

Diseases, pests, and emerging issues affecting the health of Pacific madrone

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American Forests “Famous and Historic Tree” at Magnolia Bluffs, Seattle, WA



1996



2004



2014

Factors affecting tree health

Environmental

- Climate
- Management practices
 - Fire suppression
 - Urbanization

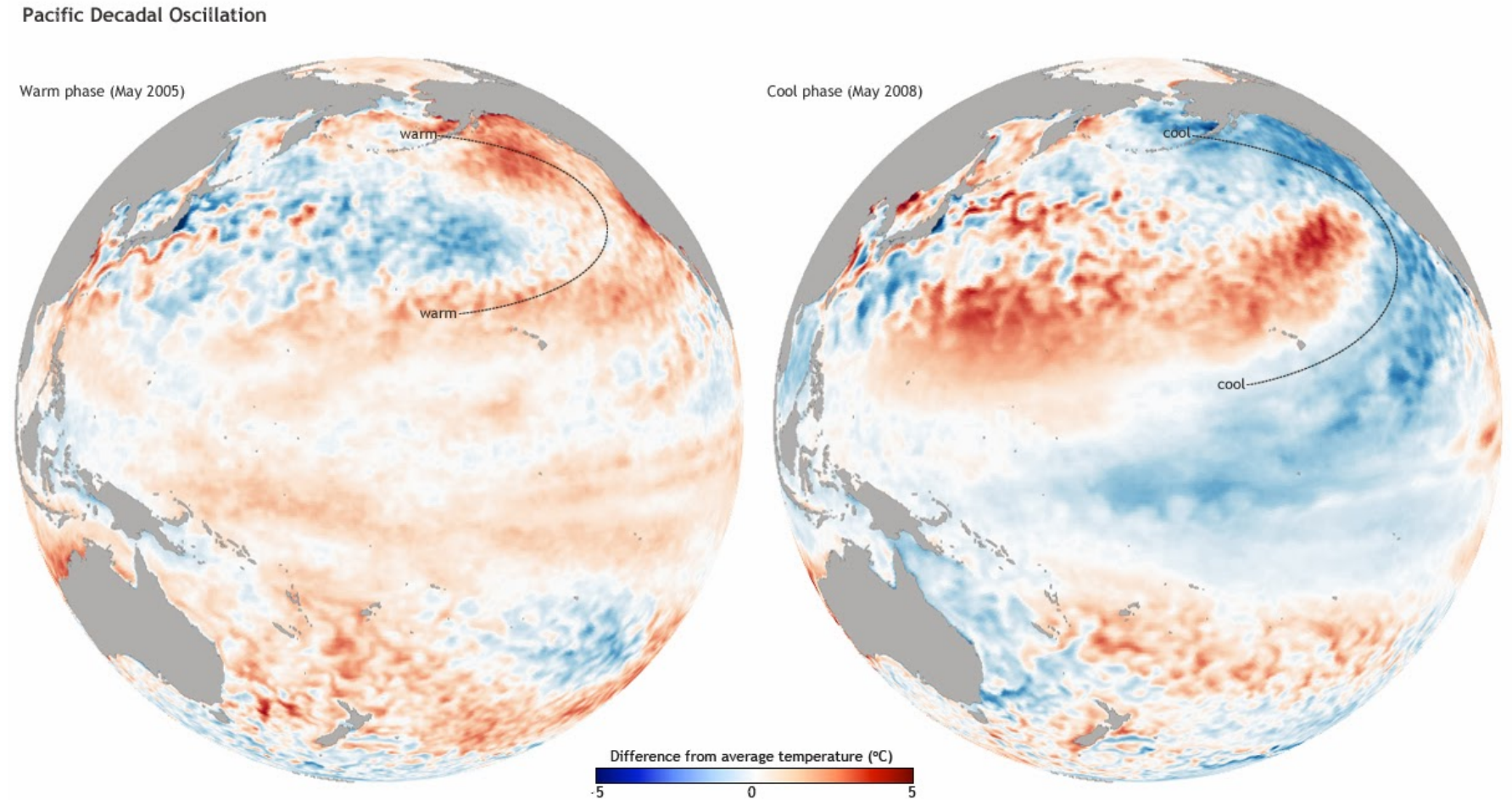
Biological

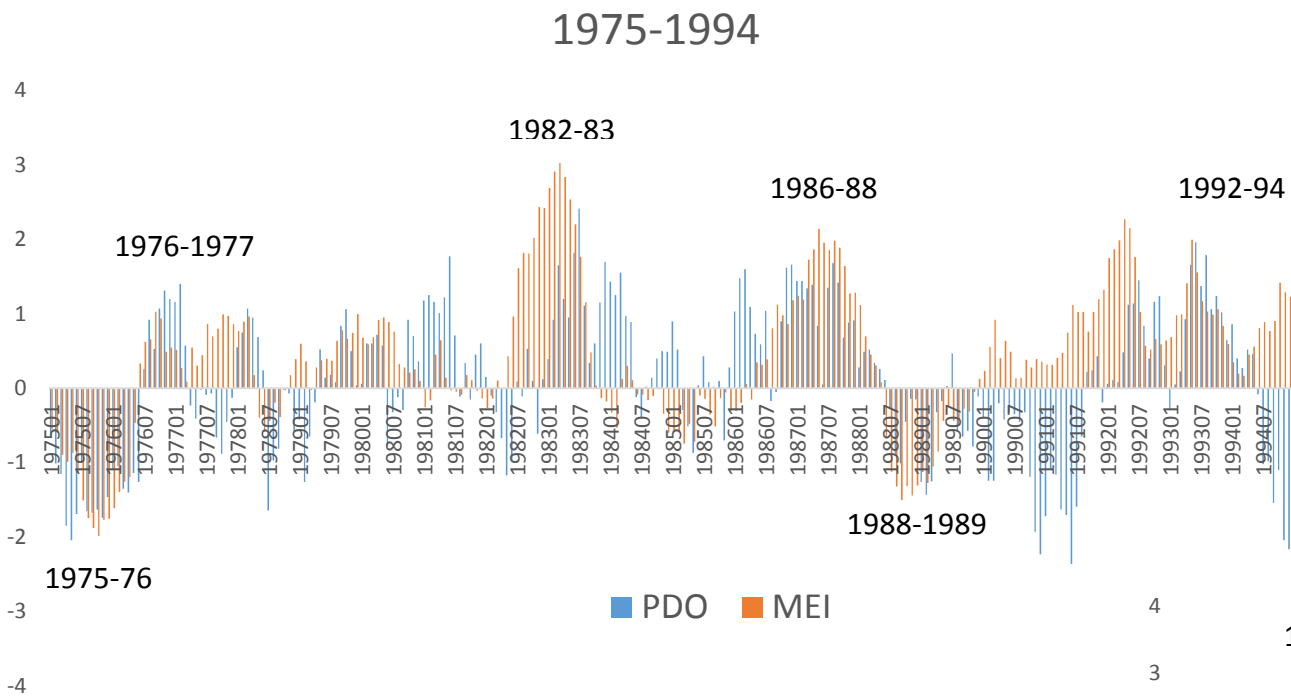
- Fungi and oomycetes
- Insects
- Wildlife
- Introduced pests and pathogens

Climate Indices

Pacific Decadal Oscillation (PDO) –
Northern Pacific

Multivariate ENSO
Index (MEI) –
Tropical Pacific

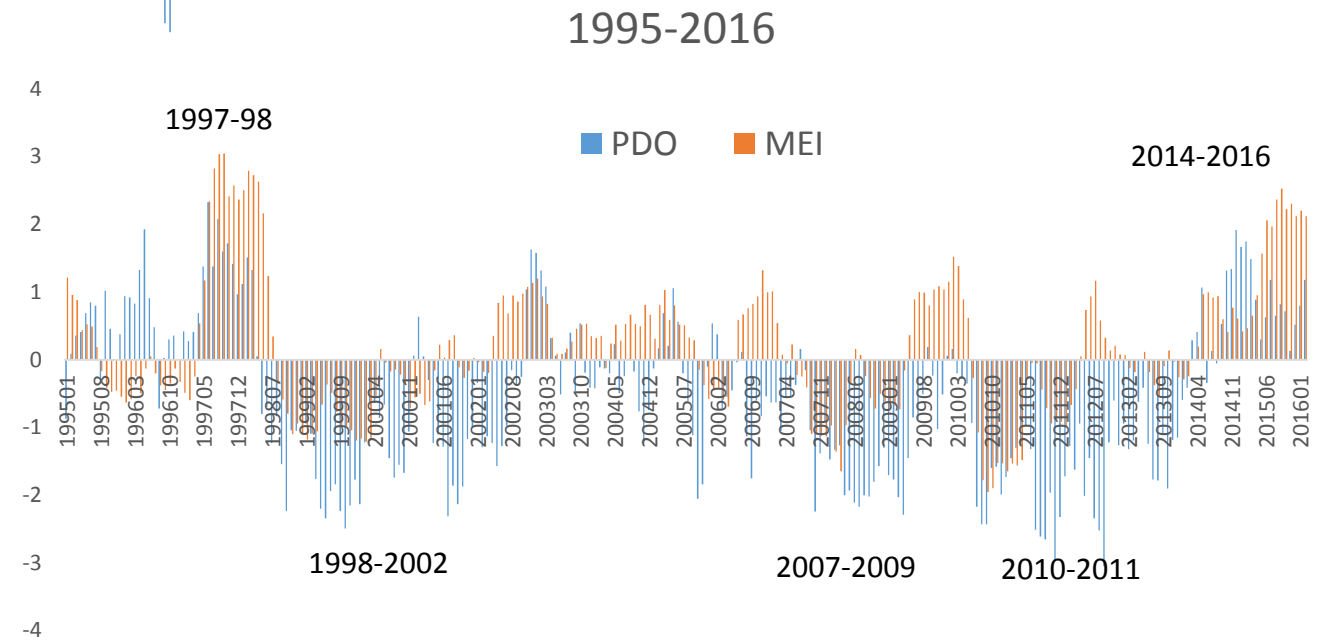




Positive values – warm, dry

Negative values – cool, wet

When both indices are in phase the effects are stronger



Fungal diseases are affected by climate conditions

Cold, wet winter/spring:

Symptom expression –
cold damage, foliar blight



Warm, wet spring:

Fungal sporulation,
germination, infection

Warm, dry summer:

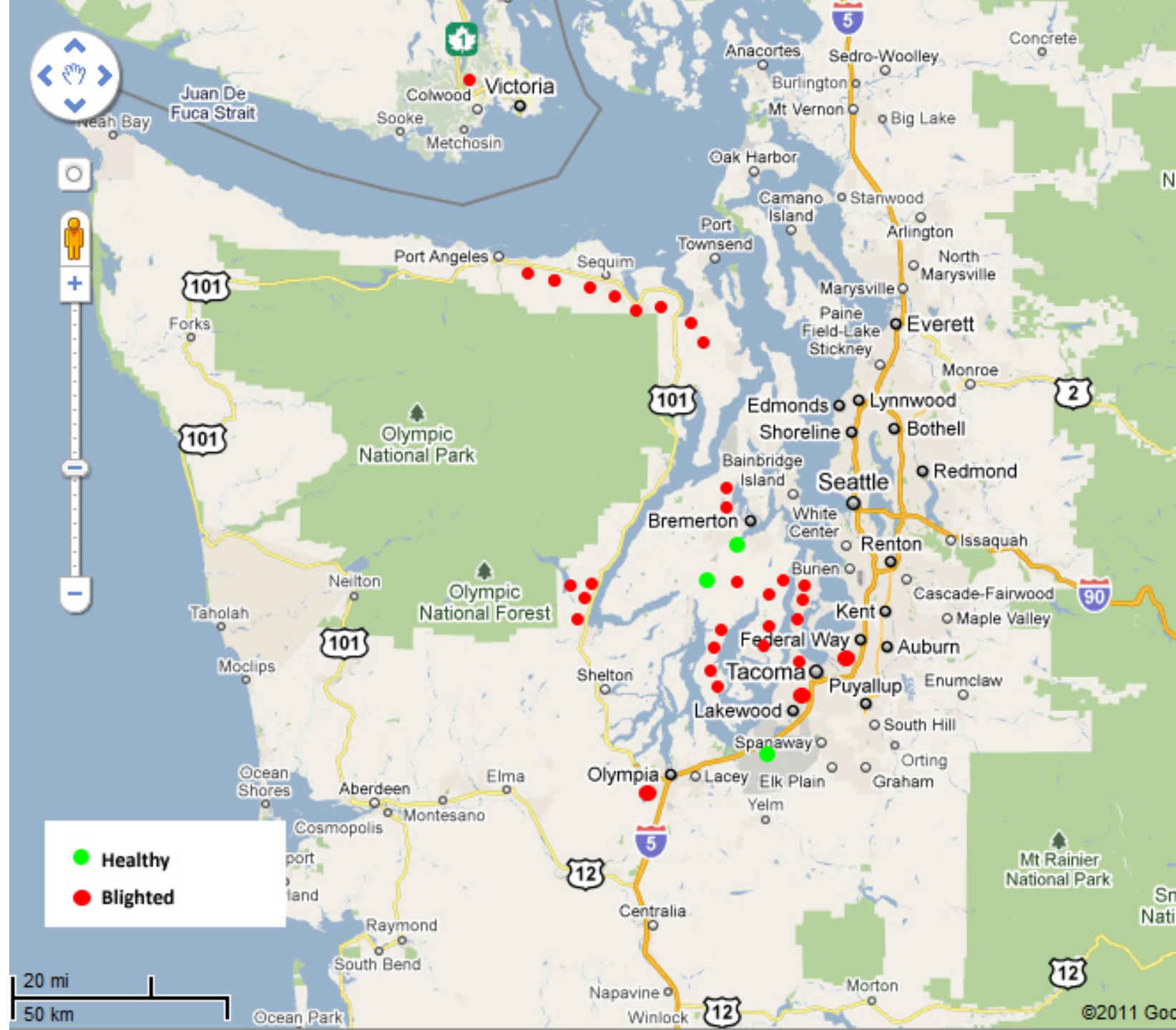
Drought
Symptom expression –
canker, dieback, root disease



Temperature and precipitation are expected to increase in PNW. This will affect insect pollinators and diseases of Pacific madrone.

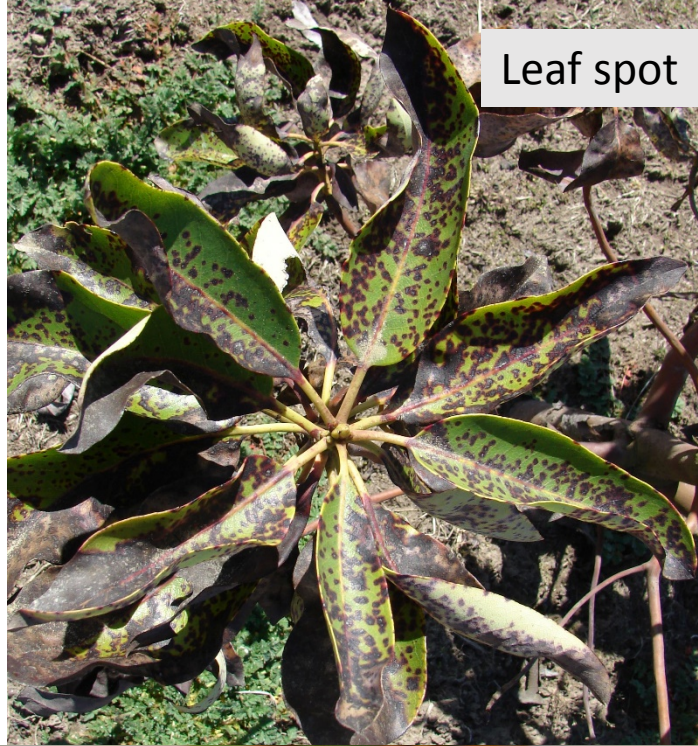
2011 Leaf Blight

- Severe leaf blight and some mortality
- Online survey
- Mapping of areas with severe and (rarely) healthy trees



Foliar fungi

- Leaf spot
- Leaf blight
- Blister blight
- Rust
- Sooty mold



Leaf spot



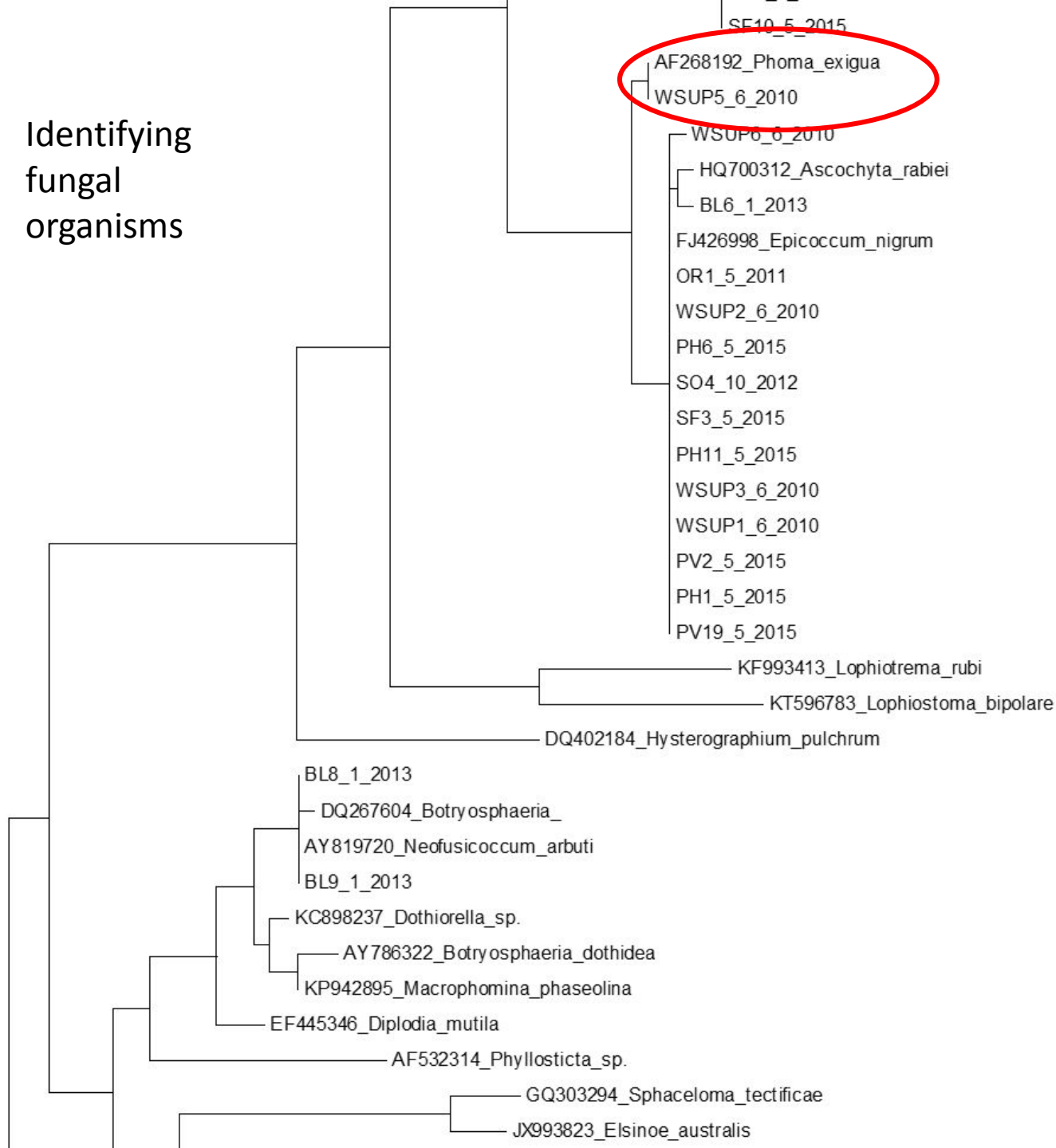
Rust



*Exobasidium
vaccinii* on fruit

“At least 19 different fungi
are associated with leaf
spots on madrone”
Byther, 1999

Identifying fungal organisms



>WSUP5_6_2010

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CNTTCTTTTTNTNTGNCGAAAAA
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Species Fungorum

Synonymy [See Note](#)

Current Name:
Boeremia exigua (Desm.) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 37 (2010)

Synonymy:
Ascochyta coffeae Henn., *Hedwigia* **41**: 307 (1902)
Ascochyta forsythiae (Sacc.) Höhn., *Verh. Naturwiss. Vereins Hamburg*, ser. 3 **47**: 36 (1909)
Ascochyta heteromorpha (Schulzer & Sacc.) Curzi, *Boll. R. Staz. Patalog. Veget. Roma* **12**(3): 380 (1932)
Ascochyta hydrangeae (Ellis & Everh.) Aksel, *Trudy bot. Inst. Akad. Nauk SSSR. Pl. Crypt.* **11**: 83 (1956)
Ascochyta linicola Naumov & Vassiljevsky, *Mater. Mycol. Phytopath. Leningrad* **5**: 3 (1926)
Ascochyta nicotianae Pass., *Atti Soc. Crittogam. Ital.* **3**: 14 (1881)
Ascochyta phaseolorum Sacc., *Michelia* **1**(no. 2): 164 (1878)
Ascochyta viburni Roum. ex Sacc., *Syll. fung.* (Abellini) **3**: 387 (1884)
Ascochyta viburni Roum. ex Sacc., *Syll. fung.* (Abellini) **3**: 387 (1884) **var. viburni**
Boeremia exigua var. **coffeae** (Henn.) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 37 (2010)
Boeremia exigua (Desm.) Aveskamp, Gruyter & Verkley, *Stud. Mycol.* **65**: 37 (2010) **var. exigua**
Boeremia exigua var. **forsythiae** (Sacc.) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 37 (2010)
Boeremia exigua var. **gilvescens** Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 37 (2010)
Boeremia exigua var. **heteromorpha** (Schulzer & Sacc.) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 38 (2010)
Boeremia exigua var. **lilacis** (Sacc.) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 38 (2010)
Boeremia exigua var. **linicola** (Naumov & Vassiljevsky) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 39 (2010)
Boeremia exigua var. **populi** (Gruyter & P. Scheer) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 39 (2010)
Boeremia exigua var. **pseudolilacis** Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 39 (2010)
Boeremia exigua var. **viburni** (Roum. ex Sacc.) Aveskamp, Gruyter & Verkley, in Aveskamp, Gruyter, Woudenberg, Verkley & Crous, *Stud. Mycol.* **65**: 39 (2010)

Phoma exigua Desm., *Annls Sci. Nat., Bot.*, sér. 3 **11**(2): 282 (1849)
Phoma exigua Sacc., *Michelia* **1**(no. 5): 525 (1879)
Phoma exigua var. **capsici** L.Z. Liang, *Acta microbiol. sin.* **31**(2): 161 (1991)
Phoma exigua Desm., *Annls Sci. Nat., Bot.*, sér. 3 **11**(2): 282 (1849) **var. exigua**
Phoma exigua var. **forsythiae** (Sacc.) Aa, Boerema & Gruyter, *Persoonia* **17**(3): 452 (2000)
Phoma exigua var. **heteromorpha** (Schulzer & Sacc.) Noordel. & Boerema, *Jaarb. plziektenk. Dienst.*: 109 (1988) [1987]
Phoma exigua var. **inoxydabilis** Boerema & Vegh, in Vegh et al., *Bull. trimest. Soc. mycol. Fr.* **90**(2): 130 (1974)
Phoma exigua var. **lilacis** (Sacc.) Boerema, *Phytopath. Mediterr.* **18**: 106 (1979)
Phoma exigua var. **linicola** (Naumov & Vassiljevsky) P.W.T. Maas, *Tijdschr. Plziekt.* **71**: 118 (1965)
Phoma exigua var. **populi** Gruyter & P. Scheer, *J. Phytopath.* **146**(8-9): 413 (1998)
Phoma exigua var. **solanicola** (Prill. & Delacr.) Popkova, Malikova & Kovaleva, (1973)
Phoma exigua var. **viburni** (Roum. ex Sacc.) Boerema, *J. Phytopath.* **146**(8-9): 414 (1998)
Phoma herbarum f. **humuli** Sacc., *Syll. fung.* (Abellini) **2**: 133 (1883)
Phoma herbarum f. **lilacis** Sacc., *Michelia* **2**(no. 6): 93 (1880)
Phoma heteromorpha Schulzer & Sacc., *Revue mycol.*, Toulouse **6**: 74 (1884)
Phoma perexigua Sacc., *Syll. fung.* (Abellini) **3**: 123 (1884)
Phoma solanicola Prill. & Delacr., *Bull. Soc. mycol. Fr.* **6**(1): 142 (1890)
Phoma solanicola Prill. & Delacr., *Bull. Soc. mycol. Fr.* **6**(1): 142 (1890) **f. solanicola**
Phoma solanicola Prill. & Delacr., *Bull. Soc. mycol. Fr.* **6**(1): 142 (1890) **var. solanicola**
Phoma viburni (Roum. ex Sacc.) Boerema & M.J. Griffin, *Trans. Br. mycol. Soc.* **63**(1): 110 (1974)
Phomopsis perexigua (Sacc.) Traverso, *Fl. ital. crypt.*, Pars 1: Fungi. Pyrenomycetae. Xylariaceae, Valsaceae, Ceratostomataceae **2**(1): 229 (1906)
Phyllosticta forsythiae Sacc., *Fungi italica autogr. del.* **1-4**: tab. 87 (1877)
Phyllosticta hydrangeae Ellis & Everh., *J. Mycol.* **5**(3): 145 (1889)
Phyllosticta hydrangeae var. **europaea** Passal., *Pilze der zweiten deutschen Nordpolfahrt 1869-70* (Leipzig) **1**: 5 (1926)
Phyllosticta hydrangeae Ellis & Everh., *J. Mycol.* **5**(3): 145 (1889) **var. hydrangeae**
Phyllosticta sambuci Desm., *Annls Sci. Nat., Bot.*, sér. 3 **8**: 14 (1847)

Synonymy Contributor(s):
Kew Mycology (2015)

Search term: Phoma exigua

Many names for the same fungus

Older records based on morphology, host

Newer records include DNA sequence

Foliar blight

- *Phacidiopycnis washingtonensis*
- *Phomopsis vaccinii*



P. washingtonensis symptom expression
may be related to cold temperatures



Phacidiopycnis washingtonensis



“Large, dying branches appear to have a necrotic leading front similar to a cambial killing canker...Limited isolations from such cankers have yielded a species of *Phacidiopycnis*. This fungus was not pathogenic in healthy madrone.”
Hunt, 1999.

The fungus was also isolated from leaf spots on emerging foliage, lesions on green shoots, and the petiole and leaf blade of dead, attached leaves.

Shoot dieback fungi

- *Neofusicoccum arbuti*
(*Botryosphaeria* spp.)
- *Phomopsis vaccinii*
(*Diaporthe eres*)
- *Phacidiopycnis*
washingtonensis



Madrone canker



Older names:

Hendersonula toruloidea = *Neoscytalidium dimidiatum*

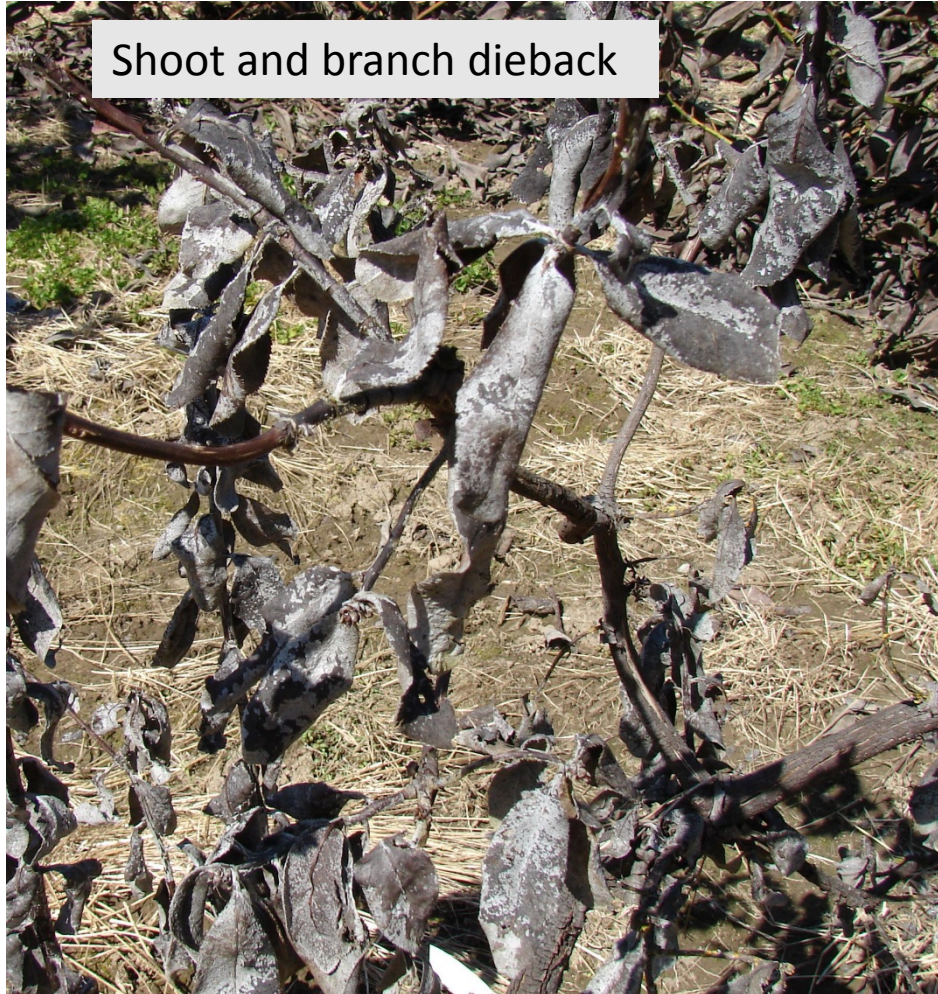
Nattrassia mangiferae = *Neofusicoccum mangiferae*

Neither of these fungi causes madrone canker

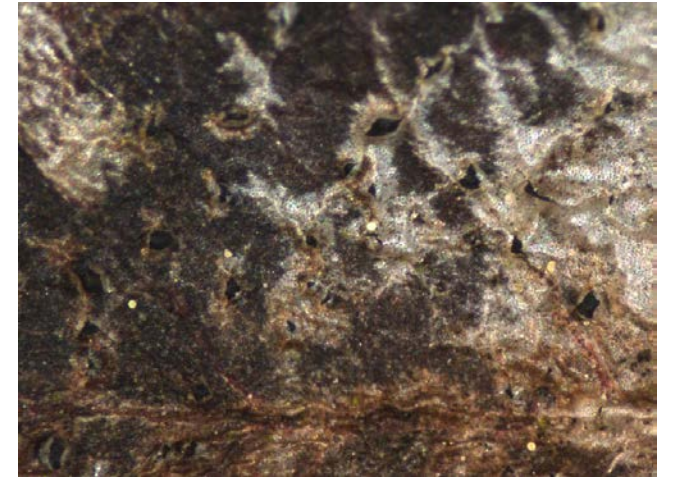


Fusicoccum arbuti = *Neofusicoccum arbuti*

Botryosphaeria spp.



Branches look “burned” or sooty



Pycnidia erupting through leaf cuticle



Root disease

- *Phytophthora* (*P. cactorum*, *P. cinnamomi*)
- *Armillaria* (*A. gallica*, *A. mellea*)
- *Heterobasidion occidentale*



Insects

Serpentine leaf miner
(*Marmara arbutiella*)



Wood boring beetle
(probably *Buprestidae*)



Fall webworm (*Hyphantria cunea*)

Damage commonly seen in summer months in
SW Oregon.

Wildlife

- Deer
- Rodents



Chewing damage and
undermining by rodents,
probably mountain beaver



Introduced pests and pathogens

- *Phytophthora cinnamomi*
- *Phytophthora ramorum*



P. cinnamomi on Pacific madrone, CA



P. ramorum infecting
madrone under bay laurel
canopy in California



Causes of decline in Pacific madrone

Climate-related

1975-1998 – warm phase – drought, canker, dieback, *Armillaria* root disease, *P. cinnamomi* root disease

1999-2014 – cool phase – leaf blight, cold damage, *Phytophthora* root disease

2014 – warm phase

Anthropogenic

Urbanization

Fire suppression

Exotic pests and pathogens (*P. cinnamomi*, *P. ramorum*, others)



Any questions?



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