WHITE PAPER

USDA Forest Service Pacific Northwest Region Umatilla National Forest

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Important Blue Mountains Insects and Diseases[1]

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INTRODUCTION

During the 1980s and early 1990s, Blue Mountain national forests (Malheur, Umatilla, and Wallowa-Whitman) responded to an intense and prolonged outbreak of western spruce budworm, an insect defoliator affecting mixed-conifer forests containing Douglas-fir, grand fir, Engelmann spruce, or subalpine fir (budworm 'host' species). This outbreak occurred from 1980 to 1992. Millions of acres in the Blue Mountains were defoliated during a 13-year period.

A budworm outbreak moved forest insect and disease issues into the forefront of public and agency attention. Forest health became a common term, and many field trips were held across the Blue Mountains to explain why insects and diseases seemed to be "causing so much damage" to forest health (white paper Silv-19 provides notes, in handout form, from a forest health field trip in July 1998). From an agency perspective, USDA Forest Service proposed many active management projects with a purpose and need of removing dead and dying trees created by insects and diseases, or to improve forest health for stands where live trees were afflicted.

This white paper was prepared to meet a need for handout materials for use with public or stakeholder field trips, and to provide simple, easily understood insect and disease information for biologists and other agency employees lacking a forestry background. As much as possible, it avoids technical terms and copious literature citations.

Insects and diseases are organized by group (bark beetles, root diseases, etc.); six items are provided for each agent: name; tree species affected; damage caused; impacts and effects; control measures; and Forest Insect and Disease Leaflet (source for more information; see app. 1).

[1] White papers are internal reports; they receive only limited review. Viewpoints expressed in this paper are those of the author – they may not represent positions of USDA Forest Service.

BARK BEETLES

Douglas-fir Beetle *(Dendroctonus pseudotsugae)*.

TREE SPECIES AFFECTED: Douglas-fir (primary); western larch (secondary).

DAMAGE CAUSED: Blue-stained sapwood; gray saprot; tree mortality.

IMPACTS AND EFFECTS: Attacks trees weakened by disease, drought, defoliation, fire, or another stressor; it was very active following an early 1970s Douglas-fir tussock moth outbreak, the 1980-1992 western spruce budworm outbreak, and a late 1980s drought episode.

CONTROL MEASURES: Salvage attacked and susceptible host trees; reduce stocking levels/stand density; manage green slash to prevent population buildups.

FOREST INSECT AND DISEASE LEAFLET: No. 5 (Furniss and Kegley 2014).

Fir Engraver *(Scolytus ventralis)*.

TREE SPECIES AFFECTED: Grand fir and subalpine fir.

DAMAGE CAUSED: Brown-stained sapwood; top killing; tree mortality.

IMPACTS AND EFFECTS: Fir engraver attacks trees weakened by drought, defoliation, or root disease; recently, it was especially active following the 1980-1992 western spruce budworm outbreak and a late 1980s drought episode.

CONTROL MEASURES: Improve host-tree vigor; treat root diseases and other stress-causing agents over which we have some control; reduce stocking levels/stand density; salvage damaged and susceptible host trees.

FOREST INSECT AND DISEASE LEAFLET: No. 13 (Ferrell 1986).

Mountain Pine Beetle *(Dendroctonus ponderosae)*.

TREE SPECIES AFFECTED: Lodgepole pine and ponderosa pine.

DAMAGE CAUSED: Tree mortality; blue-staining of sapwood.

IMPACTS AND EFFECTS: This beetle killed millions of lodgepole pines in Blue Mountains during major outbreaks from 1905-15 and 1968-78; it was also active in both lodgepole pine and ponderosa pine forest cover types following a late 1980s drought event. [At high elevations of the Blue Mountains, mountain pine beetle also attacks and kills whitebark pine.]

CONTROL MEASURES: Reduce stocking levels/stand density; chemical insecticides or attractants (pheromones) are occasionally used, primarily in recreation areas.

FOREST INSECT AND DISEASE LEAFLET: No. 2 (Gibson et al. 2009).

Pine Engraver *(Ips pini)*.

TREE SPECIES AFFECTED: Ponderosa pine and lodgepole pine.

DAMAGE CAUSED: Top-killing and tree mortality.

IMPACTS AND EFFECTS: Populations build in slash and then attack living trees. Pine engravers may escape from thinning slash to kill residual trees in thinning units.

CONTROL MEASURES: Create enough green slash to prevent killing of leave trees, although any green slash created between January and June poses a relatively high risk of favoring population buildups that could eventually move into (and kill or damage) living trees.

FOREST INSECT AND DISEASE LEAFLET: No. 122 for Pine Engraver (Kegley et al. 1997).

Spruce Beetle *(Dendroctonus rufipennis)*.

TREE SPECIES AFFECTED: Engelmann spruce.

DAMAGE CAUSED: Tree mortality; blue-staining of sapwood.

IMPACTS AND EFFECTS: Spruce beetle initially attacks downed trees resulting from windthrow, or it infests large-diameter, timber-harvest debris (slash), eventually spilling over into living trees; it was relatively active on Walla Walla Ranger District following several large wind-storm events in 1990s.

CONTROL MEASURES: Sanitation and salvage, particularly following windthrow events; reduce stocking levels/stand density; avoid creating fresh, large-diameter, timber-harvest debris.

FOREST INSECT AND DISEASE LEAFLET: No. 127 (Holsten et al. 1999).

Western Pine Beetle *(Dendroctonus brevicomis)*.

TREE SPECIES AFFECTED: Ponderosa pine.

DAMAGE CAUSED: Tree mortality; blue-staining of sapwood.

IMPACTS AND EFFECTS: This pine beetle attacks stressed, high-risk trees such as those affected by root disease, drought, overstocking, fire damage, etc. It was relatively active following a late 1980s drought episode. Primarily affects large-diameter, old-growth ponderosa pines.

CONTROL MEASURES: Sanitation and salvage cutting; reduce stocking levels/stand density; replace overmature trees with young, vigorous trees; avoid wounding or stressing overmature trees during prescribed fire treatments.

FOREST INSECT AND DISEASE LEAFLET: No. 1 (DeMars and Roettgering 1982).

DEFOLIATORS

Douglas-fir Tussock Moth *(Orgyia pseudotsugata)*.

TREE SPECIES AFFECTED: Douglas-fir and grand fir.

DAMAGE CAUSED: Severe top-killing; reduced radial (stem) and height growth; tree mortality.

IMPACTS AND EFFECTS: Cyclic – populations tend to increase every 9-11 years, building quickly over a 2- to 4-year period to outbreak levels (but not every population increase cycle results in an outbreak), and then disappearing. Recorded outbreaks occurred in 1928-29 (near Seneca, OR), 1937-39 (80,000 acres near Rudio Mountain north of Dayville, OR), 1947-48 (1,500 acres near Snow Mountain and Gold Hill in the southern Blue Mountains), 1963-65 (almost 65,000 acres near Antelope Mountain and King Mountain in the southern Blue Mountains), 1972-1974 (almost a million acres in the northern Blue Mountains, especially on the Walla Walla Ranger District), and 1999-2004 (more than 75,000 acres on the Umatilla NF, including the Indian Creek and Bologna Basin areas at Heppner Ranger District).

CONTROL MEASURES: Spray with insecticides; favor non-host species and mosaics of host and non-host stands; stocking-level control, particularly on dry sites. The 1963-1965 and 1972-1974 outbreaks were both suppressed by using a chemical insecticide – DDT.

FOREST INSECT AND DISEASE LEAFLET: No. 86 (Wickman et al. 1981).

[Note: white paper F14-SO-WP-Silv-16 deals specifically with Douglas-fir tussock moth.]

Larch Casebearer *(Coleophora laricella)*.

TREE SPECIES AFFECTED: Western larch.

DAMAGE CAUSED: Defoliation; tree growth reduction; branch die-back; tree mortality.

IMPACTS AND EFFECTS: This non-native insect was introduced into North America from Europe during late 1800s. It causes sporadic or intermittent outbreaks, and it generally affects small areas at one time. Tree damage, however, can be severe in infested stands.

CONTROL MEASURES: Chemical insecticide for individual trees; natural parasites are also effective for large areas.

FOREST INSECT AND DISEASE LEAFLET: No. 96 (Tunnock and Ryan 1985).

Western Spruce Budworm *(Choristoneura occidentalis)*.

TREE SPECIES AFFECTED: Grand fir, Douglas-fir, subalpine fir, and Engelmann spruce (some sources suggest that western spruce budworm occasionally feeds on western larch, but this is uncommon and if it happens, only small, developing larch cones are typically affected).

DAMAGE CAUSED: Reduced tree growth following defoliation; reduced seed production from budworm-caused cone damage, and from decreased tree vigor; severe top-killing; tree mortality. Tree and stand damages experienced during a 1980-92 western spruce budworm outbreak were characterized for Malheur National Forest of central and southern Blue Mountains (Powell 1994).

Note: Since budworm defoliation causes reduced radial growth in host trees, tree-ring evaluations (dendrochronological analyses) have been used to identify multi-century, budworm-outbreak trends (Wickman et al. 1994).

IMPACTS AND EFFECTS: Cyclic outbreaks are common – Blue Mountains were most recently affected from 1944 to 1959, 1980 to 1992, and 2001 to 2012. [Wickman et al. 1994 also identified budworm outbreaks in 1775-85, 1822-30, 1838-42, 1870-78, and 1898-1909.]

CONTROL MEASURES: Spray with insecticides; favor early-seral, non-host tree species during stand management; create single-story stands when dealing with pure host type (to minimize what is referred to as the 'feeding ladder' effect); reduce stocking levels/stand density; create host/non-host mosaics over large areas. Much of the 1944-59 outbreak was sprayed with DDT; portions of the 1980-92 outbreak were sprayed with carbaryl or B.t.

FOREST INSECT AND DISEASE LEAFLET: No. 53 (Fellin and Dewey 1986).

DWARF MISTLETOES

Douglas-fir Dwarf Mistletoe *(Arceuthobium douglasii)*.

TREE SPECIES AFFECTED: Douglas-fir.

DAMAGE CAUSED: Top-killing; reduced growth; deformed stems; brooms; tree mortality.

IMPACTS AND EFFECTS: This is a severe parasite – one survey found 42 percent of Douglas-fir type on east side of Pacific Northwest Region (Region 6) is affected by this parasite. This organism often causes extensive mortality on poor, low-productivity sites.

CONTROL MEASURES: Regenerate mature stands; leave buffers between infected trees and uninfected seedlings; quickly remove infected trees from partial cuts; discourage thinning of infected stands because brooming (an indicator of infection status) is suppressed and often

not apparent in smaller trees, and because many infections are latent.
FOREST INSECT AND DISEASE LEAFLET: No. 54 (Hadfield et al. 2000).

Larch Dwarf Mistletoe *(Arceuthobium laricis)*.
TREE SPECIES AFFECTED: Western larch; lodgepole pine and subalpine fir (occasional).
DAMAGE CAUSED: Reduced tree growth and seed output; some lumber defect; brooms (brooms tend to break off under snow and ice loading, and they are occasionally abundant around base of infected trees, adding to surface fuel accumulations); tree mortality.
IMPACTS AND EFFECTS: Our most serious larch enemy – one survey found 47 percent of Pacific Northwest host type is infected. This parasite tends to kill its host trees faster, and generally causes higher overall mortality levels, than is seen for most other dwarf mistletoes.
CONTROL MEASURES: Regenerate mature stands; leave buffers between infected trees and uninfected seedlings and saplings; promptly remove infected overstory trees from partial cuts; sanitize young stands by removing infected trees during thinning.
FOREST INSECT AND DISEASE LEAFLET: No. 169 (Beatty et al. 1997).

Lodgepole Pine Dwarf Mistletoe *(Arceuthobium americanum)*.
TREE SPECIES AFFECTED: Lodgepole pine; ponderosa pine (occasional).
DAMAGE CAUSED: Reduced tree vigor and growth; stem cankers; tree mortality.
IMPACTS AND EFFECTS: Generally severe – one survey found 42 percent of host type in Pacific Northwest is infected to some extent.
CONTROL MEASURES: Clearcut mature stands; sanitize young stands by removing infected trees during thinning; promptly remove infected overstory trees from partial cuts.
FOREST INSECT AND DISEASE LEAFLET: No. 18 (Hawksworth and Dooling 1984).

Western Dwarf Mistletoe *(Arceuthobium campylopodum)*.
TREE SPECIES AFFECTED: Ponderosa pine.
DAMAGE CAUSED: Reduced vigor, growth, and seed production; cankers; tree mortality.
IMPACTS AND EFFECTS: A common disease agent – one survey found 26 percent of host type in Pacific Northwest is infected to some degree.
CONTROL MEASURES: Regenerate mature stands; sanitize young stands during thinnings; promptly remove infected overstory trees from partial cuts.
FOREST INSECT AND DISEASE LEAFLET: No. 40 (Beatty and Mathiasen 2003).

ROOT DISEASES

Annosus Root Disease *(Heterobasidion annosum)*.
TREE SPECIES AFFECTED: Grand fir, subalpine fir, and pines.
DAMAGE CAUSED: Butt (lower stem) decay, and tree mortality.
IMPACTS AND EFFECTS: Relatively common in mixed-conifer stands, especially those with a history of repeated partial cutting.
CONTROL MEASURES: Favor tolerant and resistant trees; use short rotations (cyclic intervals between regeneration treatments) and fewest possible stand entries; implement density management treatments; remove infected stumps, or treat them with borax when fresh (immediately

after tree felling, especially for immature fir trees).

FOREST INSECT AND DISEASE LEAFLET: No. 172 (Schmitt et al. 2000).

Armillaria Root Disease *(Armillaria ostoyae)*.

TREE SPECIES AFFECTED: Douglas-fir and grand fir – severe; pines, Engelmann spruce, and subalpine fir – moderate.

DAMAGE CAUSED: Reduced tree growth; butt (lower stem) decay; increased windthrow susceptibility; tree mortality.

IMPACTS AND EFFECTS: Widespread in mixed-conifer stands; probably the most damaging root disease of the Blue Mountains.

CONTROL MEASURES: Favor tolerant and resistant tree species; avoid frequent entries and soil disturbance (especially compaction of ash-influenced soil types); sanitize when thinning; reduce stand density/stocking levels; stump removal in special situations (recreation sites, etc.).

FOREST INSECT AND DISEASE LEAFLET: No. 78 (Williams et al. 1986).

Black Stain Root Disease *(Ophiostoma wageneri* var. *ponderosum)*.

TREE SPECIES AFFECTED: Ponderosa pine and lodgepole pine.

DAMAGE CAUSED: Reduced tree growth and tree mortality.

IMPACTS AND EFFECTS: This disease is often spread by root-feeding bark beetles and weevils; it was recently found in ponderosa pine type in both southern (Emigrant Creek Ranger District) and northern Blue Mountains (Pomeroy Ranger District).

CONTROL MEASURES: Favor tolerant and resistant species; minimize tree injuries and site disturbance; schedule precommercial thinning to avoid insect vectors.

FOREST INSECT AND DISEASE LEAFLET: No. 145 (Hessburg et al. 1995).

Laminated Root Rot *(Phellinus weirii)*.

TREE SPECIES AFFECTED: Douglas-fir and grand fir – severe; Engelmann spruce, subalpine fir, and western larch – moderate.

DAMAGE CAUSED: Reduced tree growth; root and butt (lower stem) decay; increased windthrow susceptibility; tree mortality.

IMPACTS AND EFFECTS: This root rot causes extensive tree mortality on infected sites. The fungus can survive for long time periods in infected stumps and roots – in some circumstances, it can almost be considered a "feature of the site" due to its extreme soil persistence.

CONTROL MEASURES: Favor moderately damaged, tolerant, and resistant tree species; remove infected stumps from disease centers (only used in special situations like recreation sites).

FOREST INSECT AND DISEASE LEAFLET: No. 159 (Nelson et al. 1981).

RUSTS and ROTS

Comandra Blister Rust *(Cronartium commandre)*.

TREE SPECIES AFFECTED: Ponderosa pine and lodgepole pine.

DAMAGE CAUSED: Kills branches, tops, and entire trees.

IMPACTS AND EFFECTS: Often minor, but some tree mortality occurs over small areas.

CONTROL MEASURES: Favor non-host trees; remove infected trees during thinning; implement

clearcutting treatments for mature, infected stands.

FOREST INSECT AND DISEASE LEAFLET: No. 62 (Johnson 1986).

Rust Red Stringy Rot *(Echinodontium tinctorium)*.

TREE SPECIES AFFECTED: Grand fir primarily; subalpine fir (occasionally) and Engelmann spruce (rarely).

DAMAGE CAUSED: Stem decay of heartwood tissue.

IMPACTS AND EFFECTS: Widespread in old-growth, mixed-conifer stands; most important stem decay disease of the Blue Mountains.

CONTROL MEASURES: Maintain vigorous stands; use short rotations (cyclic intervals between regeneration treatments); avoid bole wounding; avoid managing advanced regeneration more than 50 years old (because it likely has latent infections).

FOREST INSECT AND DISEASE LEAFLET: No. 93 (Filip et al. 2009).

Red Ring Rot *(Phellinus pini)*.

TREE SPECIES AFFECTED: Most conifers.

DAMAGE CAUSED: Stem decay or white pocket rot in heartwood tissues.

IMPACTS AND EFFECTS: Common in old-growth forest, especially those on steep, rocky slopes. Also found in mixed-conifer stands growing on shallow soils.

CONTROL MEASURES: Salvage infected trees; avoid wounding of host trees; replace overmature stands with young, vigorous trees.

FOREST INSECT AND DISEASE LEAFLET: No. 52 (Decays of white, grand, and red firs; Mallams et al. 2010).

Western Gall Rust *(Peridermium harknessii)*.

TREE SPECIES AFFECTED: Lodgepole pine.

DAMAGE CAUSED: Stem deformity; breakage; tree mortality.

IMPACTS AND EFFECTS: Widespread throughout the host type, but damage is seldom severe except in young stands.

Note: Most mature lodgepole pine type in Blue Mountains was killed during a widespread mountain pine beetle outbreak occurring in late 1960s and much of the 1970s. This MPB outbreak created more than a million acres of young lodgepole pine type, and much of it is lightly to moderately infected with western gall rust.

CONTROL MEASURES: Remove damaged trees; leave rust-free individuals as residual trees when implementing partial cutting treatments.

FOREST INSECT AND DISEASE LEAFLET: No. 50 (Peterson 1960).

APPENDIX 1: FOREST INSECT AND DISEASE LEAFLETS

This appendix provides a list of Forest Insect and Disease Leaflets (FIDLs) produced by USDA Forest Service. (Canada also produces a list of Forest Pest Leaflets). FIDLs are relatively short resources (10-12 pages is a good average); they succinctly describe an insect or disease agent, its hosts, its life cycle, damages it causes to trees and forests, and treatment or remediation measures.

To download any of the forest insect and disease leaflets, visit this website: FIDLs

FIDL No.	FIDL Title
1	Western pine beetle
2	Mountain pine beetle
3	Saratoga spittlebug
4	California five-spined engraver beetle (superseded by fidl #102)
5	Douglas-fir beetle
6	Hypoxylon canker of aspen
7	Jack pine budworm
8	Larch sawfly
9	Forest tent caterpillar
10	Red pine scale
11	Jeffrey pine beetle
12	Black turpentine beetle
13	Fir engraver
14	Redheaded pine sawfly
15	Pine reproduction weevil
16	Pole blight of western white pine
17	Jack pine sawfly
18	Lodgepole pine dwarf mistletoe
19	Dwarf mistletoe of ponderosa pine in the southwest (superseded by FIDL #40)
20	Littleleaf disease
21	White pine weevil
22	Lodgepole needle miner
23	The Texas leaf-cutting ant
24	California flatheaded borer
25	The heart rots of redwood
26	Fusiform rust of southern pines
27	Southern cone rust
28	Needle cast of southern pines
29	Oak wilt

FIDL No.	FIDL Title
30	Heart rots of incense-cedar
31	Hemlock sawfly
32	Nursery diseases of southern pines
33	Canker-rots of southern hardwoods
34	Neodiprion taede linearis: a sawfly pest of loblolly and shortleaf pines
35	Pitch canker of southern pines
36	White pine blister rust
37	Sweetgum blight
38	Heart rots of Appalachian hardwoods
39	Pine root collar weevil
40	Dwarf mistletoes of ponderosa pine
41	Walnut caterpillar
42	Elytroderma disease of ponderosa pine
43	Butt rot of southern hardwoods
44	Brown-spot needle blight of pines
45	Black-headed budworm in western United States
46	Gouty pitch midge
47	Sitka spruce weevil
48	Laminated root rot of Douglas-fir (superseded by FIDL #159)
49	Southern pine beetle
50	Western gall rust on hard pines
51	Dry face of naval stores pines
52	Decays of white, grand and red firs
53	Western spruce budworm
54	Douglas-fir dwarf mistletoe
55	Red turpentine beetle
56	Monterey pine Ips
57	Pine tortoise scale
58	Southwestern pine tip moth
59	European pine tip moth
60	Silver fir beetle and fir root bark beetle
61	Needle discolorations of western larch
62	Comandra blister rust
63	White grubs in forest tree nurseries and plantations
64	Carpenterworm
65	Pine needle-sheath miner

FIDL No.	FIDL Title
66	Pine butterfly
67	Variable oakleaf caterpillar
68	Eastern subterranean termite
69	Yellow-headed spruce sawfly
70	Nantucket pine tip moth
71	The locust borer
72	California oakworm
73	Heart rots of Douglas-fir
74	White-spotted sawyer
75	Beech bark disease
76	Heterobasidion root disease in eastern conifers
77	The green-striped mapleworm
78	Armillaria root disease
79	Sweetfern rust on hard pines
80	Eastern gall rust
81	Elm spanworm
82	Walkingstick
83	White-pine cone beetle
84	Nectria canker of hardwoods
85	Walnut anthracnose
86	Douglas-fir tussock moth
87	Fir broom rust
88	White trunk rot of hardwoods
89	Fir dwarf mistletoe
90	Heart rots of western hemlock
91	Black pineleaf scale
92	The tuliptree scale
93	Rust-red stringy rot caused by the Indian paint fungus
94	Chestnut blight
95	Boxelder bugs
96	Larch casebearer in western larch
97	Bagworm
98	European pine sawfly
99	Introduced pine sawfly
100	Heart rots of balsam fir
101	Strumella canker of oaks

FIDL No.	FIDL Title
102	California five-spined Ips
103	Ponderosa pine tip moth
104	Pales weevil
105	Pine sawfly *Neodiprion excitans* Roh.
106	Zimmerman pine moth
107	Fiorinia externa ferris, a scale insect of hemlock
108	Sugar maple borer
109	The hemlock borer
110	Decay and discoloration of sugar maple
111	The bronze birch borer
112	The sugar pine cone beetle
113	Sugar pine and western white pine dwarf mistletoes
114	The pandora moth
115	Fir tree borer
116	Arizona five-spined Ips, Ips lecontei swaine, in the southwestern United States
117	Pinyon sawfly, Neodiprion edulicolus Ross
118	Balsam woolly adelgid
119	Western tent caterpillar
120	Western tussock moth
121	Poplar-and-willow borer
122	Pine engraver, *Ips pini*, in the western United States
123	Red rot of ponderosa pine
124	Mountain-mahogany looper
125	Yellow-poplar weevil
126	Slash pine seedworm
127	The spruce beetle
128	Sapstreak disease of sugar maple
129	Ips bark beetles in the south
130	Scleroderris canker of northern conifers
131	Port-Orford-cedar root disease
132	The Columbian timber beetle
133	Anthracnose diseases of eastern hardwoods
134	Eastern pineshoot borer
135	Hemlock dwarf mistletoe
136	Eutypella canker of maple
137	Nursery diseases of southern hardwoods

FIDL No.	FIDL Title
138	Atropellis canker of pines
139	The large aspen tortrix
140	Heart rots of Central Region hardwoods
141	Six-spined engraver beetle
142	Elm sawfly
143	Dothistroma needle blight of pines
144	White fir needle miner
145	Black stain root disease of conifers
146	Cytospora canker of true firs
147	Mistletoes on hardwoods of the United States
148	Pinyon needle scale
149	Decay and discoloration of aspen
150	Decays of Engelmann spruce and subalpine fir in the Rocky Mountains
151	Pine looper
152	Cankers on western quaking aspen
153	Redhumped oakworm
154	Phomopsis blight of junipers
155	Roundheaded pine beetle
156	Spear-marked black moth
157	Nursery diseases of western conifers
158	Eastern spruce dwarf mistletoe
159	Laminated root rot of western conifers
160	Spruce budworm in the eastern United States
161	Diplodia blight of pines
162	Gypsy moth
163	Red oak borer
164	Phoradendron on conifers
165	Oak decline
166	Sirococcus shoot blight
167	Saddled prominent
168	Twolined chestnut borer
169	Larch dwarf mistletoe
170	Ambrosia beetles of western conifers
171	Limber pine dwarf mistletoe
172	Annosus root rot in western conifers
173	Gray pine dwarf mistletoe

FIDL No.	FIDL Title
174	Pinyon pine dwarf mistletoe
175	Eastern larch beetle
176	Invasive bark beetles
177	Schweinitzii root and butt rot of western conifers
178	Woolly pine scale
179	Diprionid sawflies on lodgepole and ponderosa pines
180	Northern spruce engraver
181	Swiss needle cast
182	Fall cankerworm
183	Goldspotted oak borer
184	Western balsam bark beetle
185	Sequoia pitch moth
186	Western hemlock looper
189	Cone and seed insects of southwestern white pine

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APPENDIX 2: SILVICULTURE WHITE PAPERS

White papers are internal reports, and they are produced with a consistent formatting and numbering scheme – all papers dealing with Silviculture, for example, are placed in a silviculture series (Silv) and numbered sequentially. Generally, white papers receive only limited review and, in some instances pertaining to highly technical or narrowly focused topics, the papers may receive no technical peer review at all. For papers that receive no review, the viewpoints and perspectives expressed in the paper are those of the author only, and do not necessarily represent agency positions of the Umatilla National Forest or the USDA Forest Service.

Large or important papers, such as two papers discussing active management considerations for dry and moist forests (white papers Silv-4 and Silv-7, respectively), receive extensive review comparable to what would occur for a research station general technical report (but they don't receive blind peer review, a process often used for journal articles).

White papers are designed to address a variety of objectives:

(1) They guide how a methodology, model, or procedure is used by practitioners on the Umatilla National Forest (to ensure consistency from one unit, or project, to another).

(2) Papers are often prepared to address ongoing and recurring needs; some papers have existed for more than 20 years and still receive high use, indicating that the need (or issue) has long standing – an example is white paper #1 describing the Forest's big-tree program, which has operated continuously for 25 years.

(3) Papers are sometimes prepared to address emerging or controversial issues, such as management of moist forests, elk thermal cover, or aspen forest in the Blue Mountains. These papers help establish a foundation of relevant literature, concepts, and principles that continuously evolve as an issue matures, and hence they may experience many iterations through time. [But also note that some papers have not changed since their initial development, in which case they reflect historical concepts or procedures.]

(4) Papers synthesize science viewed as particularly relevant to geographical and management contexts for the Umatilla National Forest. This is considered to be the Forest's self-selected 'best available science' (BAS), realizing that non-agency commenters would generally have a different conception of what constitutes BAS – like beauty, BAS is in the eye of the beholder.

(5) The objective of some papers is to locate and summarize the science germane to a particular topic or issue, including obscure sources such as master's theses or Ph.D. dissertations. In other instances, a paper may be designed to wade through an overwhelming amount of published science (dry-forest management), and then synthesize sources viewed as being most relevant to a local context.

(6) White papers function as a citable literature source for methodologies, models, and procedures used during environmental analysis – by citing a white paper, specialist reports can include less verbiage describing analytical databases, techniques, and so forth, some of which change little (if at all) from one planning effort to another.

(7) White papers are often used to describe how a map, database, or other product was developed. In this situation, the white paper functions as a 'user's guide' for the new product. Examples include papers dealing with historical products: (a) historical fire extents for the Tucannon watershed (WP Silv-21); (b) an 1880s map developed from General Land Office survey notes (WP Silv-41); and (c) a

description of historical mapping sources (24 separate items) available from the Forest's history website (WP Silv-23).

The following papers are available from the Forest's website: Silviculture White Papers

Paper #	Title
1	Big tree program
2	Description of composite vegetation database
3	Range of variation recommendations for dry, moist, and cold forests
4	Active management of Blue Mountains dry forests: Silvicultural considerations
5	Site productivity estimates for upland forest plant associations of Blue and Ochoco Mountains
6	Blue Mountains fire regimes
7	Active management of Blue Mountains moist forests: Silvicultural considerations
8	Keys for identifying forest series and plant associations of Blue and Ochoco Mountains
9	Is elk thermal cover ecologically sustainable?
10	A stage is a stage is a stage…or is it? Successional stages, structural stages, seral stages
11	Blue Mountains vegetation chronology
12	Calculated values of basal area and board-foot timber volume for existing (known) values of canopy cover
13	Created opening, minimum stocking, and reforestation standards from Umatilla National Forest Land and Resource Management Plan
14	Description of EVG-PI database
15	Determining green-tree replacements for snags: A process paper
16	Douglas-fir tussock moth: A briefing paper
17	Fact sheet: Forest Service trust funds
18	Fire regime condition class queries
19	Forest health notes for an Interior Columbia Basin Ecosystem Management Project field trip on July 30, 1998 (handout)
20	Height-diameter equations for tree species of Blue and Wallowa Mountains
21	Historical fires in headwaters portion of Tucannon River watershed
22	Range of variation recommendations for insect and disease susceptibility
23	Historical vegetation mapping
24	How to measure a big tree
25	Important Blue Mountains insects and diseases
26	Is this stand overstocked? An environmental education activity
27	Mechanized timber harvest: Some ecosystem management considerations
28	Common plants of south-central Blue Mountains (Malheur National Forest)
29	Potential natural vegetation of Umatilla National Forest
30	Potential vegetation mapping chronology
31	Probability of tree mortality as related to fire-caused crown scorch
32	Review of "Integrated scientific assessment for ecosystem management in the interior Columbia basin, and portions of the Klamath and Great basins" – Forest vegetation
33	Silviculture facts

Paper #	Title
34	Silvicultural activities: Description and terminology
35	Site potential tree height estimates for Pomeroy and Walla Walla Ranger Districts
36	Stand density protocol for mid-scale assessments
37	Stand density thresholds as related to crown-fire susceptibility
38	Umatilla National Forest Land and Resource Management Plan: Forestry direction
39	Updates of maximum stand density index and site index for Blue Mountains variant of Forest Vegetation Simulator
40	Competing vegetation analysis for southern portion of Tower Fire area
41	Using General Land Office survey notes to characterize historical vegetation conditions for Umatilla National Forest
42	Life history traits for common Blue Mountains conifer trees
43	Timber volume reductions associated with green-tree snag replacements
44	Density management field exercise
45	Climate change and carbon sequestration: Vegetation management considerations
46	Knutson-Vandenberg (K-V) program
47	Active management of quaking aspen plant communities in northern Blue Mountains: Regeneration ecology and silvicultural considerations
48	Tower Fire…then and now. Using camera points to monitor postfire recovery
49	How to prepare a silvicultural prescription for uneven-aged management
50	Stand density conditions for Umatilla National Forest: A range of variation analysis
51	Restoration opportunities for upland forest environments of Umatilla National Forest
52	New perspectives in riparian management: Why might we want to consider active management for certain portions of riparian habitat conservation areas?
53	Eastside Screens chronology
54	Using mathematics in forestry: An environmental education activity
55	Silviculture certification: Tips, tools, and trip-ups
56	Vegetation polygon mapping and classification standards: Malheur, Umatilla, and Wallowa-Whitman National Forests
57	State of vegetation databases for Malheur, Umatilla, and Wallowa-Whitman National Forests
58	Seral status for tree species of Blue and Ochoco Mountains

REVISION HISTORY

June 1990: First version of this white paper (5 p.) was prepared in June 1990 when the author was employed as Assistant Forest Silviculturist for Malheur National Forest in John Day, Oregon. Original version was used primarily as handout material on public field trips with stakeholder groups to examine impacts resulting from a wide-ranging outbreak of western spruce budworm (an 1980-1992 Blue Mountains budworm outbreak – see Powell 1994).

January 2017: Minor formatting and editing changes were made during this revision, including adding a white-paper header and assigning a white-paper number. Two appendixes were added – Appendix 1 providing a list of available forest insect and disease leaflets, and Appendix 2 describing a white paper system, including a list of available white papers. A short Introduction section was also added.