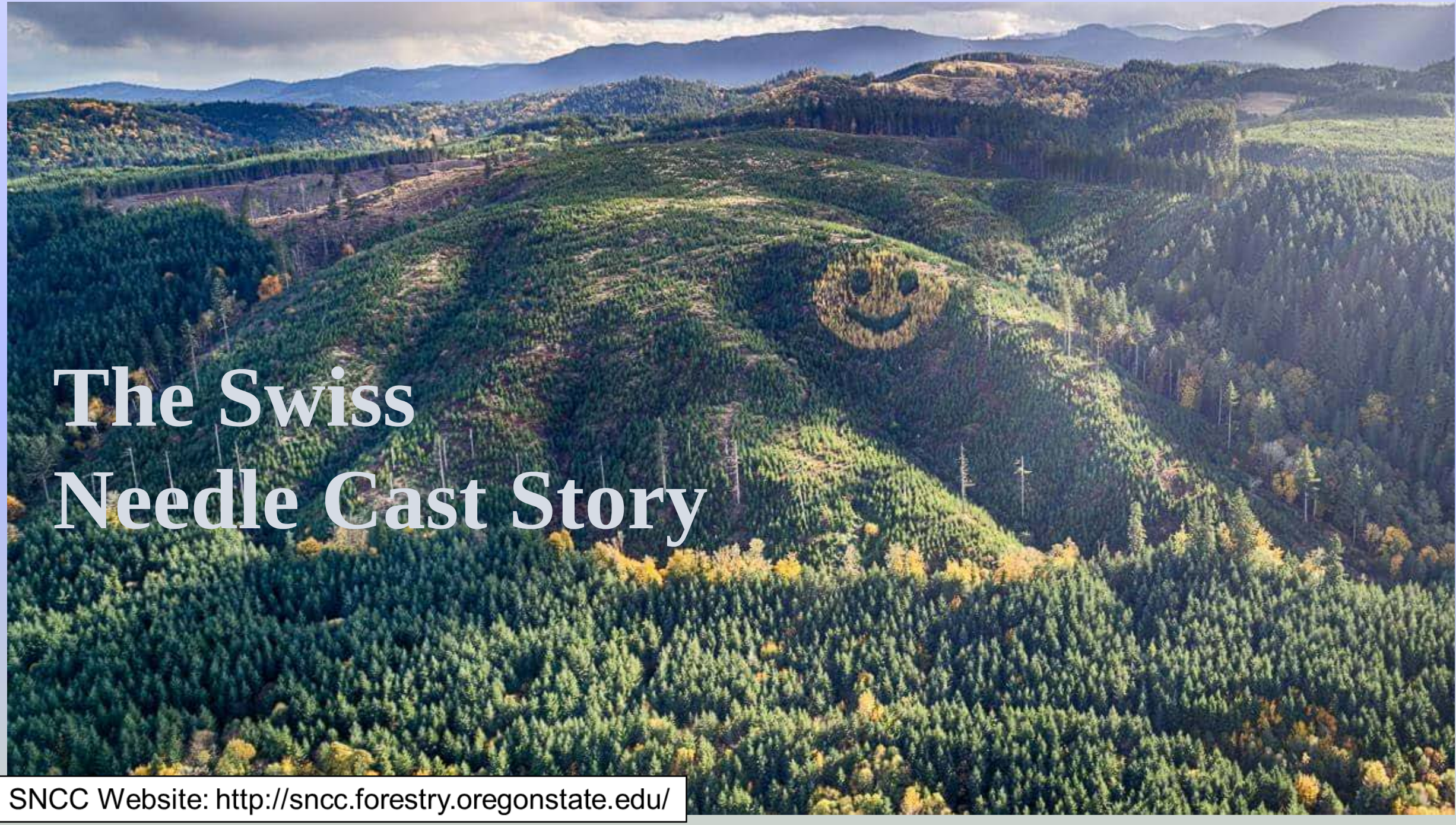


The Swiss Needle Cast Story

SNCC Website: http://sncc.forestry.oregonstate.edu/

Swiss Needle Cast

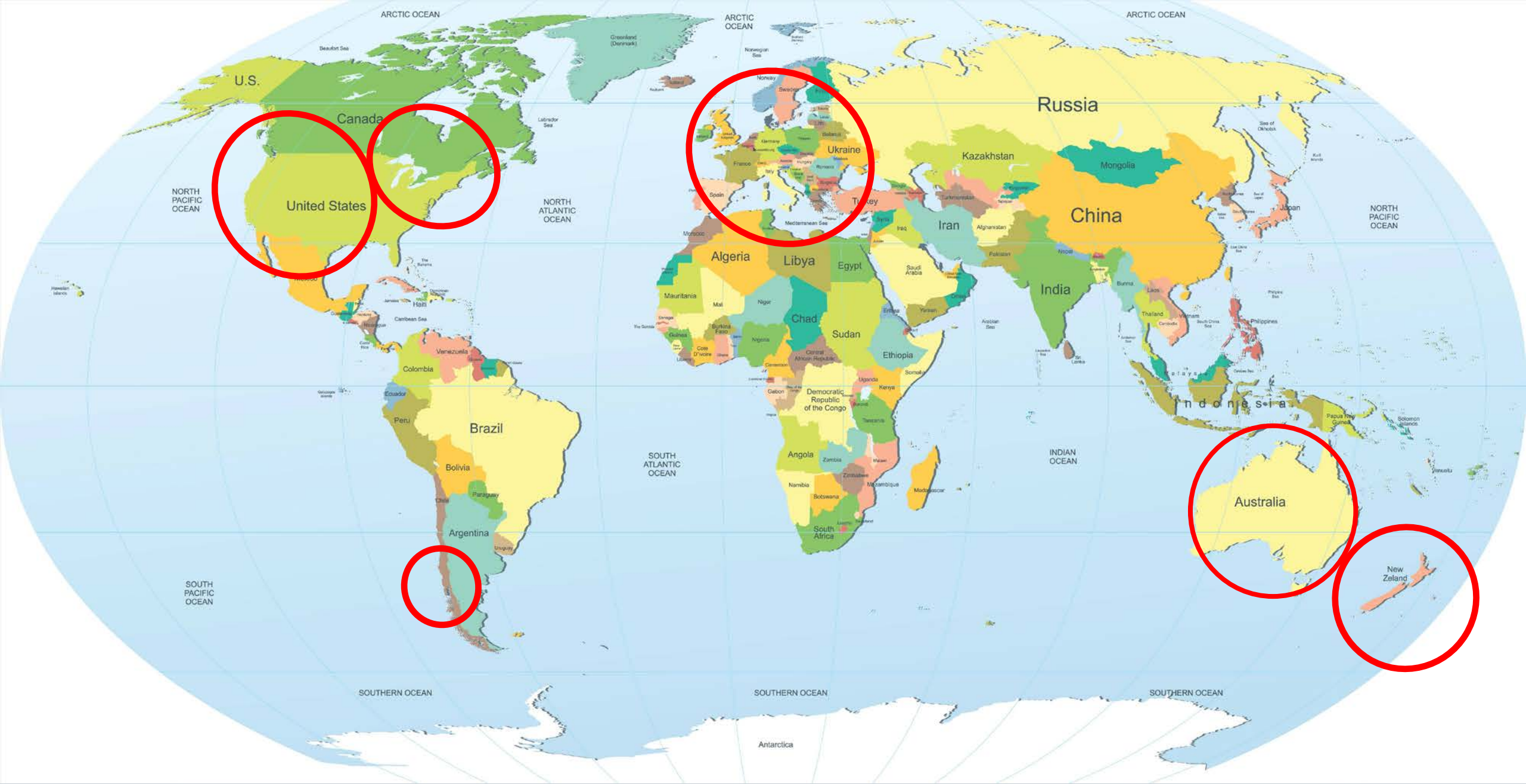
- **Caused by *Nothophaeocryptopus gaeumannii***
- **Native to North America**
- **Specific to Douglas-fir (*Pseudotsuga menziesii)***
- **Common everywhere DF grows, yet disease develops only in certain geographic locations**
- **Because it's everywhere, disease intensification depends on climatic conditions**

Native 85 yr-old severely infected stand

SNC timeline distribution
(pre-epidemic)

- Early 1827: DF seed introduction to Europe (GB)
  - Disease first described in Switzerland in 1925 on DF plantations
  - SNC considered unimportant in North America

- Subsequently found on DF throughout the world (Europe, Turkey, New Zealand, Australia, Central Chile and Argentina)



http://roundtripticket.me/global-map-of-the-world.html/global-maps-best-of-map-of-the-world

SNC timeline distribution

- Fungus became a problem in Christmas trees in the 1970's (OR, WA) and later shifted to forest plantings (1st noted in Tillamook Basin, OR)

- 1990's
  - Emerges as a major foliage disease of DF plantations in OR
  - SNCC – research initiative begun at OSU

- 2000's
  - Intensification within epidemic area
  - Marginal movement east to Cascade foothills
  - Intensification in WA, BC
  - Absent in N. California

Swiss Needle Cast Cooperative

- Began in 1996 to address problems associated with Swiss needle cast
- Mission is to conduct research on enhancing Douglas-fir productivity and forest health in the presence of Swiss Needle Cast
- Members include private, state, and federal organizations
- Annual Reports and 70 + Refereed publications to date (journal pubs and theses/dissertation)

SNCC Website: http://sncc.forestry.oregonstate.edu/

College of Forestry

Swiss Needle Cast Cooperative

What is Swiss Needle Cast?

SNC USFS/ODF/WADNR, Cooperative Aerial Survey Storyboard

Swiss needle cast (SNC) is a foliage disease that is specific to Douglas-fir and is caused by the fungal pathogen *Phaeocryptopus gaeumannii*. SNC disease symptoms include chlorotic (yellow) needles and decreased needle retention, resulting in sparse crowns and reduced diameter and height growth. It is known as a *cast* disease, because it causes the tree to prematurely shed, or cast, its needles. Although it is called Swiss needle cast, the fungus that causes this disease is native to the western United States, and is an exotic pathogen in Europe, New Zealand and other places outside of Douglas-fir's native range. However, the disease was first discovered in Douglas-fir plantations in Switzerland in the mid-1920s, and the name has persisted.

Click here for full summary.

The Swiss Needle Cast Cooperative

Mission | Objectives | Key Features

The Swiss Needle Cast Cooperative (SNCC) was established in January 1997 to address challenges to the management of Douglas-fir in OR and WA caused by the current Swiss needle cast (SNC) epidemic. The SNCC is located in the Department of Forest Engineering, Resources and Management within the College of Forestry at Oregon State University. The Membership is comprised of private, state, and federal organizations. Private membership dues are set at a fixed rate. An annual report, project reports, and newsletters are distributed to members each year. All projects are carried out in cooperation with specific members on their land holdings.

The mission of the SNCC is to conduct research to enhance Douglas-fir productivity and forest health in the presence of Swiss needle cast (SNC) and other diseases in coastal forests of Oregon and Washington. The original mission was broadened in 2004 to include research aimed to ensure that Douglas-fir remains a productive component of forests in the Oregon and Washington Coast Range.

Intensification of the Swiss Needle Cast foliage disease epidemic along The focus of SNCC research is on research that will give

SNCC

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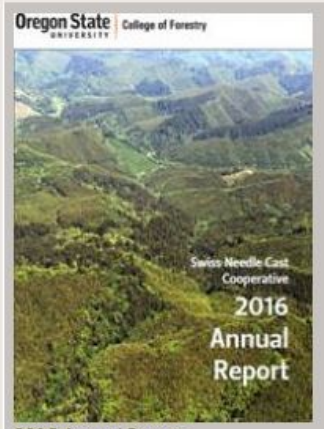
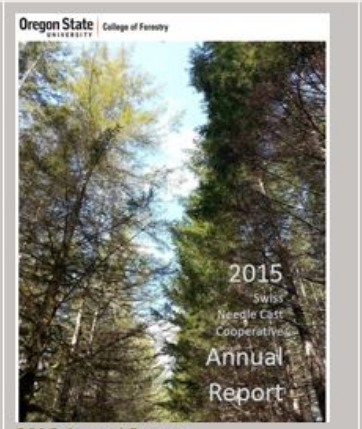
What's New

2016 Aerial Survey

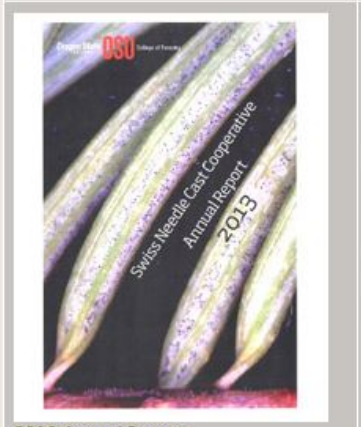


2016 Annual Report

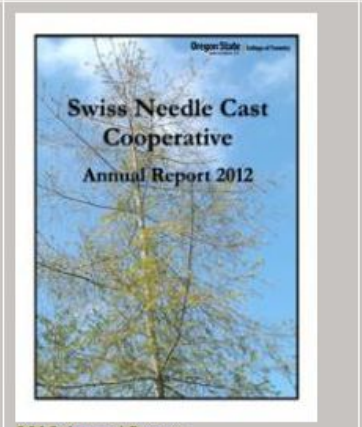


2015 Annual Report

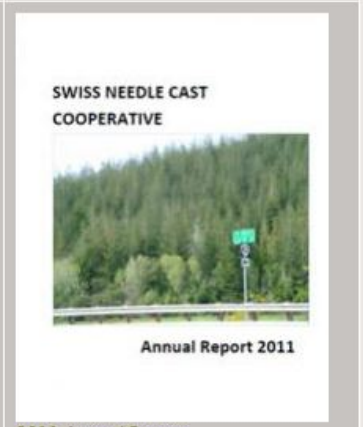
2014 Annual Report



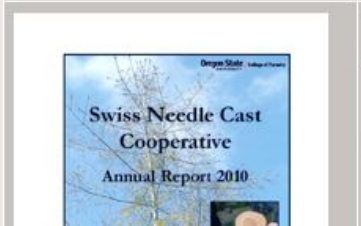
2013 Annual Report

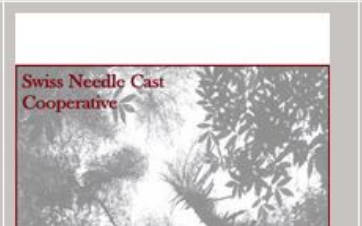


2012 Annual Report



2011 Annual Report





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Publications

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2018

Agne, MC, Beedlow PA, Shaw DC, Woodruff DR, Lee EH, Cline S, Comeleo RL. 2018. **Interactions of predominant insects and diseases with climate change in Douglas-fir forests of western Oregon and Washington, U.S.A.** Forest Ecology and Management. 409:317-332. Download: PDF (1.16 MB)

2017

Lee, EH, Beedlow PA, Waschmann RS, Tingey DT, Cline S, Bollman M, Wickham C, Carlile C. 2017. **Regional patterns of increasing Swiss needle cast impacts on Douglas-fir growth with warming temperatures.** Ecology and Evolution. 7(24):11167–11196. Download: PDF (2.88 MB)

Wilhelmi, NP, Shaw DC, Harrington CA, St. Clair JB, Ganio LM. 2017. **Climate of seed source affects susceptibility of coastal Douglas-fir to foliage diseases.** Ecosphere. 8(12):e02011. Download: PDF (9.5 MB)

2016

Boderck, M. 2016. **Incidence and Severity of Swiss Needle Cast in the Coast Forest of Western Washington: Examining Climatic Correlation.** Master of Environmental Studies Download: PDF (1.85 MB)

Bennett, P, Stone J. 2016. **Assessments of Population Structure, Diversity, and Phylogeography of the Swiss Needle Cast Fungus (*Phaeocryptopus gaeumannii*) in the U.S. Pacific Northwest.** Forests. 7,14 Download: PDF (2.81 MB)

Ritóková, G, Shaw DC, Filip GM, Kanaskie A, Browning J, Norlander D. 2016. **Swiss Needle Cast in Western Oregon Douglas-Fir Plantations: 20-Year Monitoring Results.** Forests. 7(155) Download: PDF (9.64 MB)

2015

Zhao, J, Maguire DA, Mainwaring DB, Kanaskie A. 2015. **The effect of within-stand variation in Swiss needle cast intensity on Doulgas-fir stand dynamics.** Forest Ecology and Management. 347:75-82. Download: PDF (694.93 KB)

2014

Luoma, DL, Eberhart JL. 2014. **Relationships between Swiss needle cast and ectomycorrhizal fungus diversity.** Mycologia. 106(4):666-675. Download: PDF (314.81 KB)

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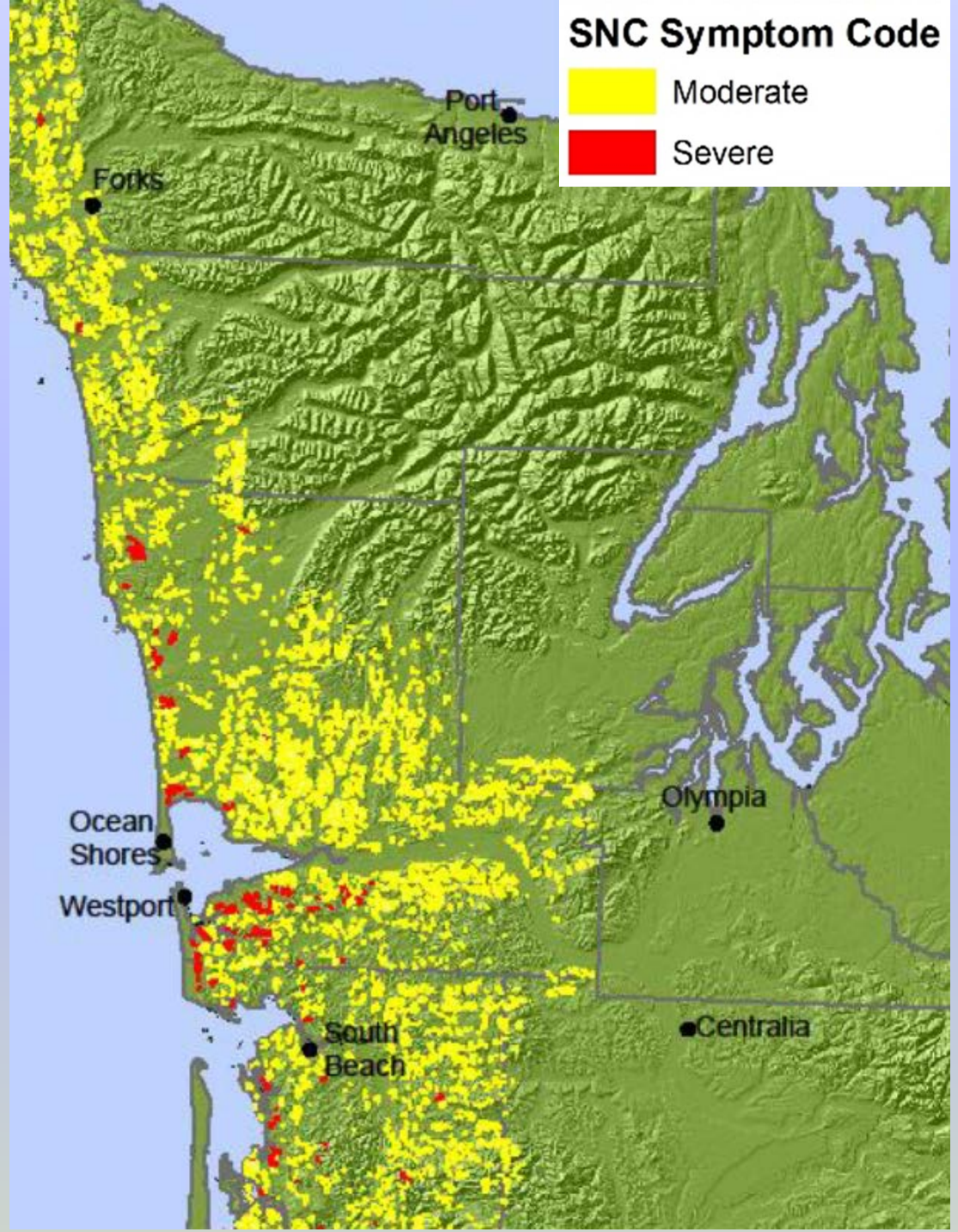
SNCC Objectives

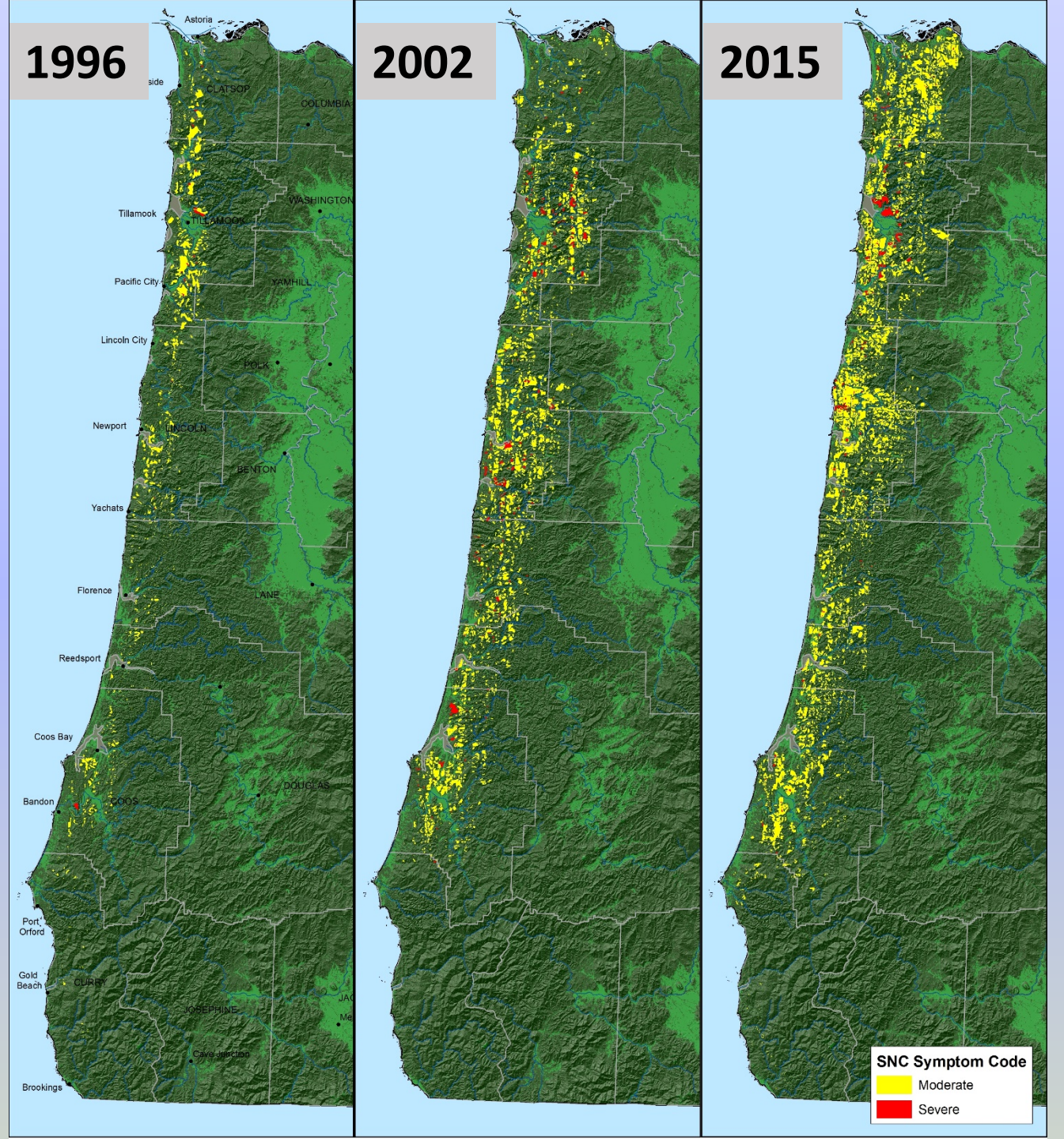
- Monitor changes in the epidemic
- Understand the biology/life cycle of the fungus
- Relate infection level to growth loss
- Investigate silvicultural treatments to combat the fungus
  - Is thinning helpful?
  - Are fertilizers effective?
  - Are fungicides useful?
  - Does DF show any resistance/tolerance?

SNCC Website: http://sncc.forestry.oregonstate.edu/

Aerial survey (ODF & USFS FHP)

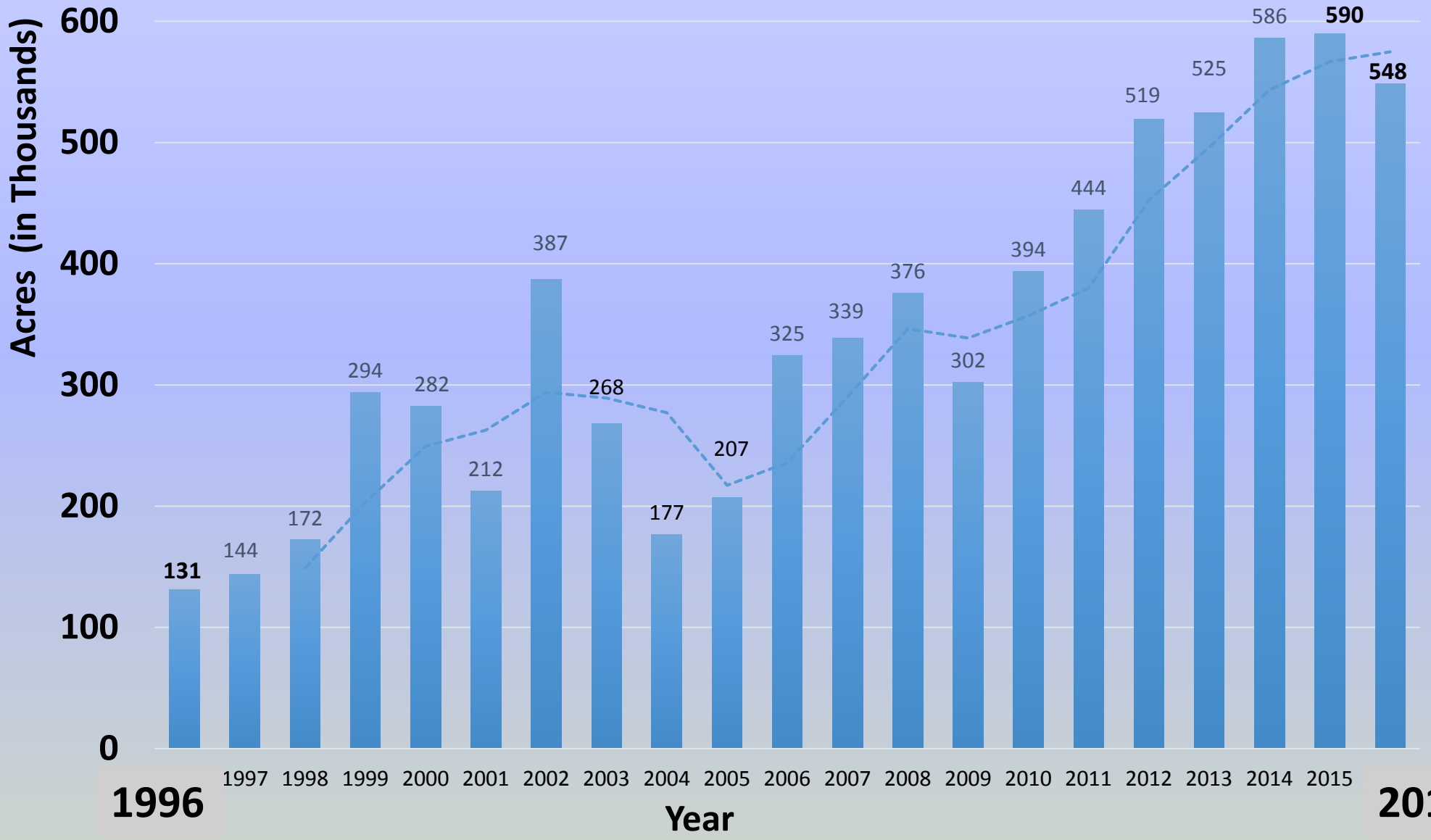
- The aerial survey began in 1996
- Flights take place in April/May, looking for areas of obvious yellowing foliage
- Survey in coastal Oregon (since 1996), Washington (1990s, 2012, 2015, 2016) and California (2014)
- Most areas that can be detected are within 25 miles of the coast. Easternmost area is ~70 miles inland (Cascade foothills.)
- 2016 surveys:
  - Washington: nearly 248,000 acres
  - Oregon: 548,500 acres of DF showed significant symptoms

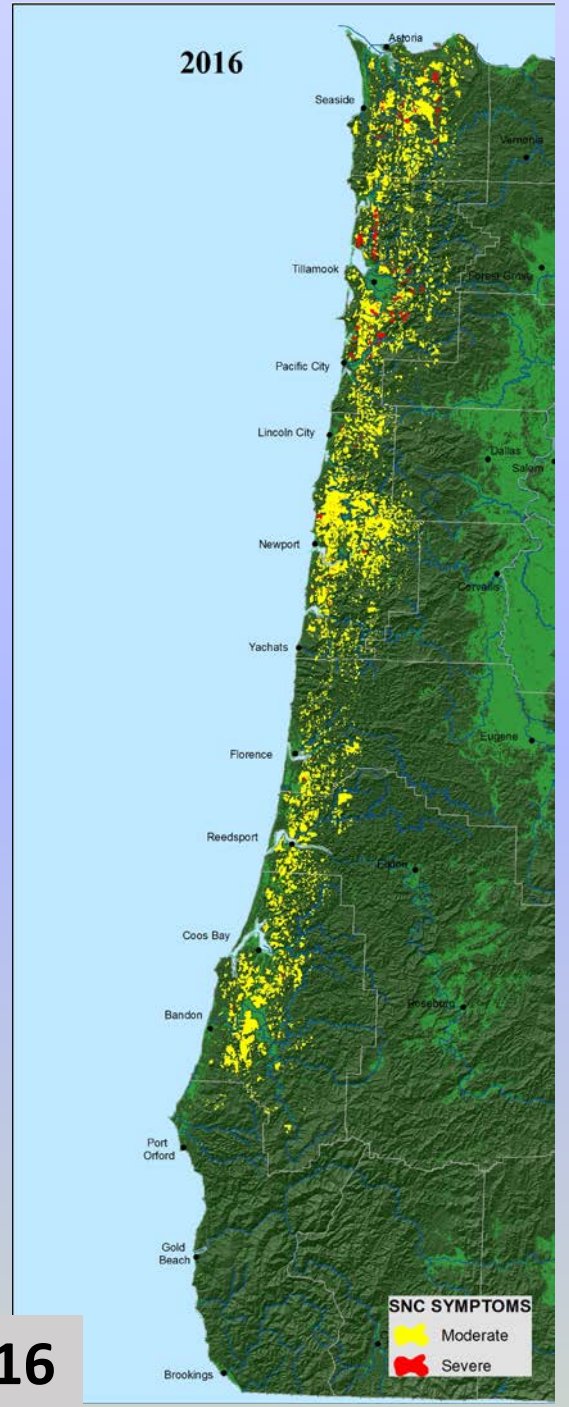

SNC Symptom Code
Moderate
Severe
Port Angeles
Forks
Olympia
Ocean Shores
Westport
South Beach
Centralia


1996
2002
2015
Astoria
CLATSOP
COLUMBIA
WASHINGTON
Tillamook
TILLAMOOK
Pacific City
YAMHILL
Lincoln City
POLK
Newport
LINCOLN
BENTON
Yachats
Florence
LANE
Reedsport
Coos Bay
DOUGLAS
Bandon
COOS
Port Orford
Gold Beach
CURRY
JOSEPHINE
Brookings
SNC Symptom Code
Moderate
Severe

SNC in Oregon 2016 = 548,500 ac

Area of Douglas-fir forest with Swiss needle cast symptoms, 1996-2016

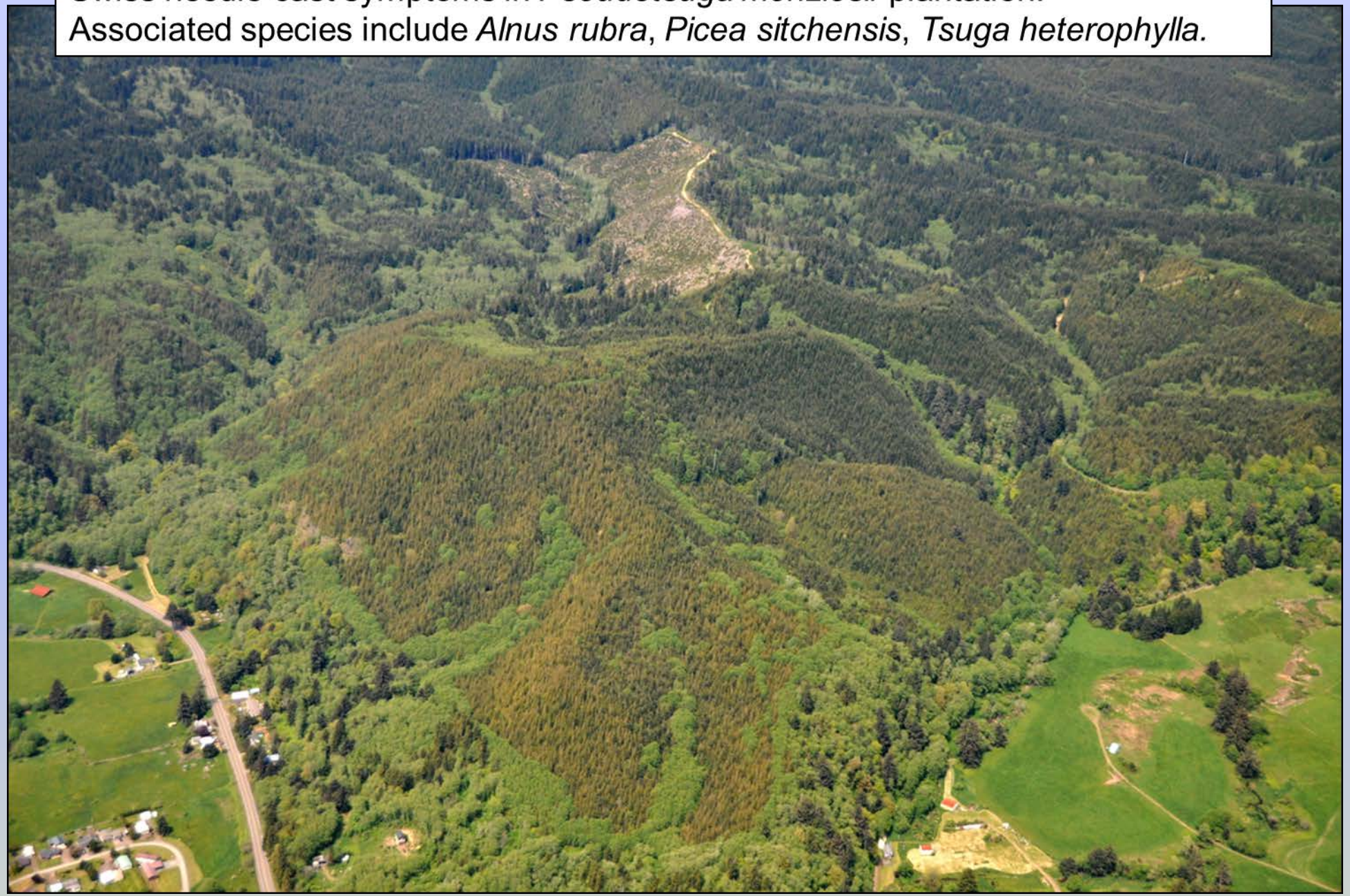




2016

http://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=4dccf7c8314e43a78a93535b633d1632

Swiss needle cast symptoms in *Pseudotsuga menziesii* plantation.
Associated species include *Alnus rubra*, *Picea sitchensis*, *Tsuga heterophylla.*



Why here, why now?

- **Favorable environment hypothesis:**
  - **Sizable acreage of Douglas-fir planted in areas historically containing Spruce, Hemlock, Red alder. Disease is most severe in the spruce-hemlock zone**
  - **Change in climate**
    - **Warmer winter**
    - **Wet May, June, July (late spring, summer precip)**
  - **Heavy spore load**

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Lee and colleagues: What climatic factors are most limiting to fungal development? (2013, Tree ring analysis of SNC. Can J. For Res (43) and more recent analysis)

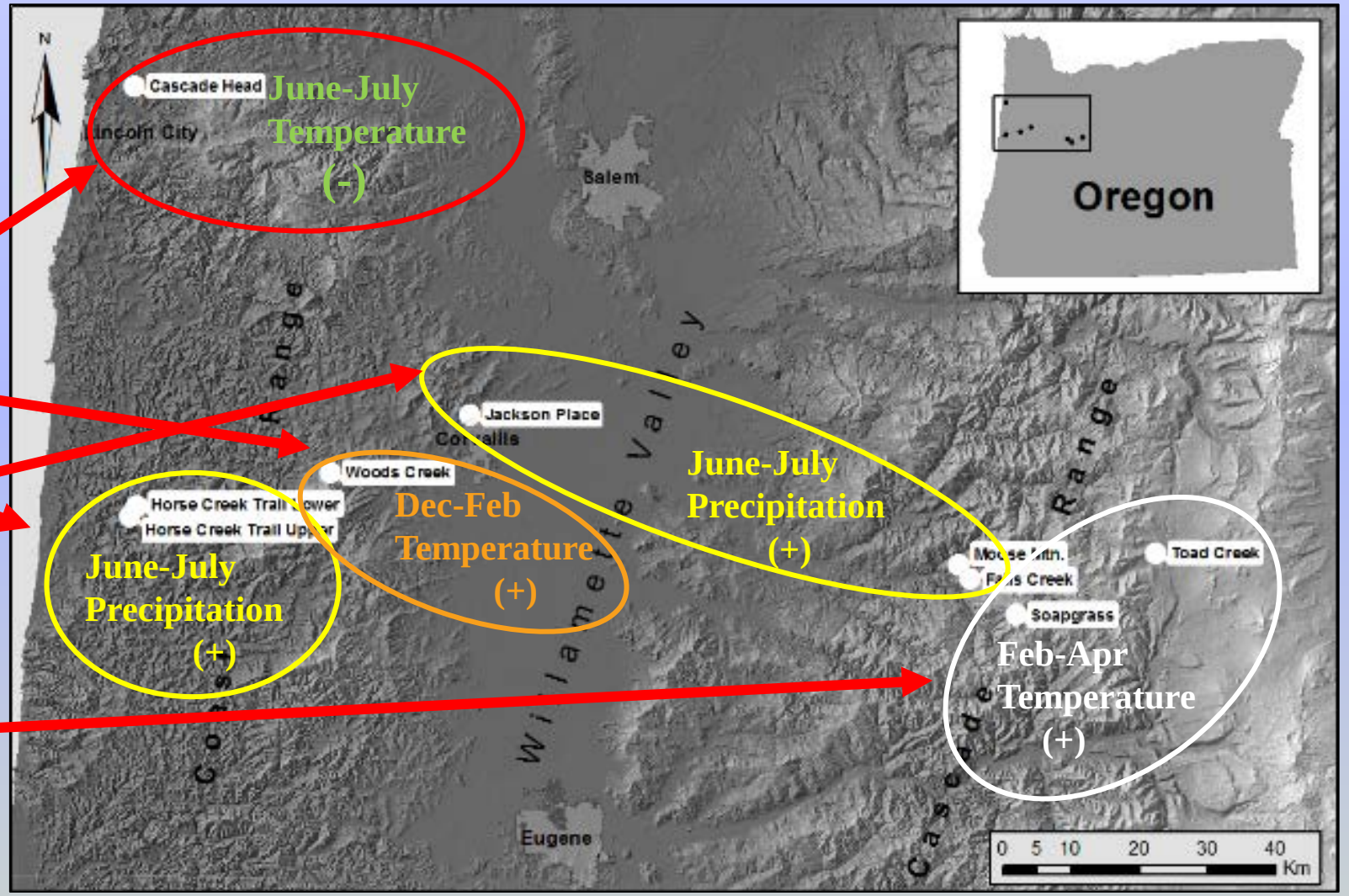
Depending on geographic setting:

June, July Temp (-)

Dec – Feb Temp (+)

June-July Precip (+)

Feb – April Temp (+)



SNC Severity – Foliage retention (yrs)

FR 4.0

FR 2.4

FR 1.0

Foliage retention

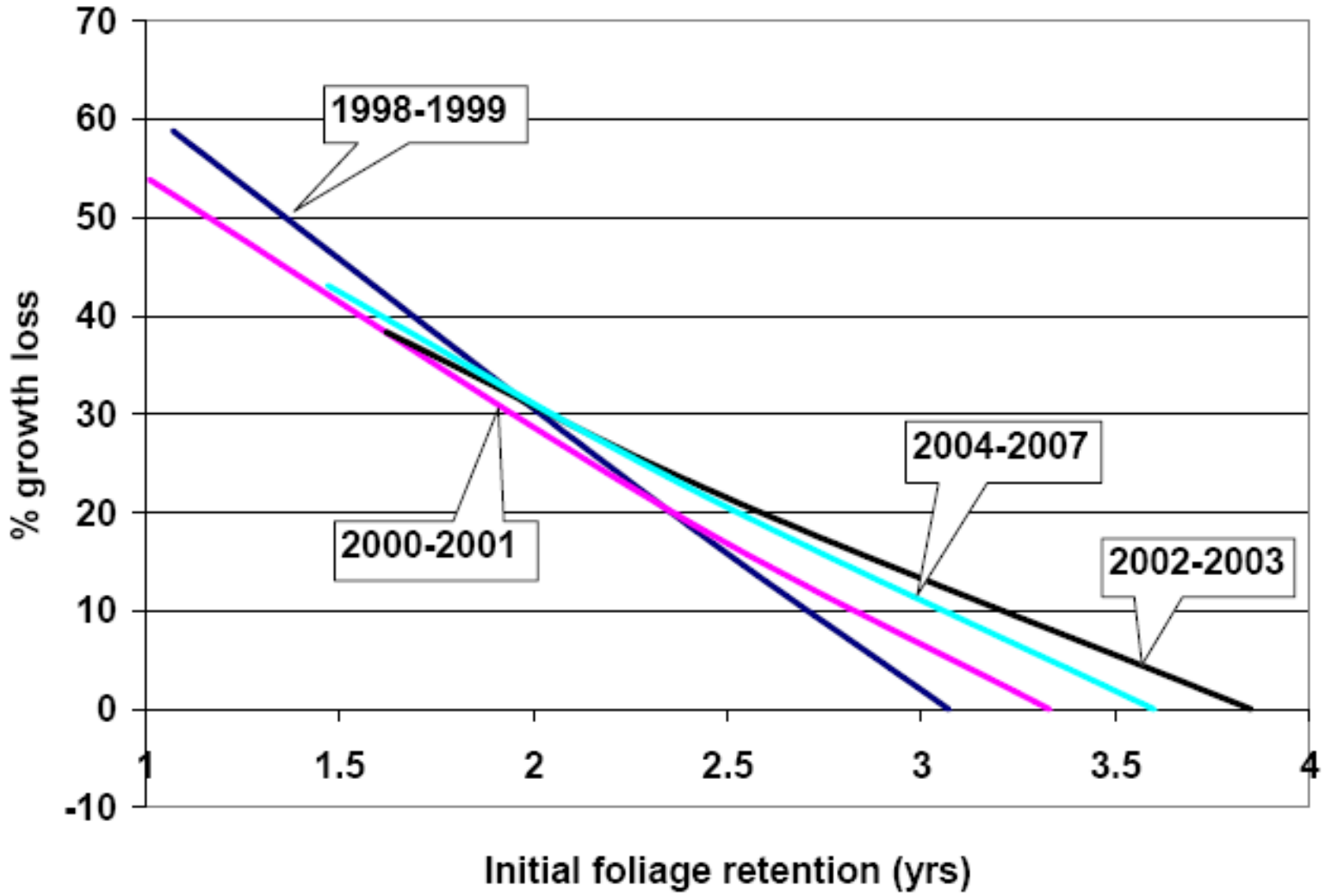


Figure 3. Implied relative growth losses for the four GIS growth periods. Ranges of foliage retention represent those measured at the start of each growth period.

Foliage retention relates to growth Maguire, Mainwaring, Kanaskie 2011. Can J. For. Res. 41.

Management tools: ORGANON

- Produced by David Hann et al. (OSU)
- Regional growth model: includes DBH and Ht growth modifiers accounting for SNC
- Enables projections to be made of SNC infected stands

Management tools: Stand growth assessment tool

- Excel-based VB program
- Produced by ODF/OSU
- Uses data from stand exams to compare measured growth to regional average (ORGANON)

Silvicultural treatments

- **Pre-commercial and commercial thinning**
  - **Infected stands will respond to thinning, though more slowly. Thinning does not appear to improve the general health of trees. Thinning should be done early and from below.**
- **Fertilization**
  - **There is no evidence that fertilization (nitrogen, blends, calciums, phosphorus) are effective at alleviating SNC.**
- **Fungicide**
  - **Bravo (Chlorothalonil) and sulfur have been used. Bravo is effective, but must be used every year to maintain foliage. Expense and toxicity make general use prohibitive.**
  - **Sulfur has shown marginal effectiveness.**
- **Mixed species**
  - **No evidence that infection levels are alleviated due to species mixes**
  - **Where SNC is particularly intense, disease gives advantage to competitors (i.e. western hemlock, red alder).**
- **Genetics**
  - **Tolerant genotypes have been identified. It is recommended that their use is limited to sites of moderate infection.**

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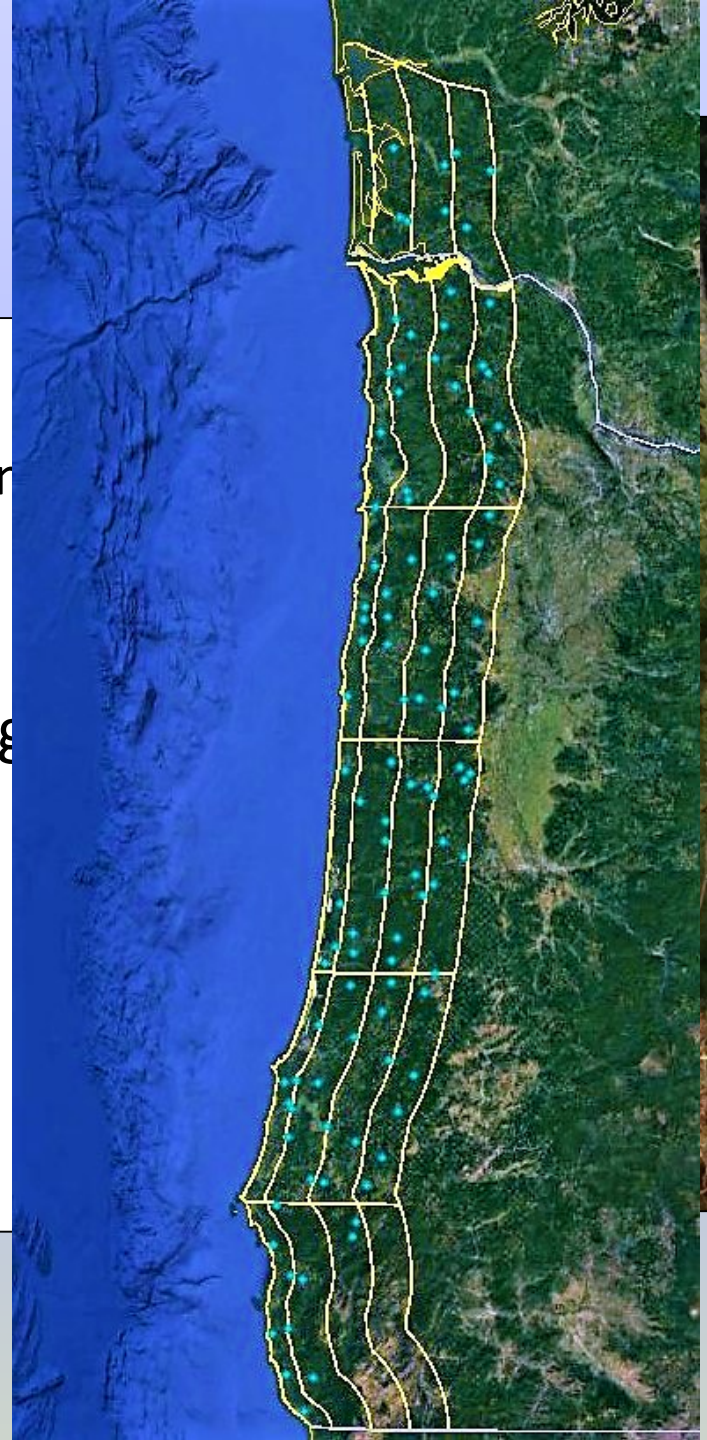
Solutions

- A new monitoring plot network (2013 – 2017)
  - California to SW Washington ar
    35 miles inland.
  - Plots in British Columbia
- Coast and Cascade monitoring
- Growth impacts
- Climate relationships
- Epidemiology
- Associated studies



Goals of the Plot Network

- Growth impact assessment
  - Tree volume growth impacts
- Monitoring trends in disease behavior/severity
  - Validation of aerial survey
  - Assessment of FR, disease severity
- Other research opportunities
  - Epidemiology
  - Baseline for new research
- Improved models
  - Disease dynamics
  - Stand dynamics under differing disease pressure

Questions?

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