Coastal Washington Swiss Needle Cast Aerial and Ground Survey, 2016

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ABSTRACT

In late April and May, an aerial survey, covering 2.4 million acres, was flown to detect and map the distribution of Swiss Needle Cast (SNC) symptoms in coastal Washington. Nearly 248,000 acres of symptomatic Douglas-fir were mapped, which is a 30% decrease from the 350,000 acres mapped in the 2015 aerial survey. Sixty-three ground sites across the range of the aerial survey were surveyed for SNC incidence and severity, determined by counting fungal reproductive structures in the stomata of Douglas-fir needles, and Douglas-fir needle retention. An average of 2.4 years of foliage were on the trees across all sites. The average percentage of occluded stomata on all sites was 1.6% for 2015 (1-year-old) foliage and 22.1% for 2014 foliage (2-years-old).

INTRODUCTION

The fungus that causes SNC, *Phaeocryptopus gaeumannii* (T.Rohde) Petrak is found throughout the range of its only host, Douglas-fir (Shaw et al. 2011). Swiss Needle Cast causes premature foliage loss and defoliation and can reduce growth of host trees, alter wood properties, and affect stand structure and development (Johnson et al. 2005, Maguire et al. 2011, Weiskittel et al. 2006). The disease is most damaging near the coast due to the fungi-favorable climatic (mild winters and wet springs and summers) and topographic conditions.

An aerial survey for SNC has been conducted in the Oregon Coast Range since 1996, with over 300,000 acres of SNC symptomatic Douglas-fir mapped since 2006 and over 400,000 acres mapped since 2011 (Kanaskie and Norlander 2014).

In 2016 a SNC aerial survey was coupled with a ground survey in Washington. Ground surveys have been conducted in Washington since 1997, with aerial surveys occurring in 1998-2000, 2012, 2015 and 2016. The objective of the ground surveys is to monitor changes in incidence and severity of the disease over time.

METHODS

The aerial survey observation plane flew at 1,500 to 2,000 feet above the terrain, following north-south or east-west lines separated by 3 miles. Observers looked for areas of Douglas-fir forest with obvious yellow-brown foliage, a rather generic symptom that appears to be indicative of moderate to severe SNC disease. Patches of forest with these symptoms were

sketched onto computer touch-screens displaying topographic maps or ortho-photos and the position of the aircraft. Each polygon was classified for degree of discoloration as either “S” (severe) or “M” (moderate). Polygons classified as “S” (CODE, SNC-S) had very sparse crowns and brownish foliage, while those classified as “M” (CODE, SNC-M) were predominantly yellow-brown foliage with slightly denser crowns than those classified as “S”.

The 2016 Washington SNC aerial survey was flown on April 18, 20 and May 2 and covered 2,431,000 acres of forest. The survey is timed to occur when the crown color symptoms have developed, but before the new foliage has emerged (bud break) in late spring. The survey area extended from the Columbia River in Washington north to the Strait of Juan de Fuca, and from the coastline eastward.

Sixty-three ground sites were included in the SNC survey. Stand color, landscape position, elevation, aspect and average tree age were recorded for each site. Foliar retention, diameter at breast height and crown color were recorded for ten trees at each site. Foliage from 2015 and 2014 were collected from the upper third of each of the ten trees at each site and taken back to the lab for microscopic examination of *P. gaeumannii* pseudothecia, a reproductive structure of the fungus. Three hundred stomata on each of ten needles from each foliage cohort were examined for pseudothecial occurrence.

RESULTS AND DISCUSSION

The aerial surveyors flew and made observations on 2.4 million acres of forest land in coastal Washington and mapped 248,000 of Douglas-fir with obvious symptoms of SNC (Figure 1). This is a 30% decrease from the 350,000 acres mapped during the 2015 SNC aerial survey (Figure 2, Table 1). The survey boundaries were similar to those in the 2012 and 2015 surveys. The easternmost area with obvious SNC symptoms was approximately 45 miles inland in central coastal western Washington.

	Severe SNC Symptoms		Moderate SNC Symptoms		Total Acres Mapped	
Year of Survey	% of total acres mapped	Severe SNC Acres	% of total acres mapped	Moderate SNC Acres	% with SNC symptoms	Total SNC Acres
2016	> 1%	14,000	10%	234,000	10%	248,000
2015	1%	19,000	13%	332,000	14%	351,000
2012	> 1%	6,000	8%	222,000	9%	228,000

Table 1. Total acres with Swiss Needle Cast symptoms mapped during the aerial survey, by year.

Swiss Needle Cast symptoms were detected on 10% of the total acres surveyed, with 0.5% of the total area surveyed mapped as severe and 10% mapped as moderate (Table 1). Severely symptomatic stands were generally located near the Grays Harbor area, which is near Ocean Shores and Westport, and the most southwest corner of the survey, near Ilwaco. The cause of the decrease in mapped acres from 2015 to 2016 remains uncertain, but it is likely a

combination of environmental factors influencing infections patterns and foliar retention and variations in aerially observed symptom signatures. Figure 3 shows how the 2016 SNC aerial survey compares to previous years SNC aerial surveys in Washington.

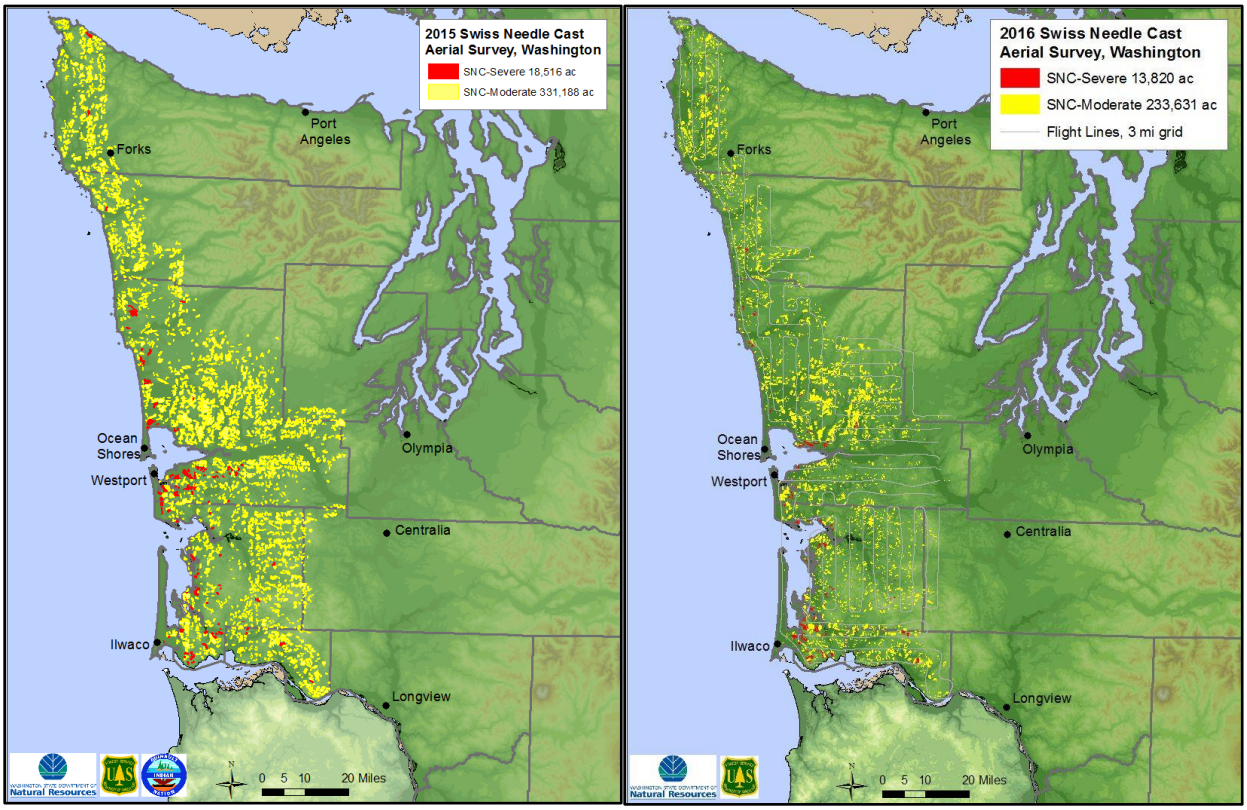

Figure 1 (right). Washington 2016 Swiss needle cast (SNC) aerial survey map. 248,000 acres of affected area mapped.

Figure 2 (left). Washington 2015 Swiss needle cast aerial survey map. 350,000 acres of affected area mapped.

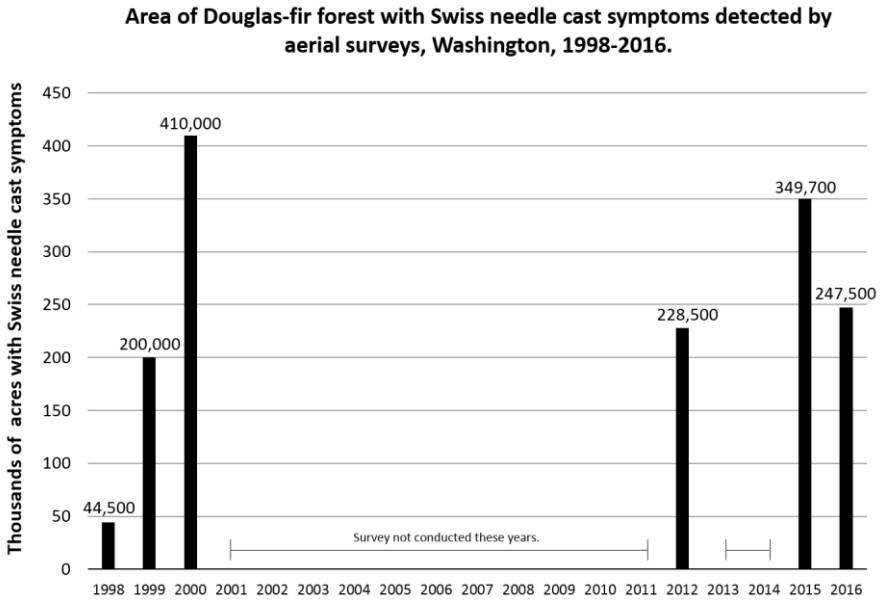

Figure 3. Area of Douglas-fir forest with Swiss needle cast symptoms detected by aerial surveys in Washington, 1998-2016.

Foliar retention varied across the survey area, ranging from 1.7 to 3.7 years, with an average of 2.4 years across all sixty-three ground survey sites. The average percentage of occluded stomata across all sites was 1.6% for 2015 (1-year-old) foliage and 22.1% for 2014 foliage (2-years-old), with ranges from 0 to 72 percent, depending on the tree, site and needle age. There were no significant differences in foliar retention values and two-year old needle pseudothecia occlusion percentages among the 2011, 2012, 2015 and 2016 ground survey data.

Caution should be advised when interpreting aerial survey data. The SNC survey should be considered a conservative estimate of the acreage affected by SNC because aerial observers can only map areas where disease symptoms have developed enough to be visible from the air. SNC aerial survey can be used to coarsely document trends in damage over time. The ground data indicates that SNC is present in areas that were not mapped during the aerial survey. While the aerial survey can be used as a guide for identifying areas impacted by SNC, on the ground surveys should be conducted in stands of interest before SNC mitigating management decisions are made.

Douglas-fir is the only host of this disease, therefore forest managers can grow non-host species such as red alder, western red cedar, western hemlock and Sitka spruce in efforts to reduce damage from SNC. However, it should be noted that if Douglas-fir has more than three years of foliage on its branches, then damage in the form of growth loss are likely to be minimal to none.

For more information about foliar retention assessments or Swiss Needle Cast in general, this document has some great information.
http://sncc.forestry.oregonstate.edu/sites/default/files/ForestHealthFS.pdf.

For more information and details about the SNC aerial survey, follow this link to a great storyboard about the survey.
http://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=4dccf7c8314e43a78a93535b633d1632

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ADDITIONAL NOTES

We appreciate any information regarding the accuracy or usefulness of the maps and ground survey data. Please contact Amy Ramsey (amy.ramsey@dnr.wa.gov or 360-902-1309) if you have questions, comments or suggestions.

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