



Pacific Madrone Provenance Trail

2015 Assessment of Starker Forest site
Trial assessed Oct 8 & 15

Draft Report

Objective

Provide the first baseline data on range-wide genetic variation in adaptive traits (e.g. growth) and resistance to pathogens for this wide ranging species.

- **105 families collected from 7 ecoregions were planted in five locations in California (1), Oregon (2), and Washington in fall 2011 / winter 2012 and a slightly different subset in BrCol (2) in 2014 (see some details at <http://puyallup.wsu.edu/ppo/madrone/research/commongarden/index.html>)**

2015 assessment (Oregon sites)

- **Assessment Team 2015: Doug Savin, Craig Bohan, Briana McTeague, Emily Boes, Molly Oppliger, Richard Sniezko (1 day), Angelia Kegley (1 day) – All USFS Dorena GRC**
- **See 2012, 2013, & 2014 Sniezko powerpoints for comments and photos from previous assessments (also see Starker Madrone Trial folder)**

Starker Forest Site

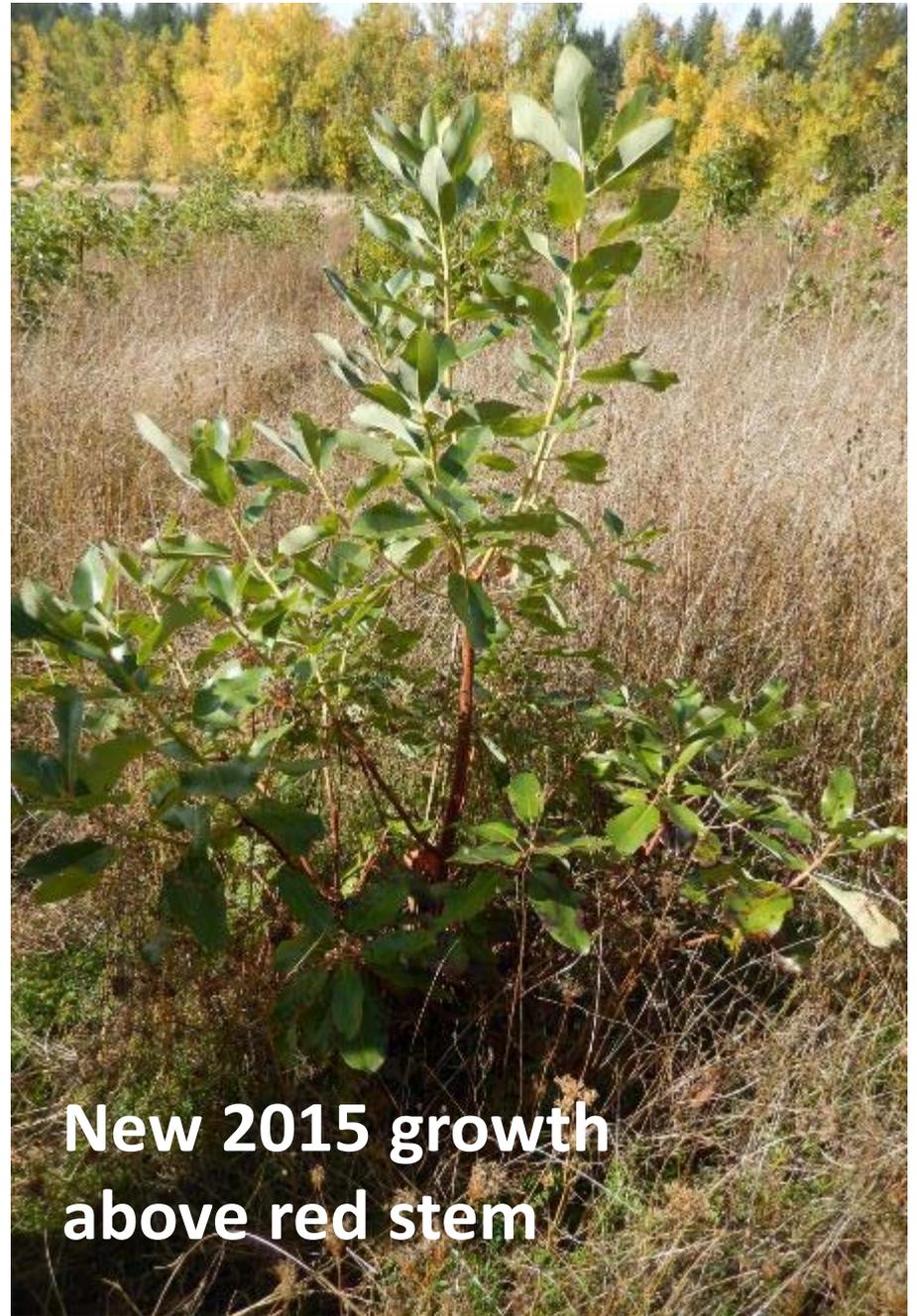
- Lots of gopher activity scattered throughout site
- Some active new growth on terminals, both swollen buds and flushing buds (224 trees, 12.1%)
- Blight severity on the whole less than 25% (very few trees in cat 3) (1543 trees, 83.6% of living trees)
- Blight incidence 0-50% on average in blocks (1481, 80.2%)
- Majority of seedlings with total severity 0-5%; a few trees with 12-15% total severity, Note of interest: Blight severity percentage seemed to increase and concentrate on NW side of seedling in block 2 & 3
- A moderate amount of insect chewing
- Few trees found with reddish green foliage
- Moderate levels of second flush (140, 7.6%)
- Lots of trees with dieback that killed terminal leader but most seedlings were putting out good new basal laterals
- Block 1 – secondary flush was counted as new growth
- Border trees on average showed more growth/vigor
- No trees found without blight on block 1 & 2 & 3
- No rust found on block 1 & 2 & 3
- Photo numbers recorded in comments on data file



Top dieback, basal sprouting

A close-up photograph of several large, ovate leaves with serrated margins. The leaves are primarily green but exhibit extensive dark brown to black necrotic spots and blotches, characteristic of blight. The veins are a reddish-brown color. The background consists of a dense thicket of dry, brown grasses and other plant stems.

**Blight /
Leaf spotting
#2350**



**New 2015 growth
above red stem**



**Blight /
leaf spotting
#2352**



**Blight /
leaf spotting
#2353**

A photograph showing a large mound of reddish-brown soil. The soil is uneven and appears to be the result of animal burrowing activity. There are several small holes and indentations in the surface. Sparse, dry, light-colored grasses and some small green plants are scattered across the mound. In the bottom right corner, the tip of a person's boot, which is dark with a light-colored sole, is visible, suggesting the photo was taken from a close-up perspective. The overall scene is outdoors, likely in a field or a construction site.

**Animal burrowing activity –
mounds of soil commonly
found throughout site**



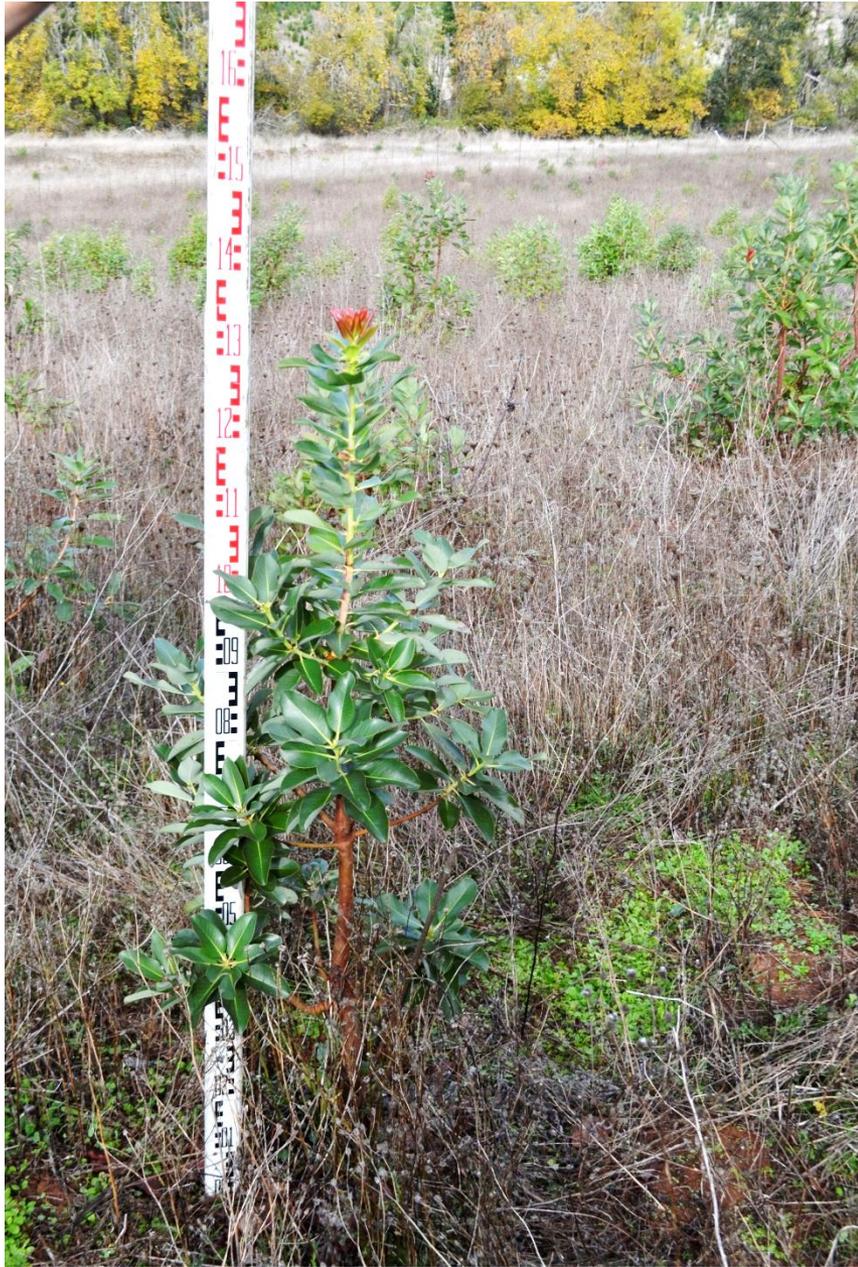
Looking North at Block 1 & 2 of site



Wilted /leaves curled



**New growth –
flushing bud
0071**





Comments - Leaf blotchy
#0075



Comments – Reddish-green fully expanded foliage

#0087

A close-up photograph of a plant stem with several large, ovate, serrated green leaves. The leaves have prominent veins and a slightly waxy texture. A central stem is visible, showing a swollen, reddish-brown bud at the top. The background is a blurred natural setting with dry grass and green foliage.

New growth –
buds swollen
#0078



**Comments –
insect activity
#0068**



New growth –
Flushing bud
#0088



A close-up photograph of a plant with large, green, serrated leaves. The leaves have a slightly wavy, scalloped edge. In the center of the plant, there is a small, yellowish-green bud that is beginning to open, showing several pointed, light-colored structures. The background is blurred, showing more of the plant and some brown, dried leaves.

**New growth –
Flushing bud
#0092**

New growth-
Flushing bud
#0095





2015 Assessment Crew

To Do

- Data validation
- Compile unified dataset over assessment dates and sites
- Basic summary info (e.g. mean height by family & source)

Starker Forest:

Average Height and
Growth from 2014 to
2015

	Data	
Ecoregion	Average of growth15	Average of 15ht
Cascades	21.4	104.8
Central CA Foothills & Coastal Mtns	13.0	70.1
Coast Range	16.3	88.5
Klamath Mountains	16.4	88.7
Puget Lowland	24.0	114.7
Sierra Nevada	20.1	93.9
Willamette Valley	27.6	128.3
(blank)	11.2	99.7
Grand Total	20.7	102.4

	Data			Data			Data			Data			Data			Data	
Fam#	Avg gth	Avg ht	Fam#	Avg gth	Avg ht												
1	23.5	116.0	21	7.0	69.6	41	27.7	126.2	60	25.7	96.9	81	22.7	112.8	99	16.5	85.2
2	19.9	125.0	22	12.9	66.9	42	23.8	109.3	61	14.1	114.1	82	24.2	104.0	100	14.0	70.5
3	20.0	128.4	23	19.7	108.1	43	34.6	143.9	62	24.2	92.6	83	23.1	103.7	101	19.8	73.2
4	30.3	138.9	24	5.9	57.3	44	17.7	103.6	64	8.3	48.1	84	21.2	116.8	102	21.7	90.4
5	24.4	108.8	26	20.4	63.9	45	21.3	94.6	66	7.9	51.6	85	24.0	96.8	103	31.5	131.0
6	25.1	102.4	27	9.4	73.2	46	19.3	103.1	67	6.7	83.7	86	25.6	109.1	104	32.6	147.0
7	22.8	114.6	28	37.5	130.8	47	16.6	77.7	68	17.9	93.8	87	35.8	128.4	105	38.9	145.6
9	34.2	128.3	29	20.9	82.4	48	11.4	83.2	69	16.8	95.2	88	-7.5	81.3	106	31.0	127.3
10	27.5	137.2	30	18.2	87.1	49	12.7	97.6	70	14.4	76.5	89	15.3	65.6	107	30.4	119.8
11	20.9	119.7	31	22.7	93.2	50	7.0	61.1	71	33.5	127.8	90	22.8	89.7	108	21.6	116.2
13	17.8	81.1	32	14.4	90.3	51	11.6	54.7	72	16.9	98.4	91	19.3	93.2	109	25.8	114.3
14	7.9	66.1	33	30.7	103.3	52	6.2	59.6	73	23.5	119.7	92	-7.3	35.3	110	28.9	124.7
15	16.4	81.9	34	26.9	123.1	54	15.8	94.4	74	17.1	119.5	93	-9.5	22.8	111	24.2	110.5
16	9.5	49.5	35	21.6	115.6	55	13.2	86.3	75	7.6	85.3	94	-11.9	23.5	112	23.1	94.4
17	11.5	54.0	37	18.1	93.4	56	21.7	101.8	77	17.8	98.1	95	14.8	80.1	113	28.6	149.3
18	12.5	77.1	38	16.2	80.1	57	11.9	101.1	78	10.4	84.2	96	24.1	95.1	114	27.1	121.2
19	17.7	123.5	39	21.9	96.3	58	23.3	79.5	79	26.1	119.6	97	13.0	70.0	115	40.7	157.1
20	27.6	117.8	40	16.2	91.8	59	15.5	78.3	80	28.9	141.5	98	10.5	59.9	Overall	20.8	102.4

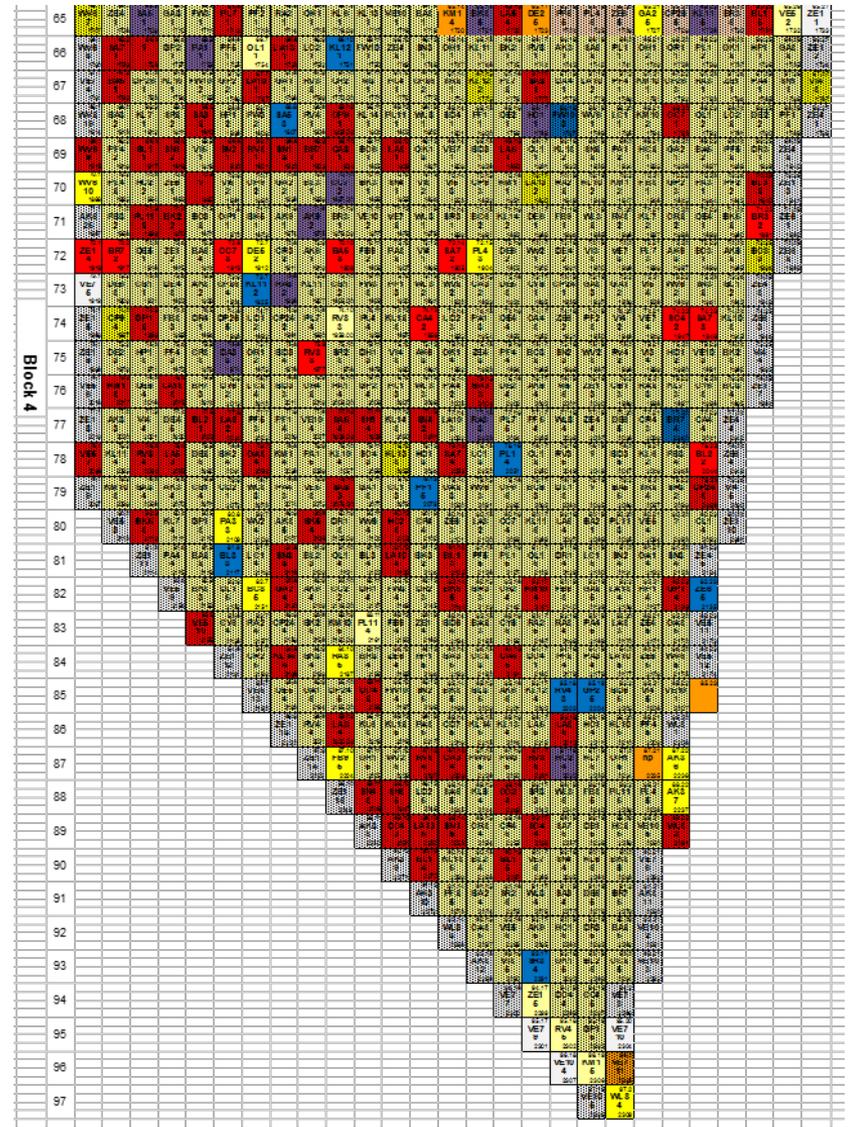
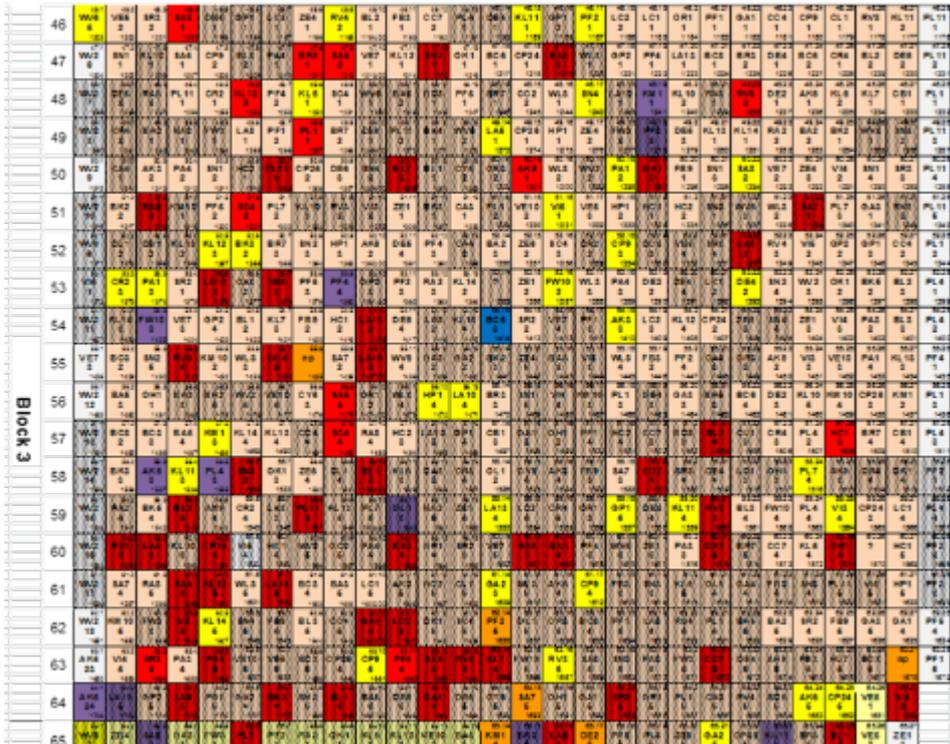
Mortality Map



		Starker Forest																																
Position		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28					
1							PA4 1	VE7 1	BN2 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1	VE7 1				
2							OK1 1	BA6 1	CB1 1	BC3 1	BR7 1	PF4 1	OP2 1	OK1 1	OK1 1	LC2 1	ZE4 1	OP1 1	RV8 1	BK3 1	CO2 1	BL3 1	BA3 1	BR2 1										
3							PA4 2	PA4 2	BA2 2	HC2 2	PL1 2	LA3 2	PA3 2	FW0 2	AK3 2	VA 2	RV4 2	DE4 2	KL10 2	KL10 2	BN2 2	BC2 2	BR4 2											
4							OH1 2	PF6 2	OR1 2	RA2 2	OP4 2	HPI 2	GA1 2	SC4 2	WV6 2	BN4 2	PL4 2	KL11 2	LA10 2	BL1 2	GA4 2	CO7 2	LA2 2	SR2 2										
5							PA4 3	BA3 3	VE3 3	OL1 3	WV2 3	AK6 3	AK6 3	CO2 3	CV6 3	OP6 3	OR4 3	BA3 3	VE6 3	BN3 3	KL10 3	BK3 3	DE6 3	BA2 3	PL4 3	AK6 3								
6							PA3 3	HPI 3	LC2 3	OP1 3	AK6 3	PF2 3	AK6 3	DE4 3	KL12 3	OR3 3	CL1 3	KL11 3	ZE4 3	VE10 3	LA13 3	OR2 3	DE2 3	KL11 3	LA10 3	AK3 3								
7							OH1 2	WV6 2	DK1 2	BN2 2	FB2 2	KL7 2	BO6 2	DE2 2	BR1 2	LA6 2	KL1 2	PA1 2	RV4 2	GA1 2	KL10 2	BN1 2	DA2 2	PA2 2										
8							OH1 2	ZE4 2	WV6 2	ZE6 2	WV6 2	BA7 2	PL11 2	OP26 2	BL2 2	BA3 2	KL6 2	FB4 2	FV6 2	VE6 2	FW0 2	BA2 2	PF1 2	VE6 2	GA2 2	VE10 2	AK6 2							
9							PA3 2	LA6 2	BR1 2	DE2 2	BK2 2	LC1 2	PL1 2	PA4 2	RA2 2	BC2 2	BL2 2	BA6 2	LA10 2	LC1 2	OH1 2	ZE6 2	PF6 2	HC1 2	BR2 2	WV2 2	AK6 2							
10							LA10 1	OK1 1	BA1 1	BA6 1	CA4 1	KL6 1	LA5 1	VA 1	OH1 1	BR7 1	RV9 1	OP2 1	BN1 1	LA13 1	RA2 1	FB3 1	VE10 1	FW6 1	FW10 1	ZE4 1	CO3 1	AK3 1						
11							PA3 2	LC2 2	OP24 2	AK6 2	DE6 2	DE6 2	OR2 2	VE2 2	PF1 2	CR4 2	CV6 2	LA2 2	AK6 2	BK3 2	BR2 2	CO7 2	WV2 2	VA 2	OP2 2	KL10 2	AK3 2							
12							UP1 2	BN2 2	RV4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	
13							PA4 2	VE3 2	BN1 2	UN4 2	PA4 2	BL3 2	SHV 2	UP26 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	
14							PA2 2	WV6 2	CB6 2	BA6 2	FW0 2	BL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	
15							UL1 2	UL1 2	FW10 2	HP4 2	LA14 2	WV6 2	HP1 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	PL7 2	
16							PA1 2	ZE1 2	LA6 2	RV10 2	RA10 2	UB1 2	BA2 2	CU4 2	BL2 2	BR6 2	BN6 2	PF9 2	RV1 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2
17							UL1 2	RV6 2	UN1 2	PA1 2	RV4 2	AL6 2	AN6 2	CU6 2	BL1 2	AL10 2	UB1 2	BN3 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2
18							PA1 2	VE6 2	WV6 2	BN6 2	PA4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2	UN4 2
19							OR1 2	CP24 2	OR1 2	AK6 2	BN1 2	HC1 2	DA2 2	VE 2	BR1 2	WV2 2	OR1 2	AK6 2	BO6 2	BL1 2	RA4 2	PF2 2	BR2 2	PA4 2										
20							PA1 2	PA2 2	HC1 2	PF1 2	WV6 2	FB6 2	FW0 2	BA6 2	VE 2	AK6 2	HC2 2	AK6 2	DE4 2	KL12 2	KL11 2	RV6 2	PF6 2	GA1 2	VE6 2	SR2 2	PL11 2	CV6 2	AK6 2					
21							AK6 2	PA1 2	OH1 2	BA2 2	AK6 2	OR6 2	FB6 2	ML3 2	RV6 2	BC4 2	PL4 2	GA3 2	OK1 2	LA10 2	BN3 2	VE7 2	PL11 2	OP2 2	LA10 2	OK1 2	GA3 2	BC4 2	OK1 2					
22							PA1 2	KL11 2	PF4 2	BA6 2	VE10 2	KL6 2	OL1 2	ZE1 2	PL1 2	CO7 2	BA6 2	ZE1 2	LA6 2	LA10 2	VE 2	BL1 2	BL2 2	CL1 2	OR2 2	CA3 2	AK6 2	RV4 2						
23							OR1 2	RV4 2	BN6 2	DE4 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2
24							OR1 2	RV4 2	BN6 2	DE4 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2	BN6 2

		Block 2																														
Position		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
25		OR1 3	KM1 3	RV3 3	PL11 3	LC1 3	DE6 3	PA1 3	PF5 3	LA6 3	BL3 3	VE7 3	GP1 3	CC2 3	BA5 3	BC3 3	DE6 3	VE6 3	SR2 3	ZE6 3	WV2 3	HC2 3	VE5 3	VE5 3	PF2 3	OK1 3	KM1 3	CR4 3	AK5 3			
26		OK1 3	CB1 3	OH1 3	RV4 3	HC1 3	PF4 3	SA7 3	PA3 3	LC2 3	BA2 3	BC3 3	ZE1 3	KL7 3	KL12 3	DE5 3	RV3 3	WV3 3	SR0 3	LC4 3	PP2 3	OP1 3	VE7 3	WV3 3	VE3 3	BL3 3	FW0 3	BK5 3	AK5 3			
27		OR1 3	LA13 3	FB9 3	VE6 3	GA1 3	SM1 3	CR4 3	ZE4 3	BC3 3	AK3 3	KL14 3	KM1 3	CC4 3	CV6 3	PA4 3	CC7 3	SN2 3	VV4 3	OL1 3	WV6 3	ZE6 3	SR0 3	CP9 3	CA4 3	LA6 3	AK5 3					
28		PA1 3	OK1 3	RV4 3	WV2 3	PA4 3	PL4 3	LA5 3	ZE1 3	BA2 3	CA4 3	BK2 3	CL1 3	BL1 3	BR7 3	PL4 3	FB3 3	GP2 3	PL7 3	OK1 3	CB1 3	KL10 3	VV4 3	BN2 3	SA7 3	AK5 3	GA2 3	AK5 3				
29		OR1 3	VE3 3	BL1 3	ZE6 3	GP1 3	VV3 3	CC2 3	WV6 3	AK6 3	CR0 3	DE2 3	CP9 3	BR3 3	CP26 3	AK6 3	HP1 3	KL11 3	PA1 3	PF4 3	LC1 3	VE7 3	DE2 3	PA2 3	CP24 3	CR2 3	WV1 3					
30		OH1 3	PL1 3	GA3 3	CR4 3	PL1 3	VE3 3	VE10 3	CA3 3	KL13 3	SN3 3	GA3 3	CP24 3	BR3 3	SN0 3	KL13 3	RV3 3	KM10 3	RV4 3	KL6 3	DE5 3	KL11 3	WV2 3	CA3 3	BC5 3	BK2 3	CP26 3	RA8 3				
31		DL1 3	FV0 3	VV3 3	FV10 3	PF1 3	SR0 3	SA5 3	KM11 3	BC3 3	AK6 3	CR2 3	CR0 3	CR2 3	CP26 3	AK6 3	1 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	
32		OK1 3	OR1 3	VE3 3	LA6 3	CV6 3	ZE4 3	SM1 3	PA4 3	BC4 3	FB3 3	LC2 3	SA8 3	BK2 3	SR0 3	KL12 3	VE10 3	AK6 3	KL11 3	KL14 3	CB2 3	VE7 3	KL12 3	PL11 3	BA2 3	BL1 3	SR0 3	LA5 3	RA2 3			
33		OL1 3	KL10 3	LA10 3	BL2 3	GP1 3	SN0 3	GA2 3	PL7 3	CC2 3	KL6 3	PF1 3	LC1 3	KL11 3	SA8 3	VP2 3	BL3 3	BC3 3	SA7 3	KM1 3	LA15 3	PL4 3	PF2 3	SN4 3	ZE6 3	OL1 3	KL6 3	RA2 3				
34		OK1 3	DE4 3	OP6 3	BR7 3	CV6 3	AK3 3	HP1 3	GA1 3	CB1 3	PF5 3	RA2 3	RA6 3	KL12 3	SN2 3	FV6 3	DE6 3	BA2 3	CA4 3	DE6 3	OP6 3	KL13 3	GP2 3	ZE1 3	LC1 3	GA2 3	RV0 3	PF1 3				
35		OH1 3	KM10 3	RV8 3	RA2 3	HC1 3	CR2 3	SA5 3	VV3 3	VE10 3	SA8 3	CA4 3	KL7 3	WV2 3	CR0 3	KL7 3	FB3 3	WV8 3	VL2 3	RA2 3	RV8 3	BL1 3	CR4 3	VE10 3	SN2 3	PF2 3	PF6 3	PA4 3	RA8 3			
36		AK6 3	CA3 3	CC7 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3	BR6 3
37		BK2 3	WV6 3	HPI 3	OP1 3	PL7 3	GP2 3	BK3 3	SN0 3	LC2 3	BC8 3	FV10 3	SA7 3	AK5 3	AK5 3	DE4 3	OL1 3	SN1 3	PF5 3	CC7 3	CR2 3	KL6 3	PA3 3	RV3 3	AK5 3	BL2 3	HC2 3	AK6 3				
38		WV6 3	AK6 3	OH1 3	LA6 3	HP1 3	BK5 3	CP26 3	FB3 3	PF5 3	BK5 3	KL10 3	LA6 3	LC2 3	VE5 3	BA5 3	VE3 3	SN0 3	KL10 3	PL1 3	DE6 3	BC8 3	BL3 3	FB6 3	PF1 3							
39		WV2 3	VE3 3	SN0 3	VE10 3	VE7 3	VE3 3	RA8 3	CL1 3	KM10 3	KL6 3	WV6 3	BL3 3	CP24 3	SA8 3	HC2 3	HP1 3	OH1 3	CC2 3	OL1 3	FV6 3	PA1 3	PL11 3	DE6 3	DE2 3	LA5 3	RA8 3					
40		WV2 3	SR2 3	SN4 3	GA3 3	WV3 3	BC6 3	SA3 3	KL14 3	BA3 3	BL2 3	DE5 3	PF6 3	LC2 3	KM10 3	KL11 3	SC4 3	SN1 3	GP1 3	PL7 3	BL2 3	LA6 3	HC1 3	CR3 3	BC6 3	CR4 3	KL12 3	WV6 3	PF5 3			
41		WV2 3	WV2 3	SC4 3	SR0 3	PA3 3	CP24 3	FV6 3	KL7 3	SR0 3	AK6 3	CC7 3	SA7 3	SN4 3	CP9 3	RV8 3	OR1 3	RV8 3	AK6 3	DE4 3	AK6 3	BA5 3	PL7 3	AK6 3	CP24 3	AK6 3	CP24 3	AK6 3	CP24 3	AK6 3	CP24 3	
42		WV2 3	ZE6 3	PA1 3	PL11 3	BR1 3	CC2 3	BA6 3	GP1 3	SA7 3	PL11 3	DE4 3	HC1 3	KL13 3	PA4 3	PF1 3	WV6 3	CP9 3	RV8 3	OR1 3	DE2 3	SA5 3	CV6 3	BA3 3	BC3 3	OH1 3	VV4 3	RA2 3				
43		WV6 3	HC1 3	WV6 3	RV6 3	RV6 3	CC4 3	BC3 3	RV6 3	RV6 3	RV6 3	RV6 3	RV6 3	RV6 3	RV6 3																	
44		GA2 3	FV6 3	LA10 3	LA6 3	SN0 3																										

Mortality map



- Cooperators: BLM (Sprague) and Starker Forests provide sites for the two Oregon trials
- Pacific Madrone Provenance Trial Team
 - Contacts:*
 - WSU (Gary Chastagner/Marianne Elliott)
 - USFS, **NFS**: (Jim Hamlin, Richard Sniezko), **PNWRS**:
Connie Harrington
 - ODF (Alan Kanaskie)
 - British Columbia Ministry of Forests (John Russell)

Pacific madrone publications

- [A First Look at Genetic Variation in Resistance to the Root Pathogen *Phytophthora cinnamomi* using a Range-wide Collection of Pacific Madrone \(*Arbutus menziesii*\)](#)
Marianne Elliott, Gary Chastagner, Annie DeBauw, Gil Dermott, and Richard A. Sniezko
- [Range-wide Genetic Variability in Pacific Madrone \(*Arbutus menziesii*\): Examining Disease Resistance, Growth, and Survival in a Common Garden Study](#)
Marianne Elliott, Gary A. Chastagner, Gil Dermott, Alan Kanaskie, Richard A. Sniezko, and Jim Hamlin