

Disease climatic risk model interpretations at multiple spatial scales

**Can remote sensing provide microclimate or
plant growth measures to improve predictions
for epidemiological process?**

Rebecca Campbell, MBIE Science Whitinga Fellow

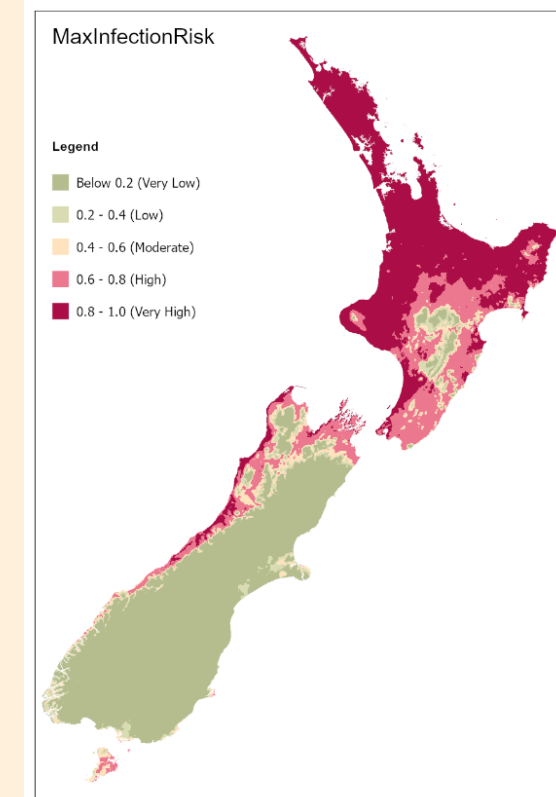
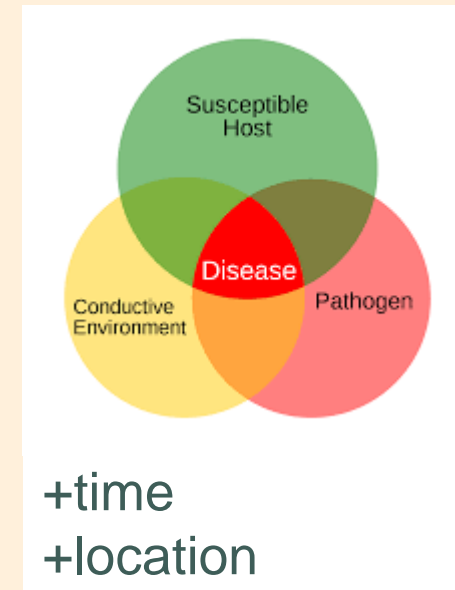
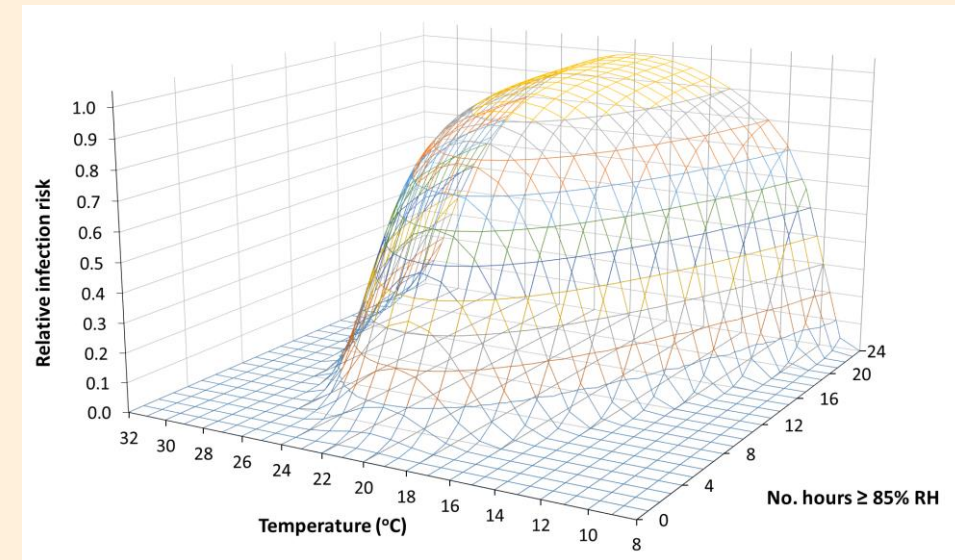
Robert Beresford

Episense satellite meeting, August 2023



Climatic risk models

- Different resolution data, used for different purposes
 - Process model, hourly weather data
- Often used for:
 - Assess risk of invasions
 - Inform management actions
- How sensitive is interpretation of these models to
 - Different sensors
 - Locations and microclimate
 - Plant responses
- **Can remote sensing data help these applications?**
- What does this mean for our use and development of risk models?



The case study disease – Myrtle rust

- Tropical – warm temperatures, moisture/humidity
- Existing climatic risk model – process model
- Dry dispersed - wind
- Infects Myrtaceae (many host plants, perennial, woody)
- Actively growing susceptible plant tissues (young growth)
- Case study plants
 - Rōhutu, *Lophomyrtus obcordata*



Study site – Nelson, Te tau ihu



- Indigenous planting restoration areas
- Edge gradients into existing native forest patches
 - Small patches, disturbed bush

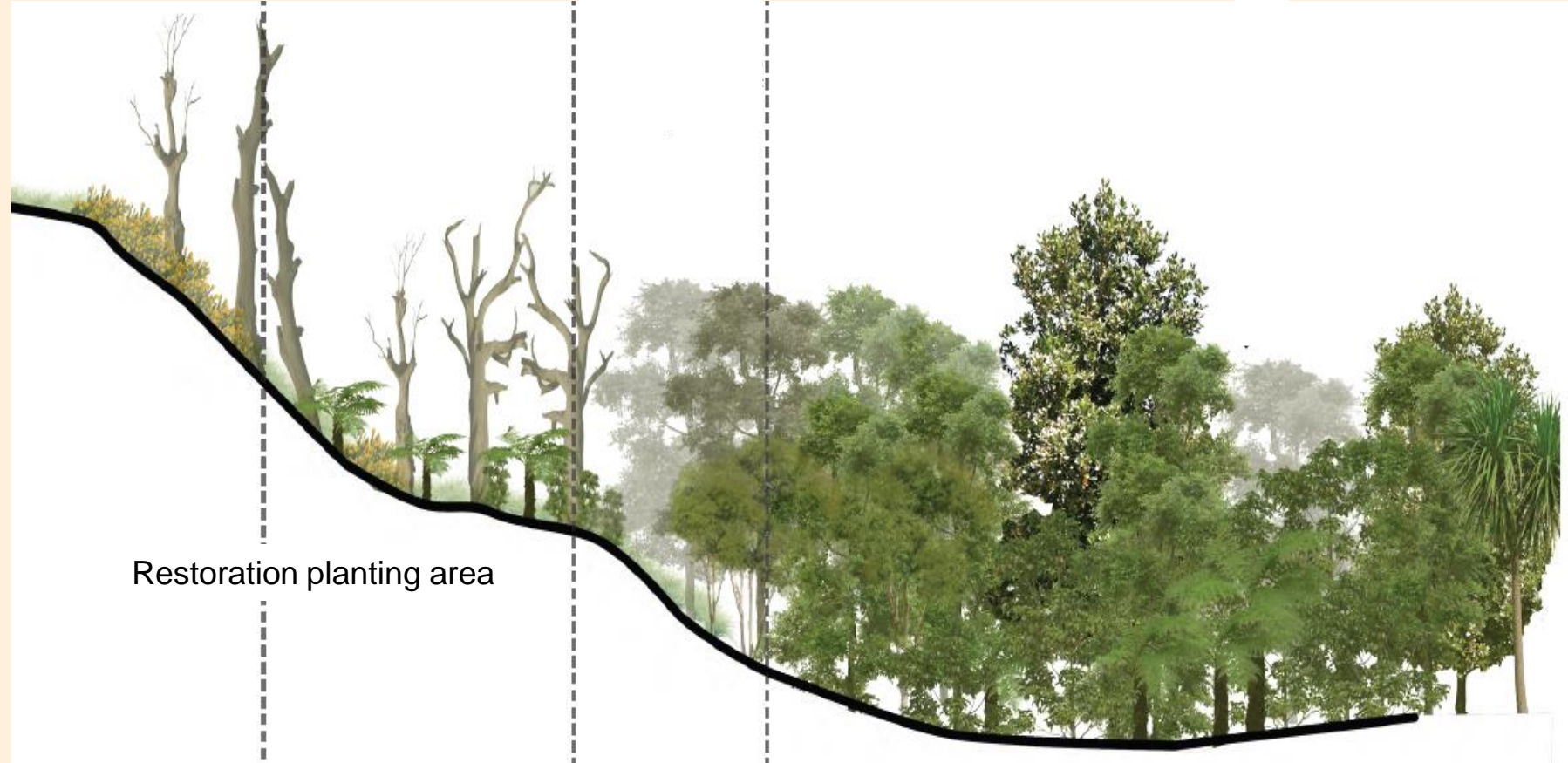
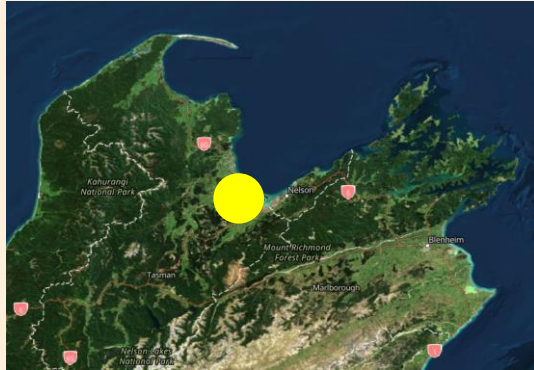


Image: Kūmānu Environmental (2021)

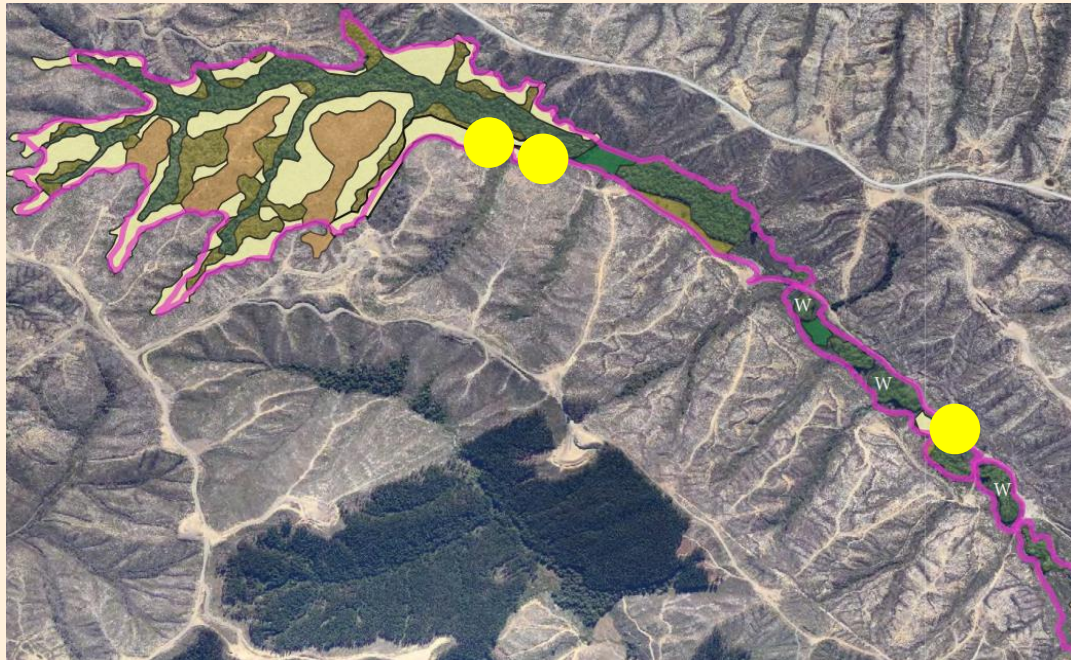


- Within pine forestry plantation

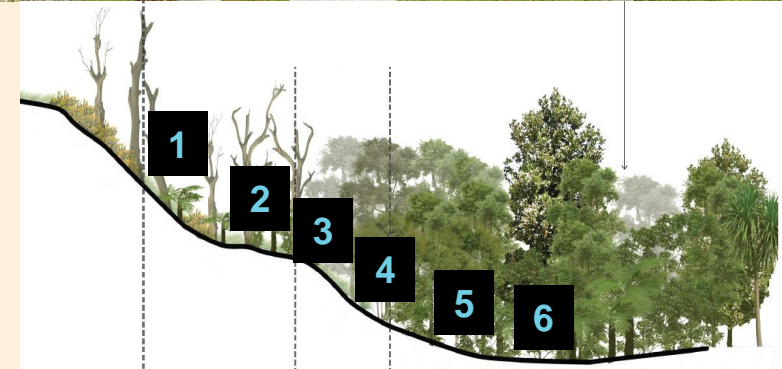
Scales of plant, pathogen, environment



Region



Valley



Transects (x 3, 6 distances across edge)

Scales of plant, pathogen, environment



Plant - Rōhutu
(x3 at each distance)



Branchlet
(x5 on each plant)



Growth tips
(count of active leaf emergence,
dieback, fruit, flowers, etc.)

Comparing sensors, housing, set up

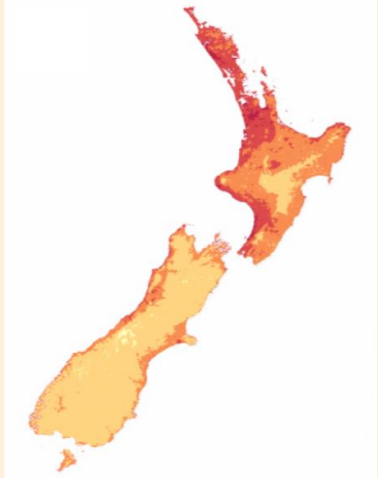
Regional weather station (Metwatch)



Local weather station (Campbell Scientific)

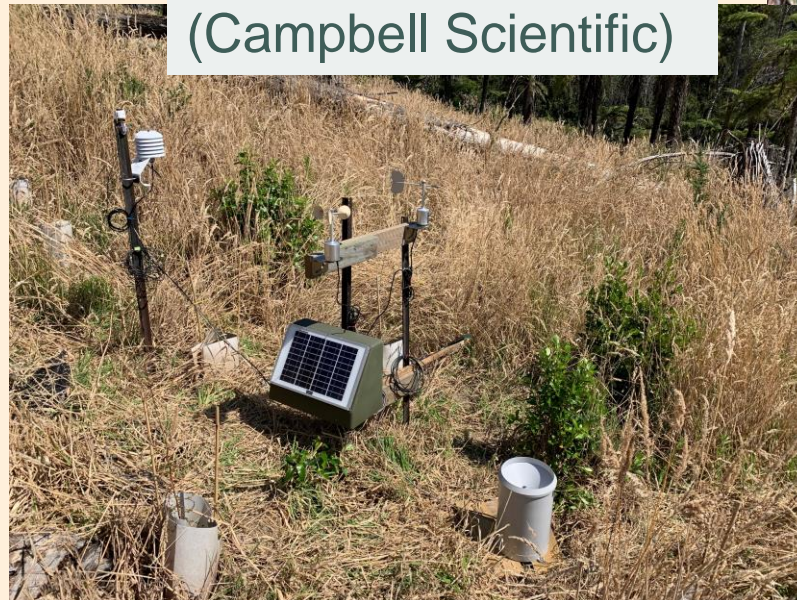


Microclimate sensors (Xsense)



National grid (NZCSM, NIWA)
1.5km grid

Remote sensed data?



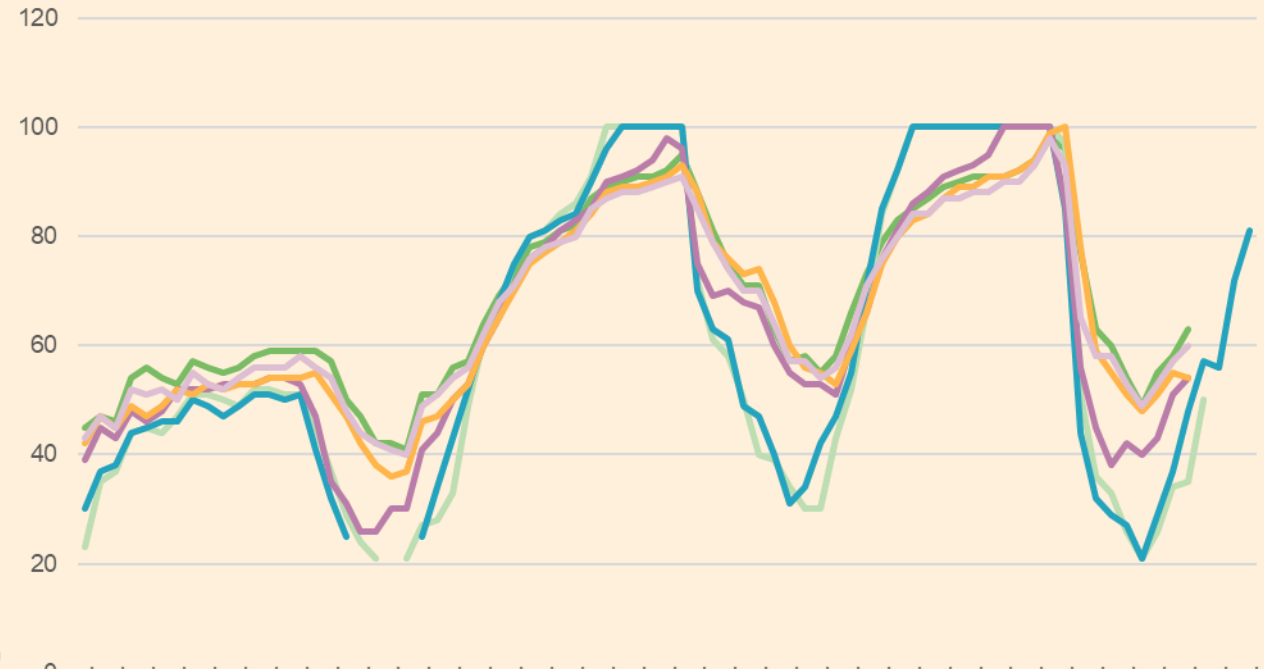
Local microclimate at a forest edge



Air temperature (°C)



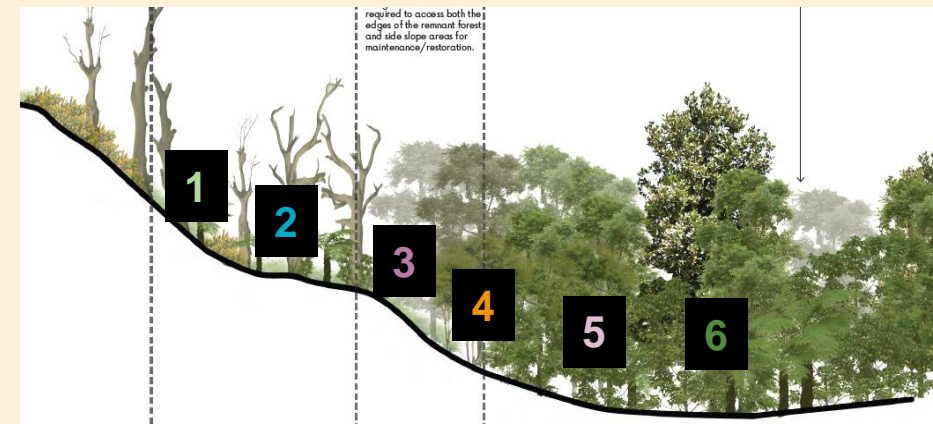
Relative Humidity (%)



Time (hourly)

Distance

- 1 (light green)
- 2 (teal)
- 3 (purple)
- 4 (orange)
- 5 (light purple)
- 6 (green)

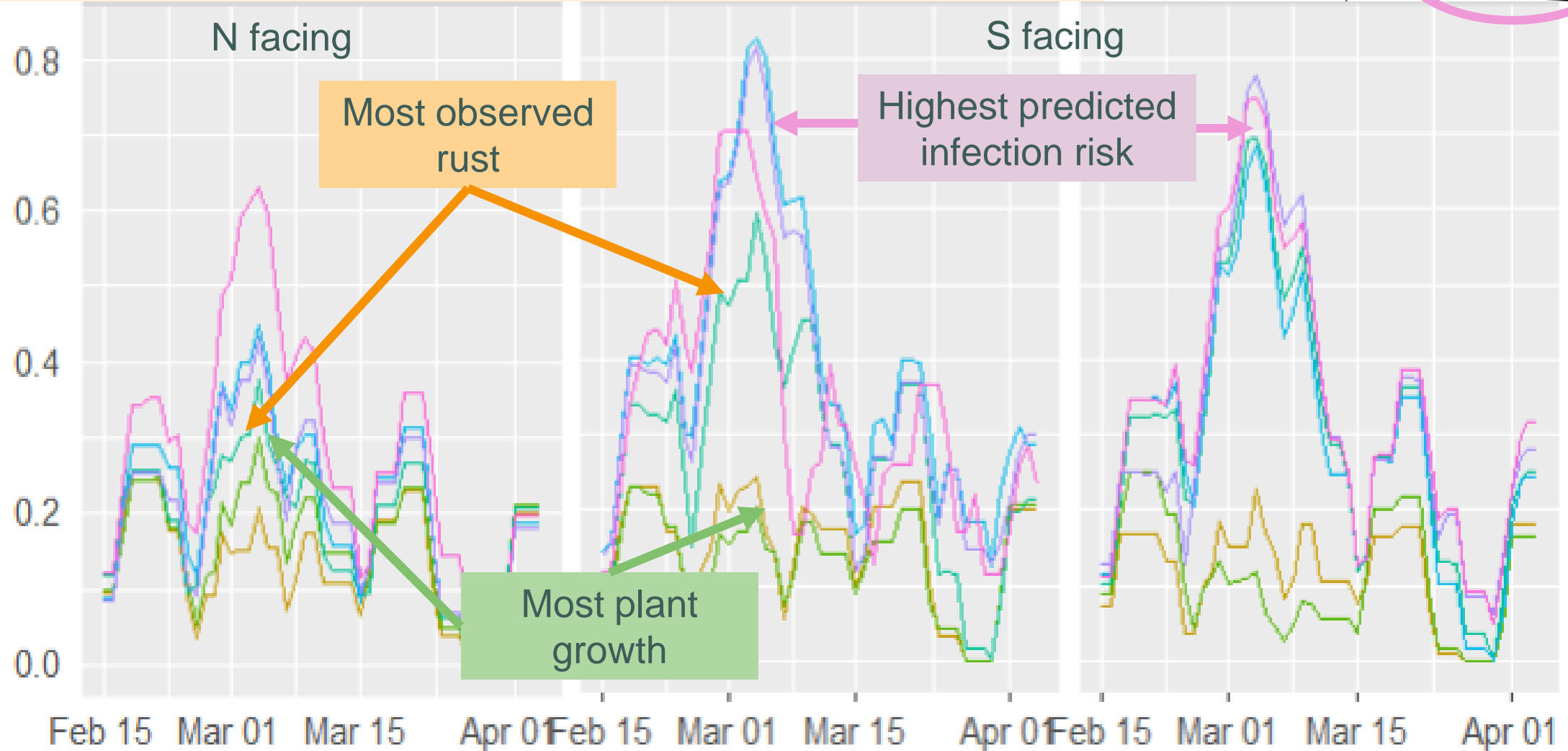


Modelled infection risk

3 transects

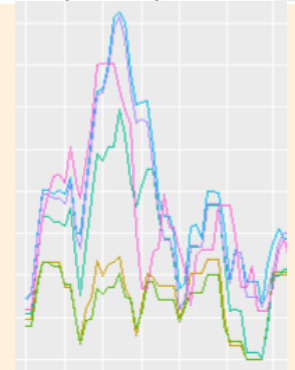
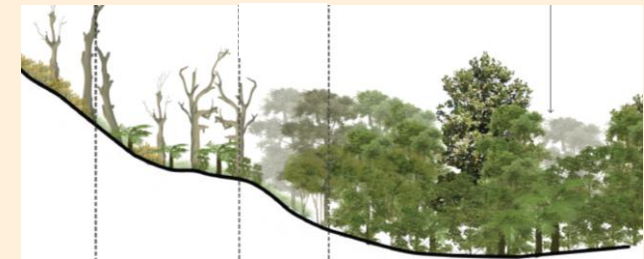
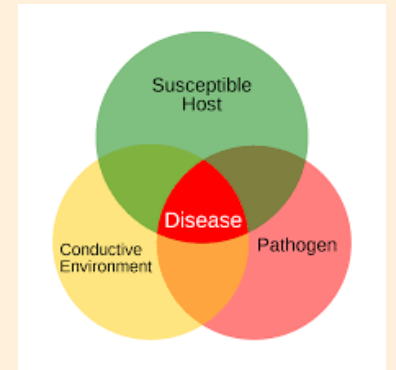


Infection risk index (mean over last 7 days)

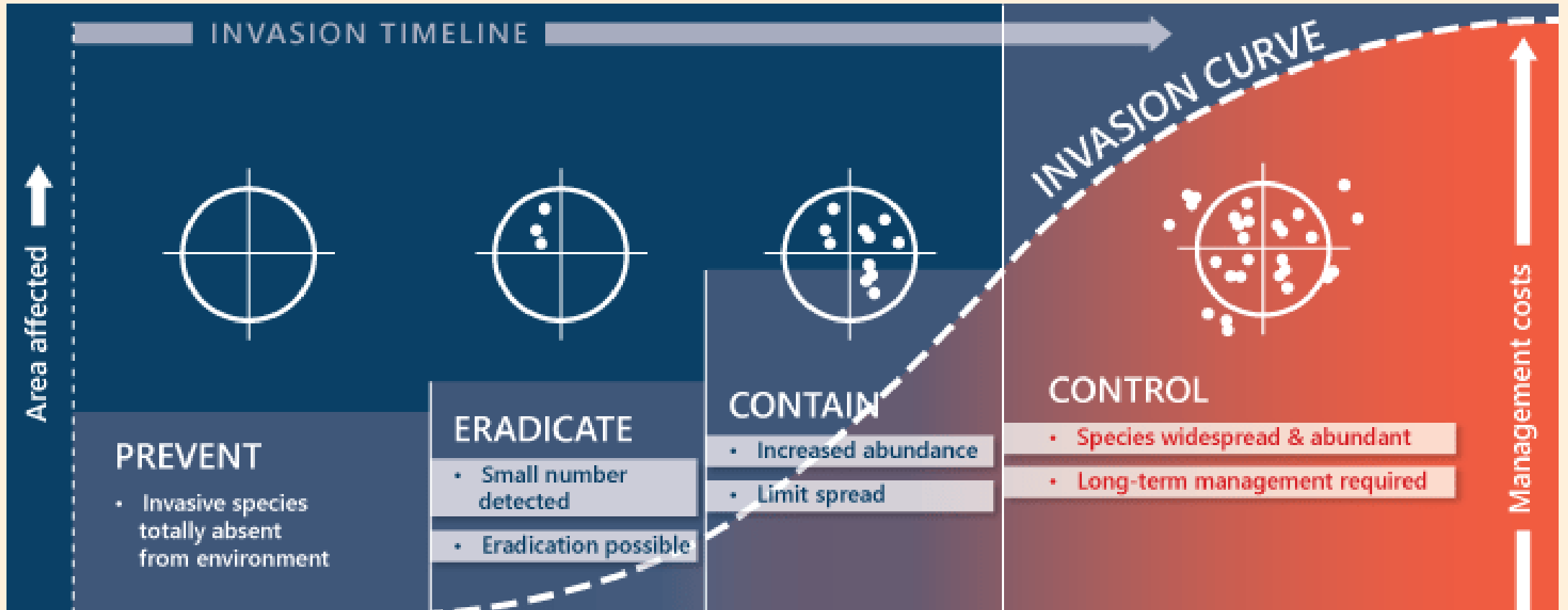


Influence on model output & interpretations

- Difference between sensors less than differences from edge to interior
 - Closest Metwatch weather station at least 10 km away
- Infection risk and plant growth/susceptibility different across the forest edge
 - Risk higher further into forest away from edge
 - Interactions with plant growth – plant growth higher at the edge
 - Rust more prevalent at the edge and just inside the edge
- Large amount of disturbed or ‘edge’ habitat in NZ
 - Implications for disease risk and management
 - E.g. *Xylella* vectors, invasion at edges, habitat disturbance
 - Effective length of disease ‘season’
- Magnitude of differences in risk across the forest edge are large enough to trigger different management choices (e.g. decision support, thresholds)



When do risk models help, what scale of precision and accuracy are needed for each?



Better outcomes if higher resolution modelling?

What is the intended purpose of the model?

What resolution is biologically meaningful?

Optimise when and where to look and manage?

What resolution is meaningful to management?



Fiona Ede



B3

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Thank you

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