Multi-scale modeling of infection pressure from *Phytophthora infestans*.

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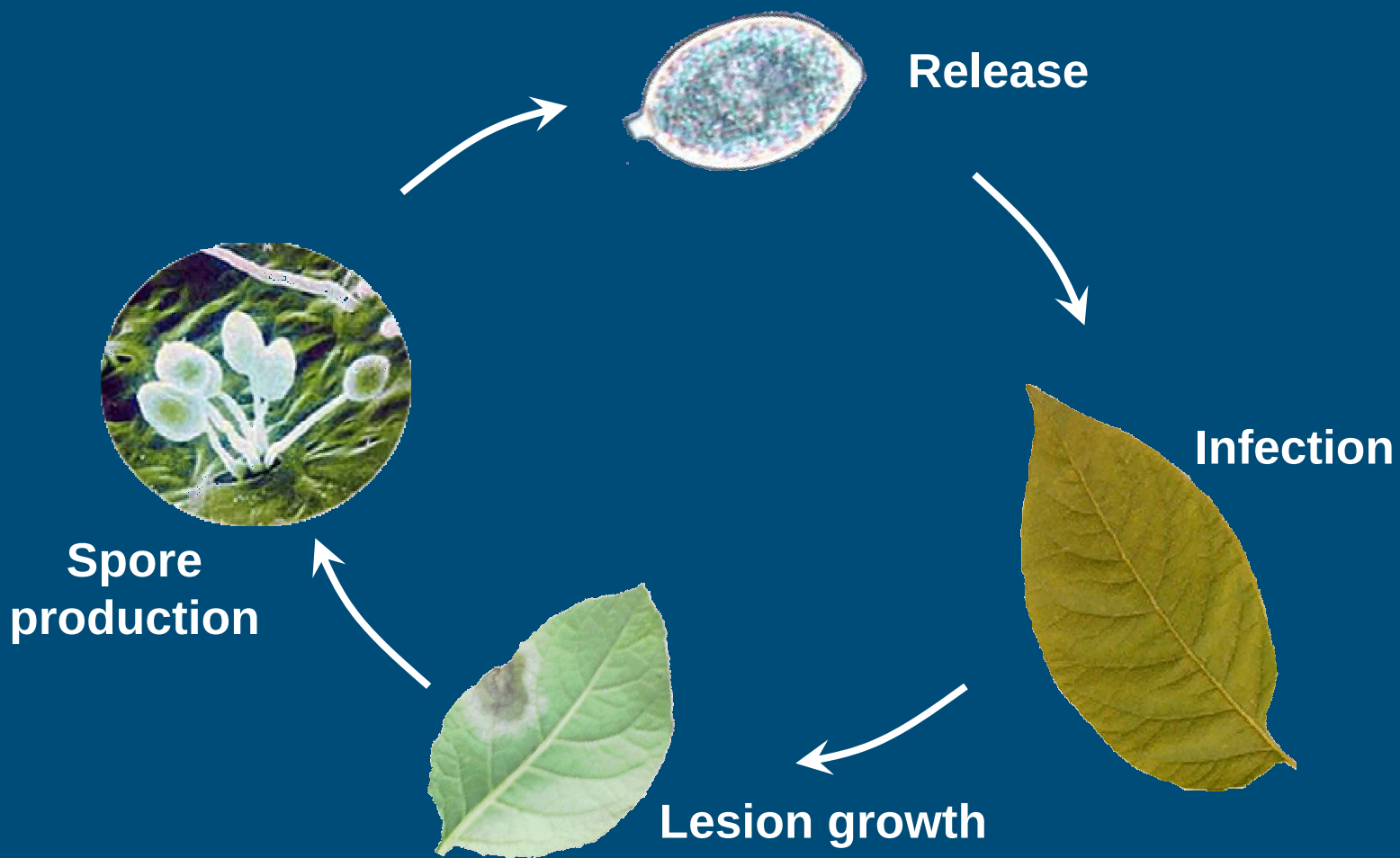
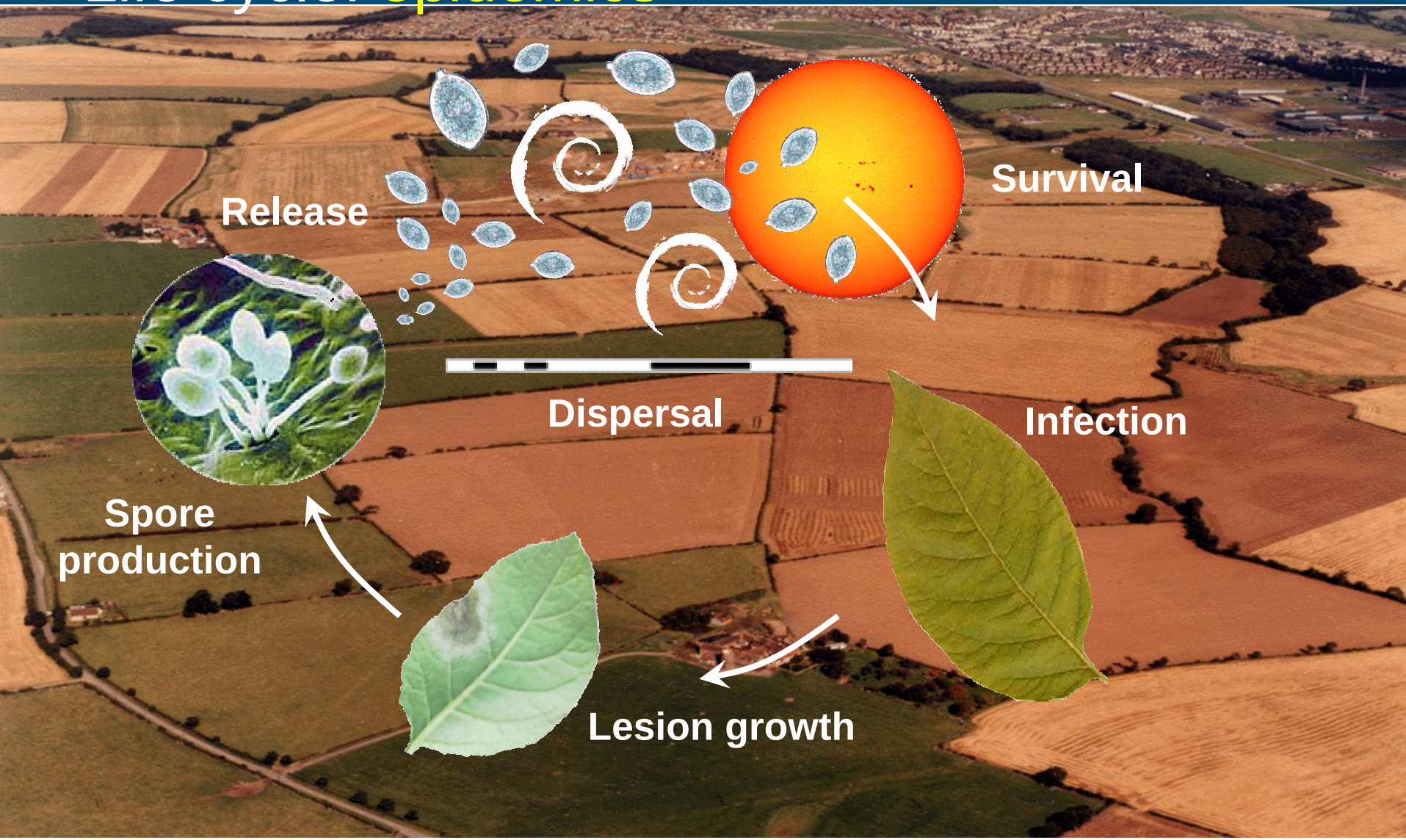
Life cycle: disease development on a plant



Life cycle: epidemics



Research objectives:

1. Improve understanding of the spatial aspects of PLB.
   - Developed and validated a potato late blight model.
   - Developed and validated a spore dispersal model.
   - Validated model for the survival of *P. infestans* spores (Mizubuti et al., 2000).
   - Integrated sub-models = multi-scale experimental arena.
2. Use our models to strengthen the predictions of DSS

   - *also investigate strategies for deployment of resistance genes.*

What level of incoming spores poses a threat?

- Is there scope for including dispersal models in DSS?

  ....*a single spore is all you need* – no model is that accurate!

- BLIGHTSPACE – Consequences of different spore loads?

1. Viable spore deposition (15 levels).
2. Epidemic development (weather / resistance / fungicide / inoculation).
3. Yield (early / late).

● = healthy crop

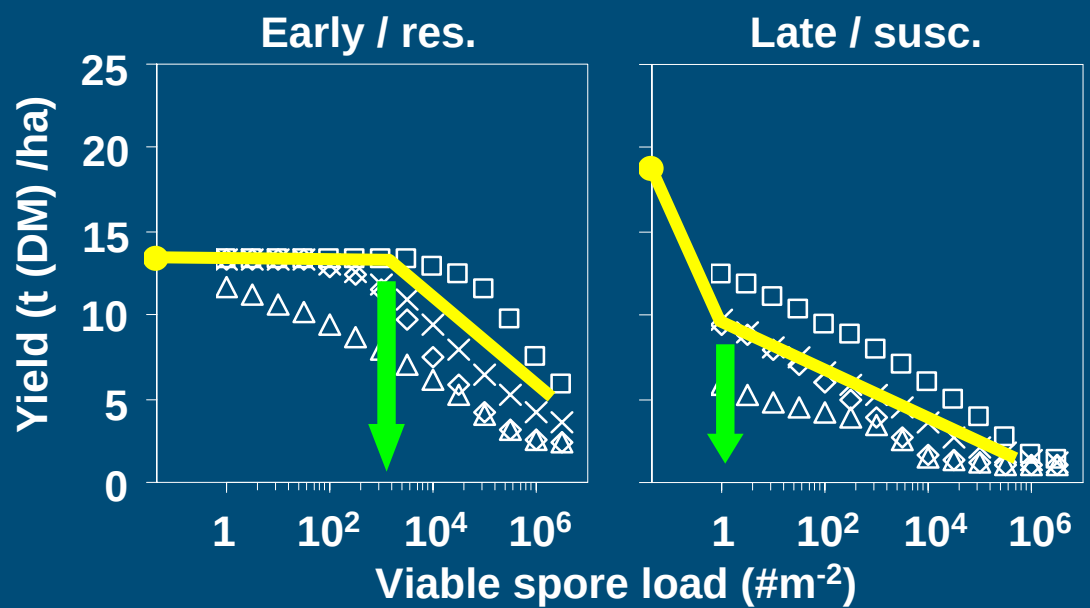
Fungicide regimes:

□ = adaptive (e.g. DSS);

× = spray every 7 days;

◇= adaptive, 1st spray is missed;

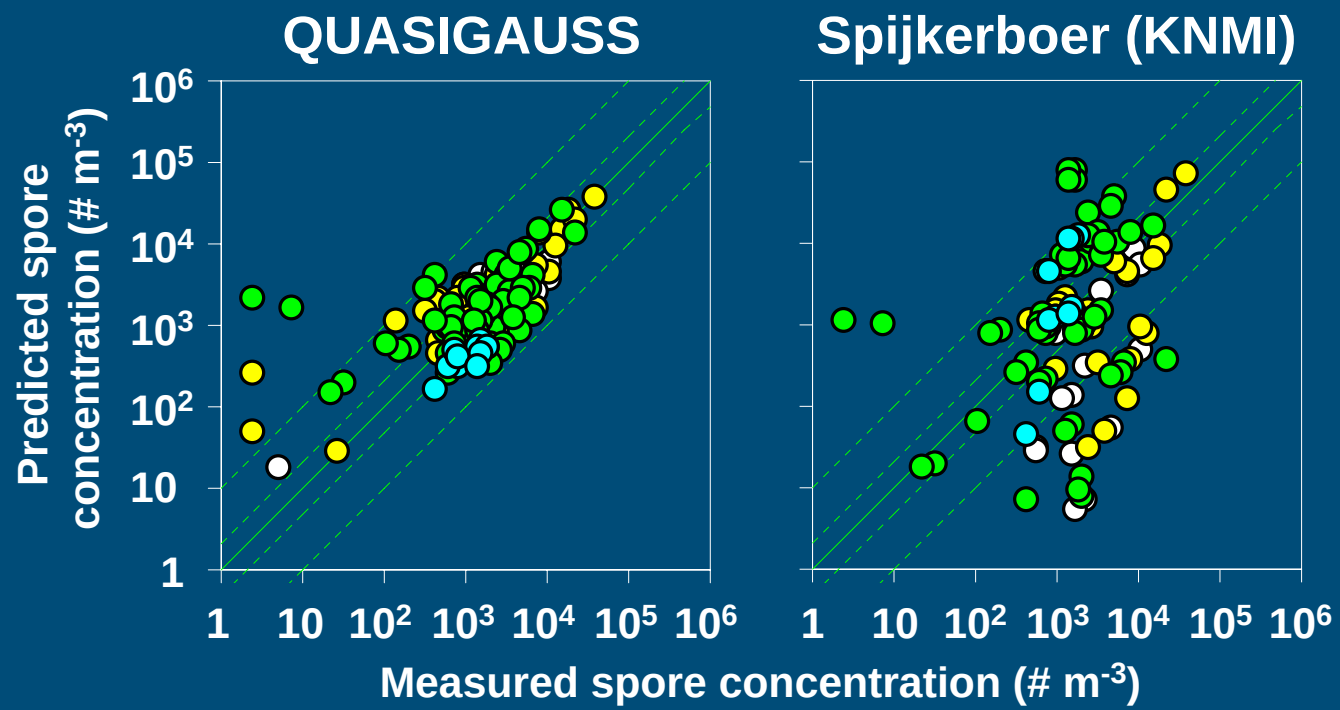
△ = no applications



Between field transport

- Model must be analytical, physically realistic, relatively simple.
- Approach - treat horizontal and vertical dispersal differently.
- Hybrid, or quasi-Gaussian plume model.
- Validated against spore trap data (Spijkerboer et al., 2000):
  - Lycopodium clavatum spores
  - 18 measurement sessions

Validation of dispersal model

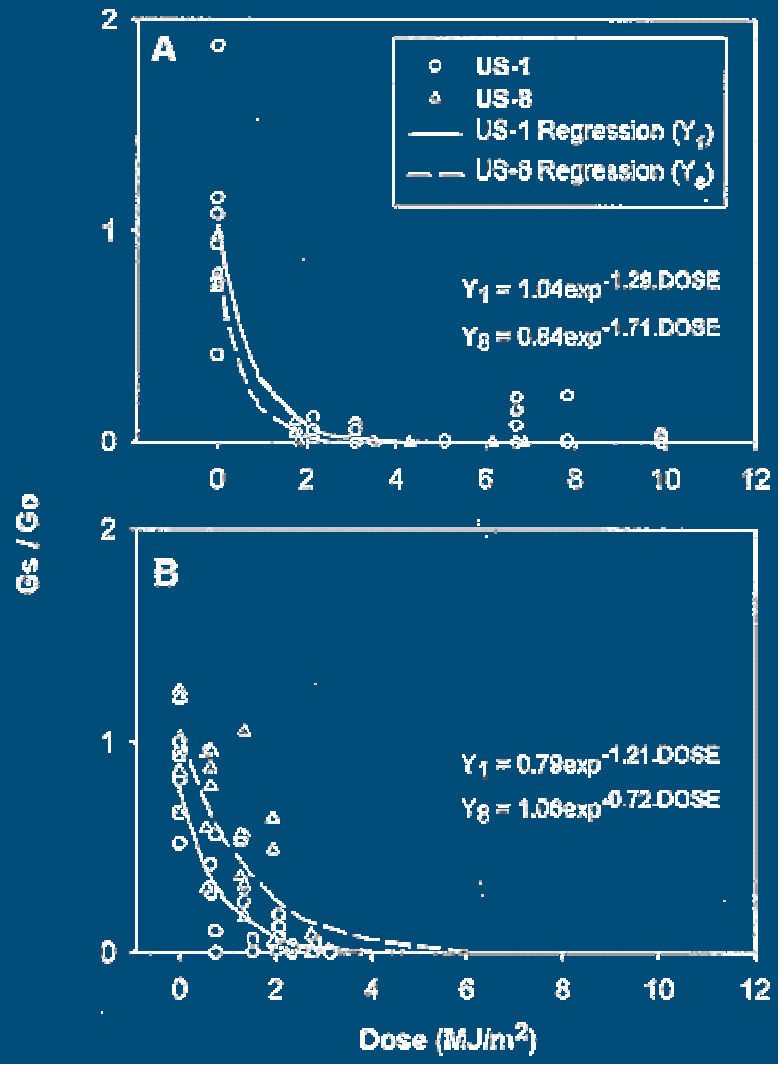


- x ≤ 25 m distance from source
- 25 < x ≤ 50 m
- 50 < x ≤ 75 m
- x > 75 m

Mean error was 5 times less for QUASIGAUSS!

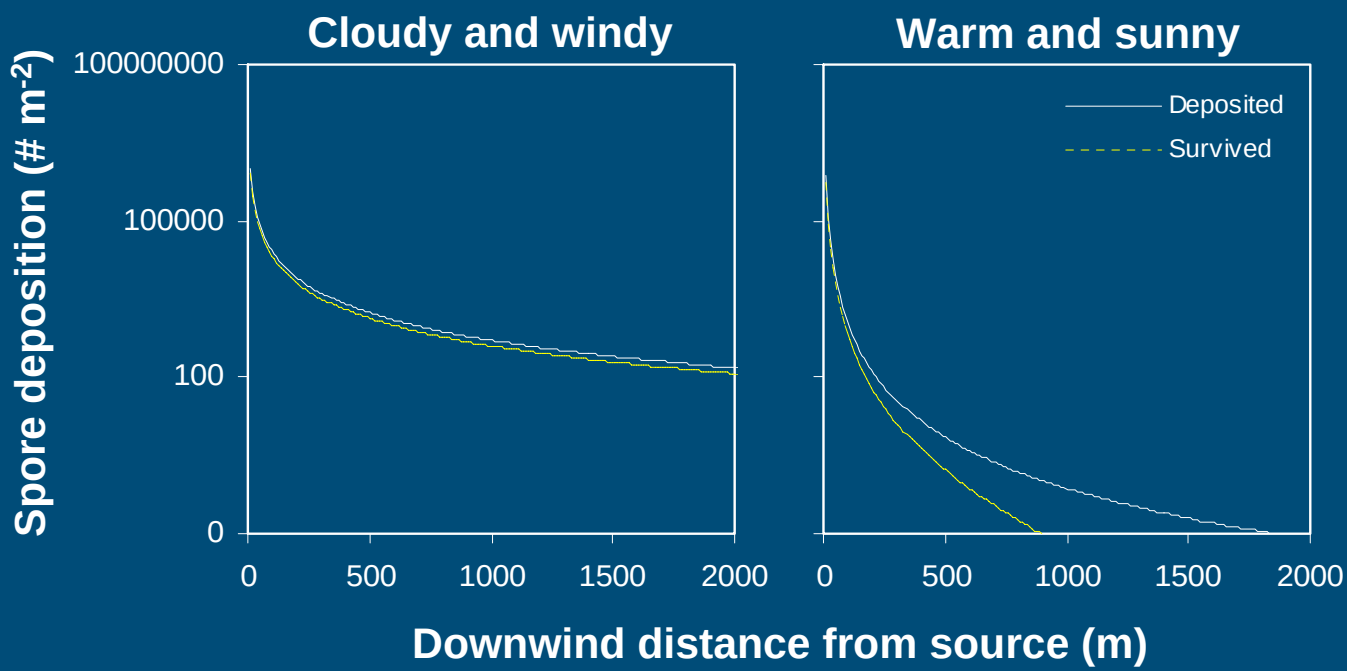
Spore survival model

- Spores are sensitive to temperature / humidity / radiation.
- Use results of Mizubuti et al., 2000.
- Simple exponential function of the dose of radiation.



Integration: Operational issues

- Could we base spray recommendations on expected spore load?
- What is the capacity of the weather for dispersing viable spores?
- Can such an estimate add value to a DSS?



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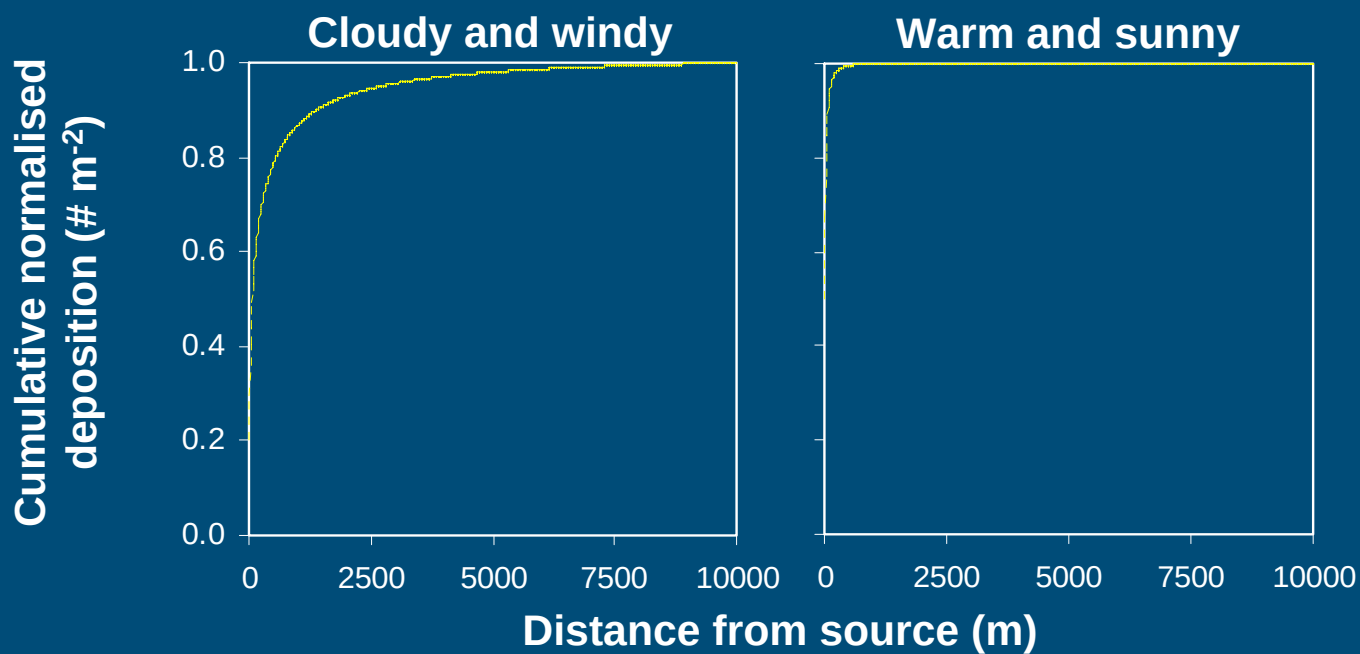
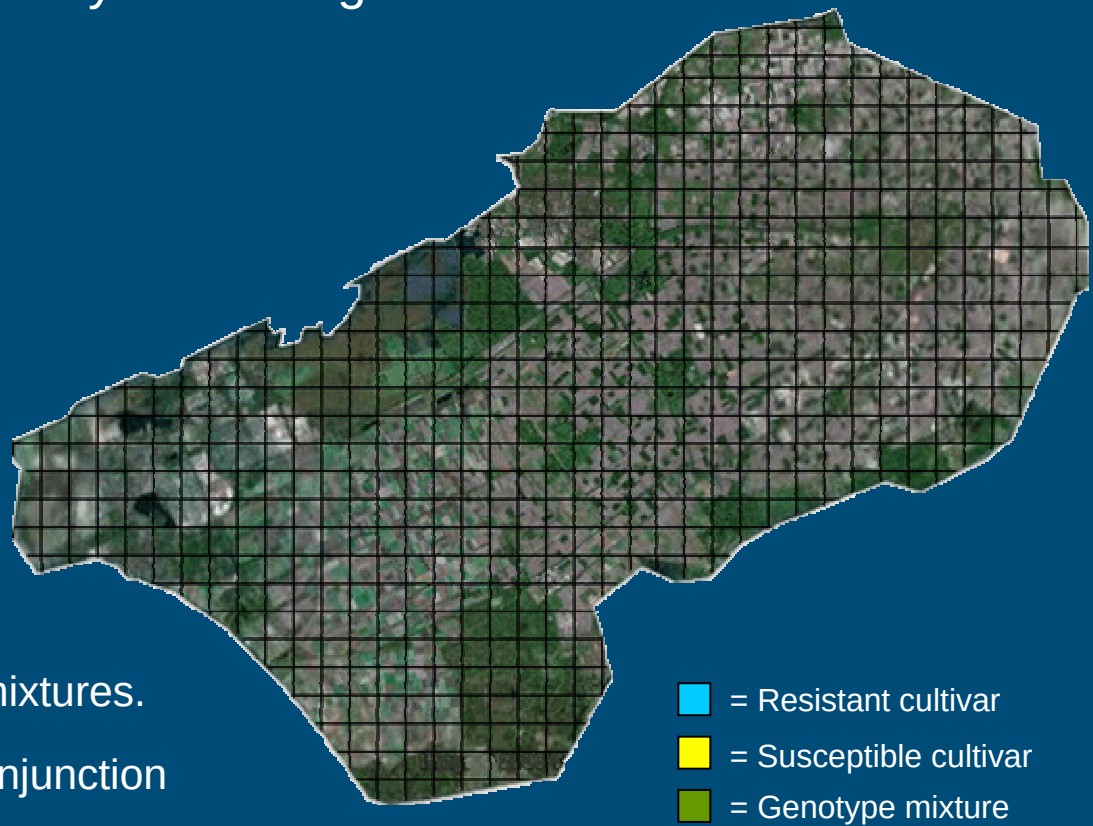


Currently working on implementing spatial aspects in DSS rules.

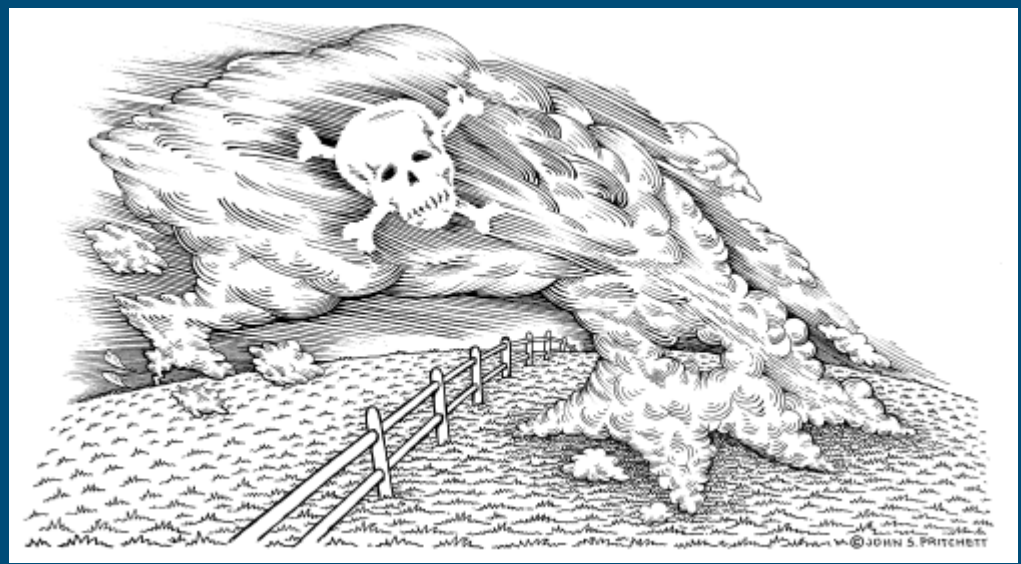
Integration: Strategic issues

- Design landscapes in order to inhibit successful spore dispersal.
- Simulate epidemics: calculate yield & fungicide costs.

1. A certain % switch from a susceptible cultivar to a more resistant cultivar.
2. Complete separation of cv's. Complete separation of organic / conventional.
3. A certain % switch from a susceptible cultivar to a genotype mixture.
4. Implement region-wide genotype mixtures.
5. All of the above will be tested in conjunction with reduced fungicide doseages.



.....thanks for listening…….



Questions?