



Swiss Needle Cast (SNC) in
BC
What are the implications?

What is it?

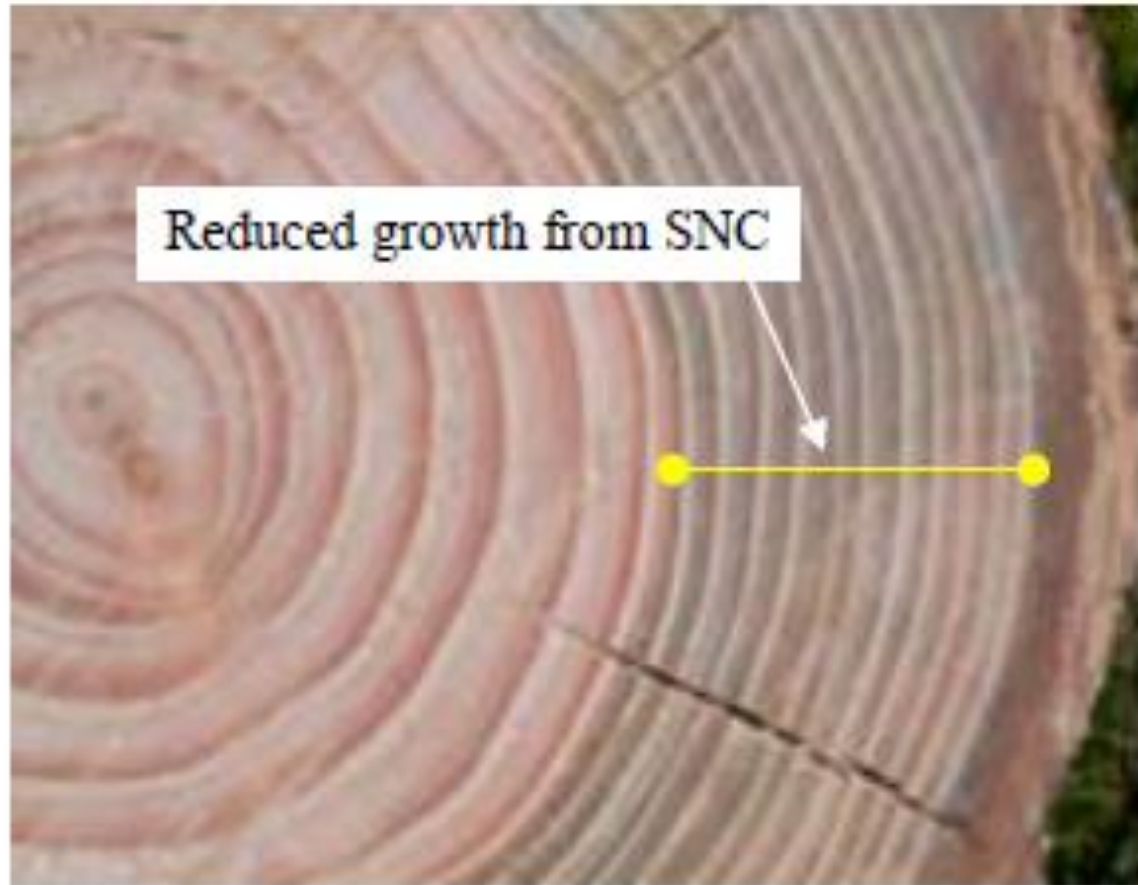
- *Nothophaeocryptopus gaeumannii*
- Historically it has behaved as an epiphytic needle fungus on Douglas-fir in BC
- An epiphytic fungus is a fungus that grows on a plant but is not considered detrimental
- The fungus produces fruiting bodies (pseudothecia) that can plug up the stomata of Douglas-fir
- If 25-50% of the stomata become plugged the needles turn yellow and are shed prematurely, presumably as a result of carbon starvation
- Stomatal occlusion might also be linked to susceptibility to drought and or heat stress
- Severely affected trees have only one or two years of needles in the outer crown
- needle loss results in growth losses when there are 3.5 or fewer years of needle retention







Effects on Diameter

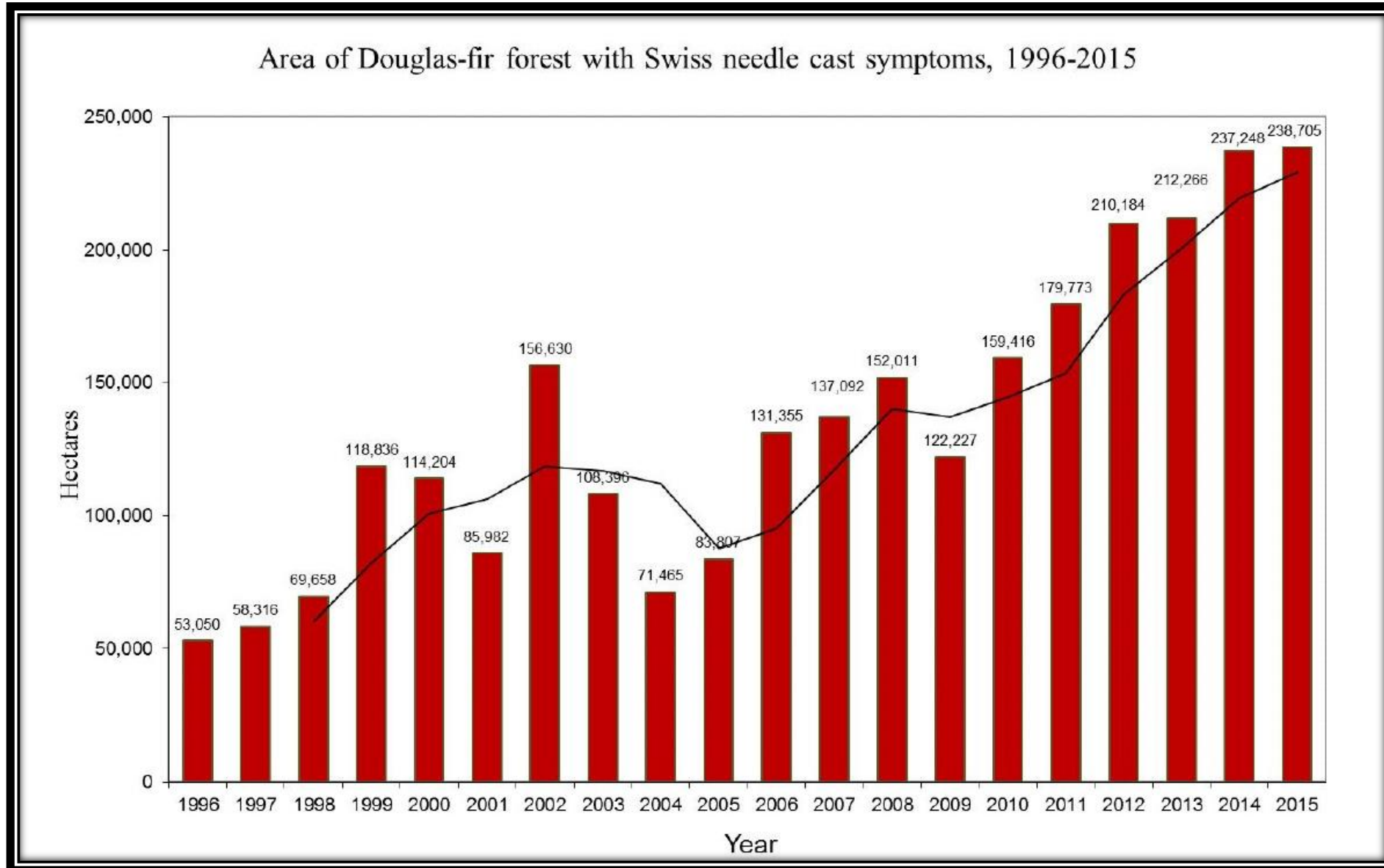




History

- It was first identified as a pathogen by Swiss Pathologists on introduced Douglas-fir in Switzerland in 1959
- Later it started showing up on Douglas-fir planted in New Zealand and in north American Christmas tree plantations
- In Oregon in the 1980's, defoliation began to be observed in Douglas-fir plantations
- Then starting in the early 1990s they began to observe growth losses in Oregon in what is described as the fog belt
- Growth losses were not observed in BC until relatively recently

Hectares affected in Oregon and Washington



SNC in BC

- In the last ten years it has become an increasing problem in coastal British Columbia
- However, unlike in Oregon it doesn't seem to be restricted to one particular area and aerial surveys are more difficult
- Further monitoring is needed to see if increased defoliation is occurring on some interior sites as well. In BC it seems to be worst in high rainfall areas such as SW Vancouver Island, the Sunshine Coast, and Chilliwack. Chilliwack has some of the worst Swiss Needle cast but it appears to be highly variable depending on where you are
- We aren't currently able to accurately predict which stands will be most significantly impacted

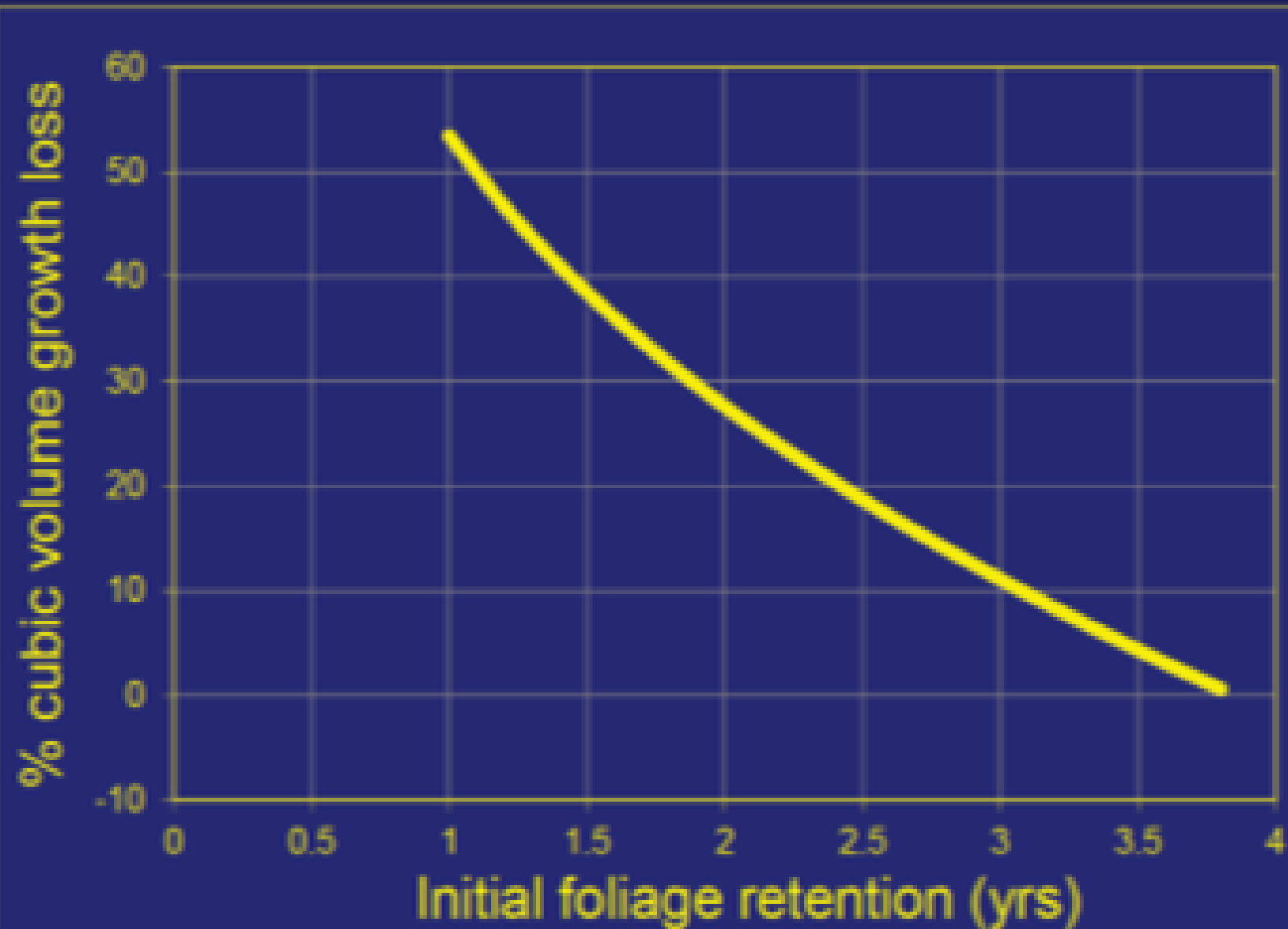
What are the impacts ?

- In New Zealand and Oregon 30% growth loss had been observed with some stands having growth losses as high as 50%
- Losses in BC have not yet been calculated but some of our most impacted stands are comparable to those in Oregon

How is Swiss needle cast severity measured

- Pseudothecia (fruiting bodies) can be seen on the underside of needles of even apparently healthy Douglas-fir
- Severity is measured by needle retention or % of stomata occluded by pseudothecia. Most unaffected trees will carry at least 4 years of needles
- Ultimately severity is measured through its impact on growth

Average growth loss by initial foliage retention, 1998-2008



What types of stands are most impacted (Oregon)

- younger stands <30m years old appear to be most impacted
- In young stands second year needles appear to be the most affected but in older (100 yr.) trees in Oregon it appears to affect older needles
- In Oregon the top crown 1/3 had the highest pseudothecial counts but in BC the lower third have had the highest counts

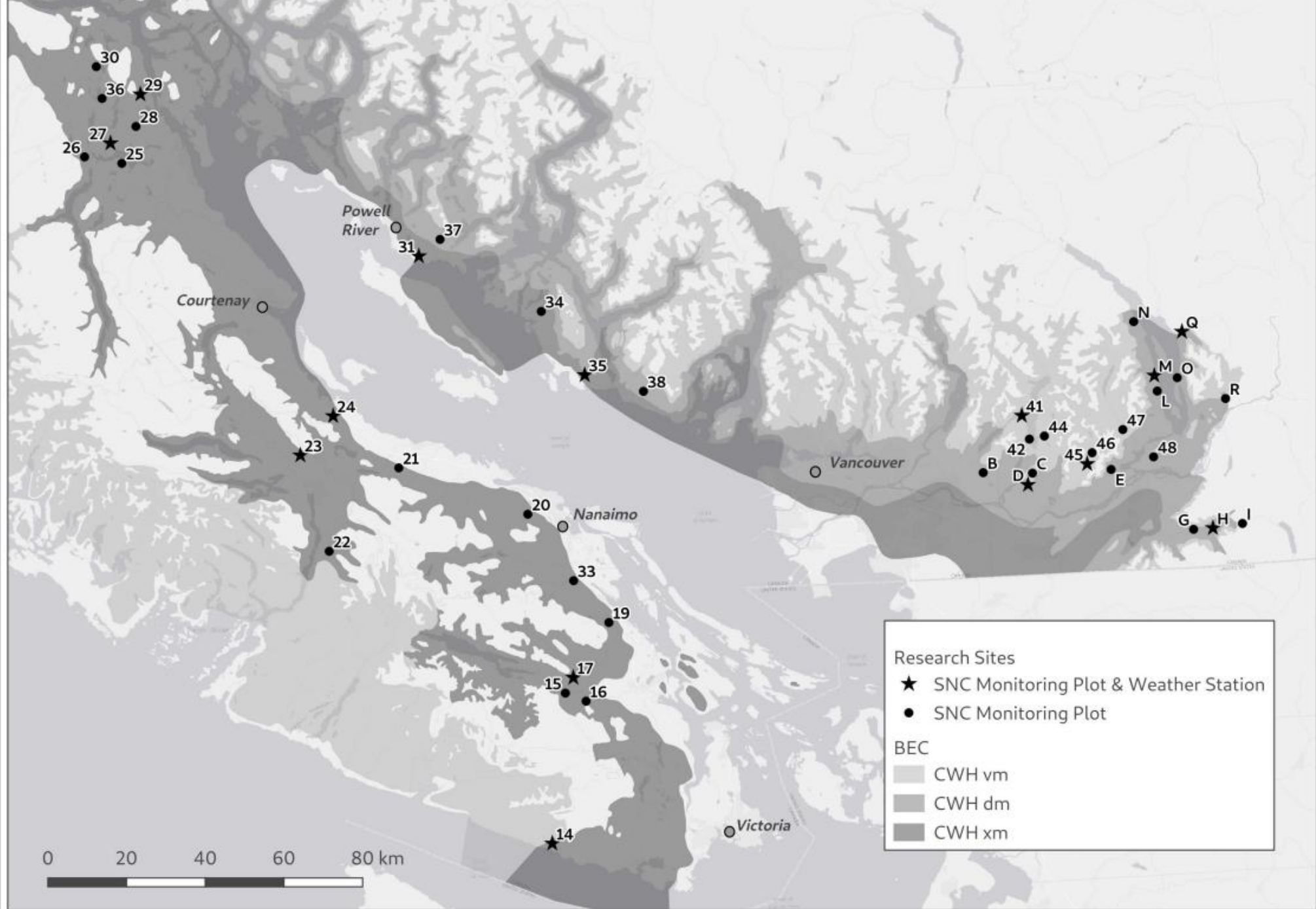
How do silviculture activities impact SNC?

- Treatments such as brushing, thinning from below, mixed planting, and fertilization have no impact on the disease but may reduce growth losses
- Reduced growth means that silviculture treatments have reduced economic return
- Pruning of the lower crown is not recommended. Lower and inner branches appear to have greater needle retention than outer and upper crown branches
- Thinning to select for other species may be warranted in severely impacted stands that contain other tree species such as western hemlock (D- rule)

What is the province doing about it?

Monitoring

- Transects in Chilliwack to measure needle retention (stewardship staff)
- 43 PSPs put in over 3 years by **Stefan Zeglen** in the CWH (21 xm, 15 dm, 7 vm) on Southern Vancouver Island (18), the Sunshine Coast (5) and Chilliwack (20)
- Large 800m² plots
- Soil, foliar analysis, stomatal occlusion and molecular ecology on 5 largest trees in each plot
- 14 of plots have weather stations
- Plots monitored for 10 years (approaching ½ way point)
- Cores will be collected at year 10 to determine growth impacts
- Less detailed and cheaper monitoring strategies also needed to cover off more areas and better understand the impacts and hazard



Other potential strategies

- 1) Adjust stocking standards to reduce the reliance on Fdc
- 2) Collect needle retention data and height increment as part of Free Growing assessments in Fdc leading SUs
- 3) Don't transfer seed from drier to wetter BEC variants
- 4) Breed for tolerance
- 5) Use monitoring data to adjust Fdc growth curves and TSR projections
- 6) Greater Investment in SNC research

Correlation with weather

- On the Oregon coast analysis of weather data was consistent with the expectation that “mild winter temperatures and late spring/ early summer precipitation would be associated with greater Swiss needle Cast severity”
- Preliminary data from BC also suggest that spring relative humidity and winter minimum temperature are important variables in determining needle colonization

Seedling inoculation tests in Oregon

Manter et al. 2005 Phytopathology 95:1256

- The number of SNC fruiting bodies on inoculated seedlings subjected to mist, irrigation, and shading was highest in the outer crown and negatively correlated with shade and mist suggesting temperature and not moisture was the critical factor in determining the number of SNC fruiting bodies on needles
- Anecdotally, needle retention in Chilliwack appears to be lowest in the upper crown and outer mid crown and greatest close to the bole and lower crown

What does molecular ecology tell us

- There appear to be 3 distinct lineages in BC that occur together in different frequencies
- Lineage 1i mostly found on (but not restricted to) interior Fd
- Lineage 1c (coastal Fd)
- Lineage 2 (coastal Fd)

Conclusion

- Slower Fdc growth as a result of SNC is happening now and poses a real threat to the future growth of our coastal forests
- Greater monitoring and adaptation strategies are needed now to mitigate potential negative impacts from SNC
- These include better monitoring and adjustments to stocking standards, seed transfer rules, timber supply projections, and greater investments in tree breeding and SNC research
- We need to do a better job of anticipating and preparing for emerging forest health problems by slowing the rate of climate change, implementing climate mitigation strategies, better forest health monitoring, and assessing future potential risks from native and non-native forest health factors
- Paying attention to what's happening in other jurisdictions (e.g. Oregon and Switzerland) can help us better prepare for problems we may be facing in the future