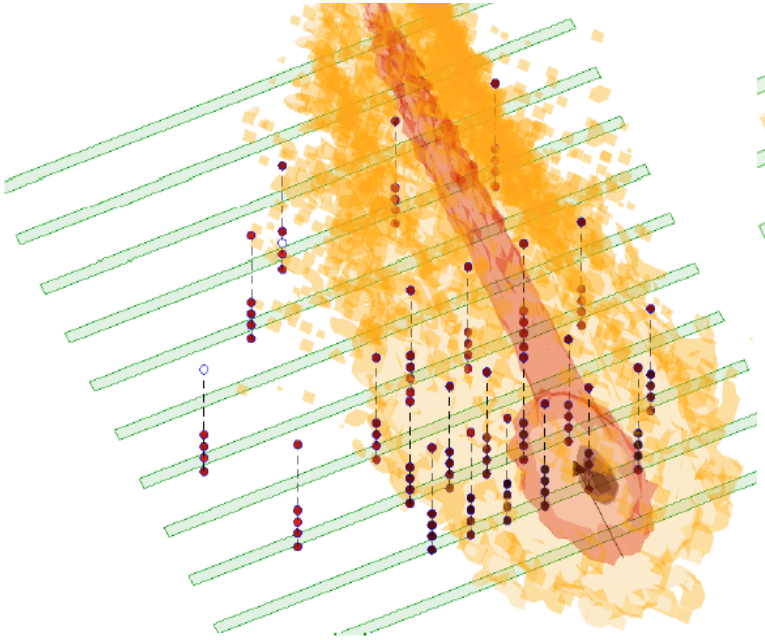
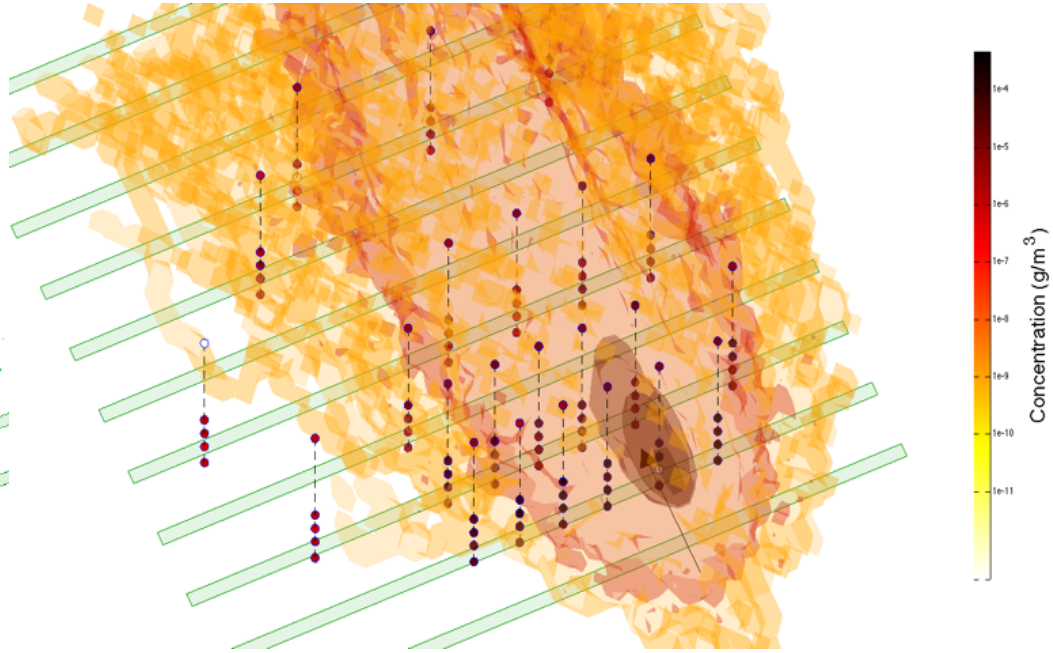
Dispersion Plume

Lucas Ulmer

QUIC
simple row geometry



QUIC
Modified for Row Geometry



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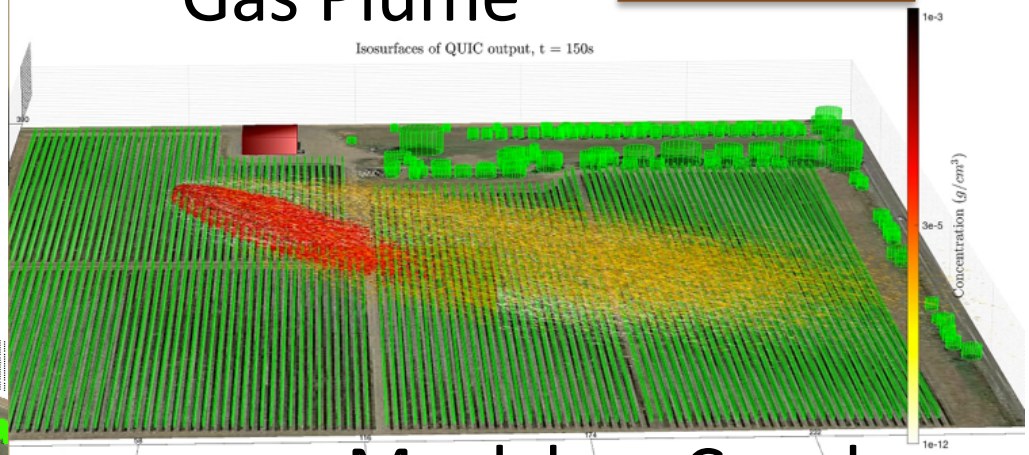
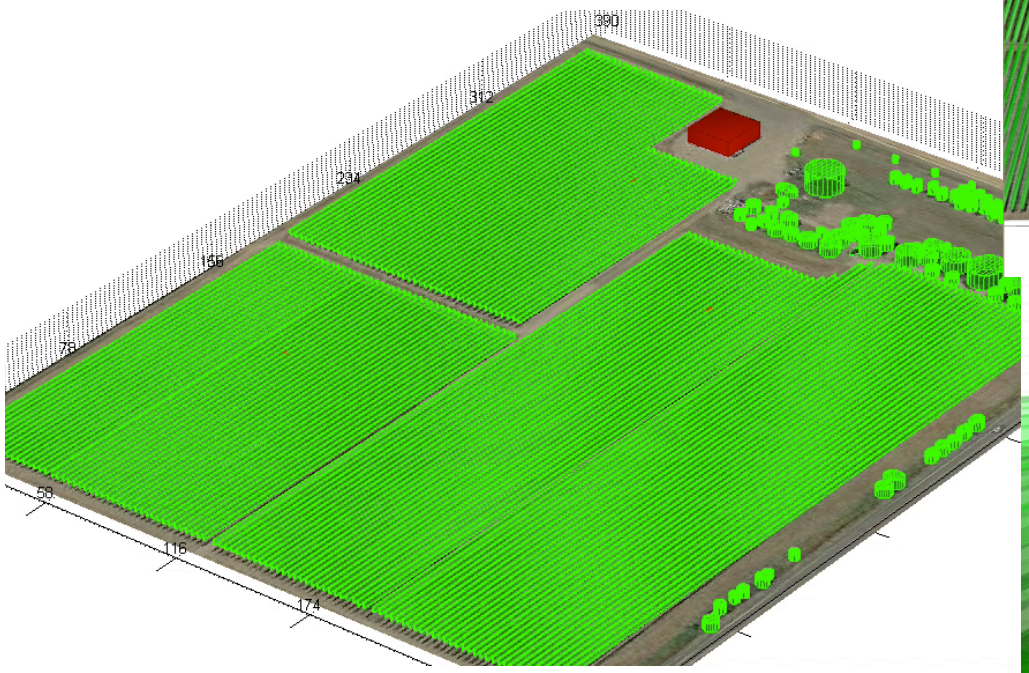
QUIC Dispersion Prediction

Lucas Ulmer

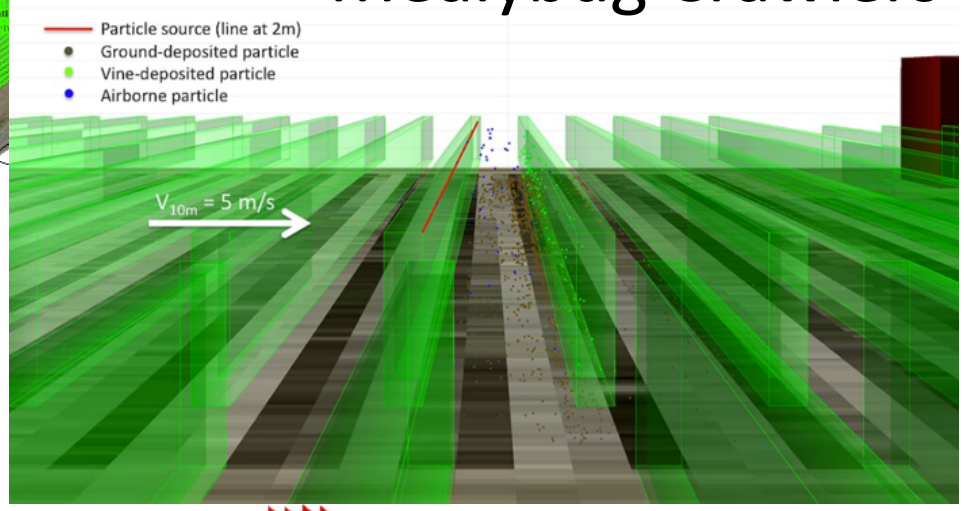
Gas Plume



Spore Plumes



Mealybug Crawlers



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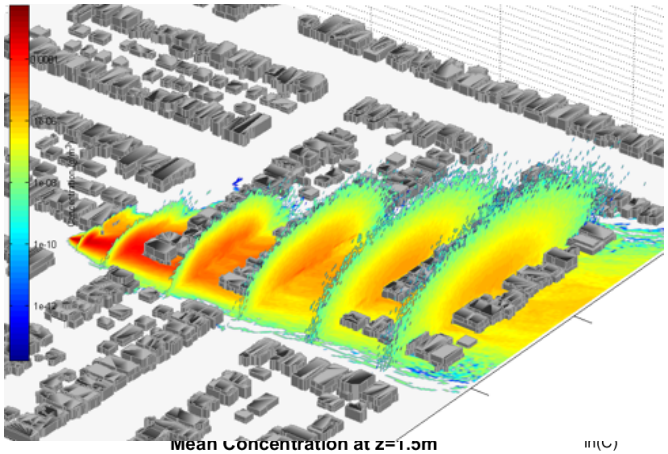
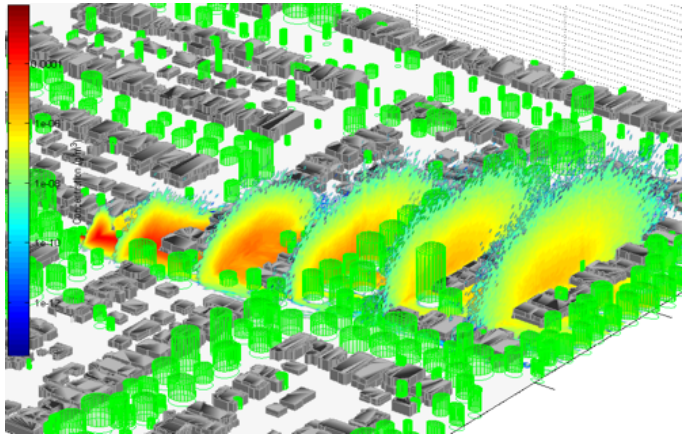
QUIC-Plume spread

- June, 22nd release, early afternoon, winds at 249°

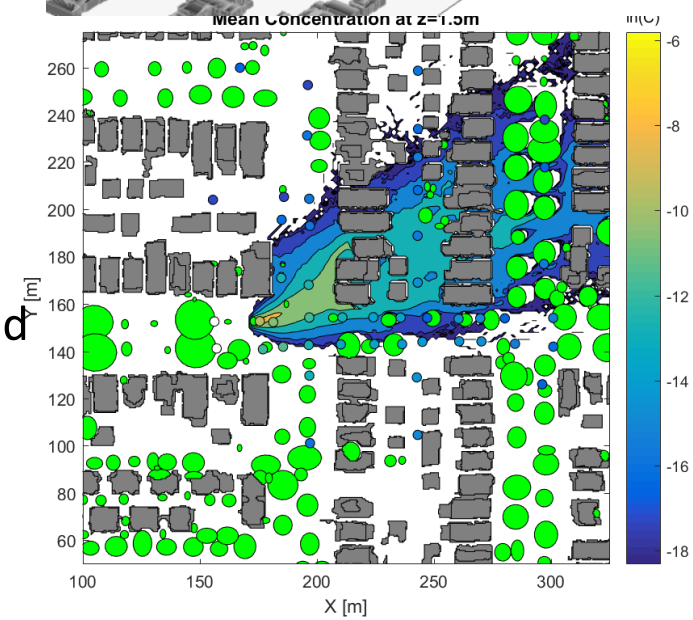
Without Trees

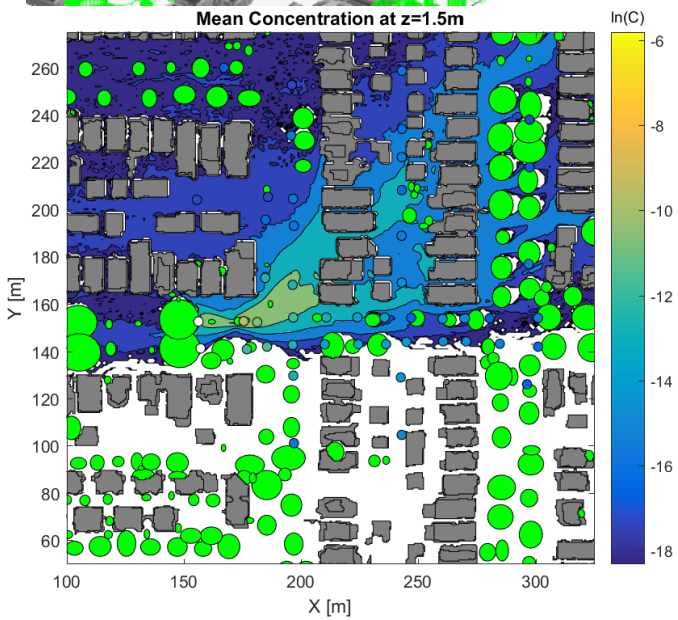




With Trees

Time Averaged Winds





Time Resolved Winds

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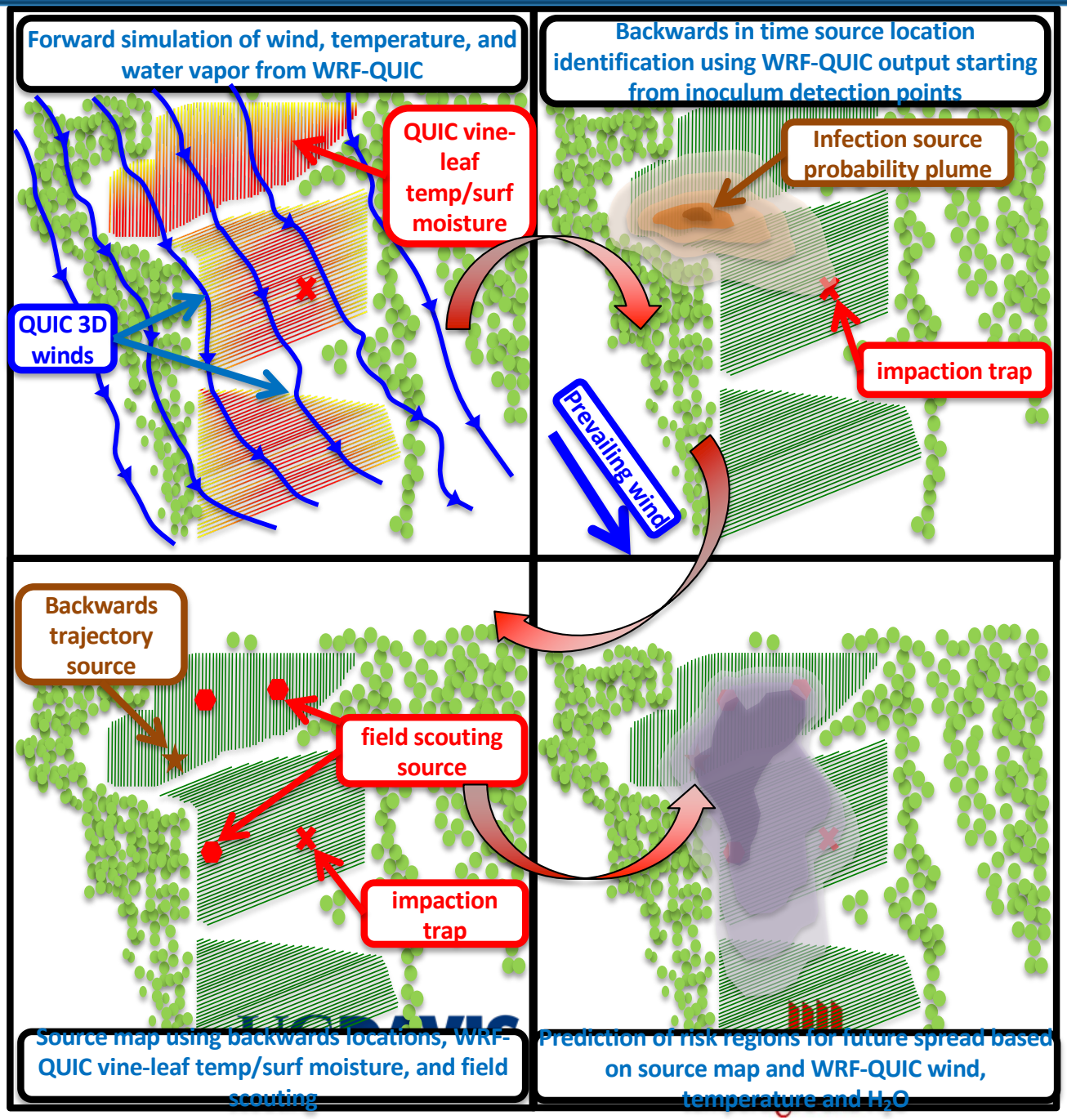
Forward and Back casting



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Simulating Disease Development

Brian Bailey

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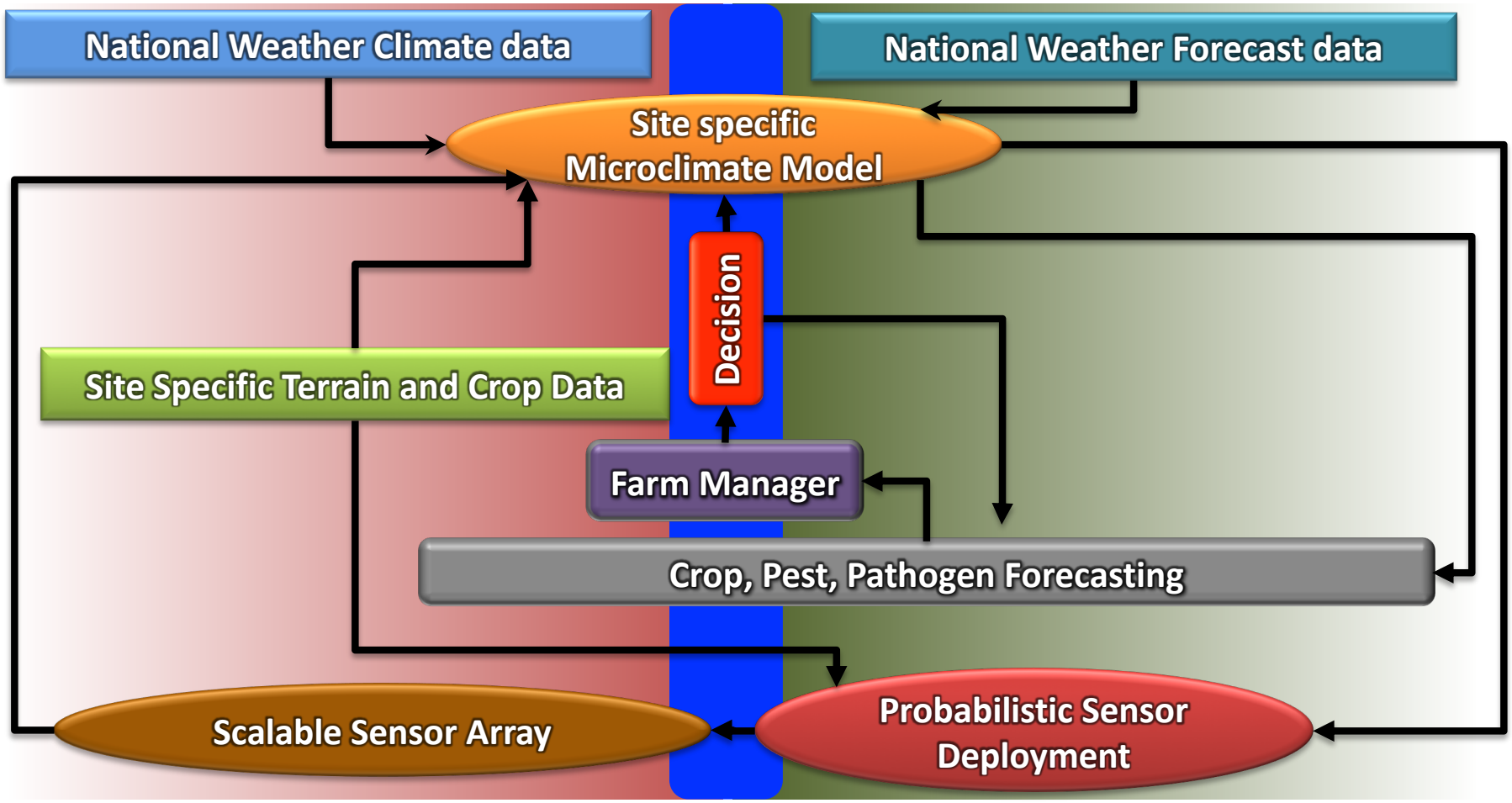
Ag-RISCS



Past **Present** **Future**

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Any Questions

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