

The Swiss Needle Cast foliage disease epidemic on the Northwestern coast of the US.

Swiss needle cast (SNC)

- A foliage disease of Douglas-fir (*Pseudotsuga menziesii*) caused by the endemic ascomycete *Phaeocryptopus gaeumannii* (figures 1, 2, 3)
- 1990s: epidemic of SNC in Oregon, Washington, British Columbia
- 1996: SNC Cooperative established and annual aerial survey begins
- In Oregon, ~104,500 ha of visible symptoms since 2006 (figures 4, 5)
- In Washington >92,000 ha had visible symptoms in 2012 (figure 6)
- SNC is impacting Douglas-fir across > 1,690,000 ha along the Pacific coast from S. OR to N. WA



Figure 1. Douglas fir needles affected by *Phaeocryptopus gaeumannii*.



Figure 2. Crown of a diseased Douglas-fir with 1-year of needle retention



Figure 3. Swiss needle cast causes Douglas-fir tree crowns to look yellow-brown in spring. Symptomatic Douglas-fir is surrounded by light-green red alder and dark-green Sitka spruce and western hemlock. Photo: Flowers and Schroeter, 2014, Oregon Department of Forestry.

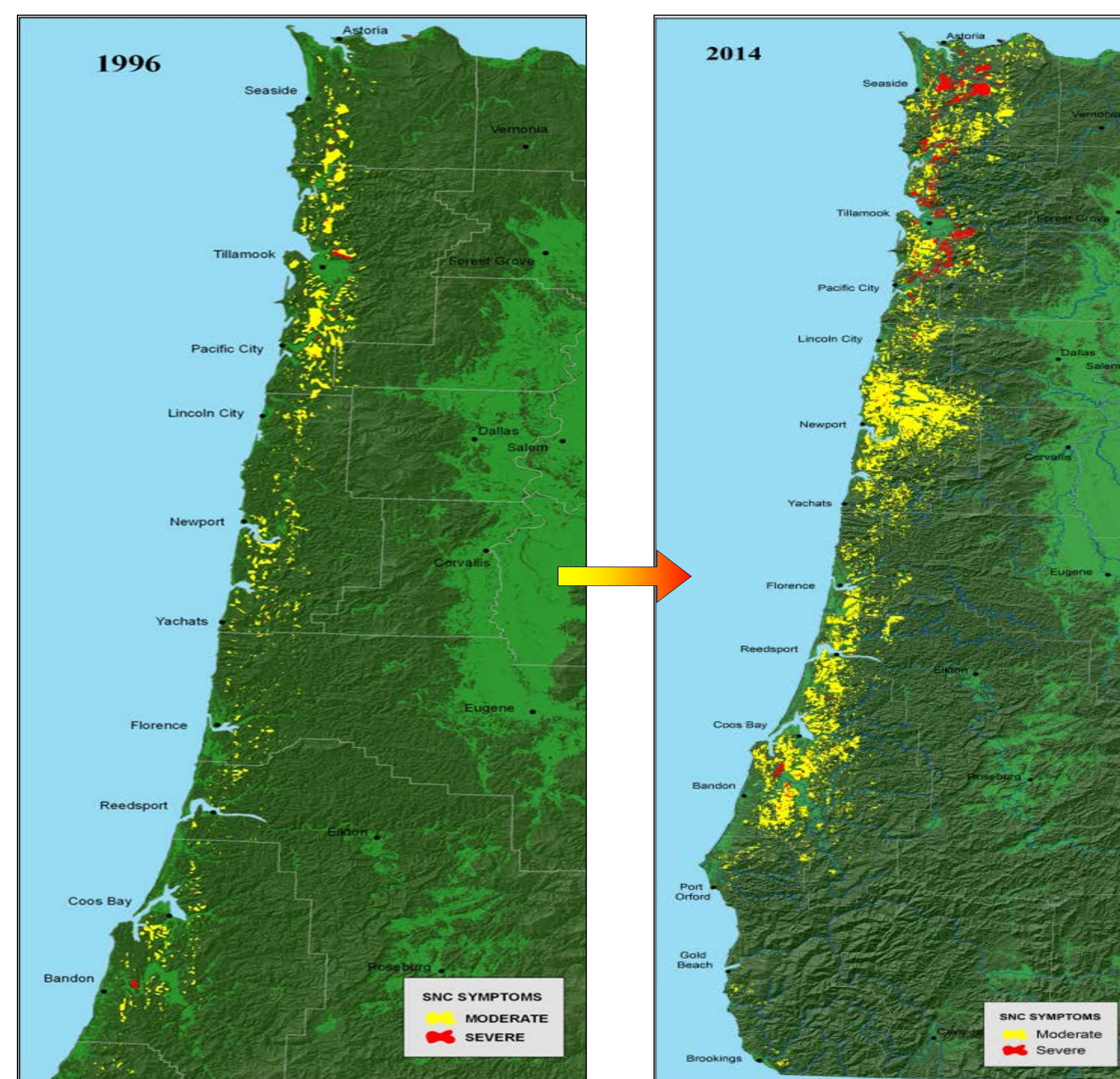
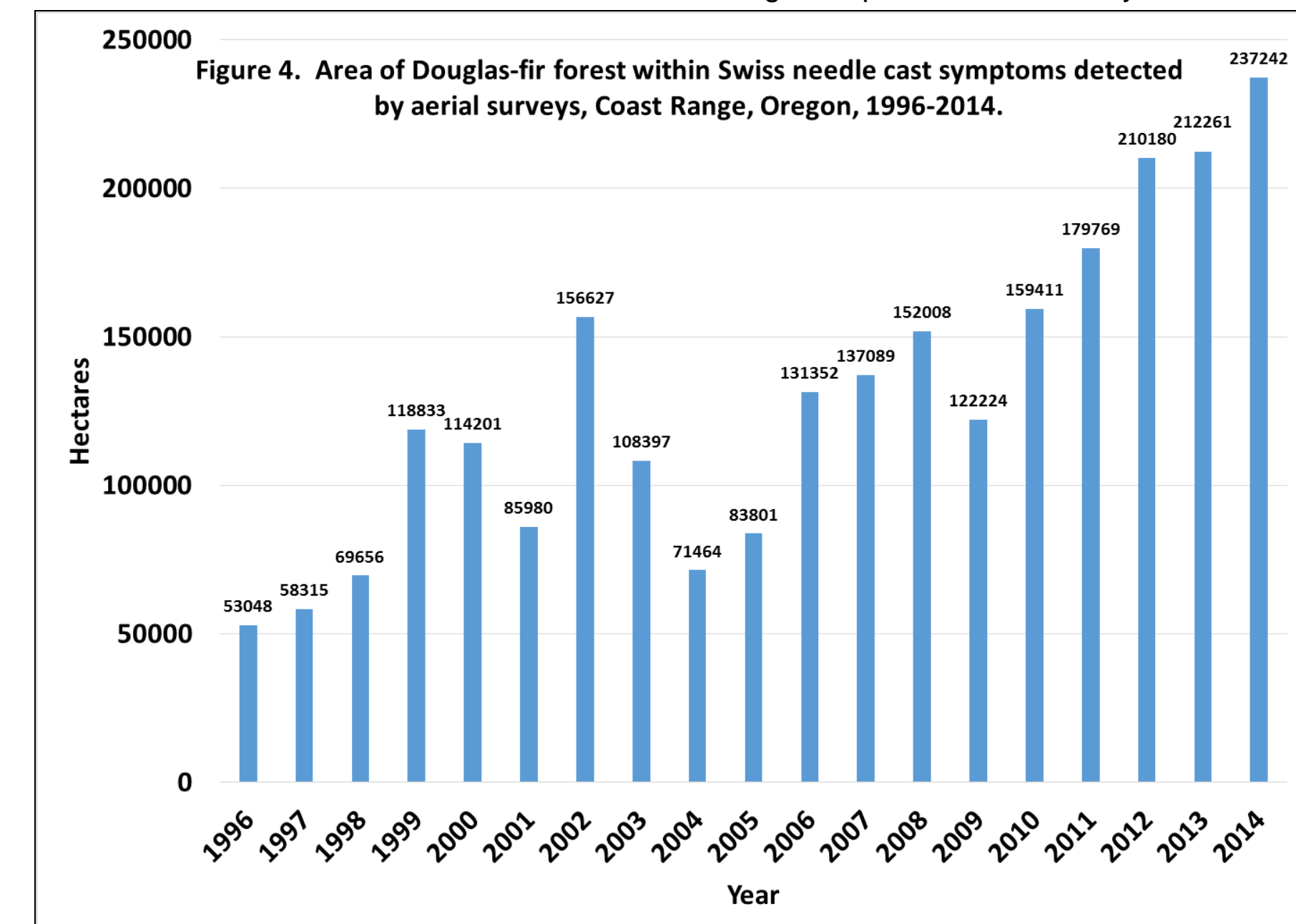


Figure 5. Distribution of SNC symptoms detected by aerial survey in western Oregon. Maps provided by the Oregon Department of Forestry



Figure 6. First aerial survey in Washington since 2000. Map provided by Washington Department of Natural Resources.

Increase in disease incidence is correlated with:

- Climate: warming winter and spring temperatures (figures 7, 8), abundant spring and summer leaf wetness from fog and precipitation (figure 9)
- Management: intensification of Douglas-fir plantations, i.e. shift from *Picea sitchensis*, *Tsuga heterophylla*, *Thuja plicata* and *Alnus rubra*
- Soils: fertility (N) high, low calcium

Impact of SNC on tree growth :

- significant reduction of tree diameter and height growth when mean needle retention < 3 years (Figure 10)

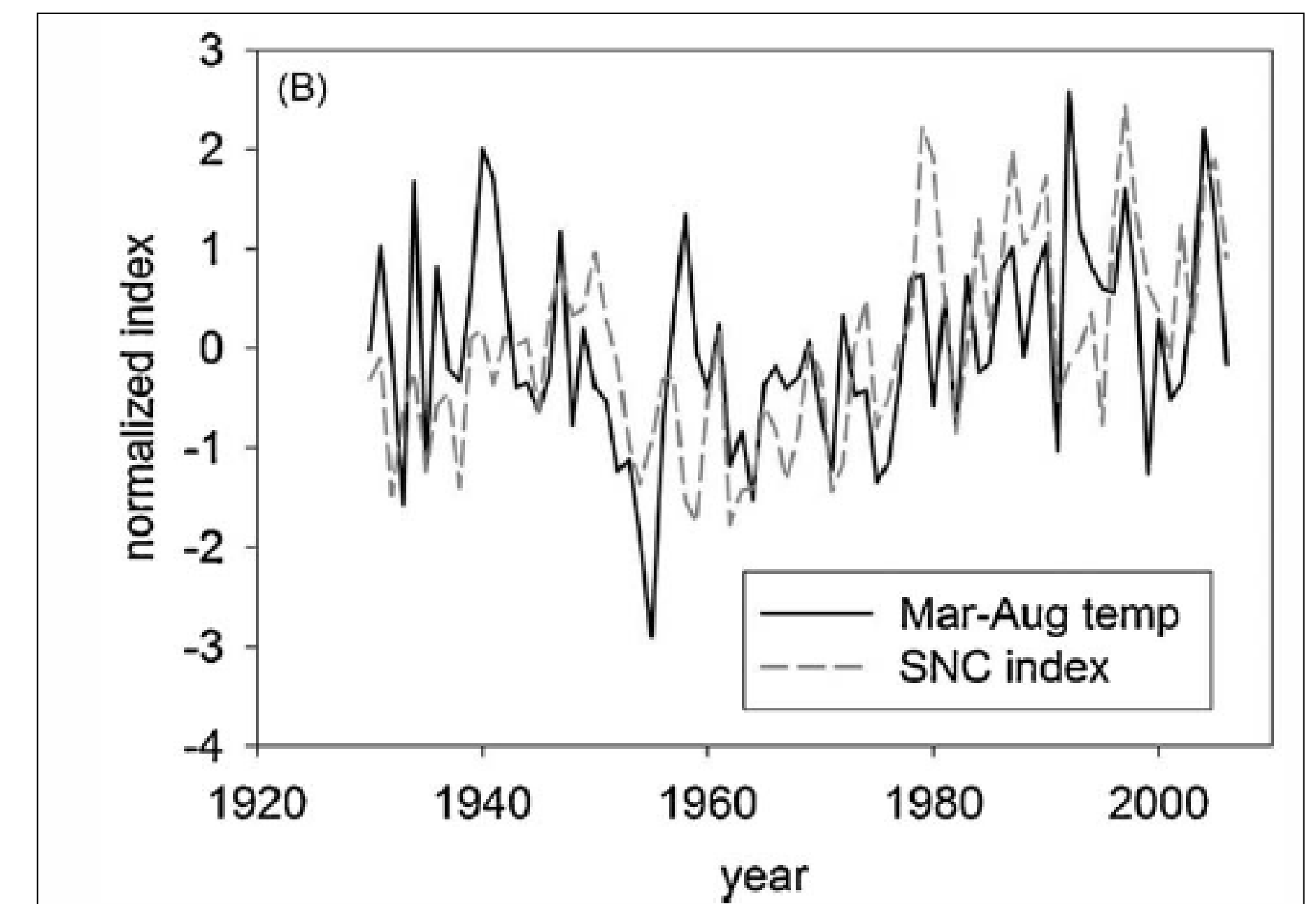


Figure 7. Black et al. 2010. Correlation found with SNC index and March – August temperature.

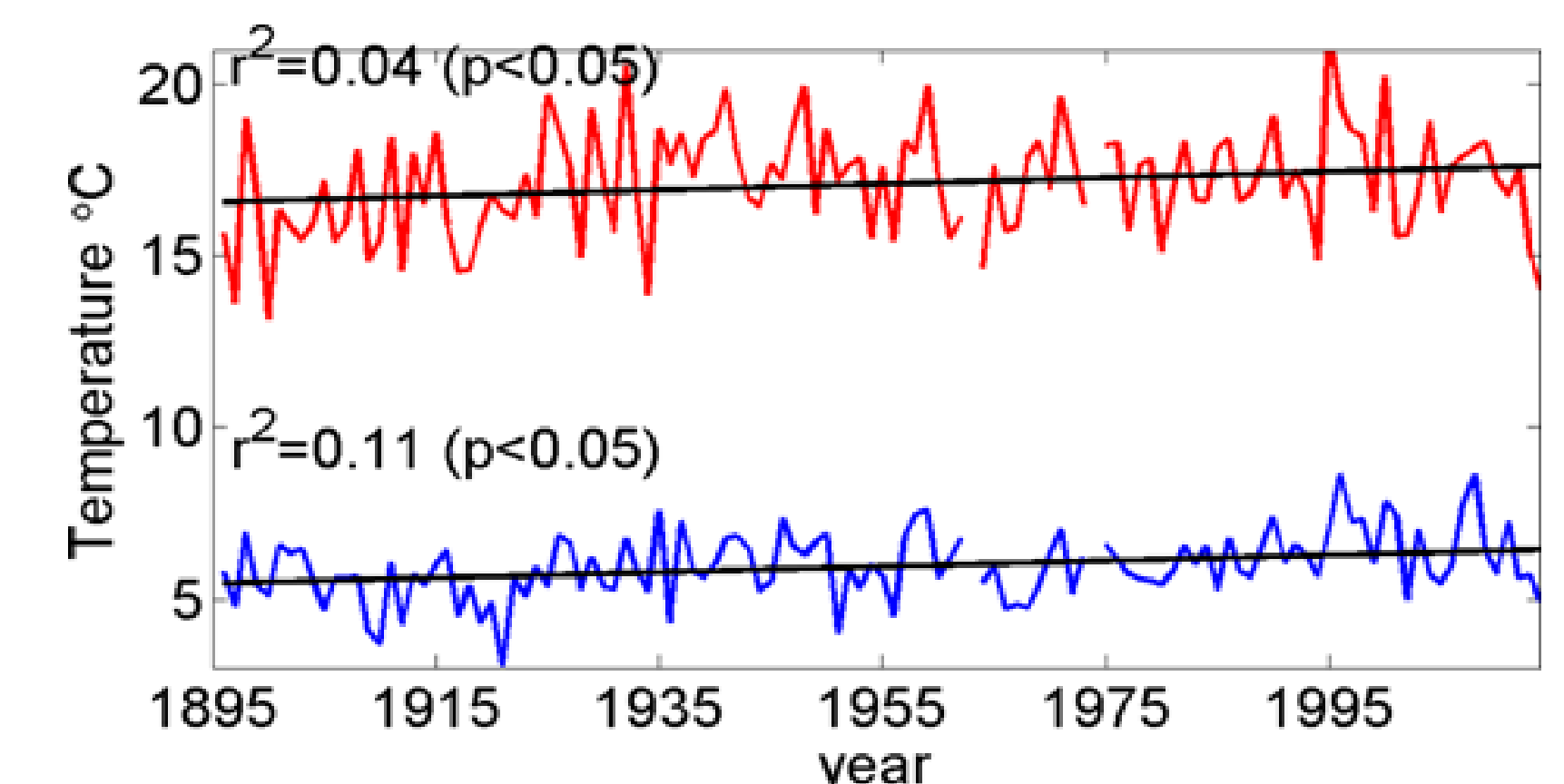


Figure 8. Upward trends in maximum and minimum spring temperatures (May) since the 1950s have been observed in areas where SNC disease has recently spread.

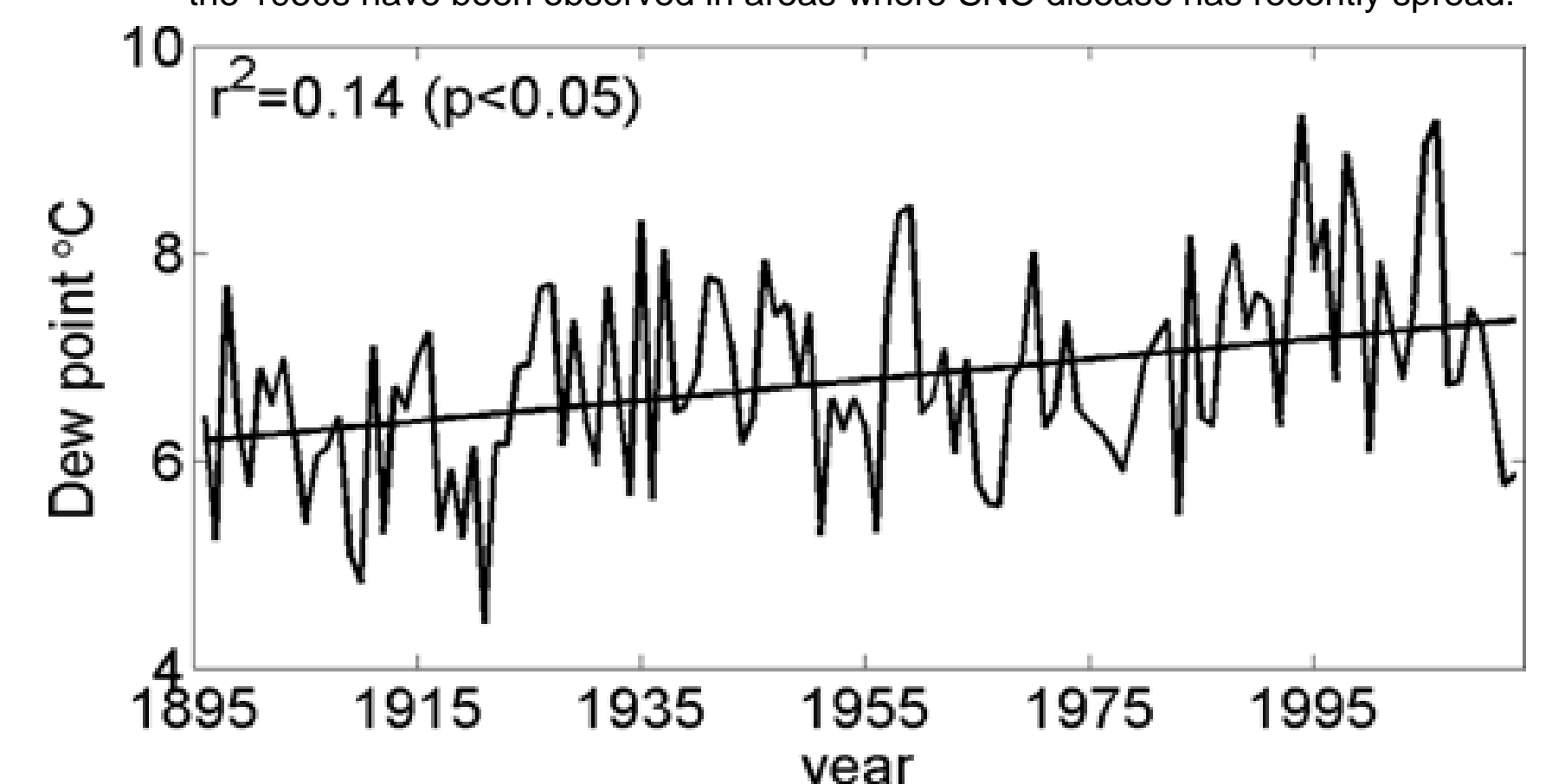


Figure 9. Related increase in dew point (from PRISM data acquired by averaging observations along a strip of Coastal Oregon from the mouth of the Columbia River to Coos Bay. Thomas Hilker and Richard Waring at OSU are investigating climate relationships with SNC.

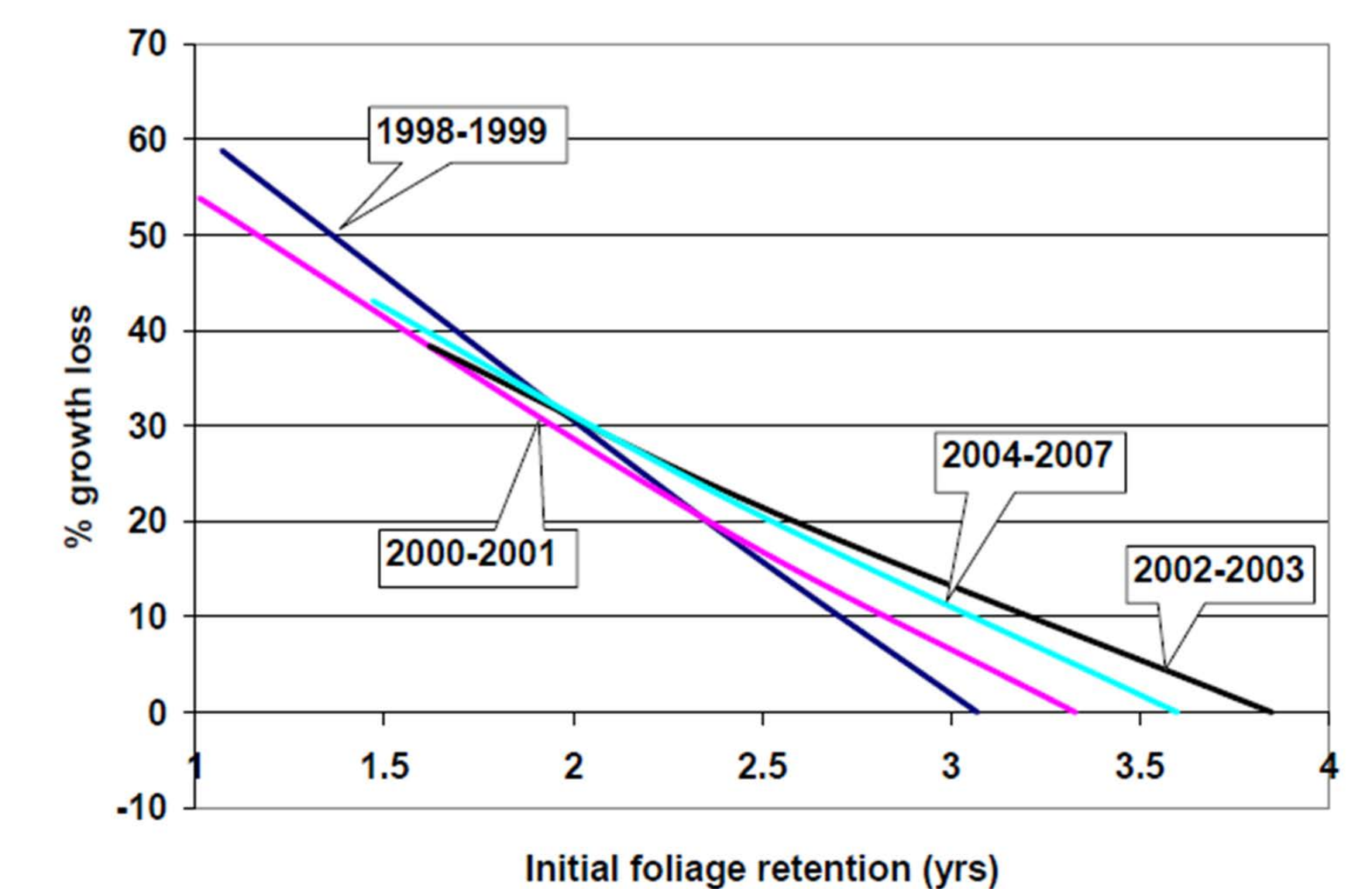


Figure 10. Mainwaring et al. 2008. Implied relative growth losses for the four GIS growth periods. Ranges of foliage retention represent those measured at the start of each growth period.

Citations

- Black, B. A., D. C. Shaw, and J. K. Stone. 2010. Impacts of Swiss needle cast on overstory Douglas-fir forests of the western Oregon Coast Range. *For. Ecol. Manage.* 259: 1673-1680.
- Manter, D. K., P. W. Reeser, and J. K. Stone. 2005. A climate-based model for predicting geographic variation in Swiss needle cast severity in the Oregon coast range. *Phytopathology* 95: 1256.
- Mulvey, R. L., D. C. Shaw, G. M. Filip, G. A. Chastagner. 2013. Swiss Needle Cast. *Forest Insect & Disease Leaflet* 181. USDA FS.
- Shaw, D. C., G. M. Filip, A. Kanaskie, D. A. Maguire, and W. Litke. 2011. Managing an epidemic of Swiss needle cast in the Douglas-fir region of Oregon: the Swiss Needle Cast Cooperative. *J. For.* 109:109-119.