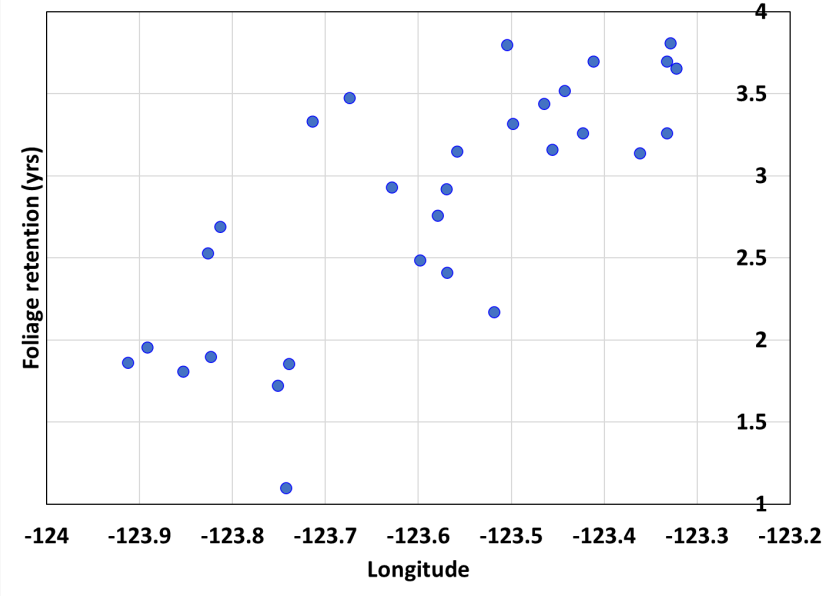
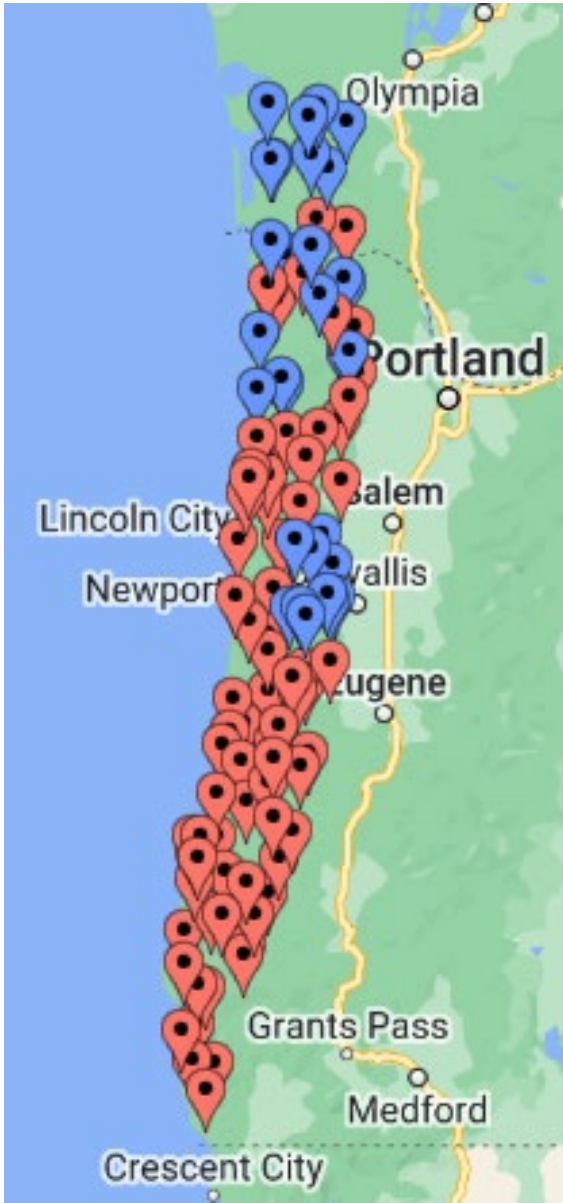
Swiss needle cast growth analysis, 2023

November 30, 2023

SNCC Research Plot Network

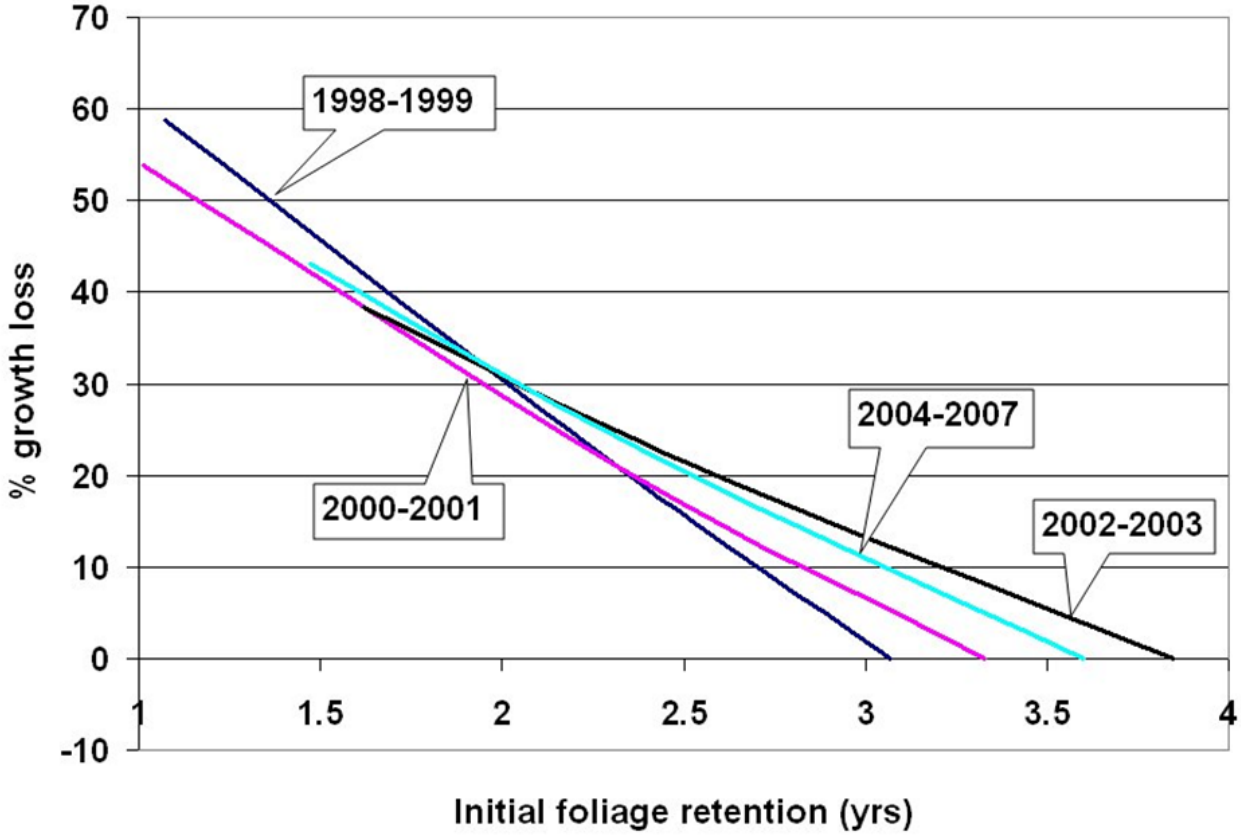
- New effort uses 102 plots from new SNCC plot network (installed 2013-2015)
  - Has greater geographic range (than GIS)
  - Indicative of current stands
  - Doesn't include stunted stands that will never become merchantable
  - 10-year remeasurement of 30% of network (in blue)



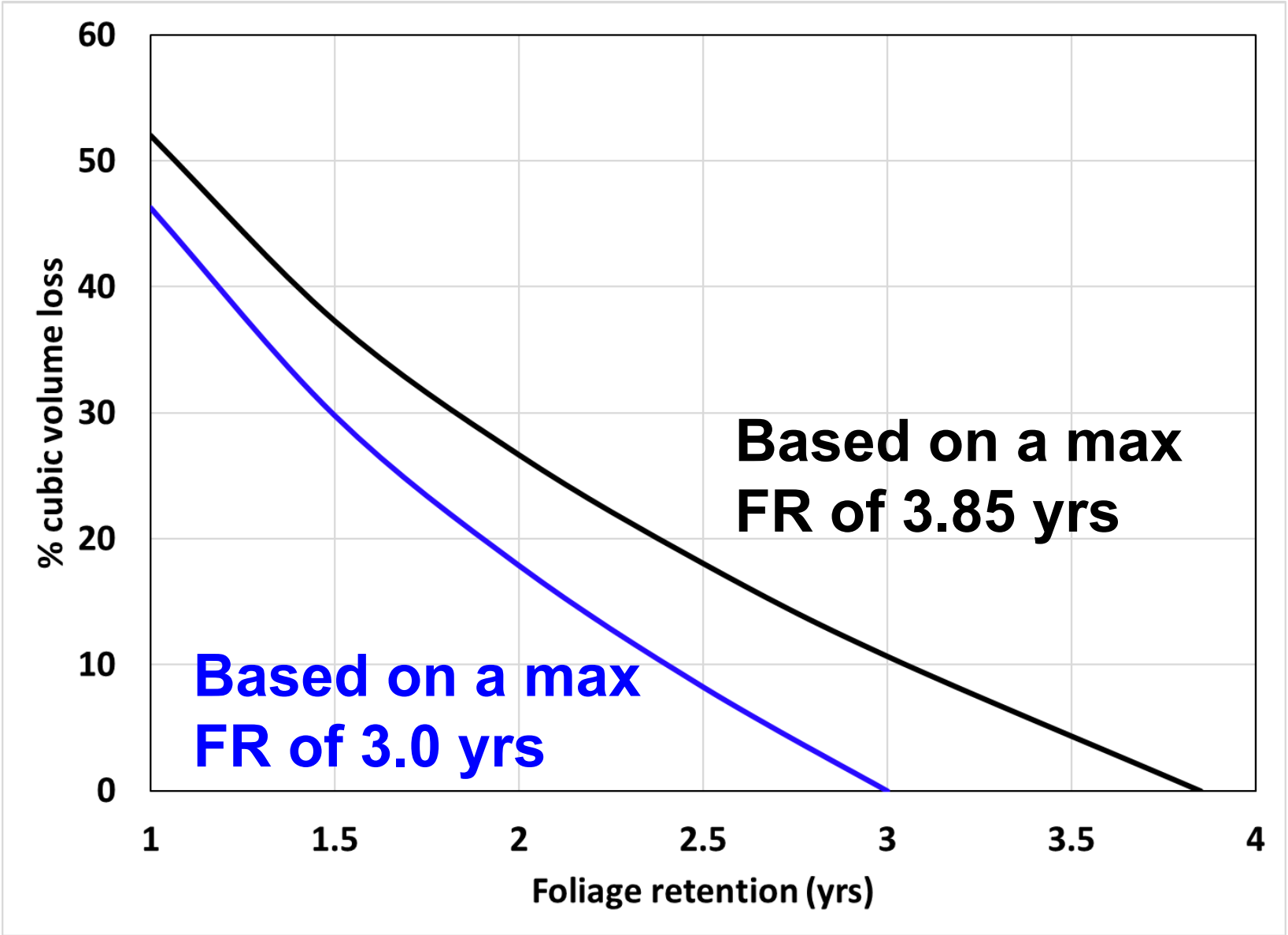


Stand level cubic volume growth loss, 1998-2008

- **Growth loss is expressed relative to maximum foliage retention of plots within each growth period**



Stand level cubic volume growth loss, 1998-2008 Combined, from 2011 publication



Stand level cubic volume growth, 2013-2019

$$CFV\_PAI = a \cdot (BA_{df}^{b}) \cdot \exp(c \cdot BA_{ndf}) \cdot SI_{adj}^{d} \cdot (1 - \exp(e + f \cdot FR^{3}))$$

CFV estimated using Bruce and Demars vol eqn.
Doesn't account for taper differences

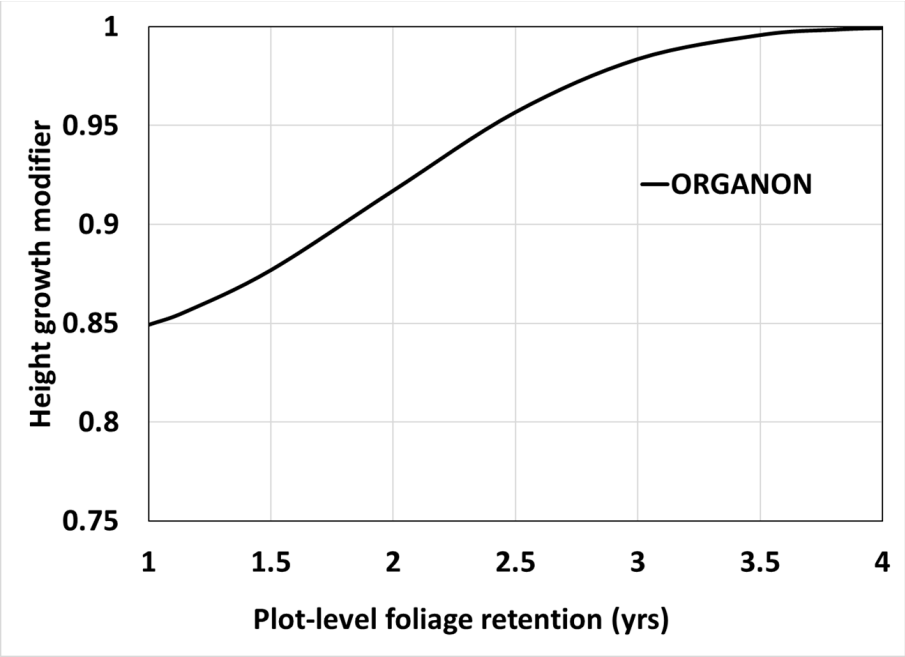
Periodic annual cubic volume growth dependent on:

- **initial DF basal area (+)**
- **basal area in other species (-)**
- **Douglas-fir site index (+)**
- **Douglas-fir foliage retention (+)**

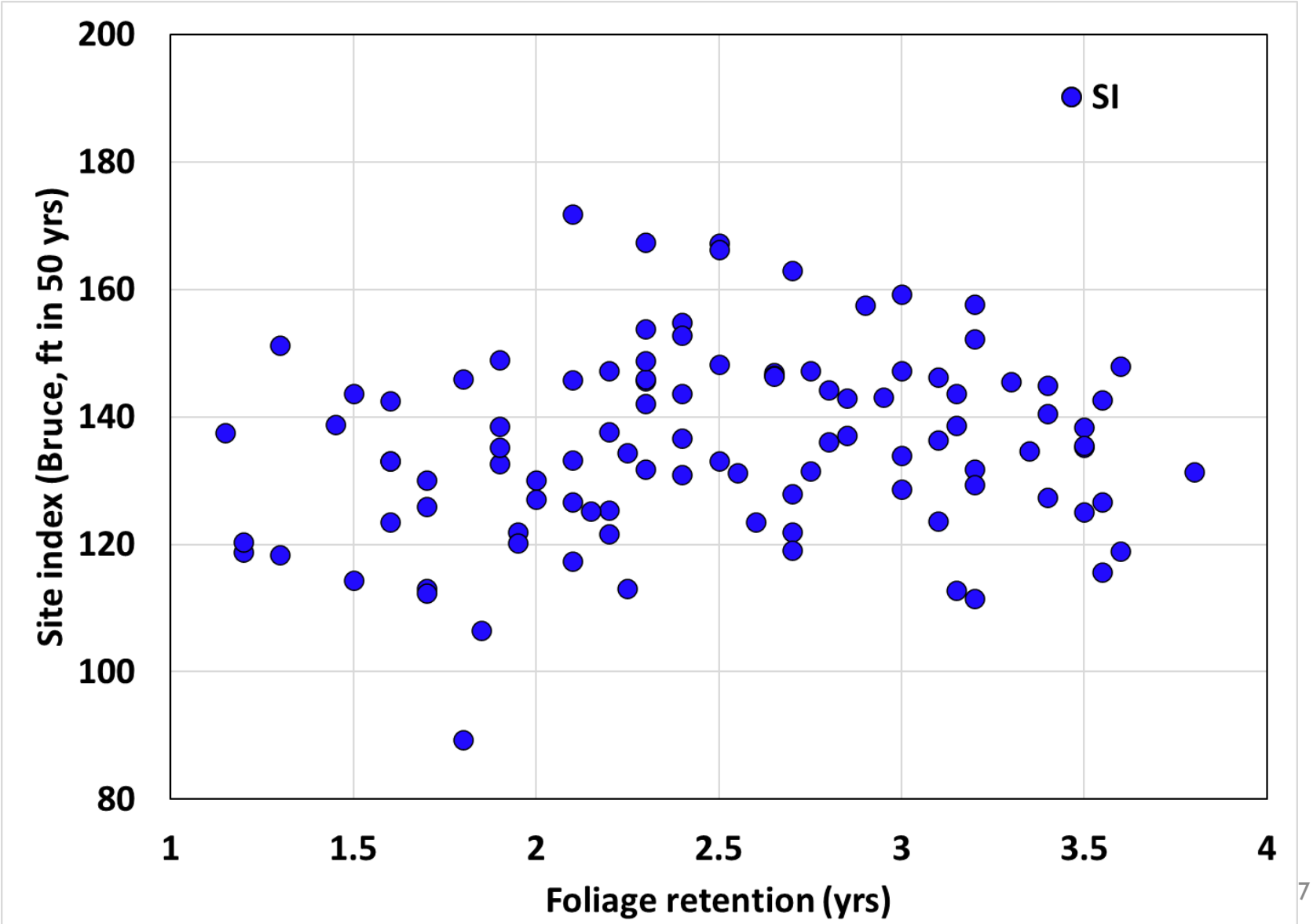
The site index problem

Dominant trees in infected stands have lost height increment due to SNC

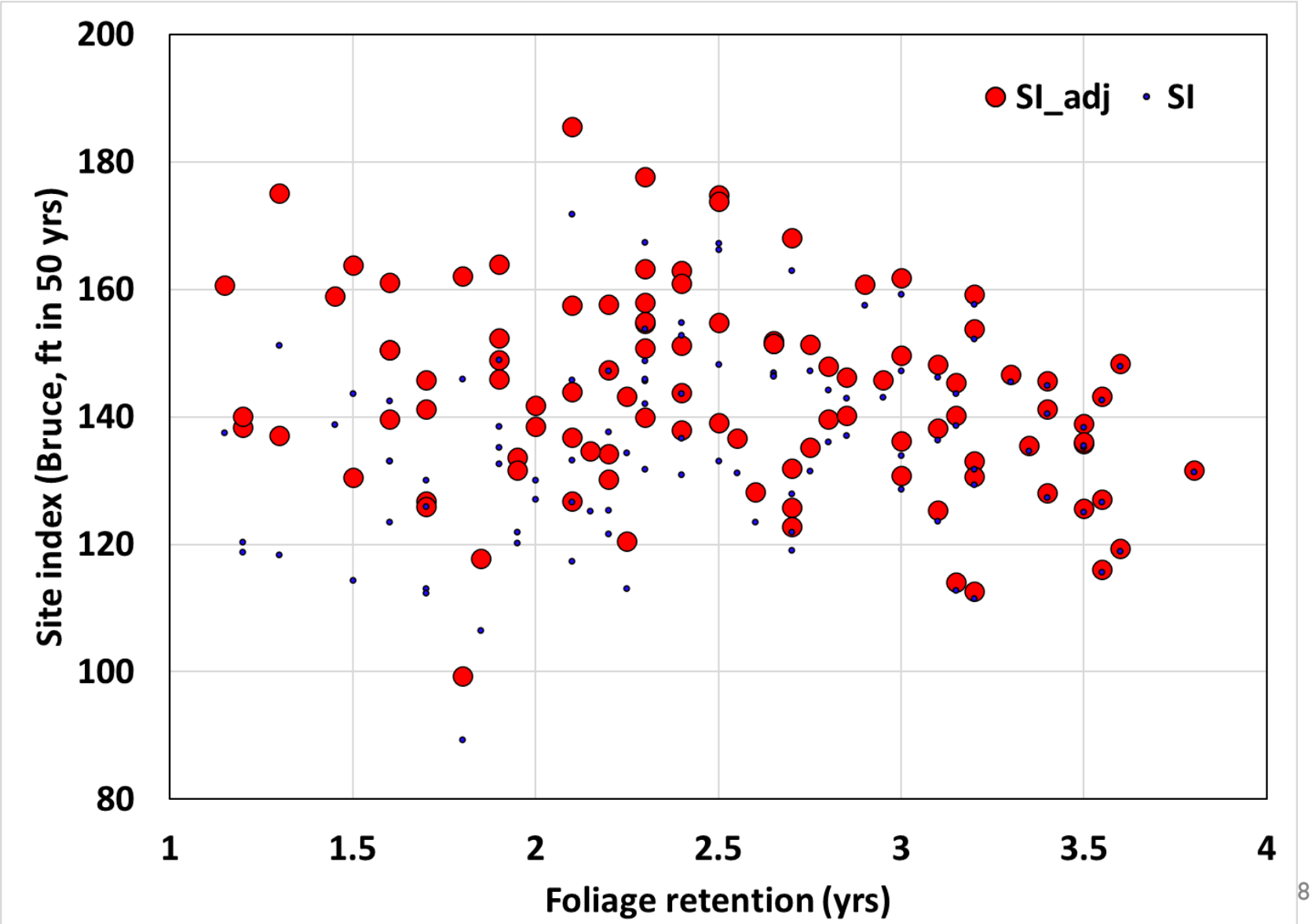
- Calculated the Bruce (1981) site index for each plot
  - SI= f(Ht_{40}, age)
- Adjusted the SI using the 2014 Hann SNC ORGANON height modifier
  - Adjusted SI =
  - SI_A= f(Ht_{40}/(SNC Htmod), age)
  - $SI_A = SI/(1-\exp(b_0+b_1 \cdot FR^3))$



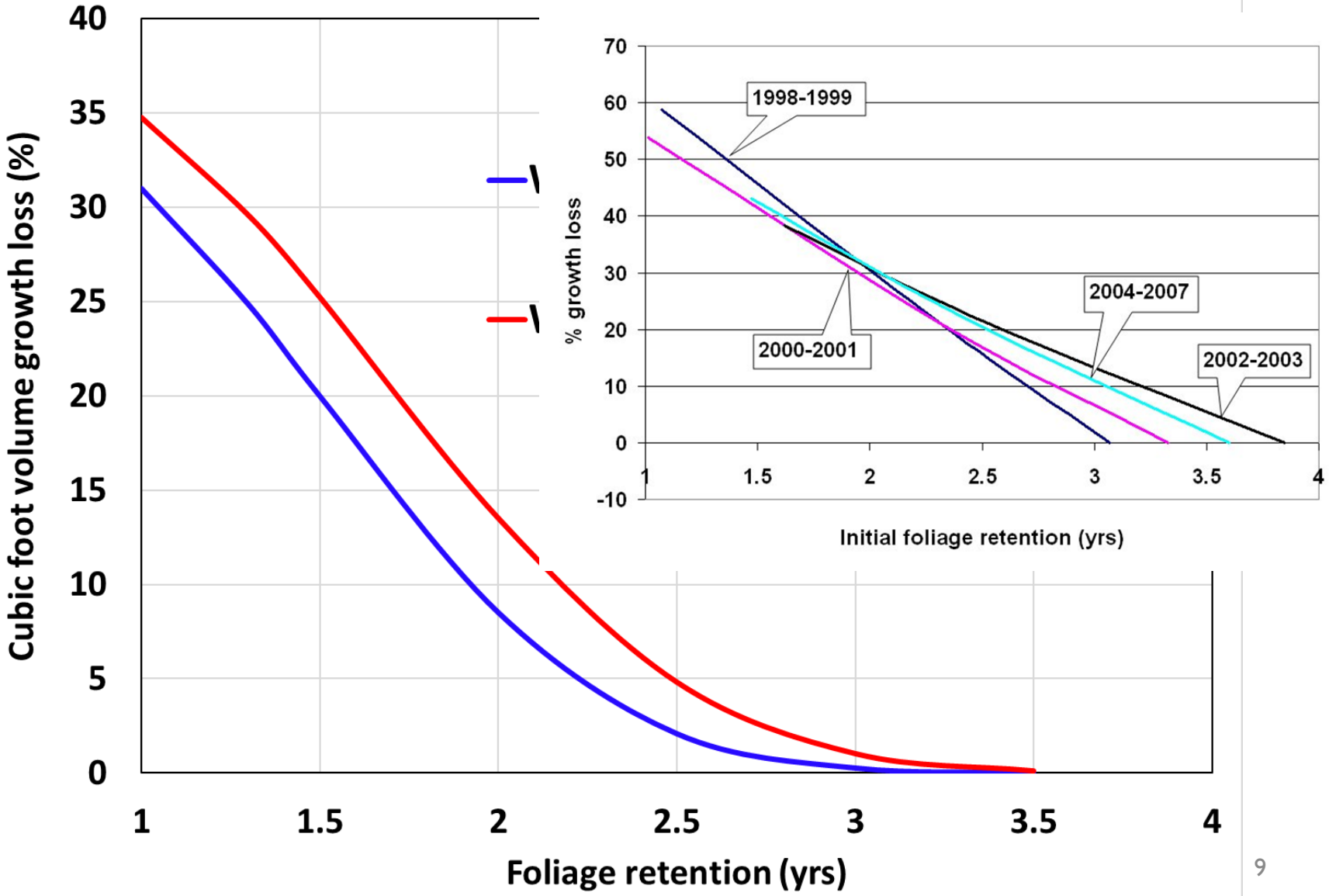
Site index (from height-age pairs) vs. Folret, new network



Site index (from height-age pairs) vs. Folret, new network, adjusted



Stand level cubic volume growth loss, 2013-2019

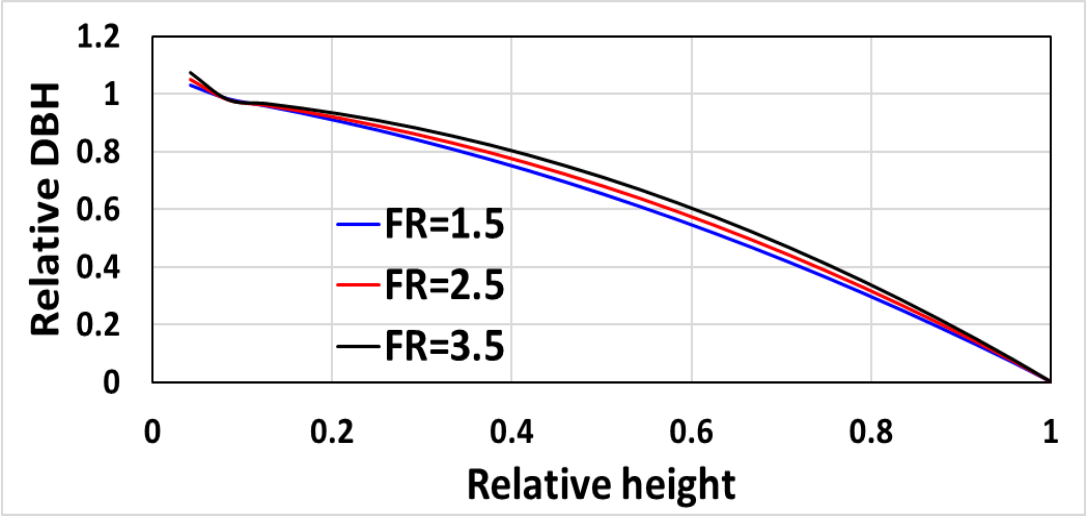


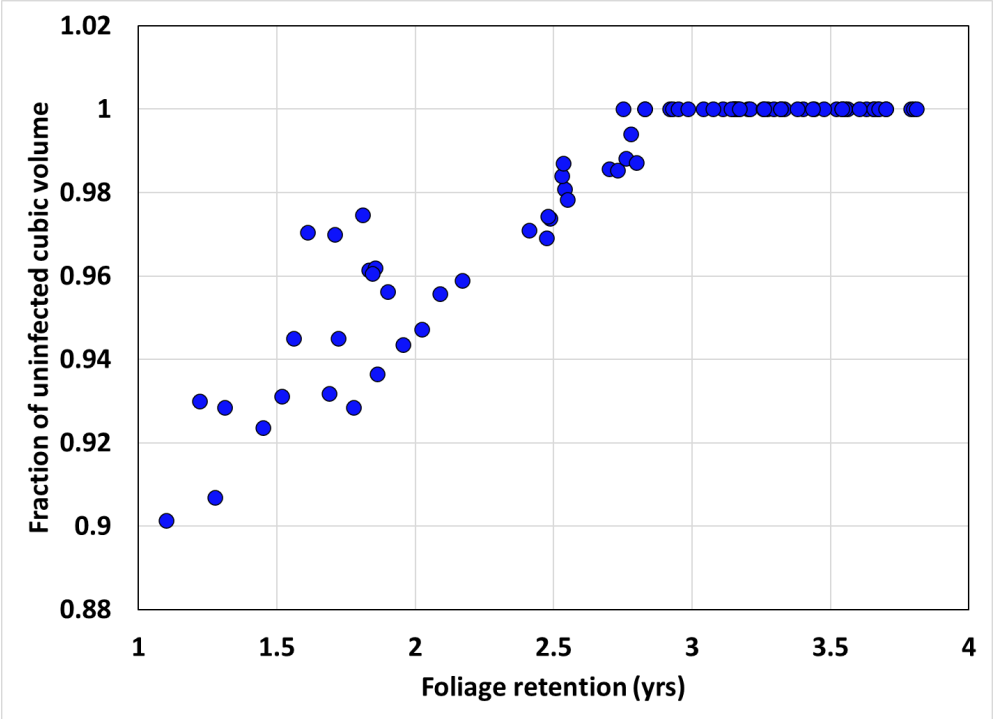
Why is the growth loss lower? The theory…

- GIS plot network represented the 1998 population.
- New plot network represents the current population
- Many of the worst stands that were sampled in 1998 are no longer present on the landscape. Those stands have been harvested and not replanted to Douglas-fir.
- Worst performing plots that resulted in high growth loss estimates are gone.
- If zones where those plots existed were replanted to DF, growth loss estimates would likely go back up.

Vol. estimates with and without accounting for taper

- For a given DBH and Ht, upper stem diameter of infected trees is smaller
- Lower graph compares summed cubic volume of treelist without SNC to that of different foliage retentions
- Application of taper modifier to treelist reduces cubic volume estimates by up to ~10%





Second growth period

- Original (full) model
- $CFV\_PAI = a \cdot (BA_{df}^{b}) \cdot \exp(c \cdot BA_{ndf}) \cdot SI_{adj}^{d} \cdot (1 - \exp(e + f \cdot FR^{3}))$

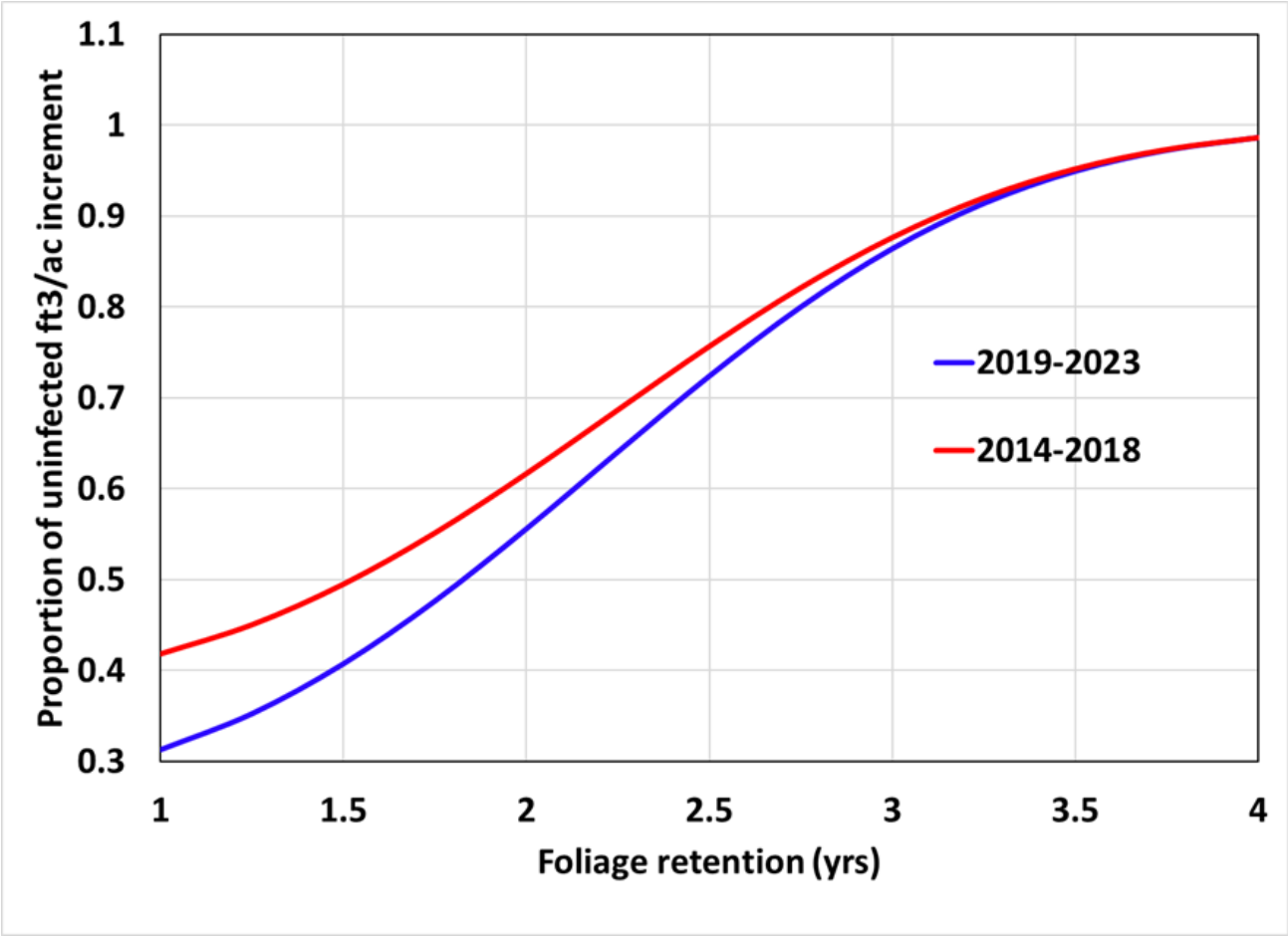
- Reduced model for limited dataset
- $CFV\_PAI = a \cdot (BA_{df}^{b}) \cdot (1 - \exp(e + f \cdot FR^{3}))$

- Absolute loss estimate (1.0 - Y-axis value) should be ignored due to the limited size of the dataset and the the over-representation of uninfected plots

- The value of this comparison is in the relative loss estimates of the plots now versus then.

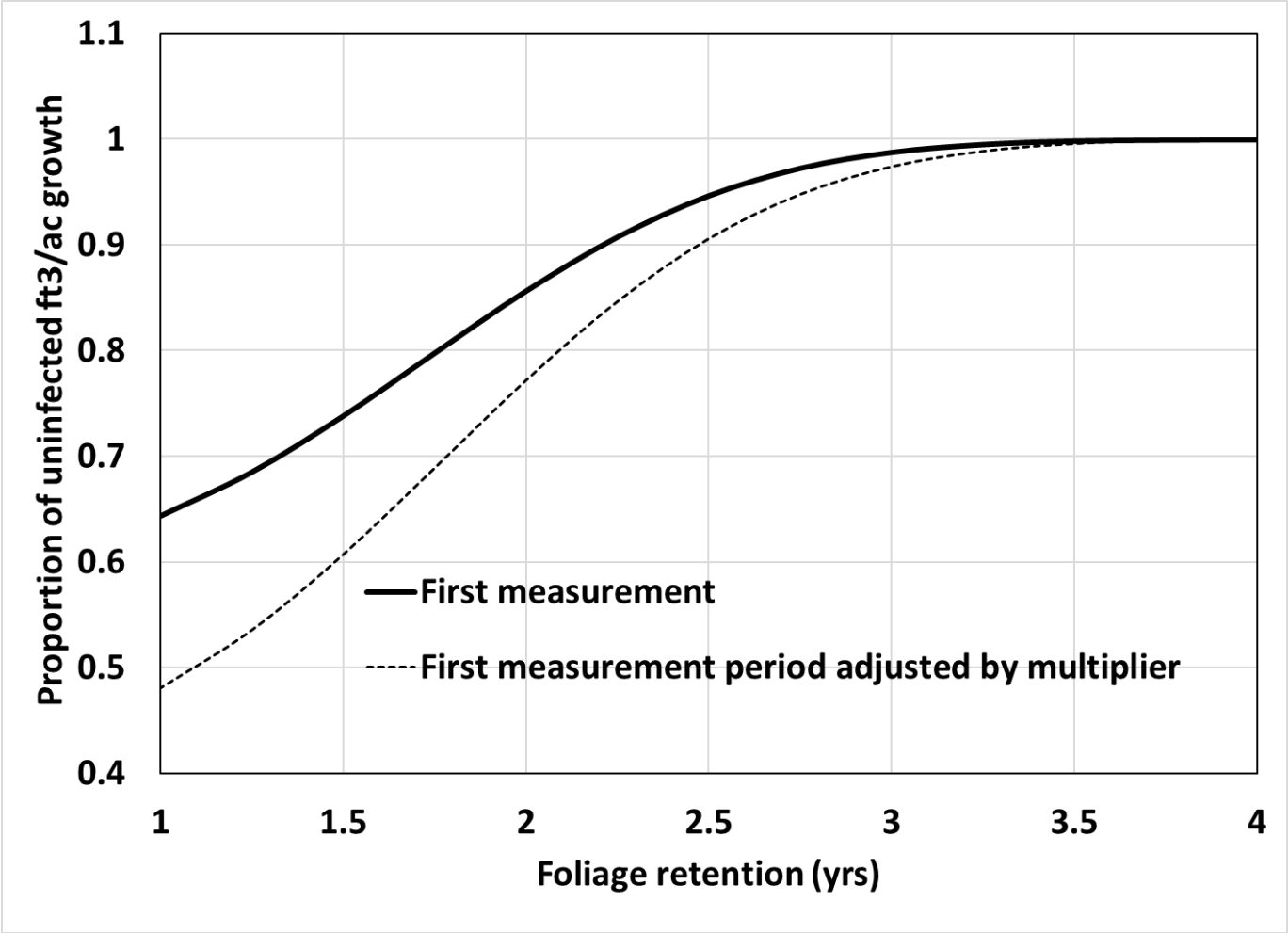
Second growth period

- Results imply that the growth losses in the most recent five-year period (2019-2023) are greater than the previous period (2014-2018)



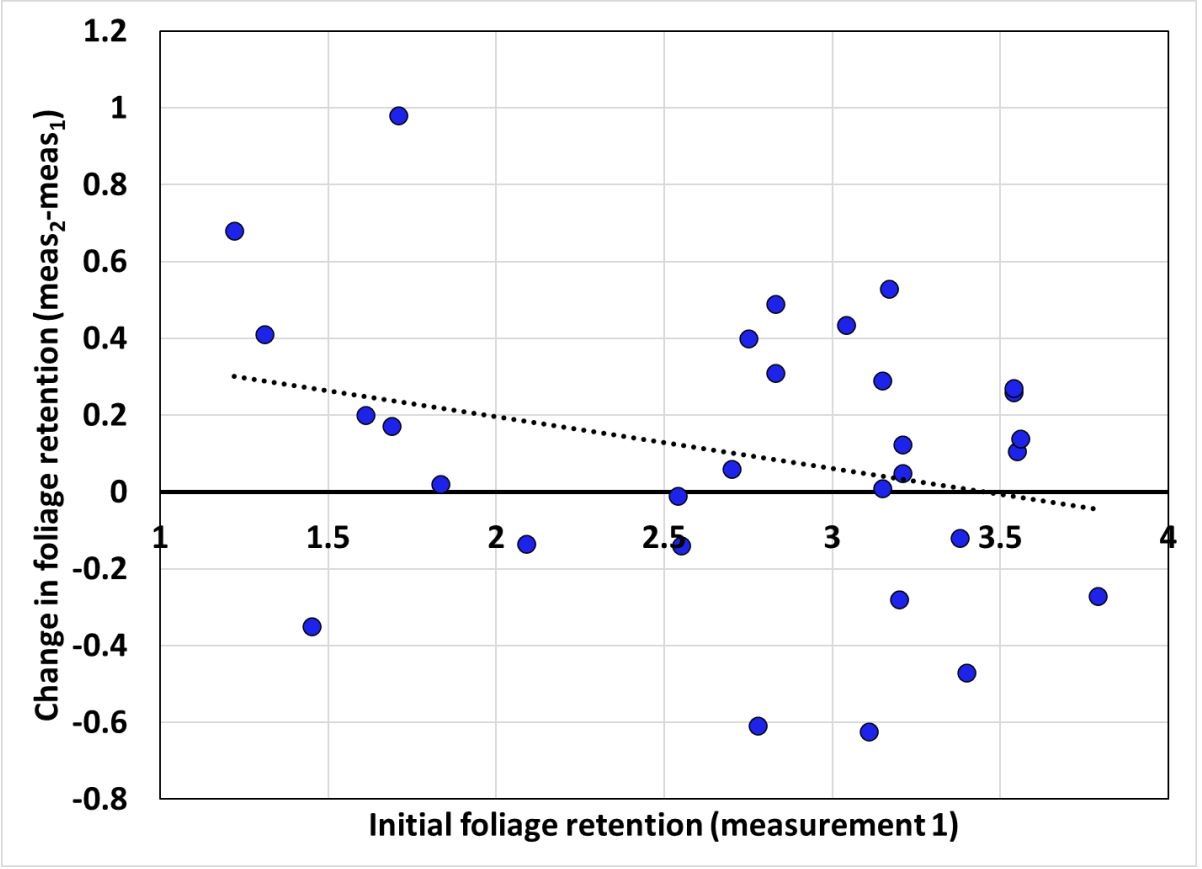
Second growth period

- If first period estimate of loss is adjusted by multiplier: ($FR\_effect_{2019\text{-}2023}$/ $FR\_effect_{2014\text{-}2018}$)



Second growth period

- Growth fit is based on initial SNC conditions
- Improved FOLRET over 5-yr period not accounted for
- Increase in FOLRET over period suggests improved conditions
- If FOLRET over second period has decreased relative to initial condition…
- Analysis will need to account for FR at start and end of period




Thanks