WHITE PAPER

USDA Forest Service Pacific Northwest Region Umatilla National Forest

WHITE PAPER F14-SO-WP-SILV-15

Determining Green-Tree Replacements for Snags: A Process Paper[1]

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INTRODUCTION

In the early 1990s, Umatilla National Forest (NF) was responding 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 (these are 'host' species for western spruce budworm in the Blue Mountains). An outbreak began in 1980 and ended in 1992. Millions of acres in the Blue Mountains were defoliated to some extent during this 13-year period.

Budworm feeding caused defoliation (missing foliage), topkilling, and mortality in mixed-conifer stands, especially on southern half of Umatilla NF (Heppner and North Fork John Day ranger districts). In some instances, almost entire stands were killed by budworm feeding, or by bark beetles or root diseases that subsequently attacked weakened trees (fig. 1).

After a budworm outbreak collapsed, south-end ranger districts (RDs) began removing dead and dying trees to capture their value as wood products (including Coal and Main timber sales at Heppner RD, and Thistle, Mullein, and Tarweed sales at North Fork John Day RD). Removing budworm-killed trees is a salvage harvest, an intermediate treatment targeting dead and dying trees caused by insects or other injurious agents such as wildfire (white paper F14-SO-WP-Silv-34, *Silvicultural activities: Description and terminology*, provides additional information about salvage harvest and salvage cutting, and differences between these two terms).

[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.

Figure 1 – A mixed-conifer stand killed by budworm defoliation (Swale Creek, Heppner RD, Umatilla NF). Stands with this amount of tree mortality are often proposed for salvage harvest. When salvage projects are prepared, some proportion of dead trees are retained as snags to provide cavity-nesting habitat. If live trees are present, then they are typically identified as green-tree replacements for existing snags.

As budworm-salvage sales were being prepared in early 1990s, there was confusion about how to properly meet snag standards contained in a recently-adopted Forest Plan (USDA Forest Service 1990) (snags are standing dead trees). And, there was also confusion about how to provide replacement trees, so that when a budworm-created snag toppled over after 5 or 10 years, there would be a green (live) tree available that could ultimately replace a lost snag – either by dying naturally, or by using management techniques (such as blasting out its top; Lewis 1998) to proactively create cavity-nester habitat.

In response to confusion about snag standards, the Forest Supervisor chartered a team of silviculturists and wildlife biologists to prepare interim snag guidance for use on Umatilla NF. The team was also charged with developing a methodology for calculating an appropriate number of green-tree replacements – live (green) trees intended to provide future snags after an era of plentiful snags ended (an era provided courtesy of spruce budworm).

This white paper describes a methodology to calculate green-tree replacements for snags. An appendix provides interim snag guidance issued in April 1993 to guide development of budworm-salvage sales. And, because snag guidance was developed during an era of high timber production, another white paper (F14-SO-WP-Silv-43) describes an analysis to determine timber volume reductions associated with provision of green-tree replacements for snags.

ASSUMPTIONS

A process was used to determine the number of live (green) trees that should be retained to replace existing snags. These assumptions about snag management were implicit in a process:

a. New snags will be created from suitable, live trees as soon as existing snags become unsuitable for cavity excavation.
b. Created snags are assumed to adequately meet biological needs of cavity-dependent wildlife species.
c. Direction and financial commitment for snag management exists and is maintained throughout a planning horizon.
d. A balanced and responsive management commitment exists to meet dead tree habitat requirements.
e. By the end of a planning horizon, enough green-tree replacements will be available from managed stands to meet snag creation objectives.
f. Stocking-level control and prescribed silvicultural treatments will be completed on schedule, so that a proper number and size of replacement trees will be available when needed.

A 5-step process, described below, was used to determine replacement snag objectives for Umatilla National Forest.

1. Replacement tree objectives were developed for the same plant community types and tree-size categories used in this publication: "Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington" (Thomas 1979; see appendix 23, pages 390-

391). For this analysis, each plant community type was associated with a working group from Umatilla NF Land and Resource Management (Forest) Plan (Table 1). Cross-walking plant community types with working groups provided an important link to yield tables, standards and guidelines, and other direction contained in the Forest Plan.

2. Next, a growth potential was determined for each snag-diameter class by working group (Table 2). Growth potential is the time required for a tree to reach a specified diameter class. Growth potentials were determined for representative site conditions for each working group, e.g., sites with average (moderate) productivity and supporting an ecologically sustainable tree species composition appropriate for both snag management and land management objectives.
3. Calculating replacement snags requires an assumption about the length of time that a snag is suitable for cavity nesters. A review of existing literature indicates that snag longevity rates are poorly documented, particularly for a range of tree species and causes of death. Snag longevity rates used for this analysis are provided in Table 3. It is important to consider that values in Table 3 are assumed to represent a mid-point of variation associated with any natural phenomenon (e.g., disturbance agent); some snags will stand for a longer period, others for a shorter time.
4. Final information needed for determining replacement snags is desired number of existing snags, by working group and diameter class. Values in Table 4, which were taken verbatim from appendix 23 in Thomas (1979), provide an average number of snags that should be present, on a per-acre basis, to meet habitat needs of primary cavity excavators at a 100% population level (for 100% population levels specified in Thomas 1979).

Table 1: Forest Plan working groups and associated plant community types.

Forest Plan Working Group	Plant Community Type (From Thomas 1979)
Ponderosa Pine	Ponderosa Pine
South Associated	Mixed Conifer
North Associated	Grand Fir (White Fir)
Lodgepole Pine	Lodgepole Pine
Subalpine Zone*	Subalpine Fir

* Forest Plan did not identify a 'subalpine zone' working group. For forested sites, a subalpine zone was defined as areas with ecological site potential to support subalpine fir. Subalpine sites are relatively uncommon on Umatilla National Forest, and they were included in North Associated or South Associated working groups for planning purposes. A separate subalpine zone is included in these snag analyses because high-elevation forests have significant differences in cavity-nesting species and associated habitats.

Table 2: Growth potentials (years) by tree diameter class and working group.

	Snag Diameter (Inches)		
Working Group	**21″**	**12″**	**10″**
Ponderosa Pine	130	70	50
South Associated	90	50	40
North Associated	80	40	30
Lodgepole Pine	N.A.	50	40
Subalpine Zone	N.A.	60	50

Table 3: Snag longevity rates by tree diameter.

Snag Size (DBH)	**Longevity (years)**
21″	10
12″	6
10″	4

Table 4: Retention objectives for existing snags (on a per-acre basis).

	Diameter Class (Inches)			
Working Group	**>20″**	**>12″**	**>10″**	**Total**
Ponderosa Pine	.14	1.36	.75	2.25
South Associated	.14	1.36	.75	2.25
North Associated	.14	1.36	.30	1.80
Lodgepole Pine		.59	1.21	1.80
Subalpine Zone		.59	1.21	1.80

5. Once growth potentials, longevity rates, and snag objectives are known, calculating replacement snag numbers is a mathematical exercise. Growth potential for a working group and diameter class is divided by snag longevity for the diameter class, and the result is then multiplied by the existing snag objective. Replacement snag objectives are shown in Table 5.

   An example of calculations, for the ponderosa pine working group, is shown below:

   a. 20″ replacements:
      120 years* (growth potential) ÷ 10 years (snag longevity) = 12 × .14 (existing) = 1.7

   b. 12″ replacements:
      60 years* (growth potential) ÷ 6 years (snag longevity) = 10 × 1.36 (existing) = 13.6

   c. 10″ replacements:
      40 years* (growth potential) ÷ 4 years (snag longevity) = 10 × .75 (existing) = 7.5

   d. Totals: 22.8

* Growth potentials were reduced by 10 years from values shown in Table 2 to account for a 'luxury abundance' period when snags are assumed to be unusually plentiful because of high mortality from western spruce budworm.

Table 5: Replacement tree objectives (per acre) by tree diameter and working group.

	Snag Diameter Classes			
Working Group	**>20″**	**>12″**	**>10″**	**Total**
Ponderosa Pine	1.7	13.6	7.5	22.8
South Associated	1.1	9.1	5.6	15.8
North Associated	1.1	6.8	1.5	9.4
Lodgepole Pine		4.3	10.1	14.4
Subalpine Zone		5.3	13.9	19.2

Note: Values in Table 5 do not account for premature tree or snag losses from windthrow, prescribed fire, or logging damage. It is assumed that users will adjust values in Table 5 to account for local experience regarding snag or tree losses. If sufficient replacement trees are not available in a particular size class, then additional trees in a larger size class should be retained as compensation. For example, if insufficient trees are available for the 10-11.9″ size class, then additional trees should be retained from the 12-20″ class.

LITERATURE CITED

Lewis, J.C. 1998. Creating snags and wildlife trees in commercial forest landscapes. Western Journal of Applied Forestry. 13(3): 97-101. doi:10.1093/wjaf/13.3.97

Thomas, J.W., tech. ed. 1979. Wildlife habitats in managed forests: The Blue Mountains of Oregon and Washington. Agric. Handbook No. 553. Washington, DC: USDA Forest Service. 512 p. https://www.fs.usda.gov/treesearch/pubs/6630

USDA Forest Service. 1990. Land and resource management plan: Umatilla National Forest. Portland, OR: USDA Forest Service, Pacific Northwest Region. Irregular pagination. http://www.fs.usda.gov/main/umatilla/landmanagement/planning

APPENDIX 1: INTERIM SNAG GUIDANCE (APRIL 1993)

The next 5 pages present interim snag guidance developed by the same interdisciplinary team that developed information presented in this white paper. Interim snag guidance was included in a memorandum signed by the Forest Supervisor on April 14, 1993.

Information in this white paper, along with information contained in white paper F14-SO-WP-Silv-43, *Timber volume reductions associated with green-tree snag replacements*, supplements Umatilla NF interim snag guidance by providing additional documentation about snag and green-tree replacement assumptions and calculations.

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Pendleton, OR 97801

File Code: 1920/2630/2470
Route To:

Date: April 14, 1993

Subject: Interim snag guidance for salvage operations

To: S.O. Staff and District Rangers

During the last 18 months, this office has issued a series of direction letters providing interim direction for the Forest's salvage program. Several of these letters have specifically addressed snag requirements (see 3400/2430 letter of 8/5/91 and 3400/2430/1920 letter of 11/25/91 for examples). However, there is still some confusion about snag requirements for salvage sales, particularly regarding provision of replacement trees.

In response to this apparent confusion, a team was assembled and presented with two objectives:

1. Prepare a quantified description of the 100% snag level contained in a publication entitled "Wildlife Habitats in Managed Forests, the Blue Mountains of Oregon and Washington" (Thomas 1979). The 100% level was to be quantified for both existing snags and green-tree snag replacements.

2. Prepare a new Forest-wide snag policy and implementation guide that includes new information and technologies relating to snag management. The new snag policy will then be incorporated into the Forest Plan.

Item 1 has been completed and is enclosed as a paper called "Interim Snag Guidance." Item 2 is a long-range project and may not be completed until next fall.

The enclosed snag guidance will be used on all areas of the Forest that meet the definition of a catastrophic situation, as specified in salvage program direction contained in a 3400/2430/1920 letter of August 18, 1992 (as amended or refined by subsequent direction letters).

On-going projects will incorporate the enclosed snag guidance unless a NEPA decision is imminent (imminent means that issuance of a draft EIS, or approval of a Decision Notice, will occur within a month of this letter).

Please contact Al Scott (Heppner District) or Dave Powell (S.O.) with any questions about this letter or the interim snag guidance enclosure.

/s/ O. Stanley Cullimore (for)
JEFF D. BLACKWOOD
Forest Supervisor

Enclosure

Cullimore
Jensen
Kline
Murphy
Rother
Tucker

Heppner
Pomeroy
North Fork John Day
Walla Walla

INTERIM SNAG GUIDANCE

Umatilla National Forest; April 1993

I. OBJECTIVES

Interim guidance for preparation of salvage sales requires that cavity-nester habitat be managed at the 100% level, as specified in a publication called *Wildlife Habitats in Managed Forests, the Blue Mountains of Oregon and Washington* (U.S.D.A. Forest Service, Agriculture Handbook No. 553, J.W. Thomas, technical editor, 1979). The objective of this paper is to describe and clarify the 100% level from Thomas (1979).

II. INTENT

The Land and Resource Management Plan (Forest Plan) for the Umatilla National Forest established a desired future condition for cavity-nester habitat (see page 4-7). The objective for forested landscapes, excluding designated Wilderness, is to provide at least 65% of the **maximum** potential habitat capability. This objective was developed by using an array of habitat potentials, ranging from 40% to 100% depending on the management area allocation. Recent results from Forest Plan monitoring indicate that some snag objectives are not being met.

The intent of this interim guidance is to assure that future habitat for cavity dependent wildlife will not be compromised. Recent levels of budworm-induced mortality should provide ample flexibility to meet short-term objectives for existing snags. It will also be important to provide replacement snags, which are needed to replace existing snags as they are lost through time. In many instances, it makes good sense to use grand firs and other budworm host trees that have survived the outbreak as replacement snags.

The objective of salvage logging is not to eradicate all of the budworm host trees from an area. It is appropriate to retain many of the surviving grand firs and Douglas-firs, especially if they have expressed genetic resistance to budworm defoliation. Some of the surviving host trees are ideal as replacement snags, particularly those with Indian paint fungus and other diseases that initiate tree decay.

In summary, this interim direction is intended to clarify the number of dead trees that should be retained as cavity-nester habitat, and to assure long-term population viability by specifying an appropriate number of replacement trees to provide future snags.

III. STANDARDS

Numeric standards for cavity-nester habitat were developed for existing habitat (snags) and for future habitat (replacement trees).

Thomas (1979) describes general snag requirements for primary cavity-nesters by plant community types (see appendix 23, page 390). These snag numbers were developed using the best scientific information available about the cavity nesting species inhabiting the community types. In some cases, the diameter classes were based on the minimum tree sizes that could be used by a particular species. For this analysis, each of the working groups from the Forest Plan has been associated with a plant community type from Thomas (1979) (Table 1).

Table 1: Forest Plan working groups and associated plant community types.

Forest Plan Working Group	Plant Community Type (From Thomas 1979)
Ponderosa Pine	Ponderosa Pine
South Associated	Mixed Conifer
North Associated	Grand Fir (White Fir)
Lodgepole Pine	Lodgepole Pine
Subalpine Zone*	Subalpine Fir

* The Forest Plan did not identify a "subalpine zone" working group. For forested sites, the subalpine zone was defined as areas with the potential to support subalpine fir. Subalpine sites are relatively uncommon on the Umatilla National Forest, and they were included in the North Associated or South Associated working groups for planning purposes. A subalpine zone is used in these snag analyses because high-elevation forests have important differences in cavity-nesting species and associated habitats.

A. Existing Habitat (Snags)

The values in Table 2 were taken directly from appendix 23 in Thomas (1979); they show the average number of snags that should be present, on a per acre basis, to provide 100% of the potential habitat capability for cavity-dependent wildlife species.

Table 2: Retention objectives for existing snags (on a per-acre basis).

	DIAMETER CLASS (INCHES)			
Working Group	**>20″**	**>12″**	**>10″**	**Total**
Ponderosa Pine	.14	1.36	.75	2.25
South Associated	.14	1.36	.75	2.25
North Associated	.14	1.36	.30	1.80
Lodgepole Pine		.59	1.21	1.80
Subalpine Zone		.59	1.21	1.80

B. Future Habitat (Replacement Trees)

It can be complex to provide for snags throughout the life of a stand, especially when considering all of the possible activities that could occur during this time (harvest, thinning, underburning, etc.). Some of the physical and biological factors influencing stand development can affect how a long-term snag management strategy is put together. In order to simplify the analysis of replacement trees, certain assumptions were made.

For this analysis, a growth potential was determined for each of the snag diameter classes, by working group. The growth potential is the time required for a tree to grow from the seedling size class to the specified diameter. The growth potentials were developed for moderate to good site conditions and with the assumption that stand tending operations, particularly thinnings and other density management treatments, would be implemented when appropriate. The growth potentials are provided in Table 3.

Calculation of replacement snags requires an assumption about the length of time that a snag is suitable for cavity nesters. A review of existing literature indicates that snag longevity rates are poorly documented, particularly for situations where trees were killed by insects or diseases instead of fire.

The longevity rates used for this analysis are provided in Table 4. The growth potentials and longevity rates allow the number of snag replacement trees to be calculated. Replacement tree objectives are summarized in Table 5.

Table 3: Growth potentials (years) by tree diameter class and working group.

	SNAG DIAMETER (INCHES)		
Working Group	21″	12″	10″
Ponderosa Pine	130	70	50
South Associated	90	50	40
North Associated	80	40	30
Lodgepole Pine	N.A.	50	40
Subalpine Zone	N.A.	60	50

Table 4: Snag longevity rates by tree diameter.

SNAG SIZE (DBH)	**LONGEVITY (YEARS)**
21″	10
12″	6
10″	4

Table 5: Replacement tree objectives (per acre) by tree diameter and working group.

	SNAG DIAMETER CLASSES			
WORKING GROUP	**>20″**	**>12″**	**>10″**	**TOTAL**
Ponderosa Pine	1.7	13.6	7.5	22.8
South Associated	1.1	9.1	5.6	15.8
North Associated	1.1	6.8	1.5	9.4
Lodgepole Pine		4.3	10.1	14.4
Subalpine Zone		5.3	13.9	19.2

The numbers in Table 5 do not account for premature tree or snag losses resulting from windthrow, prescribed fire or logging damage. It is appropriate to adjust the figures in Table 5 to account for local experience regarding snag and tree losses.

If sufficient trees or snags are not available in a particular size class, then additional trees or snags in a larger size class should be retained as compensation. For example, if insufficient replacement trees are available in the 10-11.9″ size class, then additional trees should be retained in the 12-20″ class.

It is assumed that new snags will be created from replacement trees as soon as existing snags become unsuitable for cavity excavation. The numbers in Table 5 are based on the following precepts:

a. Management direction and financial commitment for snag management exists and is maintained throughout the planning horizon;

b. Created snags will serve the biological needs of cavity dependent wildlife;

c. A balanced and responsive management commitment exists to meet dead tree habitat requirements;

d. By the end of the planning horizon, sufficient green-tree replacements will be available from managed stands to meet snag creation objectives;

e. Stocking-level control and prescribed silvicultural treatments will be accomplished on schedule, so that the proper number and size of replacement trees will be provided at specified intervals.

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

March 2014: First version of this white paper (5 p.) was prepared in November 1993 to help support implementation of interim snag guidance issued for Umatilla NF (issued as a memorandum in April 1993). Minor formatting and editing changes were made during this revision, including adding a white-paper header and assigning a white-paper number. An appendix was added describing a silviculture white paper system, including a list of available white papers.

December 2016: minor editing changes were made, and an Introduction section and Appendix 1 were added.