# Pitch canker:

## (What we know, what we don't know.)

## Answers to some of the questions…

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# Pitch canker – general background

- Casual agent = *Fusarium circinatum.*
- Disease characterised by exudation of copious amounts of resin.
- Pathogenic to species of *Pinus* and one non-pine host, *Pseudotsuga menziesii.*
- Can suppress growth or kill the tree.
- All tissue susceptible - including seed

# Global distribution of pitch canker

- **USA:** - southeastern states and California
  - Native and exotic pines.
  - *Pseudotsuga menziesii*.
- **Spain:**
  - *Pinus radiata* in nurseries and plantations, and *P. pinaster*.
- **South Africa and Chile:**
  - Present in nurseries but has not spread to adjacent plantations.
- **Haiti, Japan, Korea and Mexico:**
  - Causes little damage to pine species present and/or is not considered economically important.

Risk of establishment in New Zealand?

Predictions based on field observations.

PC-free NZ

Risk of entry

*Fusarium circinatum* introduced

Wounding agents

Wound created

Wound type, moisture, temperature, genetic resistance, silvicultural practices, induced resistance.

Spore vectors

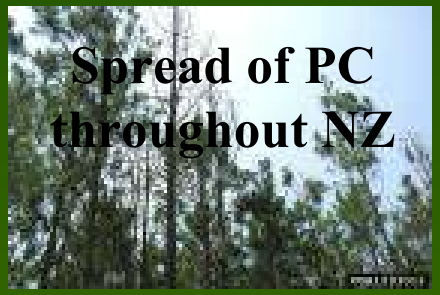
Successful infection

Spores at wound site

Resistance, silvicultural practices, temperature, moisture.

Temperature, moisture, vectors, eradication.

Severity of infection



Spread of PC throughout NZ

# Wounding agents & Vectors

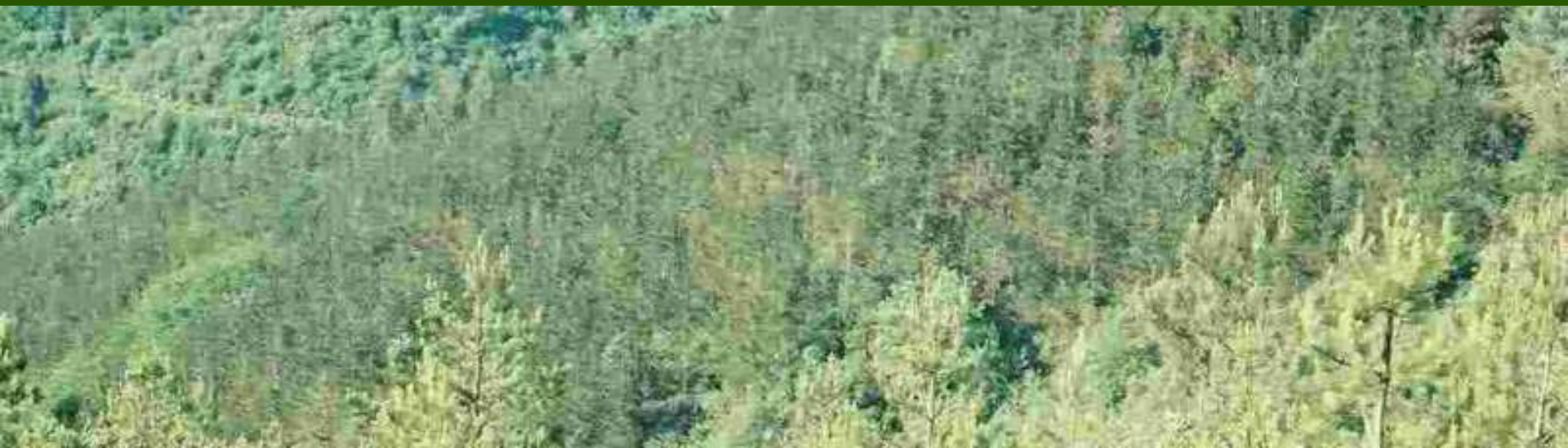
- Weather-related injuries, insects, mechanical damage, animals.

- Water, wind, soil, insects, contaminated machinery, plant material, people.

**New Zealand: Wounding agents ✓ Vectors ✓**

# Field Observations

- Weather damage was not always associated with infection in the presence of *F. circinatum* inoculum.
- Insect involvement is less important in areas other than California.
- Infections resulting from animal damage has been extremely minimal.



# NZ: Wounding agents & vectors

- New Zealand's forests have wounds, wounding agents and vectors suitable for infection.
- However, in the absence of intricate insect-host systems, such as in California, the wounding agents present in NZ are unlikely to play a significant role in disease establishment or intensity.

Instead, environmental and silvicultural conditions are more likely to influence disease establishment.

# Critical factors

- Temperature
- Humidity
- Stand moisture
- Nutrient Levels

Establishment and severity of pitch canker appears to occur from a combination of these factors…

# Temperature

Extremely important for disease establishment.

**In the laboratory:** *F. Circinatum* growth is suppressed at 10$^{o}$C, upper temperature unknown.

**In the field:** Disease has been clearly limited across all locations visited when the temperature is too high or too low.

Infections can occur in regions where temperature is not optimum but establishment is unlikely.

# NZ: Temperature

Plan to use data obtained from several countries to predict optimum temperature ranges.

- It is expected that conditions in the majority of New Zealand's forests will have temperatures within the optimum range.
- Based on field observations, low risk areas would be those that receive snow during the winter.

**However, temperature is strongly linked with humidity…**

# Humidity

Important factor in disease establishment, as well as disease severity, in all locations investigated.

Based on field observations,

**Establishment:** A minimum (but unknown) level of humidity is required. The disease is unlikely to become established in regions with optimum temperature but low humidity.

**Severity:** Increased in regions with higher levels of humidity, such as sub-tropical/tropical conditions or coastal fog belts.

# NZ: Humidity

Plan to use data obtained from several countries to determine required humidity levels for predicting establishment and increased severity.

- It is expected that humidity levels in New Zealand would be sufficient in most areas for establishment of the disease.
- The disease would be expected to be more severe in regions of New Zealand that frequently have coastal fog belts or low lying mists.

# However, optimum temperature and humidty does not mean that pitch canker will become established in an area.

In areas with *F. circinatum* inoculum, have observed:

- Plantations adjacent to highly infected areas that are disease free.
- Disease establishment in previously disease-free plantations, at crown closure when stand became overstocked.
- Chickenhouse example in southeastern USA: recent outbreaks pitch canker in association with chicken houses.

***All occurred in areas with optimum temperature and humidity conditions***

**Predict that the most important factors are stand moisture content and nutrient levels.**

# Stand moisture

In all locations visited, a correlation between stand moisture levels and pitch canker was apparent.

Based on the field observations,

- Moisture stress associated with overstocked stands can allow disease establishment in previously disease-free stands or increase disease severity.
- Thinning after disease establishment can alleviate disease levels.

**Recently thinned, infected *P. radiata* plantation that was overstocked**

# NZ: Stand moisture

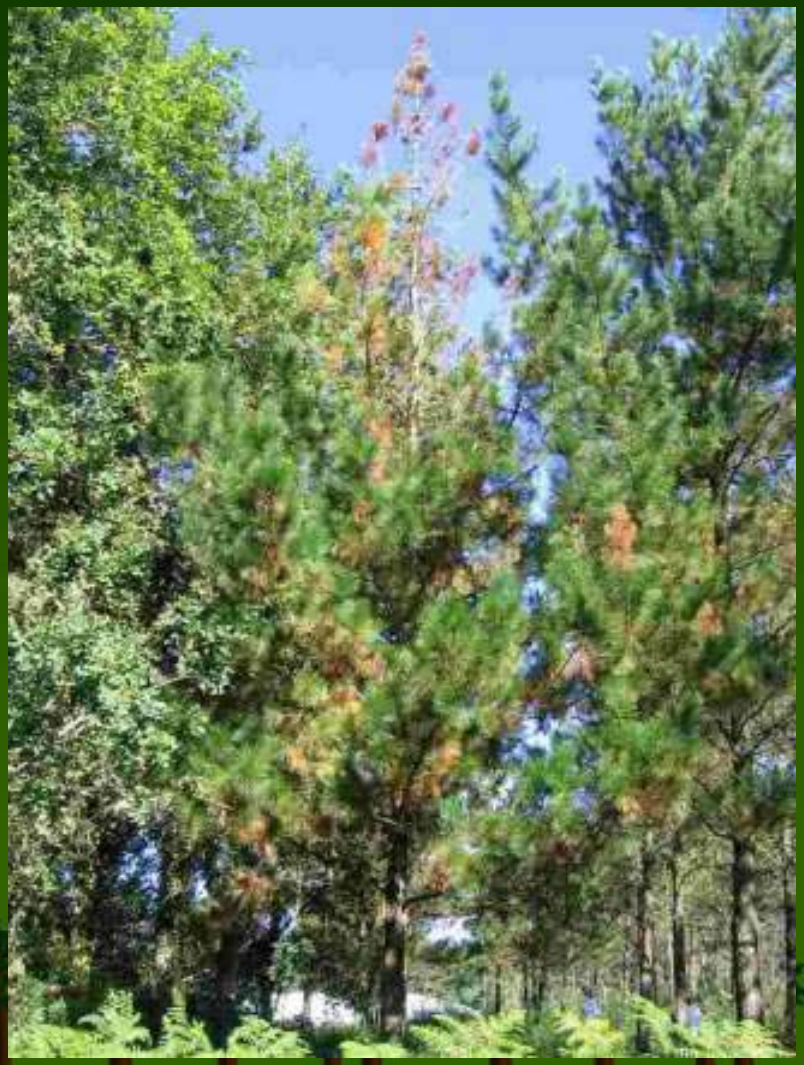
Plan to use data from several countries to determine the influence of stand moisture stress on disease establishment and severity.

Currently setting up moisture stress trials in *P. radiata* seedlings to determine interaction.

**New Zealand:** Unlikely that moisture stress will be a problem in NZ as stands have low stock density and soil moisture levels are high. Disease may be more prevalent in regions prone to drought.

# Nutrient levels

- **Fertilisation:** increased incidence and severity of pitch canker infections
    - Specifically nitrogen (N)
    - Other nutrients also shown to have an effect.



- SE USA : correlation between chicken houses and pitch canker
    - All chicken houses in the SE USA must be air-conditioned - has resulted in increased nutrient levels causing outbreaks of pitch canker in areas previously considered disease-free.

# NZ: Nutrient levels

Plan to use data from several countries to determine the interaction of nutrient levels on disease severity.

Currently setting up moisture stress trials in *P. radiata* seedlings to determine the influence of P and N on disease establishment and severity.

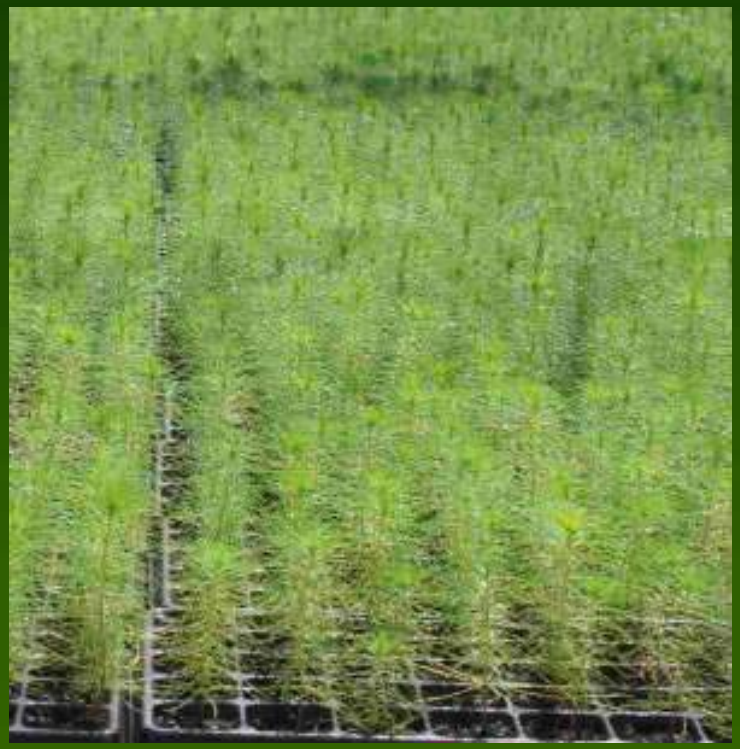
**New Zealand:** High nutrient levels.

- Unknown what nutrient levels are required in *P. radiata* to facilitate disease establishment or severity.
- Additional fertilisation would not be advised.

# Establishment of PC in New Zealand

## Nurseries and plantations:

**Eradication** – swift action and stringent sanitation procedures could prevent spread to adjacent forest lands or other nurseries.



# The good news…

- In the absence of cone-related insects, the transmission of *F. circinatum* to seed is low.
- In South Africa and Chile, pitch canker has not established in the plantations despite presence of inoculum.
- Observed nurseries surrounded by highly infected PC plantations that are disease free – some of these nurseries have been operational for 8+ years without incident, despite *F. circinatum* inoculum.