THE JOINT FORCES OF CSIRO & SCION

ensis

Lindsay Bulman
Ensis FBP

Forest Biosecurity and Protection

Research updates 2006

June 2006

CSIRO SCION

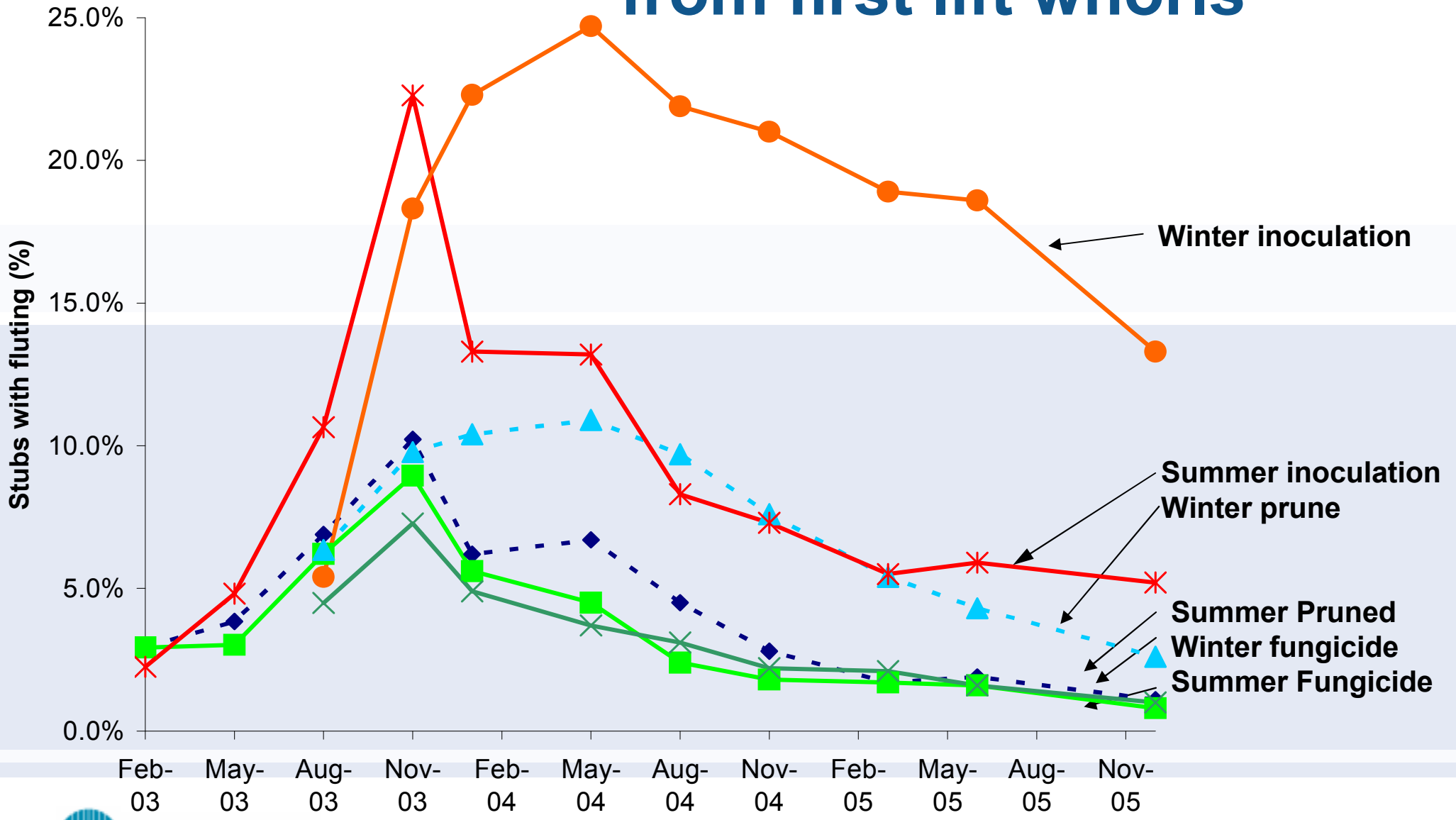
THE JOINT FORCES OF CSIRO & SCION

Pruned Stub Trial - background

- **Treatments**
  - Pruning, fungicide and inoculum application (summer and winter)
- **Goals**
  - Determine the effect of time of pruning
  - Test efficacy of fungicide application
  - Determine how long stubs remain susceptible to infection

ensis

Pruned Stub Trial – results from first lift whorls

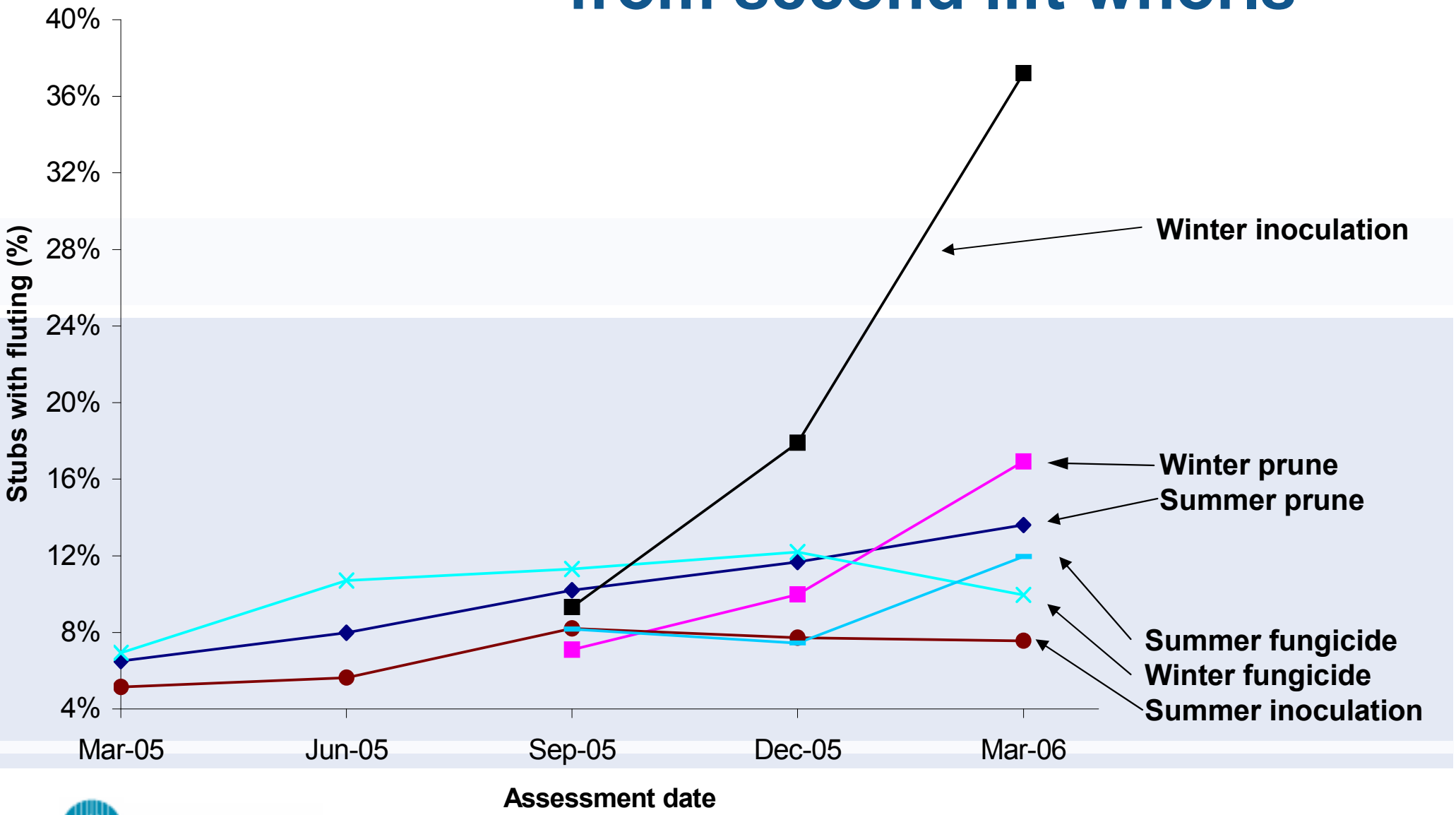


CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

Pruned Stub Trial – results from second lift whorls

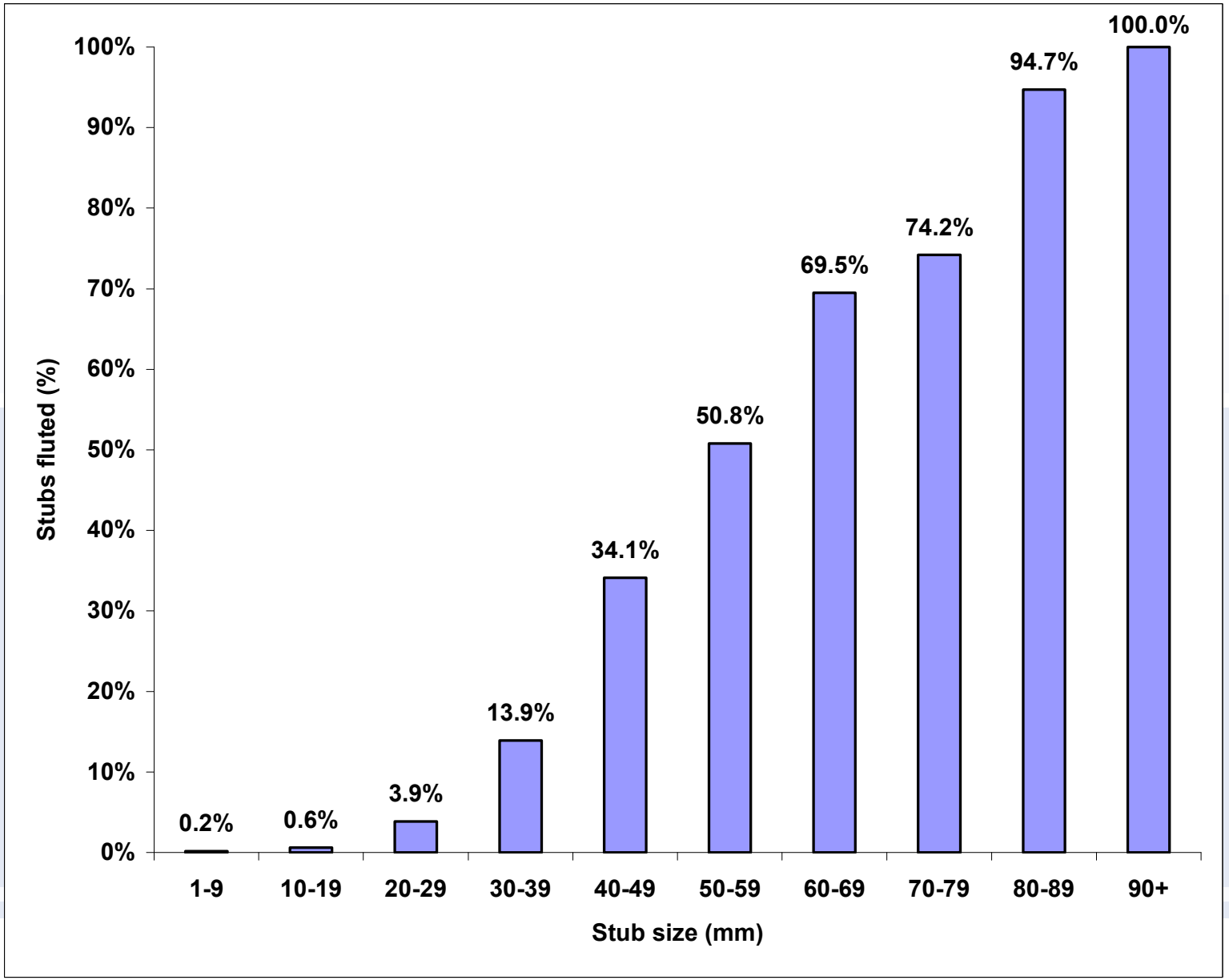


CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

Pruned Stub Trial - results



CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

Pruned Stub Trial - conclusions

- **Time of Pruning**
  - Fluting is more common after winter treatment
- **Fungicide**
  - Immediate fungicide application reduced, but did not eliminate, fluting
  - Delayed fungicide application was ineffective

Pruned Stub Trial - conclusions

- **Stub size**
  - Fluting was rarely associated with stubs smaller than 30 mm diameter
- **Pruning**
  - Fluting was more common in pruned treatments (2.6% of stubs after winter pruning), but flutes were present on unpruned trees (1.8% of stubs)
  - The incidence of fluting was high immediately after second lift pruning (14.9% of stubs cf 2.6% on first lift)

ensis

Pruned Stub Trial - conclusions

- **Ongoing and future work**
  - Maintain assessments from first and second lift pruning operations until November 2006
  - Evaluate results and then agree on the future of the trial
  - Decide on whether destructive sampling is required

Delimiting survey - background

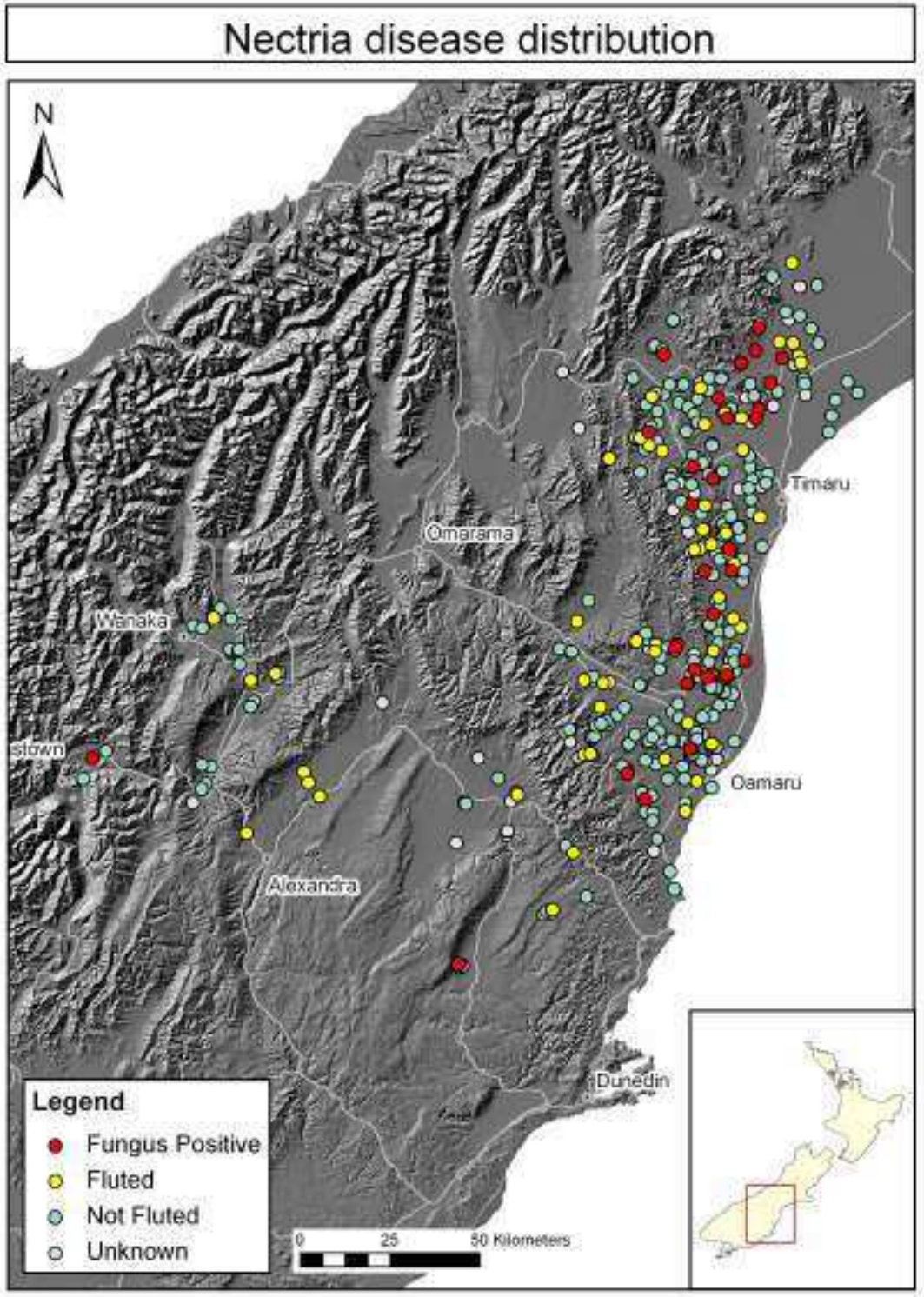
- **Objective**
  - To determine the distribution of the disease – i.e., the known infected area
  - To determine disease incidence throughout the region in order to confirm the limit of disease spread
- **Method**
  - Plan survey
  - Focus on good coverage – high intensity sampling where plantations are sparse, lower intensity where plantations are common
  - Assess stands and take core samples
  - Record assessments from all stands surveyed

ensis

Delimiting survey - progress

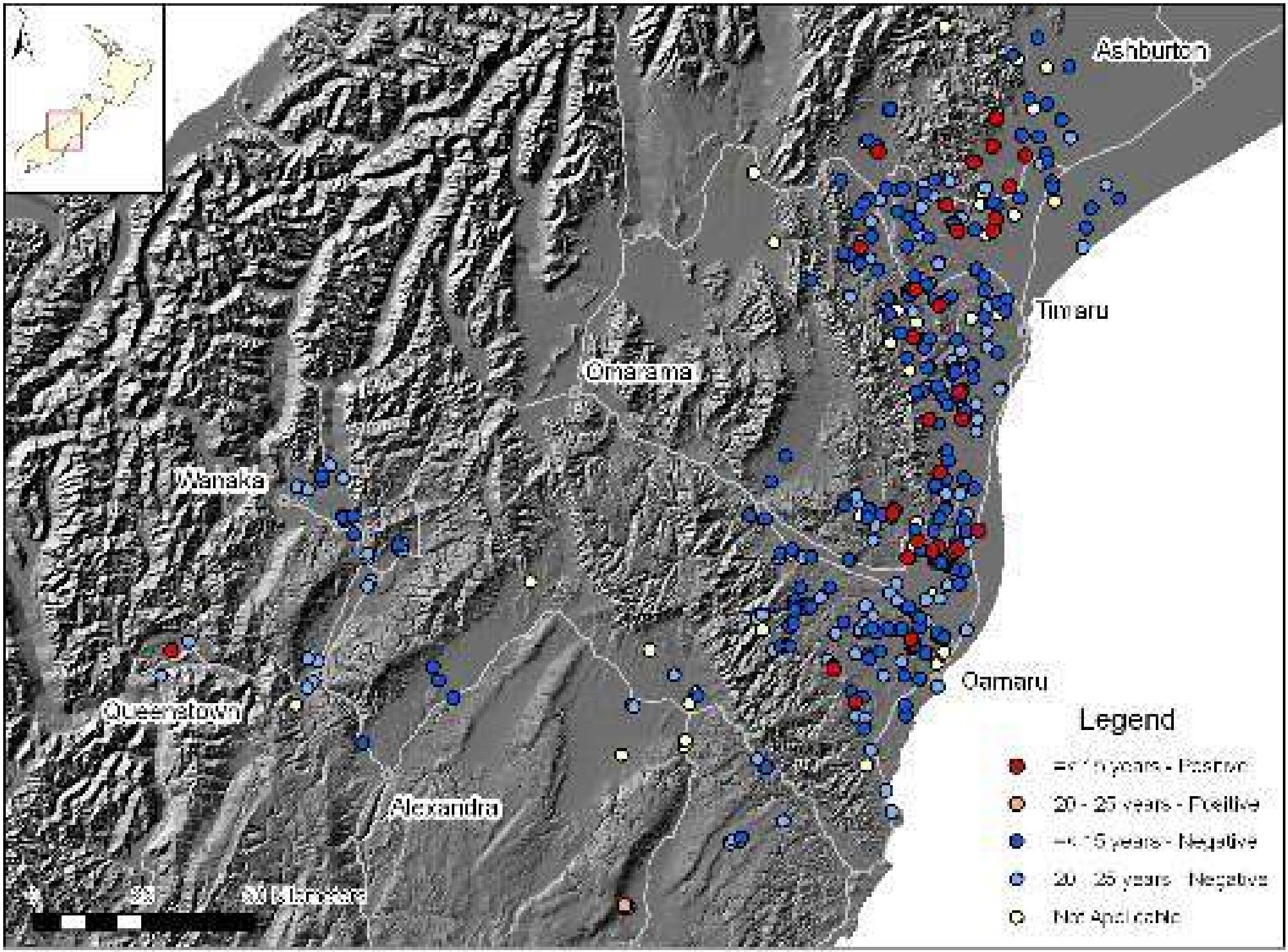
- **Planning**
  - Over 1000 owners identified and contacted
  - 280 positive responses
  - Maps produced, survey intensity and method determined
  - Operational planning started, original maps not of sufficient quality
  - Maps reproduced, GPS coordinates linked with addresses
  - Planning completed May 2005
  - Surveys started June 2005, completed Feb 2006
  - Field surveys and planning cost $40,000 – budget was $20,000

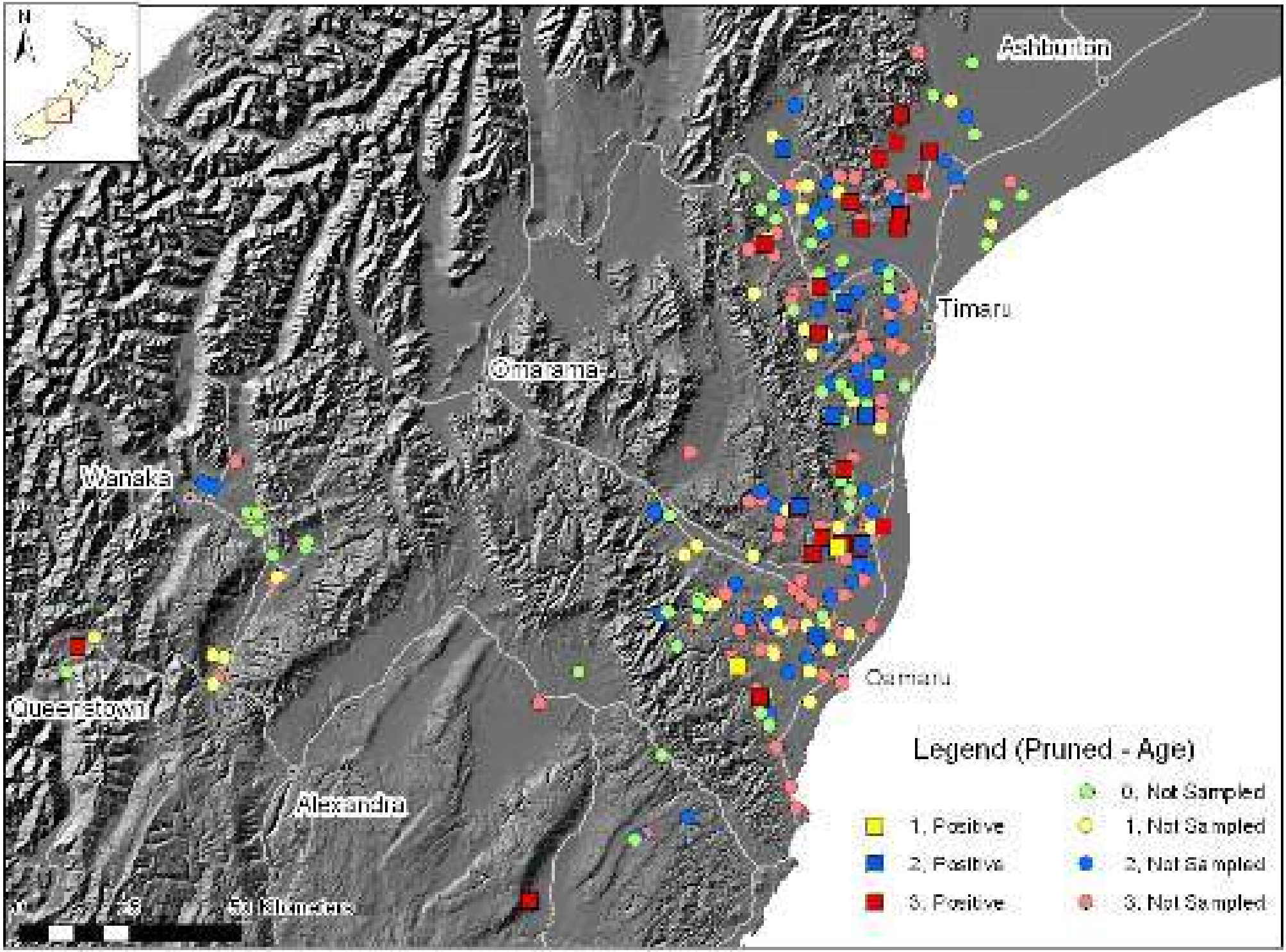
ensis

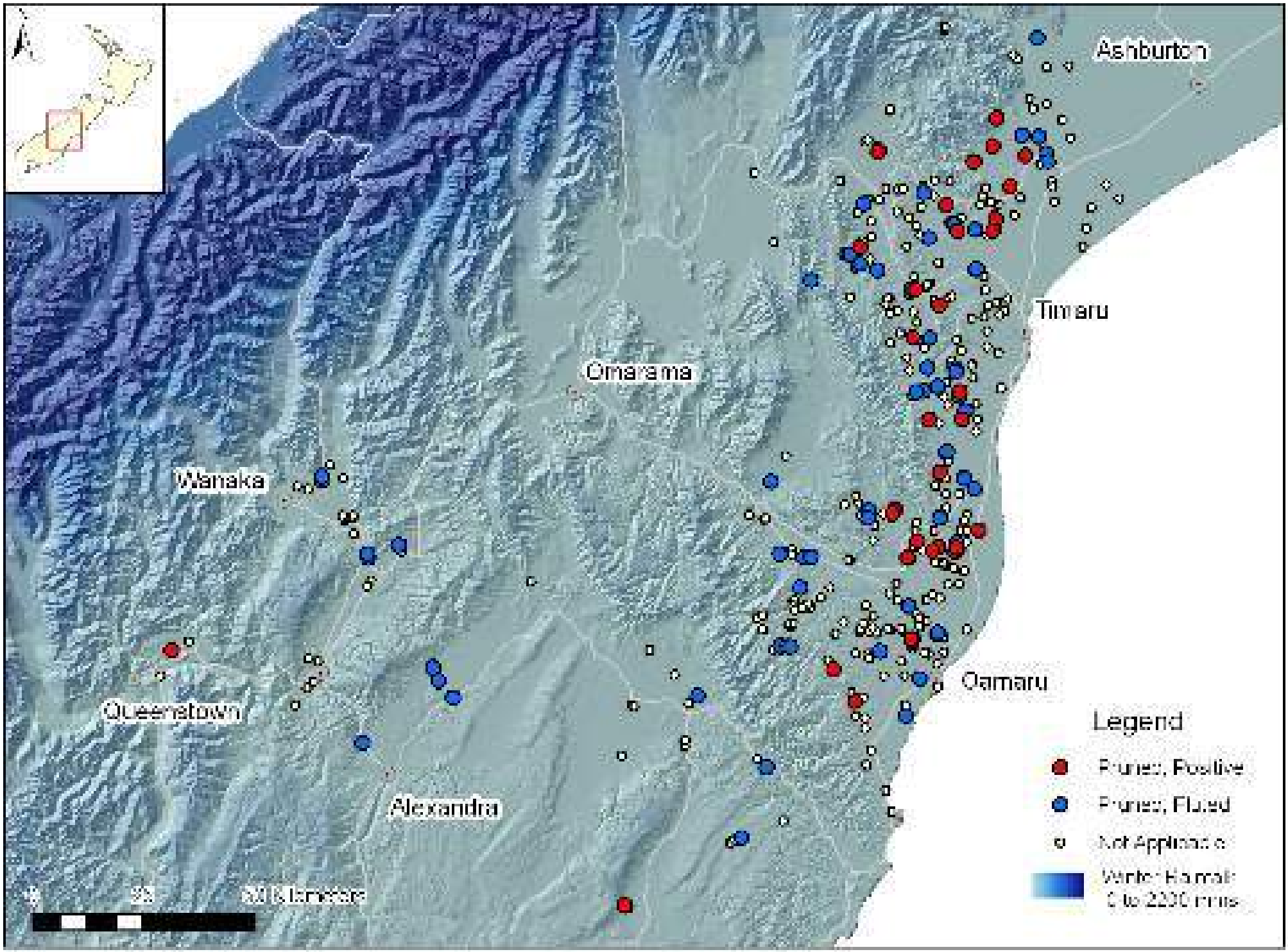


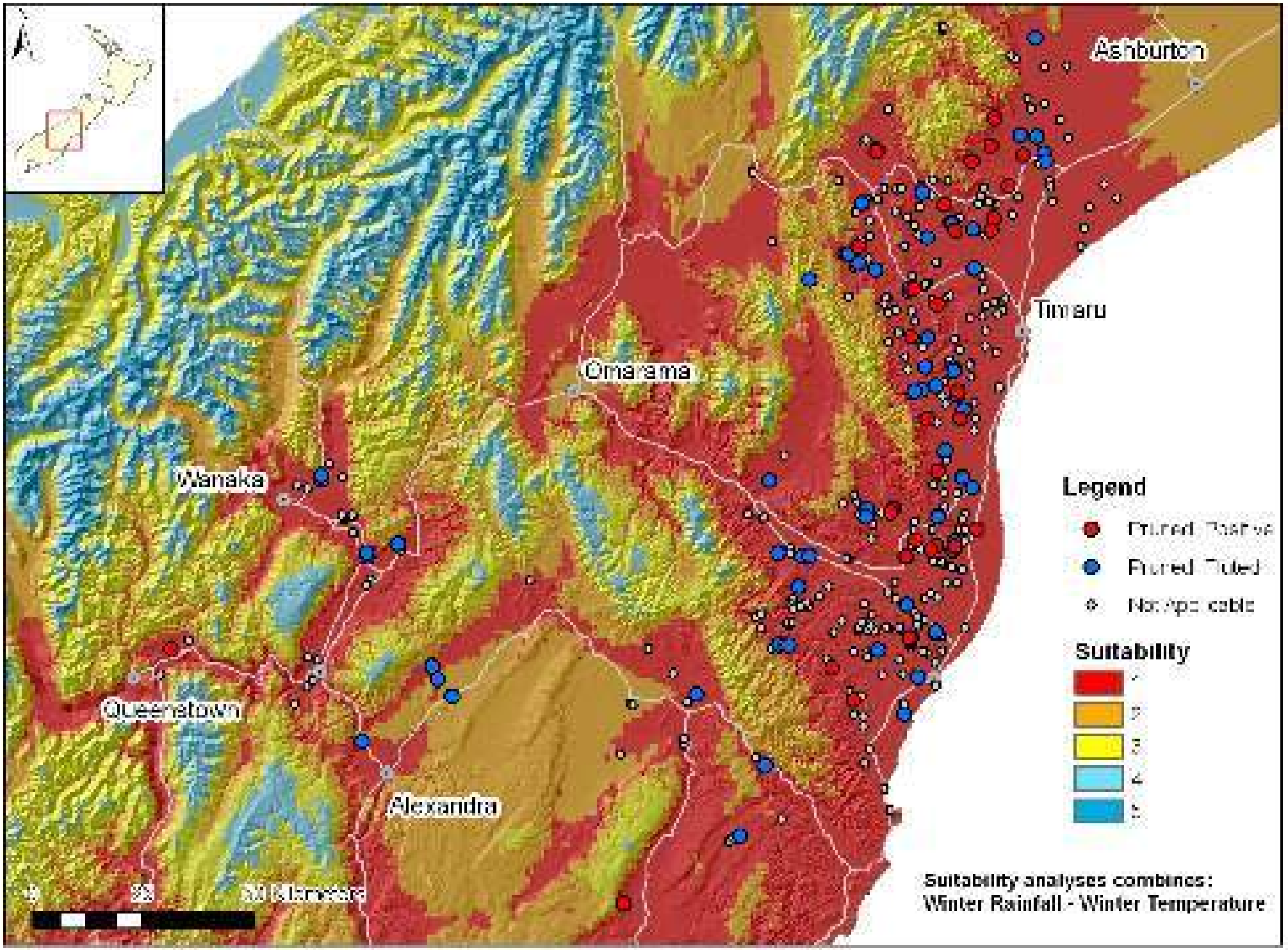
CSIRO SCION

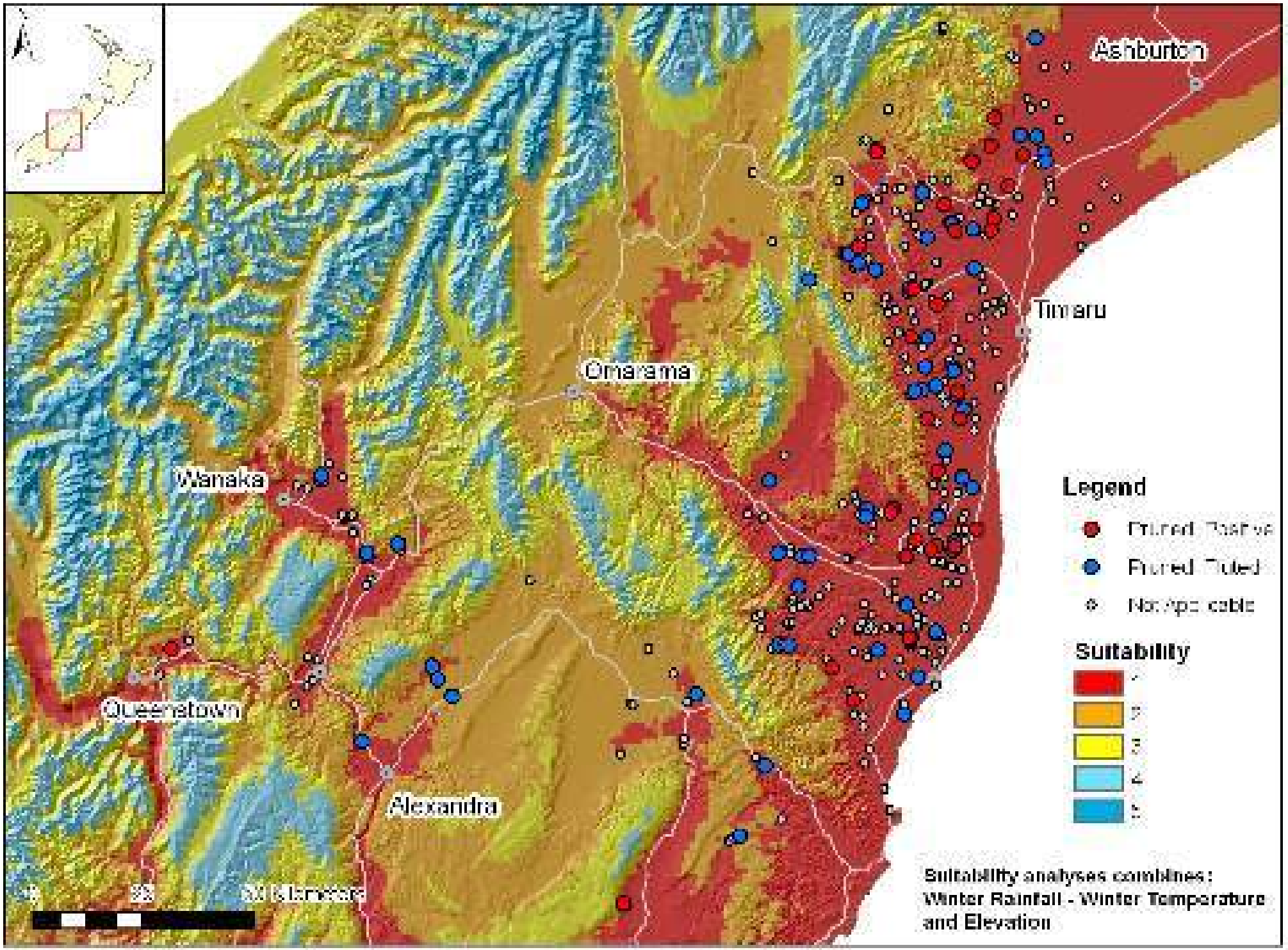
THE JOINT FORCES OF CSIRO & SCION

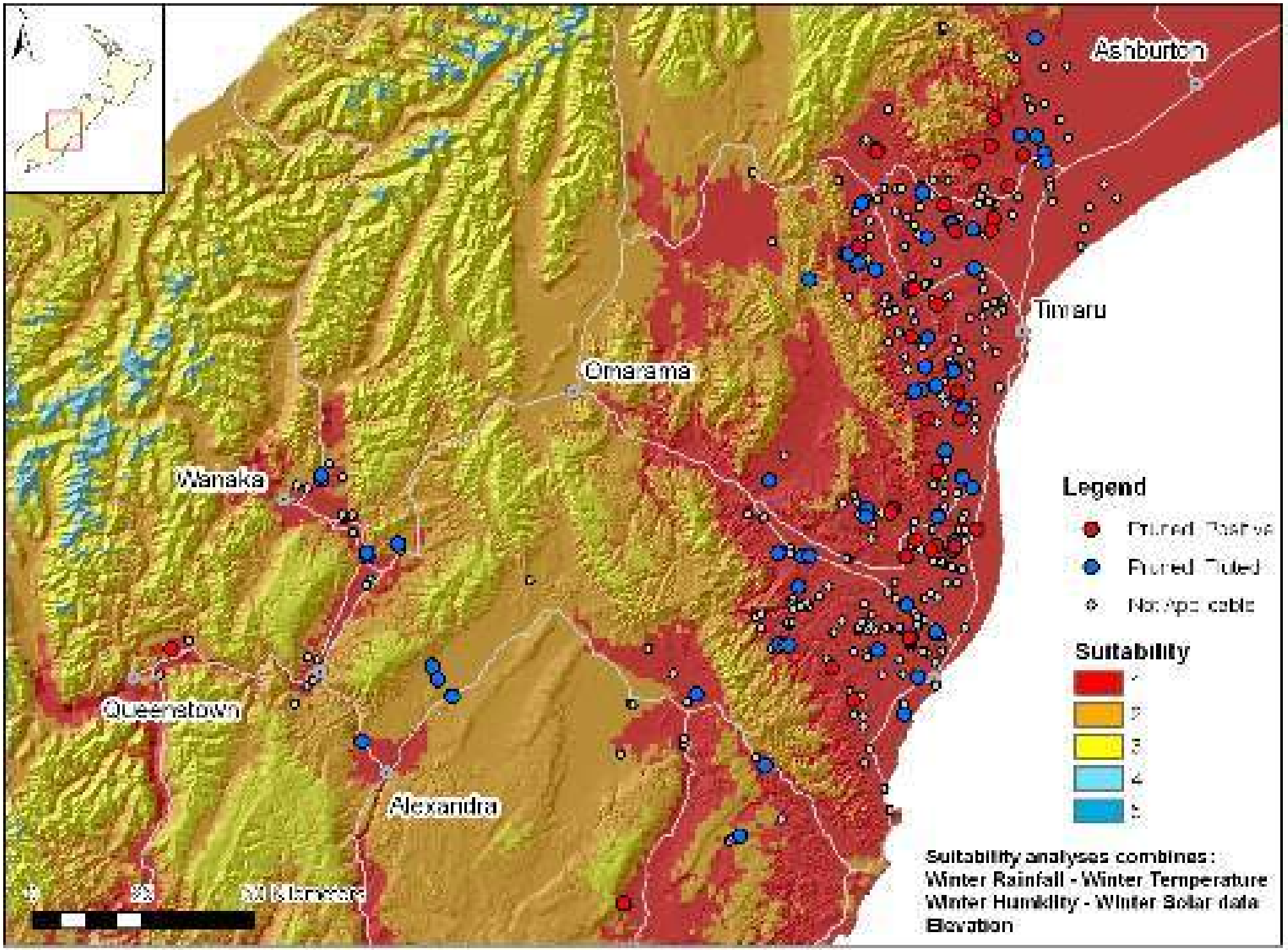

Ashburton
Timaru
Omarama
Wanaka
Queenstown
Alexandra
Oamaru
Legend
20 - 25 years - Positive
20 - 25 years - Negative


N
Ashburton
Timaru
Omarama
Wanaka
Queenstown
Alexandra
Oamaru
0 25 50 Kilometers
Legend (Pruned - Age)
0, Not Sampled
1, Positive
1, Not Sampled
2, Positive
2, Not Sampled
3, Positive
3, Not Sampled


Ashburton
Timaru
Omarama
Wanaka
Queenstown
Alexandra
Oamaru
Legend
Pruned, Positive
Pruned, Fluted
Not Applicable
Winter Rainfall
0 to 2200 mm


Ashburton
Timaru
Omarama
Wanaka
Queenstown
Alexandra
Legend
Suitability
Suitability analyses combines:
Winter Rainfall - Winter Temperature


Ashburton
Timaru
Omarama
Wanaka
Queenstown
Alexandra
Legend
Pruned Positive
Pruned Tilted
Not Applicable
Suitability
Suitability analyses combines:
Winter Rainfall - Winter Temperature
and Elevation

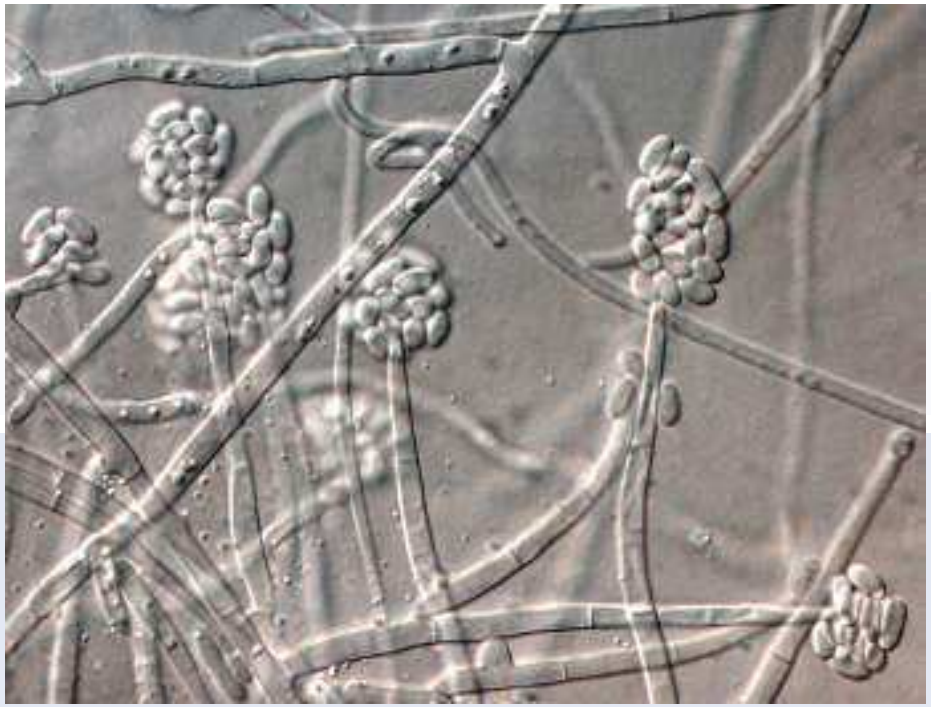

Ashburton
Timaru
Omarama
Wanaka
Queenstown
Alexandra
Legend
Suitability
Suitability analyses combines:
Winter Rainfall - Winter Temperature
Winter Humidity - Winter Solar data
Elevation

Regional survey – planned work

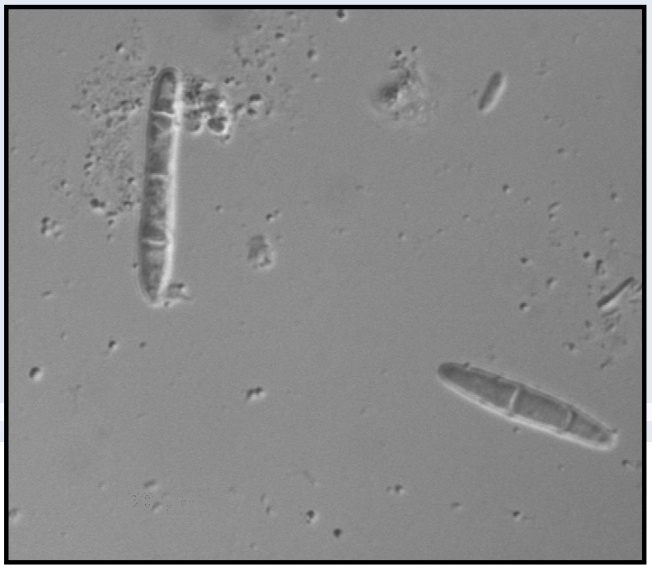
- **2005/06 work**
  - Report written for the FHRC on improved survey methodology
- **Future work**
  - Redo assessments using FIDA funding
  - Redo data analysis
  - Link with GIS and produce risk profile maps
  - Compare with findings from ecology project

ensis

Nectria has 3 different spore states

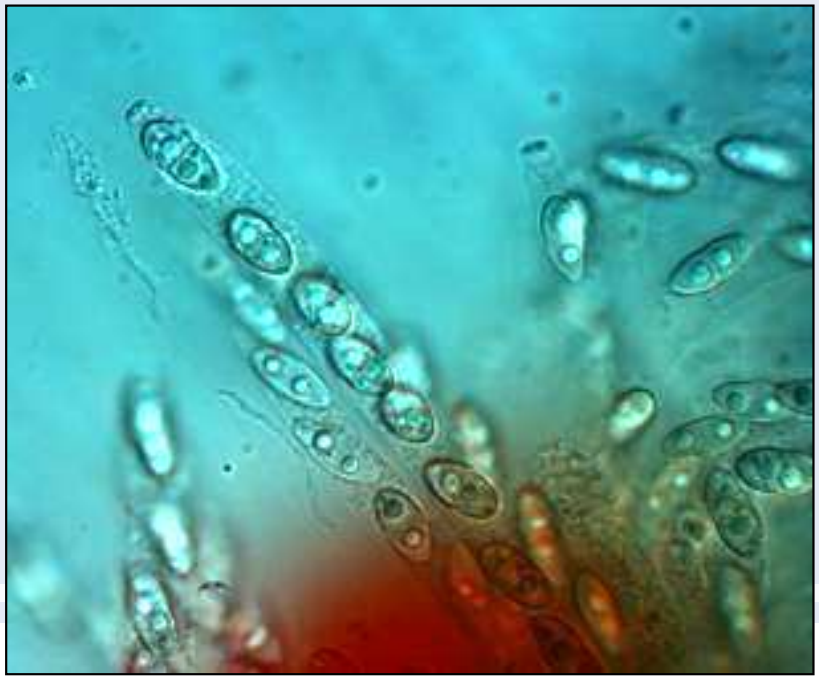


In culture



In nature, not common

ensis



CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

Spore dispersal ---mainly by water, not wind

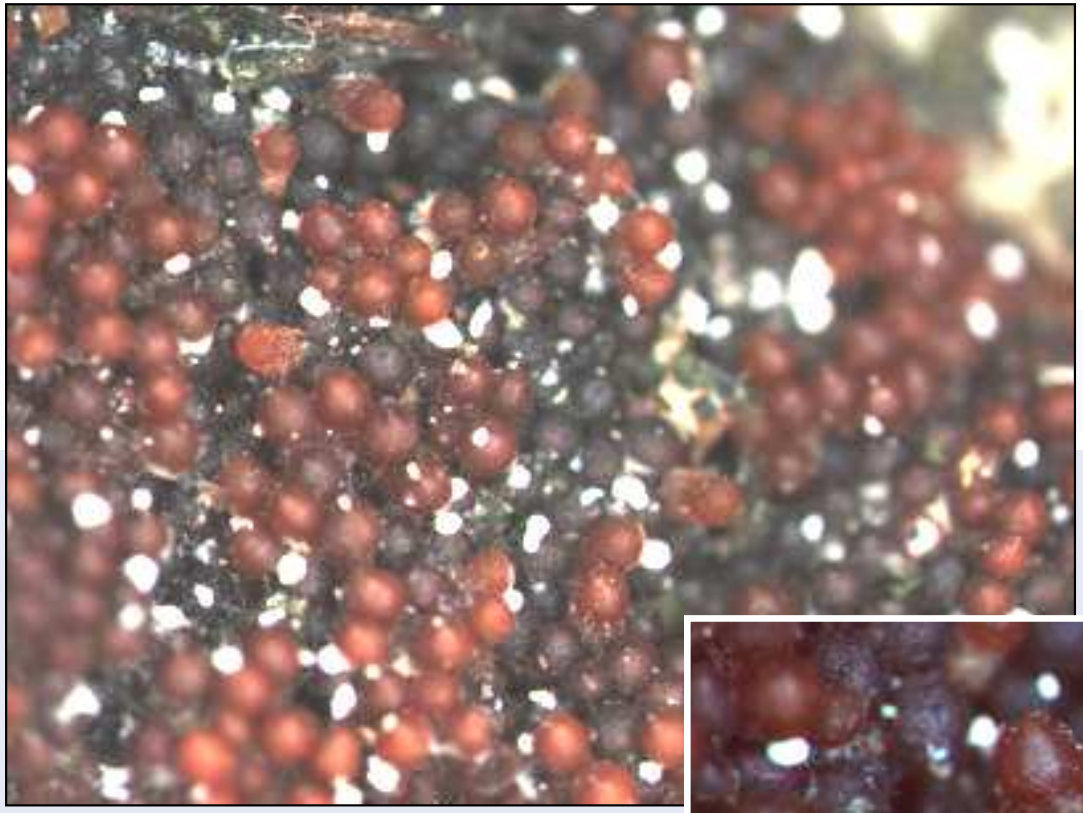
- Patchy distribution
- Slow spread

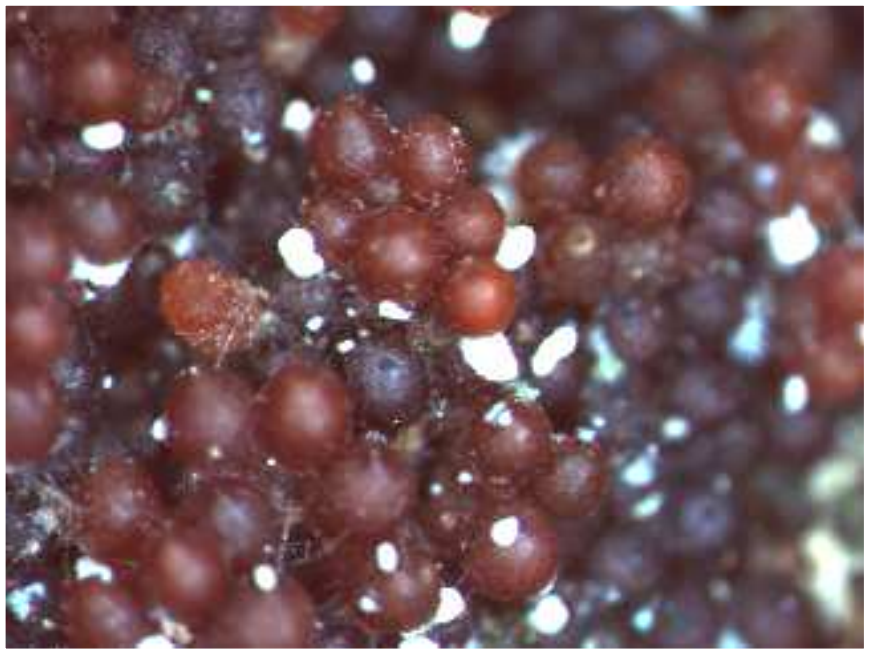
CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

The evidence





- Spores ooze out of fruit bodies when soaked in water or after a rain
- Spores dry in clumps on surface

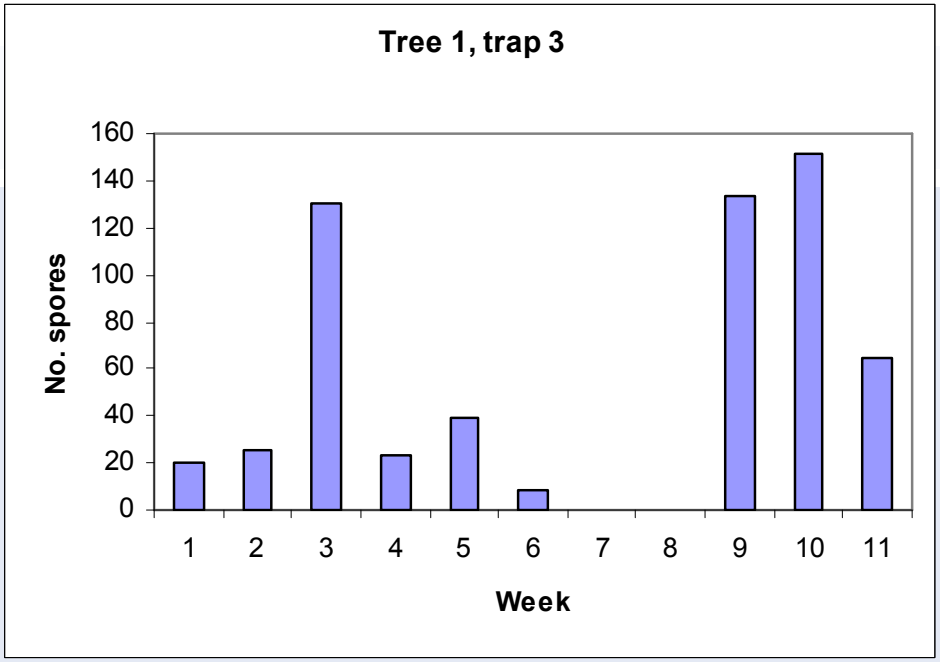
CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

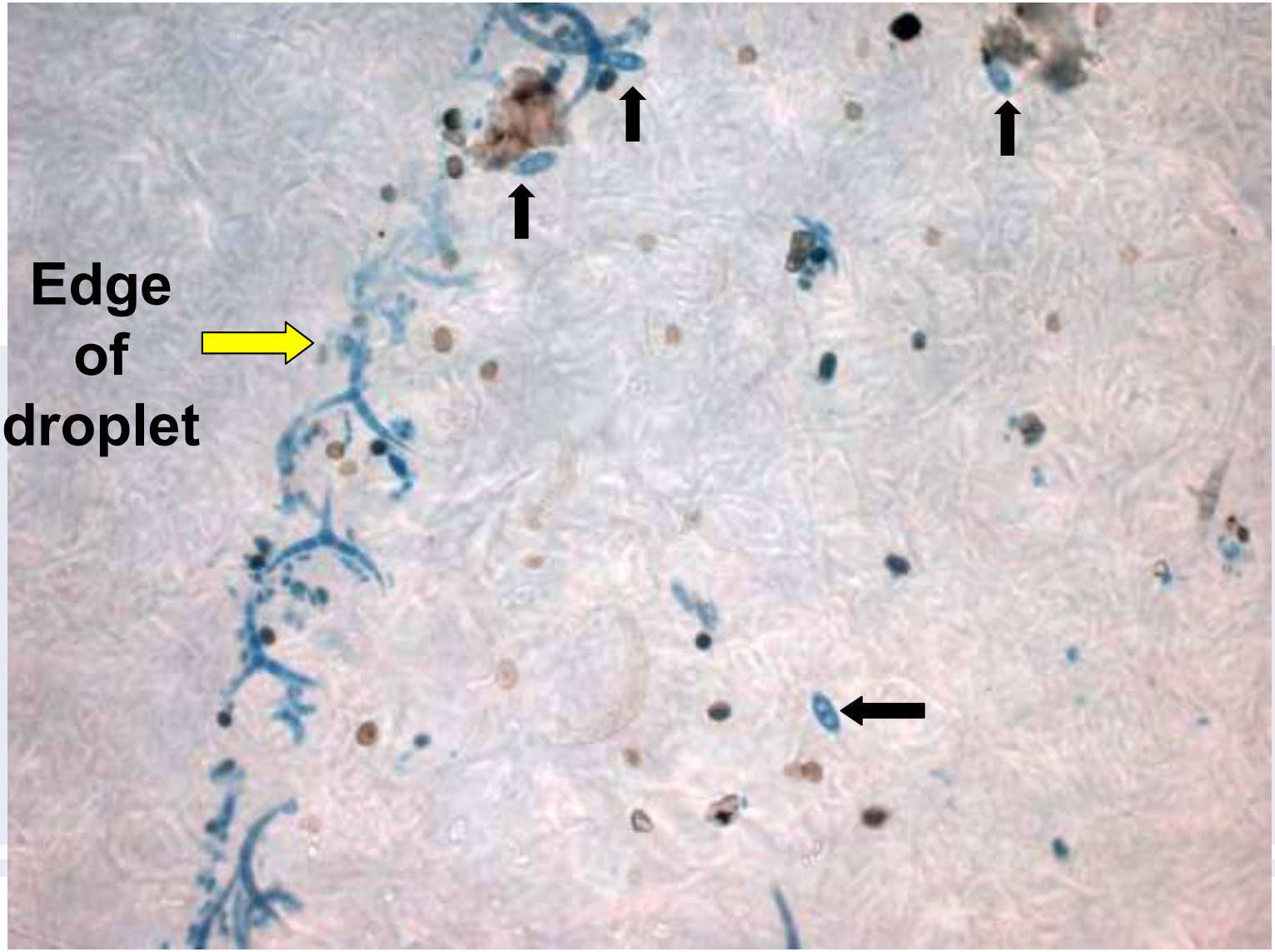
Spore trapping

- To show when dispersal occurs
- The effect of weather on dispersal



ensis

Assessing spore traps



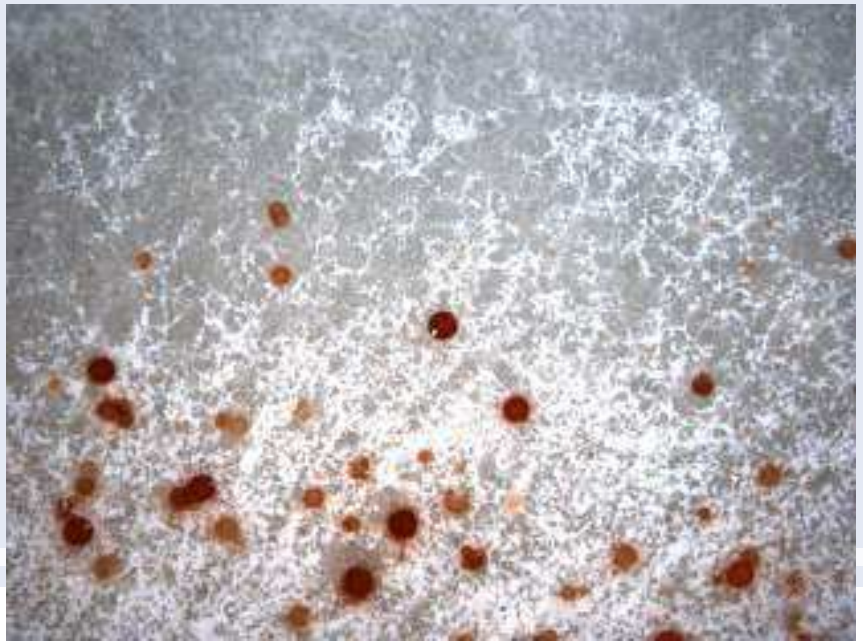
CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

Lab expts. 1. Factors that control fruit body production

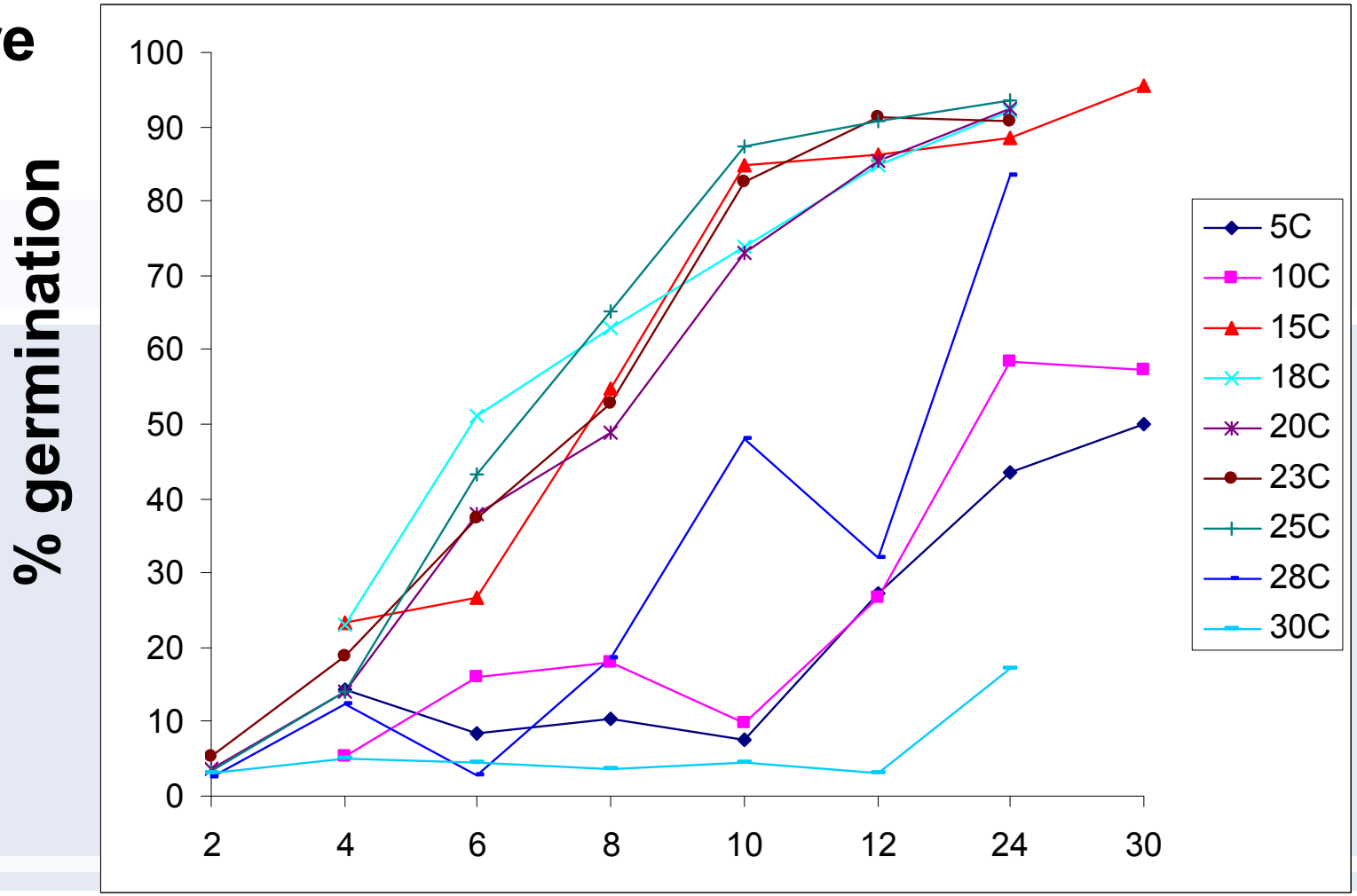
- Two compatible mating types are needed
- Suitable nutrient and light conditions



ensis

2. Conditions that induce spore germination

Effect of temperature



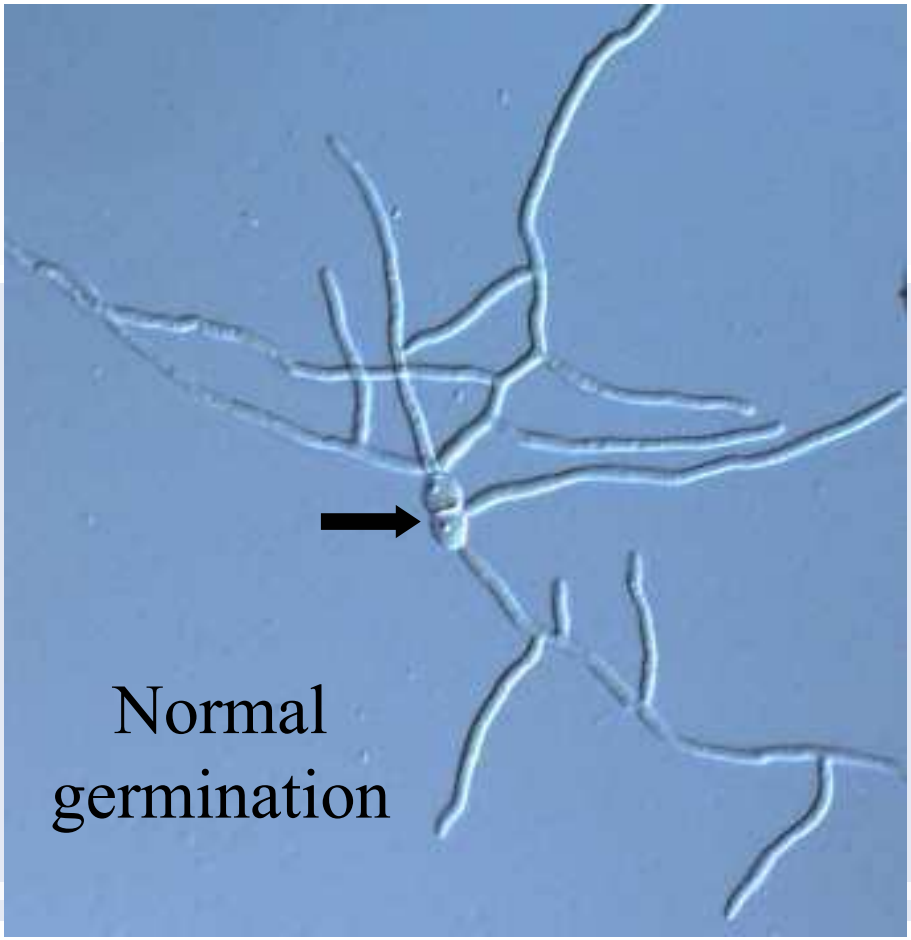
CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

Conditions that induce spore germination

- **Free water is required**

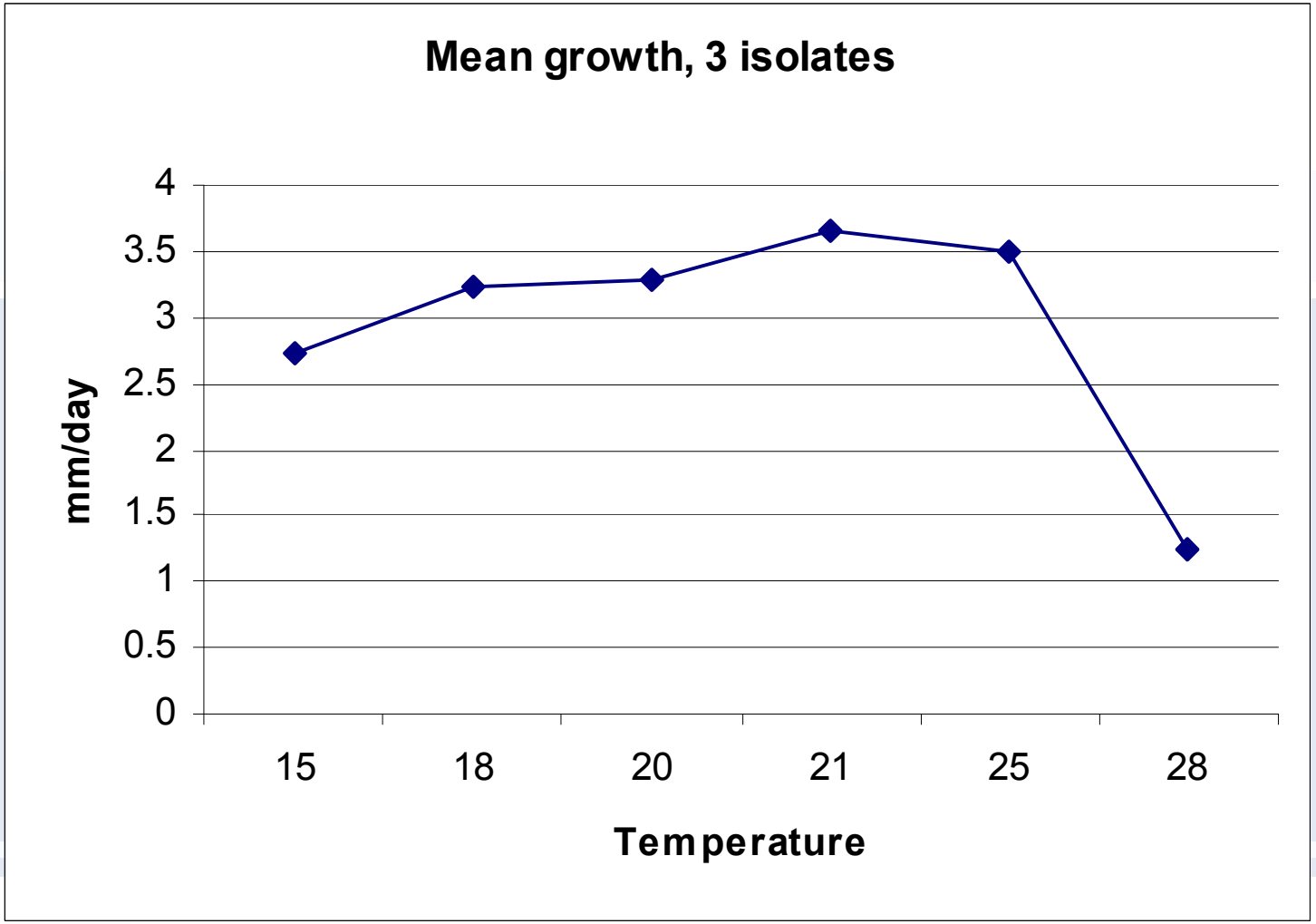


Normal germination

Abnormal germination at 30 C

ensis

3. Optimum temperatures for growth of cultures agree with spore germination data

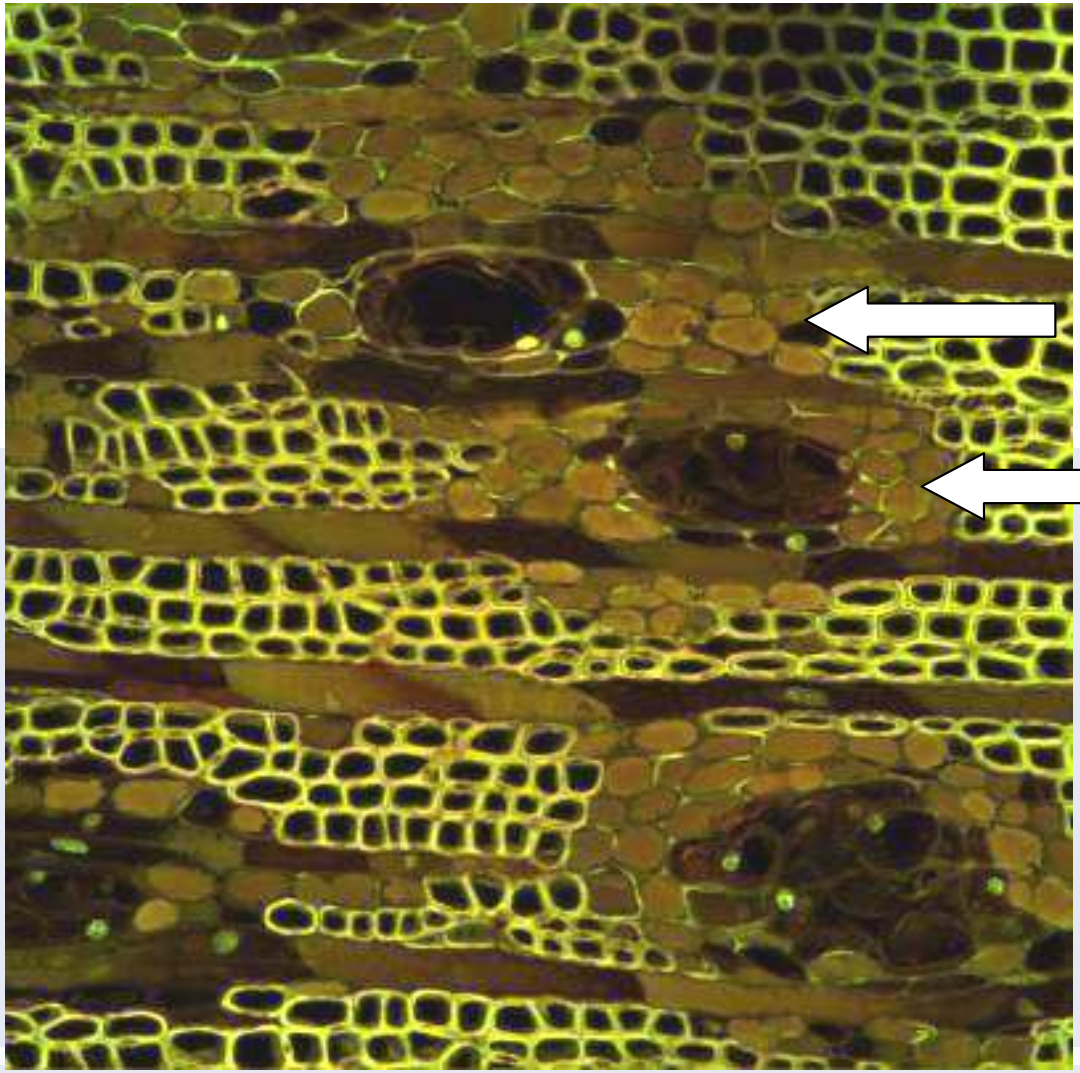


CSIRO SCION

THE JOINT FORCES OF CSIRO & SCION

ensis

Anatomy of the disease



2-yr-old infection: resistance responses (resin ducts, tannins, phenolics)

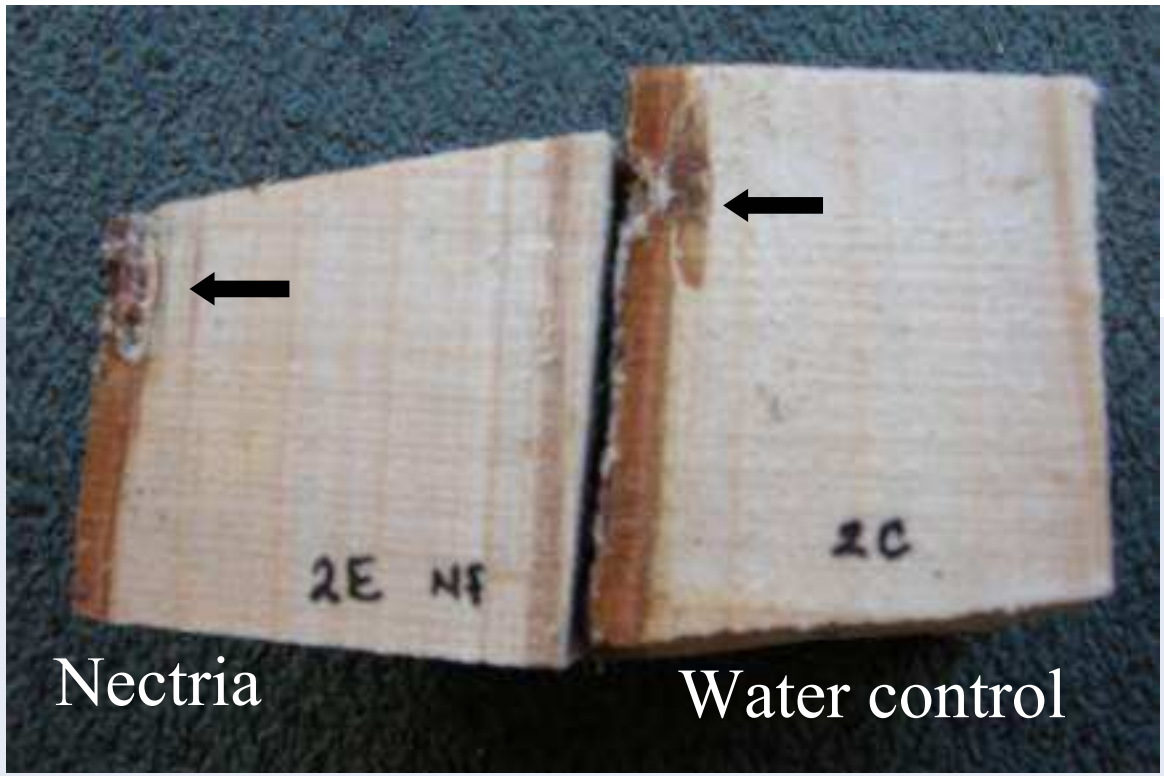
Healthy side does not have these features

ensis

Early disease development and effect on host

Early infection stages, Nov. 2005

- Inoculated 8 trees
- Harvest 2 trees every 2 months
  - Reisolate fungus
  - Study changes in wood and bark



ensis

Experiment to assess effect of spore type and inoculation method

April 2005

- 45 trees
- 3 inocula
  - Ascospores
  - Conidia
  - water
- 3 types of wounds

ensis

Results after 7 months

- Some trees of all treatments are showing fluting
- Fluting is usually greater with Nectria than with water treatment
- Type of wound has more effect than type of spore used
- Deep wounds show more fluting than shallow wounds

ensis

What do we know so far?

- Ascospores are present in fruit bodies in all seasons
- A cluster of fruit bodies probably remains active for many months
- Moisture is required for spore release and probably dispersal
- *N. fuckeliana* grows best at warm temperatures, but can probably grow to some extent year-round in NZ
- Spore trapping will allow correlation of spore release with weather conditions
- Successful fruit body production in culture
- Infected radiata pine shows active resistance response. Study of early disease development is in progress.