WHITE PAPER

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Updates of Maximum Stand Density Index and Site Index for Blue Mountains Variant of Forest Vegetation Simulator[1]

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INTRODUCTION

Land managers use growth-and-yield models to meet many needs, including forest planning at broad scales (e.g., developing yield tables to estimate future timber production from a national forest) and stand dynamics modeling for project planning at fine scales. Modeling results provide managers with estimated effects of stand development for any combination of species composition, site productivity, and tree density (stocking).

Historically, some growth-and-yield modelers had little faith in the accuracy of modeling results. A good example of this situation is provided in an excerpt from a Comptroller General report examining Forest Service use of growth simulators:

> "Each of the four national forests we reviewed had developed yield tables using a specifically designed regional computer program. These tables provided the forest managers with estimated harvest yields that could be expected from growing timber of a given species on a given land productivity classification under managed conditions. In making their analyses, forest personnel at three of the four forests made adjustments to the yield tables. They said that the tables did not accurately reflect the timber yield volumes that could be expected from on-the-ground conditions. These adjustments were made, however, with little or no analyses and were based primarily on professional judgment. For example, the forest managers of one forest said that the yield tables reflected yields under ideal conditions and depicted timber stands completely stocked and periodically thinned. They said that actual conditions usually differed. Therefore, they reduced the tables' volumes by about 15 percent to more closely approximate reality. A forest manager said that the amount of the reduction was based on professional judgment, and that no analyses of research or field studies had been made to document its reasonableness. The forest managers of two other forests also assumed that the tables' yield

[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.

> volumes were not realistic and reduced the yield estimates by 10 percent and 21 percent, respectively. As with the first forest, the reductions were based primarily on professional judgment. At the fourth forest the yield table volumes had not been adjusted. The forest manager said that a reduction should probably have been made but that the data needed for a realistic adjustment had not been developed" (Staats 1978, p. 24-25).

Although more confidence in modeling results exists today than historically, mostly because simulation modeling has improved considerably since its infancy in the 1970s, there is still a pressing need for forest managers to adjust simulation parameters to better incorporate specific stand or site characteristics for their planning area.

This white paper is designed to meet three objectives:

1. To provide Blue Mountains national forest managers with updated values of maximum SDI and site index for 10 tree species, by plant association, for Blue Mountains variant of Forest Vegetation Simulator.
2. To provide an updated selection of a default species for each plant association for which maximum SDI and site index data is available.
3. To document how updated values of maximum SDI and site index were derived.

BACKGROUND FOR MAXIMUM STAND DENSITY INDEX

Forest managers in the Blue Mountains of northeastern Oregon and southeastern Washington have been using Blue Mountains variant of Forest Vegetation Simulator (FVS) since its inception in the early 1990s (Johnson 1990). These managers need a documented basis for adjusting certain parameters influencing modeling results. Perhaps no parameter has more influence on modeling results than tree mortality rates.

In the context of FVS, tree mortality is derived from two main sources: exogenous (external) agents such as insects, diseases, and fire, and endogenous (internal) mortality. Endogenous mortality has two sources: background mortality, and density-dependent mortality (Dixon 2015).

Background mortality occurs at low levels and is not necessarily related to stand density. As stocking levels increase, density-dependent mortality becomes more important than background mortality, and it eventually predominates. For dense stands experiencing intense, intertree competition – an ecological process called self-thinning – big trees crowd out small, subcanopy trees and kill them (self-thinning and density-dependent mortality are considered synonymous terms).

For the Blue Mountains variant, exogenous mortality caused by insects, diseases, wind, animals, and other factors is accounted for by using keywords to control how it functions in a base model or in extensions to it. Some extensions are embedded in a base model (e.g., dwarf mistletoe impact model), but most extensions (fire & fuels, root disease, bark beetles, spruce budworm, etc.) are executed in tandem with a base model (Dixon 2015).

Blue Mountains variant uses an SDI-based tree mortality model (Johnson 1990), which means that density-dependent mortality (and this is certainly the more important of two endogenous mortality sources) is controlled by changes in a stand density measure called Stand Density Index (SDI). SDI-based mortality rates vary in response to a relationship between a stand's existing SDI value and a default or comparison value called maximum SDI (Dixon 2015).

For Blue Mountains variant, default values of maximum SDI vary by plant association. At present time, only one maximum SDI value is associated with each plant association, and this single value relates to a specific tree species. Since some plant associations can support all seven primary conifer species of the Blue Mountains (Douglas-fir, Engelmann spruce, grand fir, lodgepole pine, ponderosa pine, subalpine fir, and western larch), and because each of these species has its own unique value of maximum SDI, selecting only one maximum SDI value for a plant association requires an assumption about which species best represents each association.

To obtain realistic modeling results, forest managers should adjust SDI-based mortality factors in Blue Mountains variant. If input information for a simulation does not include plant association data (by including Ecoclass codes), then Blue Mountains variant will default to a single maximum SDI value (546) for all tree species. From a modeling perspective, this is a worst-case scenario because density-dependent mortality would not vary in response to either plant association or species composition.

More often, a user's input data does include plant association information, in which case FVS will establish an association-specific SDI default value for each stand in a projection file. This default SDI value, however, will be based on a single species for each plant association, and with very few exceptions, a default species is always the potential (climax) dominant (i.e., for grand fir associations, default is a grand fir SDI value; for Douglas-fir associations, default is a Douglas-fir SDI value; and so forth).

Any stocking analysis is species dependent, so having Blue Mountains variant default to a single-species maximum SDI value is problematic. Early-seral tree species are more sensitive to overcrowding than late-seral species (Cochran et al. 1994, Powell 1999), for example, and it might be important to reflect their stocking relationships when selecting a maximum SDI value to control density-dependent mortality.

Since a maximum SDI default for each association relates to a climax tree (the most shade-tolerant, late-seral species), forest managers <u>must</u> adjust the default SDI value if they want modeling results to properly reflect density-dependent mortality for non-climax (shade-intolerant, early-seral) trees. Currently, users implement this adjustment by including a keyword (SDIMAX) to establish a new default value.

IDENTIFYING A NEED FOR MAXIMUM SDI UPDATES

In autumn of 2001, work began on an assessment examining potential availability of wood products for Blue Mountains physiographic province. The assessment was directed at identifying densely-stocked stands where thinning could be implemented as a restoration activity while simultaneously providing some level of wood products for commercial uses (Rainville et al. 2008).

A primary data source for this Blue Mountains assessment was a grid-based inventory system called Current Vegetation Survey (CVS) (USDA Forest Service 1995). A Site Index section, below, provides additional background information about CVS as a data source.

During an assessment, densely-stocked stands were identified by using Blue Mountains variant – if stand density was more than 45% of maximum SDI,[2] the stand was assumed to be densely stocked and

[2] Generally, 60% of maximum density would be used as a threshold value for identifying densely stocked, even-aged stands (see table 1). For a Blue Mountains assessment, 45% was selected to account for uneven-aged or irregular stand structures, stocking variability across a stratum, time lags before treatment, and other factors.

thinned back to 35% of maximum SDI. This process relied on maximum SDI because existing density was compared with maximum density when identifying densely-stocked stands, and because densely-stocked stands were thinned to a constant percentage of maximum density.

Since maximum SDI values for climax tree species poorly reflect growing-space requirements for non-climax species such as ponderosa pine or western larch, it was necessary for the assessment's FVS modeler (Ed Uebler) to use keyword files to update maximum SDI values for thousands of CVS plots.

Late in 2006, several assessment analysts requested that a Pacific Northwest Region Silviculturist (Bill McArthur) examine options for updating maximum SDI values for Blue Mountains variant. It was hoped that by updating default values, wholesale adjustments (by using SDIMAX keyword) would no longer be necessary in the future.

An R-6 Regional Silviculturist concurred with this request, and he contacted Forest Management Service Center (FMSC) personnel early in 2007. [FMSC is steward of FVS variants and their extensions.] Bob Havis from FMSC then contacted me (Powell) in January 2007, and we began discussing how updates would need to be completed to meet FMSC's requirements.

In late January 2007, a work group was formed to develop updated values of maximum SDI and site index for Blue Mountains variant of FVS. The work group consisted of the following individuals:

Bruce Countryman, vegetation specialist, Blue Mountains Forest Plan Revision Team. [Prior to his Forest Plan Revision Team position, Bruce was silviculturist with Wallowa-Whitman National Forest.]

Don Justice, database manager and analyst, Umatilla National Forest, Supervisor's Office.

Dave Powell, silviculturist, Umatilla National Forest, Supervisor's Office.

Mike Tatum, silviculturist, Malheur National Forest, Supervisor's Office.

Ed Uebler, analyst and silviculturist, Malheur National Forest, Supervisor's Office.

BACKGROUND & CONTEXT FOR BLUE MOUNTAINS STOCKING LEVELS

Stand density index (SDI) expresses a relationship between number of trees per acre and quadratic mean diameter (QMD); SDI is indexed to a QMD of 10 inches (Daniel et al. 1979, Reineke 1933). So, an SDI of 140 can be the same as 140 trees per acre, but only when a stand's QMD is 10 inches; at any other QMD, tree density associated with an SDI of 140 would be something other than 140 trees per acre.

When L.H. Reineke developed SDI (Reineke 1933), he plotted tree densities for fully stocked, even-aged stands and then drew a freehand line skimming the outermost data values, such that all size-density points fell below the boundary line (fig. 1).

An outermost boundary line (Maximum Density in fig. 1) represents maximum density, and if Reineke's sample of fully-stocked stands was reasonably comprehensive, then maximum density is a threshold that will not be breached – areas above (right) of this line function as a "no-go" area for stand density.

Suggested Blue Mountains stocking levels were published in a research note from Pacific Northwest Research Station in April 1994 (Cochran et al. 1994). The Cochran note includes stocking levels for two geographical portions of Blue Mountains: Blue-Ochoco physiographic province (Johnson and Clausnitzer 1992), and Wallowa-Snake physiographic province (Johnson and Simon 1987). Stocking levels are presented separately for these two provinces (as tables 3 and 4 in Cochran et al. 1994).

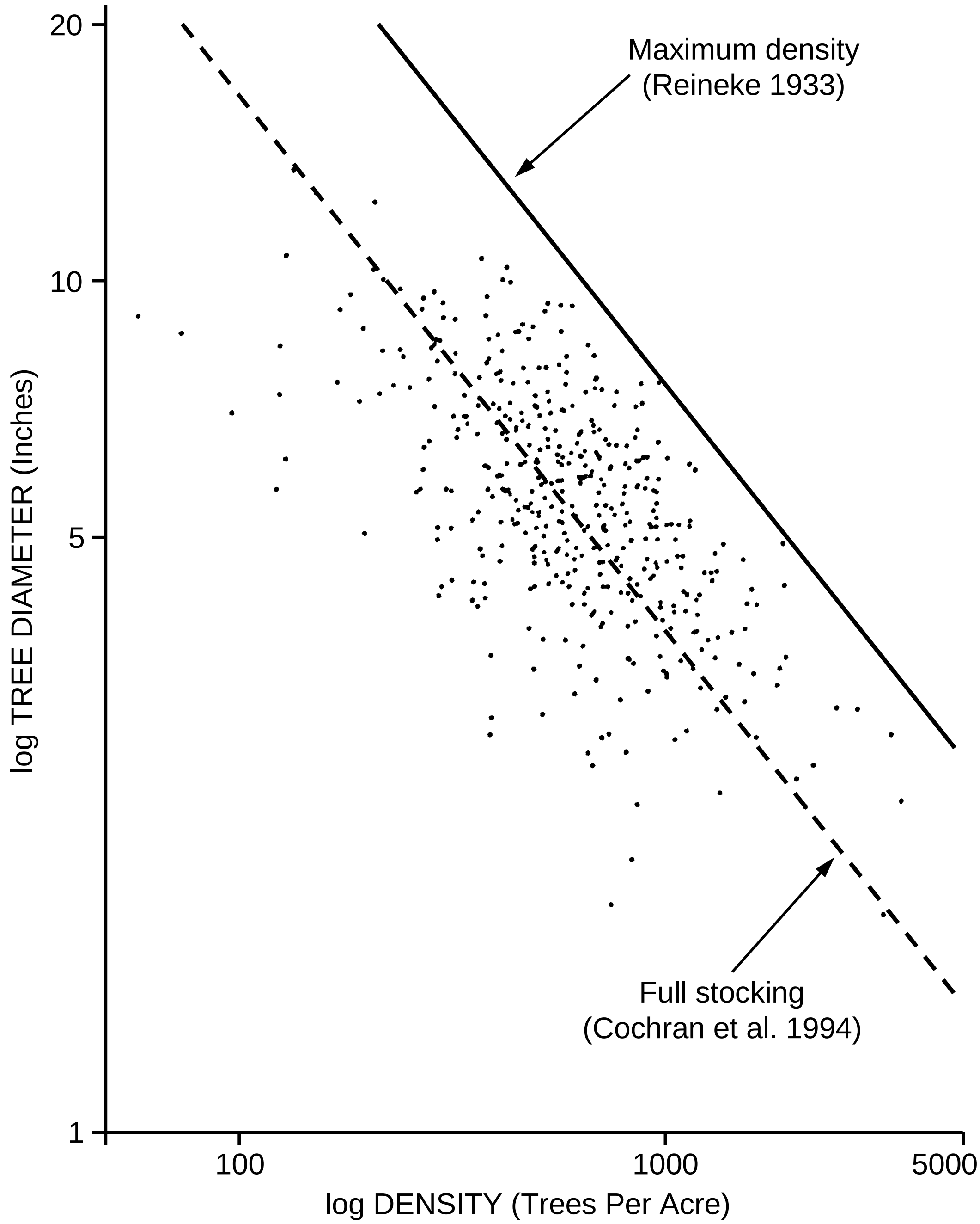

Figure 1 – Relationship between maximum density and full stocking. L.H. Reineke, creator of stand density index, plotted tree diameter and density for well-stocked, even-aged stands of an individual tree species on logarithmic scales (Reineke 1933). This process resulted in a scatter plot where each dot represents one stand's data for mean diameter and trees per acre. Instead of following typical statistical methods (minimizing squared deviations), Reineke drew a straight 'boundary' line above the cloud of points (not through them). But, when a 'least-squares' regression line is fitted to his scatter plot data, the result is average density for fully stocked stands. This average line is referred to as normal density or full stocking (Meyer 1961, McArdle et al. 1961); it represents an 'average-maximum' level of competition. Cochran et al. (1994) used full stocking (dashed line) as a relative density reference level, which differs from Reineke's approach because Reineke used his maximum density level (solid line) as a reference level.

In the Cochran note, suggested stocking levels are expressed as stand density index (SDI). But Blue Mountains plant association field guides presented stocking information as growth basal area (GBA) (Hall 1989), so the Cochran group needed to convert GBA values into their corresponding SDI values before developing suggested stocking levels. A mathematical process for how GBA was converted to SDI is described in Cochran et al. 1994 (pages 5-7).

When considering tables 3 and 4 from the Cochran note, suggested stocking levels are provided for a total of 66 plant associations (both physiographic provinces combined). Tables also include stocking levels for seven conifer species: Douglas-fir, Engelmann spruce, grand fir, lodgepole pine, ponderosa pine, subalpine fir, and western larch. This level of detail makes the Cochran note unique because suggested stocking levels are provided for 462 possible combinations (66 plant associations × 7 tree species = 462 possible SDI values). Not all these combinations exist because it is uncommon to have every species occur on every plant association.

The Cochran note presents suggested stocking levels by using one stand density benchmark or threshold level – full stocking. Why did the Cochran note use full stocking (normal density) as its reference level instead of selecting maximum density for this purpose? The answer is simple – to be consistent with national Forest Service policy regarding development of stocking-level guides.

National stocking-guide policy historically stipulated that a reference level "be based on a standard of average maximum competition or no competition" (Ernst and Knapp 1985). Since full stocking is the same as normal density (fig. 1), and because normal density represents an average-maximum level of competition (Curtis 1970, MacLean 1979), the Cochran group selected full stocking as its reference level in accordance with national FS policy.

Note: national stocking-guide policy also established standards for how Forest Service Regions were supposed to format their stocking charts (e.g., they should be in a 'Gingrich format'). To my knowledge, this national policy is no longer followed. But, the Cochran note does provide 13 Gingrich-style stocking charts (Cochran et al. 1994, figures 1-13), along with simple QuickBASIC computer code to allow users to generate their own stocking charts in a Gingrich format (see appendix 2, pages 19-21, in the Cochran note).

The Cochran note provides Blue Mountain land managers with an ecologically appropriate basis for establishing sustainable stocking levels. Ecological appropriateness is assured by using potential vegetation (plant association) as an indicator of 'carrying capacity' for tree density (i.e., moist-site associations can support more tree density than dry-site associations).

Sustainability is assured by establishing a relative density reference level, allowing managers to design sustainable density management regimes by establishing upper and lower limits of a 'management zone' located below an unsustainably elevated density level (e.g., full stocking).

The Cochran note did not provide explicit SDI values for upper and lower limits of a management zone, but it described how managers could calculate them (Cochran et al. 1994, pages 7-10).

As one of its authors, I began receiving questions or concerns from managers about how suggested stocking levels from the Cochran note could be implemented. Since the Cochran note lacks much detail desired by managers – quantified values for upper and lower limits of a management zone, basal area and trees per acre data, intertree spacing expressed in feet, and canopy cover percentages – it quickly became apparent that the Cochran note provides a solid conceptual foundation (along with quantified values for full stocking, by tree species), but it lacks many of the 'nuts and bolts' needed by practitioners.

In response to these questions and concerns, I developed an 'implementation guide' to provide information for stocking-level practitioners working on Umatilla National Forest portion of the Blue Mountains. This implementation guide was published exactly five years after the Cochran note – in April of 1999.

METHODOLOGY FOR DEVELOPING MAXIMUM DENSITY VALUES

The Cochran note describes full stocking in detail, but it neither discusses nor quantifies maximum density. Powell's implementation guide does not quantify maximum density explicitly, but it provides a mathematical basis for how this stocking level could be calculated (see table 3, page 15, in Powell 1999). Table 3 from Powell (1999), modified slightly for formatting purposes, is provided below as table 1.

Figure 2 shows five stocking levels and indexes them to maximum density as a reference level. The Cochran note, and Powell's follow-up implementation guide, express suggested stocking levels as some proportion of full stocking (table 1). In figure 2, full stocking, ULMZ, and LLMZ terms relate directly to the Cochran note and Powell's implementation guide. But the Cochran note uses full stocking as a reference level, so ULMZ and LLMZ stocking levels are indexed to full stocking, not to maximum density (i.e., in fig. 2, full stocking would be at the top, at the 100% level, instead of maximum density).

Table 1 below shows that information from Cochran et al. (1994), along with material from an implementation guide (Powell 1999), is easily used to calculate maximum density.

1. Experience, professional judgment, and personal communication with Dr. James Long (Utah State University) suggests that full stocking (normal density) is about 80% of maximum density, which means that maximum density can be calculated as 125% of full stocking (see table 1, below). [In addition to personal communication with Long, see Long and Shaw 2005 for further validation of this mathematical relationship between full stocking/normal density and maximum density.]

   This assumption is also supported by an analysis of red fir data showing that critical (near-maximum) density occurred at about 130% of normal density (Daniel et al. 1979, p. 319).
2. Both sources (Cochran et al. 1994, Powell 1999) provide maximum, species-wide SDI values <u>of full stocking</u> for seven conifers in the Blue Mountains (see table 1 in Cochran et al. 1994, and table 2 in Powell 1999). Note that province-wide data is used as a 'cap' to prevent any calculated value for a plant association from exceeding a maximum, species-specific value established for Blue Mountains as a whole (and, species values calculated for certain plant associations did have to be reduced to a province-wide cap value). Province-wide species data is reproduced here, as table 2, for reference purposes (adapted from Powell 1999). Note that intercept values and slope factors in table 2 are used with Reineke's equation for calculating SDI (see equation 2 on page 3 in Cochran et al. 1994).
3. Both sources (Cochran et al. 1994, Powell 1999) provide full stocking SDI values for combinations of plant association and tree species (see tables 3 and 4 in Cochran et al. 1994, and table 2 in Powell 1999).
4. SDI values for a full stocking level were used to calculate corresponding values of maximum density (full stocking SDI × 1.25 = maximum density SDI; see table 1, below).

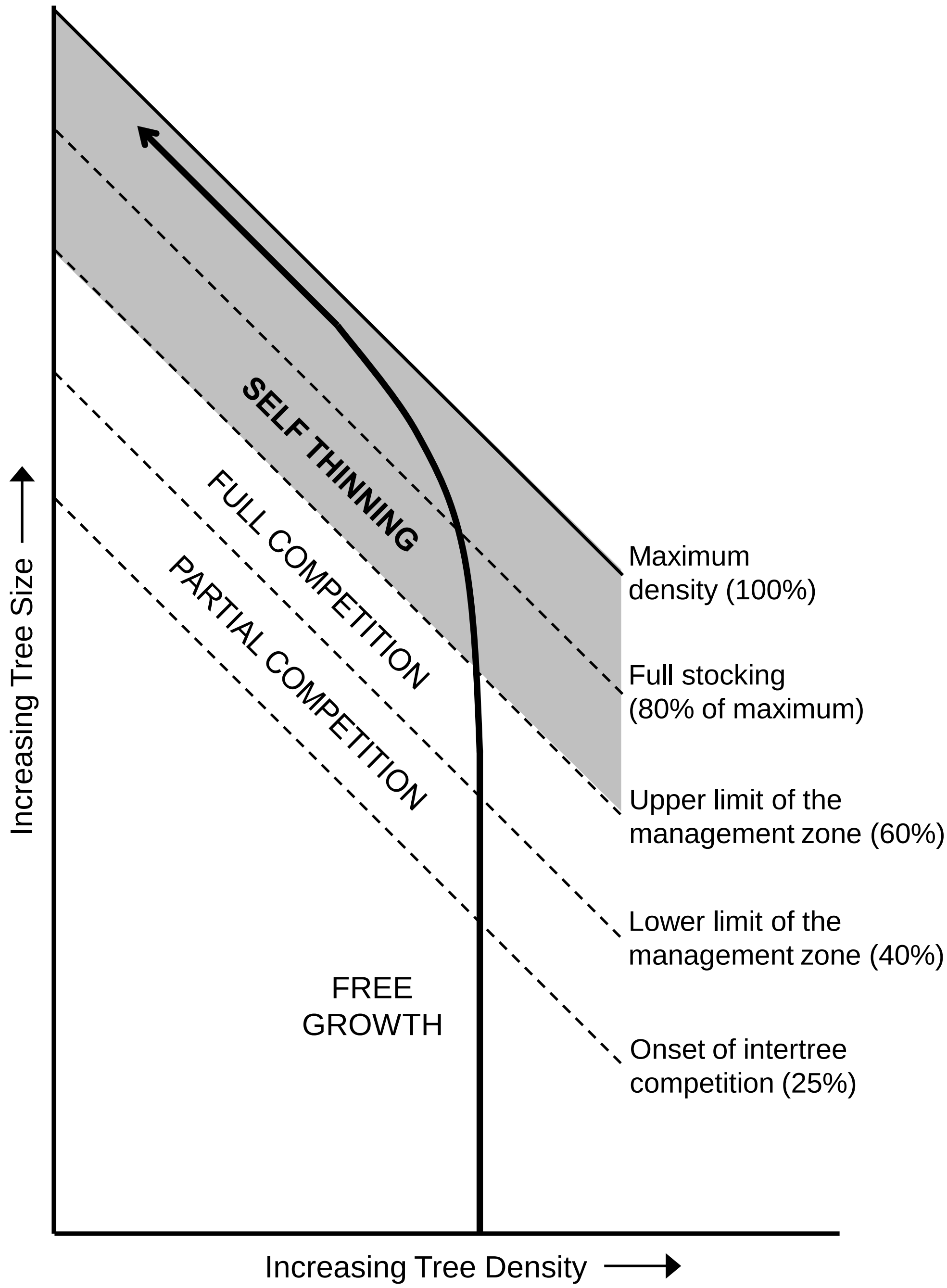

Figure 2 – Stand development indexed to maximum density. When Cochran et al. (1994) published suggested stocking levels for plant associations and tree species of northeastern Oregon and southeastern Washington, stocking levels were always expressed as some proportion of full stocking. This figure presents stocking levels as a percentage of maximum density instead of full stocking. Note that full stocking, as used in the Cochran note, is the same as 'normal density' because density information for fully-stocked natural stands was traditionally published in normal yield tables such as Barnes (1962), McArdle et al. (1961), and Meyer (1961). Although the names are different, ***full stocking and normal density are the same stocking level***. Upper and lower limits of a management zone can be established by setting consistent percentages of full stocking or maximum density. The Cochran note did not use an "onset of intertree competition" threshold as a suggested stocking level.

Table 1: Characterization of selected stand development benchmarks or stocking level thresholds as percentages of maximum density and full stocking.

Stand Development Benchmark or Stocking Level Threshold	Percent of Maximum Density[1]	Percent of Full Stocking[2]
Maximum density[3]	100%	125%
Full stocking (normal density)[4]	80%	100%
Lower limit of self-thinning zone[5]	60%	75%
Upper limit of the management zone	60%	75%
Crown ratio of 40 percent	50%	~63%
Lower limit of full site occupancy	35%	~45%
Lower limit of the management zone	~40%	50%
Onset of competition/crown closure	25%	~30%

[1] Percent of maximum density values are based on Long (1985), or were calculated.

[2] Percent of full stocking values are based on Cochran et al. (1994), or were calculated.

[3] Maximum density is maximum stand density observed for a tree species; although rare in nature, it represents an upper limit (see fig. 1).

[4] Full stocking refers to normal stand density values as published in sources such as Meyer (1961); it has also been called 'average-maximum' density (see fig. 1).

[5] Lower limit of self-thinning zone stocking threshold has also been referred to as a "zone of imminent competition mortality" (Drew and Flewelling 1979).

Note: Gray bands show adjacent thresholds considered to be identical or equivalent.

Table 2: Intercept values, slope factors, province-wide full stocking, and maximum density for tree species included in Cochran et al. (1994).

Tree Species	Intercept Value[1]	Slope Factor[1]	Province-Wide Full Stocking[1]	Maximum Density[2]
Ponderosa pine	9.97	1.77	365	456
Douglas-fir	9.42	1.51	380	475
Western larch	10.00	1.73	410	512
Lodgepole pine	9.63	1.74	277	346
Engelmann spruce	10.13	1.73	469	586
Grand fir	10.31	1.73	560	700
Subalpine fir	10.01	1.73	416	520

[1] Intercept values, slope factors, and full stocking values are taken from table 1 in Cochran et al. (1994). Because full-stocking values are province-wide for a Blue Mountains physiographic province of northeastern Oregon and southeastern Washington, they do not pertain to any specific plant association.

[2] Maximum density was calculated as 125% of full stocking (see table 3). These values are also province wide for a Blue Mountains physiographic province of northeastern Oregon and southeastern Washington.

RESULTS FOR MAXIMUM STAND DENSITY INDEX

By using analysis methodology described in a previous section, a Blue Mountains work group calculated new values of maximum SDI for many combinations of tree species and plant association included in a Blue Mountains variant of Forest Vegetation Simulator, and they are presented in table 3.

Note that there are three tree species (western white pine, mountain hemlock, and whitebark pine) for which no maximum SDI values are provided in table 3. These three species have limited occurrence in the Blue Mountains, so they were seldom encountered when field sampling occurred during development of Blue Mountains plant association field guides. Since growth basal area (GBA) data is not available for western white pine, mountain hemlock, and whitebark pine, the Cochran process could not be used to convert GBA to SDI, and then include their suggested SDI stocking levels in Cochran et al. (1994).

Also note that table 3 includes many plant associations for which no maximum SDI values are provided. These are newer associations included in plant association field guides published after the Cochran note was released in April 1994. Newer associations are described in Crowe and Clausnitzer (1997) and Wells (2006) for riparian sites, in Johnson (2004) and Johnson and Swanson (2005) for upland forest and herbland sites, and in Swanson et al. (2010) for quaking aspen communities.

New plant association field guides generally lack stockability information, so it would not be possible to use the Cochran methodology to develop suggested stocking levels for their forested plant associations. Table 3 includes every forested association for the Blue Mountains, and it clearly demonstrates how many of them lack detailed stocking data!

A Blue Mountains work group believes that one approach for addressing this lack of stocking information is to copy data from associations for which it is available to ecologically similar associations for which it is lacking – ***we recommend this approach be evaluated and if found to have merit, that it be implemented as soon as practicable***.

BACKGROUND FOR SITE INDEX

Site index (SI) is defined as "a species-specific measure of actual or potential site quality, expressed in terms of the average height of trees included in a specified stand component" such as dominant and codominant trees (Helms 1998). SI is derived by measuring total height and age (either breast-height age, or total age) for 'top-height' trees defined as dominant and codominant crown classes in a stand, and then using their height and age measurements to calculate an SI value for each site tree.

By definition, site index provides potential height of dominant and codominant trees – the tallest trees in an even-aged stand, or the topmost layer in a multi-layered stand structure. This definition means that *SI does not provide an estimate of average stand height* because certain crown classes (intermediate and subordinate trees) are intentionally not sampled when selecting site trees.

If site trees selected for measurement are chosen carefully, and if they meet specifications of published SI curves (such as lack of top damage from budworm or defoliating insects, little or no evidence of growth suppression in an increment core, etc.), then SI values are assumed to provide an accurate assessment of inherent site quality.

SI values are expressed in feet – an SI value of 70 means that total height for dominant and codominant trees at 50 years of age (if the site index curves use 50 as a base age) would average 70 feet. If the curves use 100 as a base age, then an SI value of 70 means that dominant and codominant trees would average 70 feet in total height at 100 years of age.

Site index values pertain to a base age (such as 50 years or 100 years), and base age varies from one set of published curves to another. Base age is an 'indexing' mechanism because it scales all measurements to a common baseline, and without a common baseline age, it would be difficult to know if top-height differences reflect site quality variation (is one area more productive than another?) or if a sampled stand had more time to grow (it was older) than another sampled stand.

Site index (SI) base age often varies between tree species, including whether the base age pertains to breast-height or total age (recent SI curves tend to use breast-height age because it is easily measured in the field – for total age, most older curves require that breast-height age be determined first, and then a growth factor, such as 15 years, be added to breast-height age to derive total age).

For the Blue Mountains, published sources of SI curves are provided below in table 4.

Table 4: Source of site index curves for major Blue Mountains tree species.

Tree Species	Species Code	Site Index Source	Base Age (Years)	Age Limit (Years)
Engelmann spruce	PIEN	Brickell 1970	50 (total)	≤ 200
Grand fir	ABGR	Cochran 1979b	50 (BH)	≤ 100
Interior Douglas-fir	PSME	Cochran 1979a	50 (BH)	≤ 100
Lodgepole pine	PICO	Dahms 1975	90 (BH)	≤ 120
Mountain hemlock	TSME	Means et al. 1986	100 (BH)	≤ 240
Ponderosa pine	PIPO	Barrett 1978	100 (BH)	≤ 140
Subalpine fir	ABLA2	Brickell 1970	50 (total)	≤ 200
Western larch	LAOC	Cochran 1985	50 (BH)	≤ 100
Western white pine	PIMO	Brickell 1970	50 (total)	≤ 105
Whitebark pine	PIAL	Hegyi et al. 1981	100 (total)	≤ 300

Sources/Notes: Species code is an alphanumeric code used for species identification in a CVS database; "BH" in a Base Age column indicates that base age is a breast-height age rather than total age; Age Limit is an age range of measured site trees for which a site index curve (source) is applicable (note that trees beyond this age range are not preferred site trees according to published specifications for the site index source).

Table 3: Calculated values of maximum stand density index (Max) and site index (SI) for major tree species and potential vegetation types of Blue Mountains in northeastern Oregon and southeastern Washington.

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
ABLA2-PIAL/POPU	TFI	CAF0											51				26							
ABLA2-PIAL/POPH	TFI	CAF2									65													
ABLA2/CAGE	BO	CAG111	1				48		65	346	78		66			465	62							LP
ABLA2/STOC	BO	CAG4					56			346	78		64			465	48							LP
PSME/CAGE	BO	CDG111	2	278	77	351	52		59						62									PP
PSME/CARU	BO	CDG112	3	329	83	330	53		55						48									PP
PSME/CARU	WS	CDG121	4	451	86	475	55																	PP
PSME/bunchgrass	TFI	CDG3					43																	
PSME/HODI	BO	CDS611	5	425	86	319	64																	DF
PSME/SYAL	WS	CDS622	6	416	84	475	60																	PP
PSME/SYAL	BO	CDS624	8	341	81	309	61	256							70									DF
PSME/SYOR	WS	CDS623	7	451	90		55																	PP
PSME/SYOR	BO	CDS625			72		52																	
PSME/SPBE	WS	CDS634	9	441	82	464	61																	PP
PSME/PHMA	BO	CDS711	10	343	87	281	59	320	64															DF
PSME/PHMA	WS	CDS711		290	87	388	59		64															PP
PSME/ACGL-PHMA	WS	CDS722	11	351	96	346	64																	DF
PSME/VAME	BO	CDS821	12	241	92	229	53																	DF
PSME/VAME	WS	CDS812					60																	
PSME/CELE/CAGE	BO	CDSD			67		47																	
ABLA2/LIBO2	WS	CEF221	13					348	62	333	65	538	67			488	40							LP
ABLA2/STAM	WS	CEF311	14							346	65	586	69		57	443	65							LP
ABLA2/TRCA3	BO	CEF331	15							346	65	430	60			478								LP
ABLA2/POPU	WS	CEF411				475	59	513		346	65	568	58		54	483	54							LP
Unknown type (error?)	TFI	CEF9											55											
ABLA2/CARU	WS	CEG312					54		43		74		66		60		59							
PIEN/CAEU	COR	CEM111	16																					
PIEN/EQAR-STRO	COR	CEM221	17																					
PIEN/CLUN	COR	CEM222	18																					
PIEN/VAOC2-FORB	COR	CEM311	19																					
PIEN/VAOC2/CAEU	COR	CEM312	20																					
ABLA2/CLUN	WS	CES131	21	379				414	83			586	72	681	77	429	69							WL
ABLA2/MEFE	WS	CES221	22				56			346	65	460				410								LP
ABLA2/MEFE	BO	CES221					56									520								

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
ABLA2/VAME	BO	CES311	23					478	63	319		478	58		72	331	51							AF
ABLA2/CLUN	BO	CES314	24					513	79			586	69		69	520	53							WL
ABLA2/VAME	WS	CES315	25			475	55	460	62	346	82	573	65		55	425	63							LP
ABLA2/VASC	BO	CES411	26			458		475	46	346	66	458	53		61	456	44						19	LP
ABLA2/LIBO2	BO	CES414	27				64	513	58		66	474	60		52	419	53							AF
ABLA2/VASC/POPU	WS	CES415	28			475		513	51	346	70	568	57		51	483	48							LP
JUOC/FEID-AGSP	Both	CJG111			67		46																	
JUOC/ARTRV/FEID-AGSP	TFI	CJS2			61																			
JUOC/CELE	TFI	CJS4			58																			
PICO/LIBO2	WS	CLF211	29						55		72													
PICO/bunchgrass	TFI	CLG1									73		51		48		48							
PICO/rhizomatous grass	TFI	CLG2			82		53		55		68				49		44							
PICO/CARU-VASC	B73	CLG211	30																					
PICO/POPR	COR	CLM112	31																					
PICO/CAEU	COR	CLM113	32																					
PICO/CAAQ	COR	CLM114	33																					
PICO/VAOC2/CAEU	COR	CLM312	34																					
PICO/SPDO/FORB	COR	CLM313	35																					
PICO/SPDO/CAEU	COR	CLM314	36																					
PICO-PIEN/ELPA2	COR	CLM911	37																					
PICO/shrub, cool xeric	TFI	CLS4					51		55		65		50		46		44							
PICO/VASC	B73	CLS411	38																					
PICO/VASC/POPU	WS	CLS415	39						45		61		52				42							
PICO/CARU	BO	CLS416	40		78		53		55	279	66													
PICO(ABGR)/VAME-LIBO2	BO	CLS5		456		475	55	463	52	346	67	499	56	645	52	466								LP
PICO/VAME	B73	CLS511	41																					
PICO/VAME	WS	CLS515	42						46		65		46											
PICO(ABGR)/ALSI	BO	CLS6				475		513	59	346	65	586		700										LP
TSME/VASC	WS	CMS131	43							283	68	371				520					56			LP
TSME/VAME	WS	CMS231	44							283	68	371				520					58			
PIPO/bunchgrass	TFI	CPG1			47																			
PIPO/AGSP	BO	CPG111	45	166	72		52								69									PP
PIPO/FEID	BO	CPG112	46	243	74		59																	PP
PIPO/FEID	WS	CPG131	47	259	79		57																	PP
PIPO/AGSP	WS	CPG132	48	233	77		62																	PP
PIPO/CARU	BO	CPG221	49	456	77		55								66									PP
PIPO/CAGE	BO	CPG222	50	251	73		51				70													PP

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
PIPO/ELGL	B73	CPM111	51																					
PIPO/ARTRV	TFI	CPS1			76																			
PIPO/ARTRV/FEID-AGSP	BO	CPS131	52	238	73																			PP
PIPO/PUTR/CARO	BO	CPS221	53	304	74																			PP
PIPO/PUTR/CAGE	BO	CPS222	54	255	79																			PP
PIPO/PUTR/FEID-AGSP	BO	CPS226	55	231	64																			PP
PIPO/CELE/CAGE	BO	CPS232	56	290	65		53																	PP
PIPO/CELE/PONE	BO	CPS233	57	199	67																			PP
PIPO/CELE/FEID-AGSP	BO	CPS234	58	196	66		51																	PP
PIPO/SYAL-FLOODPLAIN	COR	CPS511	59																					
PIPO/SYAL	WS	CPS522	60	301	85		70																	PP
PIPO/SPBE	WS	CPS523	61	276	96		71																	PP
PIPO/SYAL	BO	CPS524	62	398	81		56																	PP
PIPO/SYOR	BO	CPS525	63	325	79																			PP
ABGR/TABR/CLUN	BO	CWC811	64									533	76	700	69									ES
ABGR/TABR/CLUN	WS	CWF422					73		82				76		78									
ABGR/TABR/LIBO2	BO	CWC812	65			475	76	378				374	66	700	90									ES
ABGR/LIBO2	WS	CWF311	66		104	475	60	511	60	346	73		59	700	59									LP
ABGR/LIBO2	BO	CWF312	67	456	92	475	62	463	58	346	72	499	53	645	56	466								LP
ABGR/CLUN	WS	CWF421	68	456	111	475	69	455	79	346	81	586	72	700	74				40					LP
ABGR/CLUN	BO	CWF421			111	475	69	513	79	346	81	586	72	700	74				40					LP
ABCO/CLUN	COR	CWF431	69																					
ABGR/TRCA3	BO	CWF512	70				75	498				485	72	693	79									ES
ABGR/GYDR	BO	CWF611	71											691	79									GF
ABGR/POMU-ASCA3	BO	CWF612	72					438	79			586		608	78									WL
ABGR/CARU-CAGE	TFI	CWG1			80		62						65		53									
ABGR/CAGE	BO	CWG111	73	263	81	376	56		64		70		68	700	50									PP
ABGR/CARU	WS	CWG112	74	456	90	475	60		55				75		56									PP
ABGR/CARU	BO	CWG113	75	395	80	446	56	384	59	346	76			555	52									PP
ABGR/BRVU	BO	CWG211	76					513	79			586		700	57		55							WL
ABGR/VAME	WS	CWS211	77	424	86	439	66	464	84	331	54	586	66	700	61									LP
ABGR/VAME	BO	CWS212	78	365	79	475	61	513	57	298	68	426	67	569	60	515								LP
ABGR/SPBE	WS	CWS321	79	456	92	475	58				74				65									PP
ABGR/SPBE	BO	CWS322	80	319	82	248	57				60			443	49									DF
ABGR/ACGL-PHMA	WS	CWS412	81		107	475	66	444	79					628	65									DF
ABGR/ACGL	BO	CWS541	82			301	70	439				405		576	71									DF
ABGR/VASC	BO	CWS811	83	215	101	343	59	380	61	346	65		43	460	48									LP

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
ABGR/VASC-LIBO2	BO	CWS812	84		81	434	56	316	56	346	75	436	70	618	56	230								WL
ABGR/ACGL	WS	CWS912	85	456		475	67		64					700	69									DF
POTR/ELGL	COR	HQM121	86																					
POTR-PICO/SPDO/CAEU	COR	HQM411	87																					
POTR/SYAL/ELGL	COR	HQS221	88																					
PIAL/ARAC2	GTR	CAF322																						
PIAL/LUAR3	GTR	CAF323																						
ABLA-PIAL/ARAC2	GTR	CAF324																						
PIAL/CAGE2	GTR	CAG131																						
ABLA-PIAL/JUPA-STLE2	GTR	CAG132																						
ABLA-PIAL/CAGE2	GTR	CAG133																						
PIAL/FEVI	GTR	CAG221																						
ABLA-PIAL/FEVI	GTR	CAG222																						
ABLA-PIAL/JUDR	GTR	CAG3																						
PIAL/VASC/LUHI4	GTR	CAS311																						
PIAL/VASC/ARCO9	GTR	CAS312																						
PIAL/VASC/ARAC2	GTR	CAS313																						
PIAL/JUCO6-ARNE	GTR	CAS422																						
ABLA-PIAL/JUCO6-ARNE	GTR	CAS423																						
ABLA-PIAL/JUCO6	GTR	CAS424																						
PIFL2/JUCO6	GTR	CAS511																						
PIAL/RIMO2/POPU3	GTR	CAS512																						
ABLA-PIAL/RIMO2/POPU3	GTR	CAS611																						
ABLA-PIAL/VASC/ARCO9	GTR	CAS621																						
ABLA-PIAL/VASC/CARO5	GTR	CAS622																						
ABLA-PIAL/VASC/ARAC2	GTR	CAS623																						
ABLA-PIAL/VASC-PHEM	GTR	CAS624																						
ABLA-PIAL/VASC/FEVI	GTR	CAS625																						
ABLA-PIAL/VASC/OREX	GTR	CAS626																						
ABLA-PIAL/VASC/LECOW2	GTR	CAS627																						
ABLA-PIAL/VASC-PHEM (AVALANCHE)	GTR	CAS628																						
ABLA-PIAL/VASC/FEVI (AV-ALANCHE)	GTR	CAS629																						
PSME/TRCA	GTR	CDF313																						
PSME-PIPO-JUOC/FEID	GTR	CDG333																						
PSME/SYAL (FLOODPLAIN)	GTR	CDS628																						

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
PSME/SYOR2/CAGE2	GTR	CDS642																						
PSME/ARNE/CAGE2	GTR	CDS664																						
PSME/ACGL-PHMA5 (FLOODPLAIN)	GTR	CDS724																						
PSME/ACGL-SYOR2	GTR	CDS725																						
PSME/RIMO2/POPU3	GTR	CDS911																						
ABLA/XETE	GTR	CEF111																						
ABLA-PIEN/LIBO3	GTR	CEF2																						
ABLA/ATFI	GTR	CEF332																						
ABLA/SETR	GTR	CEF333																						
PIEN/ATFI	GTR	CEF334																						
PIEN/SETR	GTR	CEF335																						
ABLA-PIEN/SETR	GTR	CEF336																						
ABLA/ARCO9	GTR	CEF412																						
ABLA-PIEN/TRCA	GTR	CEF425																						
ABLA-PIEN/POPU3	GTR	CEF426																						
ABLA/ARCO9	GTR	CEF435																						
ABLA-PIEN/ARCO9	GTR	CEF436																						
ABLA-PIEN/CLUN2	GTR	CEF437																						
ABLA/POPH	GTR	CEF511																						
ABLA-PIEN/LUHI4	GTR	CEG131																						
PIEN-ABLA/CASC12	GTR	CEG201																						
ABLA/STOC2	GTR	CEG323																						
ABLA/FEVI	GTR	CEG411																						
ABLA/JUDR	GTR	CEG412																						
ABLA/JUTE	GTR	CEG413																						
ABLA/JUPA (AVALANCHE)	GTR	CEG414																						
PIEN/CADI6	GTR	CEM121																						
ABLA/CADI6	GTR	CEM122																						
ABLA/CAAQ	GTR	CEM123																						
ABLA/CACA4	GTR	CEM124																						
PIEN/BRVU	GTR	CEM125																						
PIEN/CILA2	GTR	CEM126																						
PIEN-ABLA/SETR	GTR	CEM201																						
PIEN/EQAR	GTR	CEM211																						
ABLA/VAUL/CASC12	GTR	CEM313																						
ABLA-PIEN/MEFE	GTR	CES2																						

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
ABLA/RHAL2	GTR	CES214																						
ABLA-PIEN/RHAL2	GTR	CES215																						
ABLA/VAME (FLOODPLAIN)	GTR	CES316																						
ABLA-PIEN/VASC-PHEM	GTR	CES427																						
ABLA/VASC-PHEM	GTR	CES428																						
ABLA/ARNE/ARAC2	GTR	CES429																						
PIEN/COST4	GTR	CES511																						
ABLA-PIEN/LEGL (FLOOD-PLAIN)	GTR	CES610																						
ABLA-PIEN/LEGL	GTR	CES612																						
ABLA-PIEN/MEFE (FLOOD-PLAIN)	GTR	CES710																						
ABLA-PIMO3/CHUM	GTR	CES8																						
JUOC/AGSP	GTR	CJG113																						
JUOC/ARAR8	GTR	CJS1																						
JUOC/ARAR8/FEID	GTR	CJS112																						
JUOC/PUTR2/FEID-AGSP	GTR	CJS321																						
JUOC/CELE3/FEID-AGSP	GTR	CJS41																						
JUOC/CELE3/CAGE2	GTR	CJS42																						
JUSC2/CELE3	GTR	CJS5																						
JUOC/ARRI2	GTR	CJS8																						
JUOC/ARRI2 (SCAB)	GTR	CJS811																						
PICO(ABLA)/STOC2	GTR	CLG11																						
PICO(ABGR)/CARU	GTR	CLG21																						
PICO(ABLA)/CAGE2	GTR	CLG322																						
PICO/DECE	GTR	CLM115																						
PICO/CALA30	GTR	CLM116																						
PICO/CACA4	GTR	CLM117																						
PICO/CASC12	GTR	CLM118																						
PICO/ALIN2/MESIC FORB	GTR	CLM511																						
PICO(ABGR)/VASC/CARU	GTR	CLS417																						
PICO(ABLA)/VASC	GTR	CLS418																						
PICO(ABGR)/VAME/CARU	GTR	CLS512																						
PICO(ABGR)/VAME	GTR	CLS513																						
PICO(ABLA)/VAME	GTR	CLS514																						
PICO(ABLA)/VAME/CARU	GTR	CLS516																						
PICO(ABGR)/VAME/PTAQ	GTR	CLS519																						

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
PICO(ABGR)/ARNE	GTR	CLS57																						
PICO(ABGR)/ALSI3	GTR	CLS58																						
PIPO-JUOC/CELE3-SYOR2	GTR	CPC212																						
PIPO/POPR	GTR	CPM112																						
PIPO/ARTRV/CAGE2	GTR	CPS132																						
PIPO/PUTR2/AGSP-POSA12	GTR	CPS229																						
PIPO/PUTR2/AGSP	GTR	CPS231																						
PIPO/ARAR8	GTR	CPS61																						
PIPO/CRDO2	GTR	CPS722																						
PIPO/PERA4	GTR	CPS8																						
PIPO/RHGL	GTR	CPS9																						
PIMO3/DECE	GTR	CQM111																						
ABGR/TABR2/LIBO3 (FLOODPLAIN)	GTR	CWF424																						
ABGR/ARCO9	GTR	CWF444																						
ABGR/COOC	GTR	CWF511																						
ABGR/ATFI	GTR	CWF613																						
ABGR/CALA30	GTR	CWM311																						
ABGR-CHNO/VAME	GTR	CWS232																						
ABGR/SYAL (FLOODPLAIN)	GTR	CWS314																						
ABGR/CRDO2/CADE9	GTR	CWS423																						
ABGR/ACGL (FLOODPLAIN)	GTR	CWS543																						
POTR15/SALA5	GTR	HCS112																						
POTR15/ALIN2-COST4	GTR	HCS113																						
POTR15/ACGL	GTR	HCS114																						
POTR15/SYAL	GTR	HCS312																						
POTR5/CAGE2	GTR	HQG112																						
POTR5/POPR	GTR	HQM122																						
POTR5/CACA4	GTR	HQM123																						
POTR5/CALA30	GTR	HQM211																						
POTR5/CAAQ	GTR	HQM212																						
POTR5/MESIC FORB	GTR	HQM511																						
POTR5/ALIN2-COST4	GTR	HQS222																						
POTR5/ALIN2-SYAL	GTR	HQS223																						
POTR5-PIEN/GLST-CACA4	APC	HQC113																						
POTR5/CRDO2	APC	HQS4																						
POTR5/CAFL4	APC	HQG113																						

POTENTIAL VEGETATION TYPE	Area	Ecoclass Code	FVS Eco	PP(10) Max	PP SI	DF(3) Max	DF SI	WL(2) Max	WL SI	LP(7) Max	LP SI	ES(8) Max	ES SI	GF(4) Max	GF SI	AF(9) Max	AF SI	WP(1) Max	WP SI	MH(5) Max	MH SI	WB Max	WB SI	Def Spp
POTR5/ALPR3	APC	HQM611																						
POTR5 (RUBBLE, HIGH)	APC	HQR101																						
POTR5 (RUBBLE, LOW)	APC	HQR102																						
POTR5(ABLA)/RUOC2	APC	HQC114																						
POTR5(ABGR)/HODI	APC	HQC115																						
POTR5(ABGR)/SYMPH	APC	HQC116																						
POTR5/PRVI	APC	HQS5																						
POTR5(PSME)/PREM	APC	HQC117																						
POTR5(PIPO-PSME)/SYMPH	APC	HQC118																						
POTR5/CARU	APC	HQG114																						
POTR5/EXOTIC GRASS	APC	HQC115																						

Sources/Notes: Potential vegetation type and Ecoclass codes are used to record potential vegetation types (plant associations, plant community types, plant communities) on field forms and in computer databases; both codes are taken primarily from Powell et al. (2007), and are translated into their common names in appendix 1. Area column provides source of potential vegetation type and Ecoclass codes for the potential vegetation type: B73 is Blue Mountain plant communities (Hall 1973), BO is Blue-Ochoco (Johnson and Clausnitzer 1992), Both refers to types included in both the BO and WS sources and yet the same Ecoclass code was used for the type in both guides, COR is central Oregon riparian (Kovalchik 1987), GTR is used for types included in Powell et al. (2007) and not covered by another Area source (these are primarily riparian or nonforest types from Crowe and Clausnitzer 1997, Johnson and Swanson 2005, and Wells 2006), APC refers to aspen plant communities described by Swanson et al. (2010), TFI refers to types established for a Tri-Forest Inventory program and documented in Hall (1998), and WS is Wallowa-Snake (Johnson and Simon 1987). FVS Eco provides a 2-digit numeric code used by FVS to denote habitat types or plant associations. Species columns (PP, DF, WL, LP, ES, GF, AF, WP, MH, WB) show calculated values of maximum stand density index (Max) and site index (SI); maximum SDI values are based on Cochran et al. (1994) and Powell (1999), whereas site index values are based on measured values of height and age from 6,509 site trees selected during establishment of occasion 1 Current Vegetation Survey plots across all three Blue Mountains national forests from 1993 to 1996. Site Index (SI) is calculated by using an equation referencing tree age and tree height as input variables. Site trees were pooled (all 3 Blue Mountain national forests combined) and then stratified by potential vegetation type (Ecoclass). Species code (PP) and a number after a species code (10) refers to FVS species identifier and sequence number, respectively. For plant communities or plant community types, which are seral stages of a plant association, maximum SDI and site index values, by species, from the parent plant association were used (an example: CAG4 is derived from CAG111, so max SDI and SI values from CAG111 were used for CAG4). Default species (Def Spp) is a recommended default species to use for a potential vegetation type, as determined by a Blue Mountains working group that compiled this table. Note that information in this table was developed by a Blue Mountains working group, consisting of Bruce Countryman, Don Justice, Dave Powell, Mike Tatum, and Ed Uebler, during a series of meetings between 2007 and 2009.

CVS PLOTS AS A DATA SOURCE FOR SITE INDEX

In 1990s, Blue Mountains national forests installed a grid-based inventory system called Current Vegetation Survey (CVS) (USDA Forest Service 1995). CVS plots were installed on a 1.7-mile grid (each plot was located 1.7 miles away from adjoining plots) except for designated Wilderness areas, where grid spacing was 3.4 miles between plots.

For Blue Mountains national forests of northeastern Oregon, southeastern Washington and west-central Idaho, initial installation of forested CVS plots occurred in 1993 and 1994; nonforest CVS plots were established across all three national forests in 1995 and 1996. Plot information collected during this 1993-1996 period is referred to as occasion 1 data. Since their initial installation, every CVS plot has been re-measured once, and this subsequent information is referred to as occasion 2 data (Christensen et al. 2007).

When considering data sources providing measured values for a wide range of tree attributes, CVS information is generally acknowledged to be the best Blue Mountains dataset available because its grid-based approach prevents plot location bias, and because its quality control/quality assurance emphasis was very high (Max et al. 1996). For this reason, it was decided to use CVS information when developing updated values of site index for Blue Mountains variant of FVS.

ANALYSIS METHODOLOGY FOR SITE INDEX

Occasion 1 CVS data for all three Blue Mountains national forests was pooled, and a resulting database was queried to extract site tree records and their associated information, including plots and points they occurred on. Site trees were easily identified in a CVS database because they have a unique vegetation (tree history) code: 13.

Potential vegetation is represented in a CVS database by using Ecoclass codes (Hall 1998). Each CVS plot consists of a 5-point cluster, and an Ecoclass code was recorded for each of five points. Site trees are coded to the sample point they occur on or near, so an Ecoclass code was readily assigned to each site tree record by using a database query and CVS plot and point identifiers as common (linking) fields between Ecoclass and site index tables.

After 6,664 site tree records were extracted from a CVS occasion 1 database (these were all records with a vegetation code of 13), the data was filtered to remove problem records.

Problematic records are those missing a measured height or age value, which means that site index could not be calculated, or the measured age value exceeded an age limit established for a source (see Age Limit column in table 4). Certain site index curves, especially Cochran's curve for western larch (Cochran 1985), are very sensitive to an age limit, and age values beyond a limit quickly produce nonsensical results.

A total of 155 problem records were removed from the dataset, resulting in 6,509 records being usable for further analysis.

An analysis dataset was then transferred to Excel and stratified by potential vegetation type (plant association) by using the Ecoclass code associated with each record. Site index was calculated for each record by using an equation referencing measured values of tree age and tree height as input variables.

Source of calculation equations varied – most came from a published site index source document (see table 4), whereas others came from USDA Forest Service (1987) or Hanson et al. (2002).

RESULTS FOR SITE INDEX

By using an analysis methodology described in a previous section, a Blue Mountains work group calculated new values of site index for many potential vegetation types (plant associations primarily, but also consisting of plant communities and plant community types) included in Blue Mountains variant of Forest Vegetation Simulator. New site index values are presented in tables 3 and 5.

Close inspection of table 3 reveals that for any plant association code (column 1), site index information was available for some species and not for others. And in many instances, a new value of site index was available for a tree species and yet a new value of maximum SDI was not. In a few cases, the opposite situation occurred – an updated value of maximum SDI was available for a species, and yet a new value of site index was not.

Data patterns expressed in table 3 demonstrate that SDI and site index update processes are not linked – a not-unsurprising result because each update item was based on a different data source!

Table 5 provides the number of site tree records available for each Ecoclass-species combination (see Tree Count column), along with minimum (Min), maximum (Max), and mean values of site index (mean value is final column of table 5, labeled Site Index).

Table 5: Summary of site index information for potential vegetation types of Blue Mountains in northeastern Oregon and southeastern Washington.

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
CAF0	ABLA2	3	17.3	36.2	25.9
	PIEN	6	34.8	72.7	51.4
CAF2	PICO	3	53.0	73.8	64.9
CAG111	ABLA2	4	41.6	77.1	61.5
	LAOC	4	44.6	78.5	64.9
	PIEN	6	55.2	72.6	66.3
	PSME	5	26.6	65.6	48.3
CAG4	ABLA2	10	32.5	65.9	47.7
	PICO	3	73.7	80.3	77.8
	PIEN	3	59.5	66.8	64.1
	PSME	3	48.9	62.7	55.7
CDG111	ABGR	5	41.9	97.4	62.3
	LAOC	6	46.6	74.4	59.1
	PIPO	121	41.7	127.3	76.7
	PSME	276	17.8	88.8	51.6
CDG112	ABGR	5	34.7	62.6	47.9
	LAOC	5	50.2	61.1	55.1

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
	PIPO	94	47.9	122.3	82.8
	PSME	160	26.5	78.0	53.0
CDG121	PIPO	19	53.9	120.4	85.7
	PSME	89	19.4	100.8	55.0
CDG3	PSME	4	35.0	58.8	43.2
CDS611	PIPO	7	70.8	110.1	86.1
	PSME	28	47.6	86.3	63.8
CDS622	PIPO	10	62.3	107.4	84.0
	PSME	64	32.9	88.3	60.2
CDS623	PIPO	5	77.2	100.5	90.0
	PSME	28	34.3	75.6	55.3
CDS624	ABGR	6	52.7	97.8	70.3
	PIPO	33	49.2	112.0	81.0
	PSME	125	35.7	94.9	61.3
CDS625	PIPO	10	57.4	105.9	71.7
	PSME	23	32.8	70.0	51.7
CDS634	PIPO	19	53.1	109.0	82.1
	PSME	81	33.3	88.4	60.5
CDS711	LAOC	3	53.4	72.7	64.3
	PIPO	44	58.1	121.8	86.9
	PSME	183	23.0	103.8	58.9
CDS722	PIPO	8	76.6	141.1	96.1
	PSME	120	38.1	96.7	64.3
CDS812	PSME	4	54.3	64.2	59.7
CDS821	PIPO	5	85.3	105.6	92.3
	PSME	9	47.4	59.4	53.3
CDSD	PIPO	16	48.9	87.7	66.5
	PSME	49	28.4	78.9	47.3
CEF221	ABLA2	9	21.7	55.2	40.4
	LAOC	1	61.7	61.7	61.7
	PIEN	11	38.4	80.2	66.8
CEF311	ABGR	3	24.5	76.5	56.6
	ABLA2	3	50.1	76.8	64.6
	PIEN	6	57.3	84.9	69.1
CEF331	PIEN	8	38.5	75.5	59.8
CEF411	ABGR	5	39.1	86.8	54.4
	ABLA2	41	24.4	80.9	53.8
	PICO	9	54.7	78.1	65.4
	PIEN	14	37.0	86.3	57.8
	PSME	16	45.5	68.4	59.1
CEF9	PIEN	3	49.9	65.4	55.2

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
CEG312	ABGR	3	34.7	74.3	59.8
	ABLA2	5	25.1	73.1	58.8
	LAOC	2	38.3	46.9	42.6
	PICO	3	64.8	85.3	73.9
	PIEN	2	60.4	71.3	65.9
	PSME	7	44.4	66.6	53.5
CES131	ABGR	9	62.4	94.2	77.1
	ABLA2	7	53.1	84.9	68.5
	LAOC	3	74.9	89.7	83.3
	PIEN	34	44.6	97.4	72.3
CES221	PSME	2	51.1	61.1	56.1
CES311	ABGR	7	37.3	135.2	71.6
	ABLA2	6	37.5	74.1	50.5
	LAOC	1	62.9	62.9	62.9
	PIEN	12	40.6	83.9	58.0
CES314	ABGR	4	43.2	114.6	69.1
	ABLA2	5	35.3	81.9	53.2
	LAOC	3	70.8	84.8	79.2
	PIEN	26	47.3	87.2	68.7
CES315	ABGR	17	22.4	94.0	55.0
	ABLA2	7	57.3	67.8	63.1
	LAOC	9	31.5	84.6	62.4
	PICO	8	71.4	94.9	82.2
	PIEN	37	26.7	91.9	65.1
	PSME	4	51.7	59.7	55.4
CES411	ABGR	4	44.4	90.6	60.9
	ABLA2	12	18.6	65.7	43.6
	LAOC	5	21.6	66.7	45.8
	PIAL	2	16.3	21.4	18.9
	PICO	17	48.5	87.7	65.8
	PIEN	39	20.5	71.2	52.5
CES414	ABGR	5	42.9	59.3	51.5
	ABLA2	4	31.1	64.7	52.8
	LAOC	10	37.0	84.3	58.2
	PICO	6	50.2	77.9	65.6
	PIEN	38	23.6	88.9	59.5
	PSME	4	58.0	70.0	63.9
CES415	ABGR	9	19.8	75.7	51.0
	ABLA2	19	22.1	66.8	48.3
	LAOC	2	44.1	58.2	51.2
	PICO	5	55.1	78.3	69.9

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
	PIEN	13	33.5	78.0	56.8
CJG111	PIPO	21	46.8	98.6	66.9
	PSME	6	37.2	50.4	45.5
CJS2	PIPO	3	54.2	69.9	61.2
CJS4	PIPO	9	35.4	74.6	58.1
CLF211	LAOC	9	37.5	73.9	55.4
	PICO	5	63.3	84.5	71.6
CLG1	ABGR	2	45.9	51.0	48.4
	ABLA2	2	44.9	51.8	48.4
	PICO	3	66.4	81.9	72.9
	PIEN	2	43.4	58.6	51.0
CLG2	ABGR	40	15.2	92.5	49.4
	ABLA2	3	43.3	44.9	44.1
	LAOC	11	29.9	73.5	55.2
	PICO	23	53.8	83.2	68.4
	PIPO	23	48.4	101.4	82.0
	PSME	23	29.8	78.4	53.0
CLS4	ABGR	27	25.8	59.7	46.3
	ABLA2	15	25.9	59.6	44.4
	LAOC	5	28.1	69.0	55.1
	PICO	25	42.9	81.7	64.5
	PIEN	20	20.4	77.8	49.8
	PSME	6	31.1	69.7	50.8
CLS415	ABLA2	2	39.5	43.5	41.5
	LAOC	6	35.6	51.7	45.3
	PICO	8	42.4	85.3	60.8
	PIEN	4	46.0	56.5	52.4
CLS416	LAOC	7	32.7	74.0	55.4
	PICO	39	33.7	91.7	65.9
	PIPO	20	50.3	96.8	77.8
	PSME	2	47.0	59.2	53.1
CLS5	ABGR	27	25.9	153.3	51.6
	LAOC	33	25.0	76.7	52.0
	PICO	7	47.1	81.9	66.5
	PIEN	4	44.4	67.2	56.1
	PSME	10	47.9	70.2	55.4
CLS515	LAOC	5	33.0	58.6	45.7
	PICO	2	63.5	65.6	64.6
	PIEN	3	41.4	49.0	46.3
CLS6	LAOC	3	54.3	61.8	58.7
CMS131	PICO	4	64.1	71.8	67.7

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
	TSME	3	53.3	61.3	56.4
CMS231	TSME	5	52.2	78.1	57.9
CPG1	PIPO	2	45.6	47.5	46.6
CPG111	ABGR	3	38.1	94.2	68.7
	PIPO	301	34.9	119.8	71.7
	PSME	13	40.9	64.6	52.3
CPG112	PIPO	71	40.4	119.3	74.3
	PSME	3	40.0	76.1	58.7
CPG131	PIPO	49	45.0	108.8	79.0
	PSME	6	45.1	63.3	56.7
CPG132	PIPO	20	51.2	108.3	76.6
	PSME	2	54.7	68.3	61.5
CPG221	ABGR	6	40.7	129.2	66.0
	PIPO	133	41.3	151.2	77.3
	PSME	4	51.1	59.1	55.0
CPG222	PICO	3	56.5	77.6	69.9
	PIPO	243	36.8	133.0	72.7
	PSME	11	41.3	59.0	50.9
CPS1	PIPO	6	62.0	90.1	75.7
CPS131	PIPO	27	42.5	94.4	72.7
CPS221	PIPO	6	48.0	92.2	74.2
CPS222	PIPO	9	42.5	102.3	78.8
CPS226	PIPO	11	47.1	85.8	64.3
CPS232	PIPO	38	34.2	89.3	65.4
	PSME	2	47.9	57.1	52.5
CPS233	PIPO	8	51.5	88.6	66.9
CPS234	PIPO	30	36.3	94.6	66.3
	PSME	3	47.1	55.3	51.0
CPS522	PIPO	27	47.7	113.2	85.0
	PSME	3	60.5	74.9	69.5
CPS523	PIPO	29	57.6	124.3	95.7
	PSME	3	60.8	89.2	71.1
CPS524	PIPO	120	38.6	128.7	80.5
	PSME	8	37.0	73.7	56.3
CPS525	PIPO	23	51.7	109.8	78.7
CWC811	ABGR	4	62.5	78.5	69.3
CWC812	ABGR	8	35.8	165.1	89.5
	PIEN	2	63.3	68.0	65.7
	PSME	3	58.9	89.9	75.7
CWF311	ABGR	44	26.1	90.5	58.6
	LAOC	6	49.4	65.7	59.5

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
	PICO	2	72.8	73.2	73.0
	PIEN	3	56.3	63.0	58.9
	PIPO	3	88.0	112.6	103.6
	PSME	23	48.7	76.2	59.8
CWF312	ABGR	80	13.4	122.8	56.1
	LAOC	30	32.8	93.8	58.0
	PICO	7	56.7	85.1	72.4
	PIEN	22	26.1	68.0	53.4
	PIPO	8	54.7	108.0	92.1
	PSME	38	47.0	76.5	61.8
CWF421	ABGR	112	17.6	153.2	74.0
	LAOC	15	54.3	105.6	78.5
	PICO	5	68.2	104.0	80.8
	PIEN	24	39.4	100.9	72.2
	PIMO	2	29.6	49.6	39.6
	PIPO	4	94.9	125.5	111.4
	PSME	28	50.9	82.4	69.4
CWF422	ABGR	27	41.3	164.8	77.8
	LAOC	3	76.8	84.7	81.6
	PIEN	6	64.6	97.4	75.9
	PSME	11	46.9	96.6	73.3
CWF512	ABGR	8	55.6	106.8	79.4
	PSME	4	68.0	81.4	74.9
CWF612	ABGR	5	48.1	103.4	77.8
CWG1	ABGR	26	29.7	84.0	52.6
	PIEN	2	62.2	67.2	64.7
	PIPO	4	69.7	91.6	80.0
	PSME	15	40.5	87.1	61.9
CWG111	ABGR	259	14.2	101.0	49.7
	LAOC	25	42.0	93.3	63.9
	PICO	19	32.5	95.3	69.5
	PIEN	5	48.6	91.8	67.8
	PIPO	66	45.1	112.9	81.3
	PSME	100	25.0	83.6	55.5
CWG112	ABGR	97	20.9	91.9	56.1
	LAOC	2	39.9	69.6	54.8
	PIEN	3	58.9	91.6	74.9
	PIPO	20	65.3	108.2	89.9
	PSME	58	32.1	85.3	60.1
CWG113	ABGR	302	14.0	166.8	51.5
	LAOC	33	21.6	90.4	59.1

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
	PICO	2	75.6	75.7	75.7
	PIPO	81	42.6	111.3	80.3
	PSME	99	30.6	97.6	56.1
CWG211	ABGR	5	29.2	73.1	57.0
	ABLA2	2	52.4	56.9	54.7
CWS211	ABGR	89	20.9	105.4	60.5
	LAOC	2	64.3	104.0	84.2
	PICO	2	42.7	64.5	53.6
	PIEN	8	54.6	80.5	66.0
	PIPO	3	82.5	90.0	86.4
	PSME	28	35.5	79.1	65.8
CWS212	ABGR	46	10.3	139.7	59.5
	LAOC	22	17.5	93.0	57.1
	PICO	5	53.9	76.0	67.8
	PIEN	6	46.3	84.4	67.4
	PIPO	8	23.2	94.3	79.2
	PSME	22	47.6	73.4	60.8
CWS321	ABGR	31	26.9	97.4	64.5
	PICO	2	71.4	76.7	74.1
	PIPO	12	80.6	115.5	91.5
	PSME	11	47.6	74.1	57.9
CWS322	ABGR	32	19.5	81.1	49.1
	PICO	2	56.7	63.8	60.3
	PIPO	9	64.3	100.3	82.2
	PSME	23	42.7	84.2	57.2
CWS412	ABGR	45	34.6	102.9	64.6
	LAOC	1	78.5	78.5	78.5
	PIPO	3	98.8	116.9	107.4
	PSME	44	47.0	97.0	66.2
CWS541	ABGR	39	36.0	124.1	71.2
	PSME	16	53.3	89.6	69.8
CWS811	ABGR	68	12.8	115.3	47.6
	LAOC	30	29.4	90.9	60.9
	PICO	33	43.2	89.8	65.2
	PIEN	3	36.0	48.3	43.1
	PIPO	5	70.9	148.8	100.8
	PSME	20	41.9	76.3	59.3
CWS812	ABGR	28	24.1	106.8	56.4
	LAOC	22	26.9	74.5	55.5
	PICO	12	50.8	90.7	74.7
	PIEN	6	65.0	78.8	70.4

Ecoclass	Tree Species	Tree Count	Min Value	Max Value	Site Index (Feet)
	PIPO	2	80.7	81.3	81.0
	PSME	15	43.7	69.0	55.9
CWS912	ABGR	16	47.4	100.6	69.0
	LAOC	2	56.8	71.2	64.0
	PSME	14	26.8	78.9	66.8
TOTAL		6,509			

Sources/Notes: Ecoclass codes are used to record potential vegetation data on field forms and in computer databases; Blue Mountains Ecoclass codes are summarized in Powell et al. (2007), Hall 1998, and in appendix 1. Information in table 3 will help decipher alphanumeric acronyms (such as ABGR/LIBO2 for CWF311) for each Ecoclass code included in column 1. Tree species is an alphanumeric code derived from scientific genus and species names (PIPO for *Pinus ponderosa* or ponderosa pine); species codes were taken from original plant association field guides and they might not agree with contemporary coding from a national PLANTS database (USDA NRCS 2009). Tree count shows number of site trees for a given species and Ecoclass combination as provided from occasion 1 CVS plots for all three Blue Mountains national forests. Minimum and maximum values of calculated site index are provided in columns four and five. Mean value of calculated site index, in feet, is provided in column 6. Sources of equations used for site index calculations are provided in table 4.

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Appendix 1: Potential vegetation types (PVT) of the Blue Mountains section (from Powell et al. 2007)[1]

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
ABGR/ACGL	grand fir/Rocky Mountain maple	PA	CWS912	Warm Very Moist UF	Moist UF
ABGR/ACGL (FLOODPLAIN)	grand fir/Rocky Mountain maple (floodplain)	PA	CWS543	Warm Moderate SM RF	Moderate SM RF
ABGR/ACGL-PHMA	grand fir/Rocky Mountain maple-ninebark	PCT	CWS412	Warm Moist UF	Moist UF
ABGR/ARCO	grand fir/heartleaf arnica	PCT	CWF444	Cold Dry UF	Cold UF
ABGR/ATFI	grand fir/ladyfern	PA	CWF613	Warm High SM RF	High SM RF
ABGR/BRVU	grand fir/Columbia brome	PA	CWG211	Warm Moist UF	Moist UF
ABGR/CAGE	grand fir/elk sedge	PA	CWG111	Warm Dry UF	Dry UF
ABGR/CALA3	grand fir/woolly sedge	PC	CWM311	Warm High SM RF	High SM RF
ABGR/CARU	grand fir/pinegrass	PA	CWG112	Warm Dry UF	Dry UF
ABGR/CLUN	grand fir/queencup beadlily	PA	CWF421	Cool Moist UF	Moist UF
ABGR/COOC2	grand fir/goldthread	PA	CWF511	Cool Dry UF	Cold UF
ABGR/GYDR	grand fir/oakfern	PA	CWF611	Cool Very Moist UF	Moist UF
ABGR/LIBO2	grand fir/twinflower	PA	CWF311	Cool Moist UF	Moist UF
ABGR/POMU-ASCA3	grand fir/sword fern-ginger	PA	CWF612	Cool Very Moist UF	Moist UF
ABGR/SPBE	grand fir/birchleaf spiraea	PA	CWS321	Warm Dry UF	Dry UF
ABGR/SYAL (FLOODPLAIN)	grand fir/common snowberry (floodplain)	PCT	CWS314	Warm Low SM RF	Low SM RF
ABGR/TABR/CLUN	grand fir/Pacific yew/queencup beadlily	PA	CWC811	Cool Wet UF	Moist UF
ABGR/TABR/LIBO2	grand fir/Pacific yew/twinflower	PA	CWC812	Cool Wet UF	Moist UF
ABGR/TRCA3	grand fir/false bugbane	PA	CWF512	Cool Very Moist UF	Moist UF
ABGR/VAME	grand fir/big huckleberry	PA	CWS211	Cool Moist UF	Moist UF
ABGR/VASC	grand fir/grouse huckleberry	PA	CWS811	Cold Dry UF	Cold UF
ABGR/VASC-LIBO2	grand fir/grouse huckleberry-twinflower	PA	CWS812	Cool Moist UF	Moist UF
ABGR-CHNO/VAME	grand fir-Alaska yellow cedar/big huckleberry	PCT	CWS232	Cool Moist UF	Moist UF
ABLA2/ARCO	subalpine fir/heartleaf arnica	PCT	CEF412	Cool Moist UF	Moist UF
ABLA2/ATFI	subalpine fir/ladyfern	PA	CEF332	Cold High SM RF	High SM RF
ABLA2/CAAQ	subalpine fir/aquatic sedge	PCT	CEM123	Cold High SM RF	High SM RF
ABLA2/CACA	subalpine fir/bluejoint reedgrass	PA	CEM124	Cold Moderate SM RF	Moderate SM RF
ABLA2/CADI	subalpine fir/softleaved sedge	PCT	CEM122	Cold High SM RF	High SM RF
ABLA2/CAGE	subalpine fir/elk sedge	PA	CAG111	Cold Dry UF	Cold UF
ABLA2/CARU	subalpine fir/pinegrass	PCT	CEG312	Cool Dry UF	Cold UF
ABLA2/CLUN	subalpine fir/queencup beadlily	PA	CES131	Cool Moist UF	Moist UF
ABLA2/LIBO2	subalpine fir/twinflower	PA	CES414	Cool Moist UF	Moist UF
ABLA2/MEFE	subalpine fir/fool’s huckleberry	PA	CES221	Cold Moist UF	Cold UF
ABLA2/POPU	subalpine fir/skunkleaved polemonium	PCT	CEF411	Cold Dry UF	Cold UF
ABLA2/RHAL	subalpine fir/white rhododendron	PCT	CES214	Cold Moist UF	Cold UF
ABLA2/SETR	subalpine fir/arrowleaf groundsel	PA	CEF333	Cold High SM RF	High SM RF
ABLA2/STAM	subalpine fir/twisted stalk	PCT	CEF311	Cool Wet UF	Moist UF
ABLA2/STOC	subalpine fir/western needlegrass	PCT	CAG4	Cold Dry UF	Cold UF
ABLA2/TRCA3	subalpine fir/false bugbane	PA	CEF331	Cool Moist UF	Moist UF

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
ABLA2/VAME	subalpine fir/big huckleberry	PA	CES311	Cool Moist UF	Moist UF
ABLA2/VASC	subalpine fir/grouse huckleberry	PA	CES411	Cold Dry UF	Cold UF
ABLA2/VASC/POPU	subalpine fir/grouse huckleberry/skunkleaved polemonium	PA	CES415	Cold Dry UF	Cold UF
ABLA2/VAUL/CASC5	subalpine fir/bog blueberry/Holm's sedge	PCT	CEM313	Cold High SM RF	High SM RF
ABLA2-PIAL/JUDR	subalpine fir-whitebark pine/Drummond's rush	PCT	CAG3	Cold Dry UF	Cold UF
ABLA2-PIAL/POPH	subalpine fir-whitebark pine/fleeceflower	PCT	CAF2	Cold Dry UF	Cold UF
ABLA2-PIAL/POPU	subalpine fir-whitebark pine/skunkleaved polemonium	PCT	CAF0	Cold Dry UF	Cold UF
ADPE	maidenhair fern	PCT	FW4213	Warm High SM RH	High SM RH
AGDI	thin bentgrass	PCT	MD4111	Warm Low SM RH	Low SM RH
AGSP	bluebunch wheatgrass	PA	GB41	Hot Dry UH	Dry UH
AGSP-ERHE	bluebunch wheatgrass-Wyeth's buckwheat	PA	GB4111	Hot Dry UH	Dry UH
AGSP-POSA3	bluebunch wheatgrass-Sandberg's bluegrass	PA	GB4121	Hot Dry UH	Dry UH
AGSP-POSA3-ASCU4	bluebunch wheatgrass-Sandberg's bluegrass-Cusick's milkvetch	PA	GB4114	Hot Dry UH	Dry UH
AGSP-POSA3 (BASALT)	bluebunch wheatgrass-Sandberg's bluegrass (basalt)	PA	GB4113	Hot Dry UH	Dry UH
AGSP-POSA3-DAUN	bluebunch wheatgrass-Sandberg's bluegrass-onespike oatgrass	PA	GB4911	Hot Dry UH	Dry UH
AGSP-POSA3-ERPU	bluebunch wheatgrass-Sandberg's bluegrass-shaggy fleabane	PA	GB4115	Hot Dry UH	Dry UH
AGSP-POSA3 (GRANITE)	bluebunch wheatgrass-Sandberg's bluegrass (granite)	PA	GB4116	Hot Dry UH	Dry UH
AGSP-POSA3-OPPO	bluebunch wheatgrass-Sandberg's bluegrass-pricklypear	PA	GB4118	Hot Dry UH	Dry UH
AGSP-POSA3-PHCO2	bluebunch wheatgrass-Sandberg's bluegrass-Snake River phlox	PA	GB4117	Hot Dry UH	Dry UH
AGSP-POSA3-SCAN	bluebunch wheatgrass-Sandberg's bluegrass-narrowleaf skullcap	PA	GB4112	Hot Dry UH	Dry UH
AGSP-SPCR-ARLO3	bluebunch wheatgrass-sand dropseed-red threeawn	PCT	GB1911	Hot Dry UH	Dry UH
ALIN/ATFI	mountain alder/ladyfern	PA	SW2116	Warm High SM RS	High SM RS
ALIN/CAAM	mountain alder/bigleaved sedge	PA	SW2114	Warm High SM RS	High SM RS
ALIN/CAAQ	mountain alder/aquatic sedge	PC	SW2126	Warm High SM RS	High SM RS
ALIN/CACA	mountain alder/bluejoint reedgrass	PA	SW2121	Warm Moderate SM RS	Moderate SM RS
ALIN/CADE	mountain alder/Dewey's sedge	PCT	SW2118	Warm Moderate SM RS	Moderate SM RS
ALIN/CALA3	mountain alder/woolly sedge	PA	SW2123	Warm Moderate SM RS	Moderate SM RS
ALIN/CALEL2	mountain alder/densely tufted sedge	PC	SW2127	Warm Moderate SM RS	Moderate SM RS
ALIN/CALU	mountain alder/woodrush sedge	PC	SW2128	Warm Low SM RS	Low SM RS
ALIN/CAUT	mountain alder/bladder sedge	PA	SW2115	Warm High SM RS	High SM RS
ALIN/EQAR	mountain alder/common horsetail	PA	SW2117	Warm Moderate SM RS	Moderate SM RS
ALIN/GLEL	mountain alder/tall mannagrass	PA	SW2215	Warm High SM RS	High SM RS
ALIN/GYDR	mountain alder/oakfern	PCT	SW2125	Warm Moderate SM RS	Moderate SM RS
ALIN/HELA	mountain alder/common cowparsnip	PCT	SW2124	Warm Moderate SM RS	Moderate SM RS
ALIN/POPR	mountain alder/Kentucky bluegrass	PCT	SW2120	Warm Low SM RS	Low SM RS
ALIN/SCMI	mountain alder/smallfruit bulrush	PCT	SW2122	Warm High SM RS	High SM RS
ALIN-COST/MESIC FORB	mountain alder-redosier dogwood/mesic forb	PA	SW2216	Warm Moderate SM RS	Moderate SM RS
ALIN-RIBES/MESIC FORB	mountain alder-currants/mesic forb	PA	SW2217	Warm Moderate SM RS	Moderate SM RS
ALIN-SYAL	mountain alder-common snowberry	PA	SW2211	Warm Low SM RS	Low SM RS
ALPR	meadow foxtail	PCT	MD2111	Warm Low SM RH	Low SM RH

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
ALRU (ALLUVIAL BAR)	red alder (alluvial bar)	PCT	HAF226	Warm Moderate SM RF	Moderate SM RF
ALRU/ATFI	red alder/ladyfern	PCT	HAF227	Warm High SM RF	High SM RF
ALRU/COST	red alder/redosier dogwood	PC	HAS511	Warm Moderate SM RF	Moderate SM RF
ALRU/PEFRP	red alder/sweet coltsfoot	PCT	HAF211	Warm Moderate SM RF	Moderate SM RF
ALRU/PHCA3	red alder/Pacific ninebark	PA	HAS211	Warm Moderate SM RF	Moderate SM RF
ALRU/SYAL	red alder/common snowberry	PCT	HAS312	Warm Moderate SM RF	Moderate SM RF
ALSI	Sitka alder snow slides	PCT	SM20	Cold Very Moist US	Cold US
ALSI/ATFI	Sitka alder/ladyfern	PA	SW2111	Warm High SM RS	High SM RS
ALSI/CILA2	Sitka alder/drooping woodreed	PA	SW2112	Warm High SM RS	High SM RS
ALSI/MESIC FORB	Sitka alder/mesic forb	PCT	SW2113	Warm Moderate SM RS	Moderate SM RS
ALVA	swamp onion	PCT	FW7111	Cold High SM RH	High SM RH
AMAL	western serviceberry	PCT	SW3114	Hot Low SM RS	Low SM RS
ARAR/FEID-AGSP	low sagebrush/Idaho fescue-bluebunch wheatgrass	PA	SD1911	Warm Moist US	Moist US
ARAR/POSA3	low sagebrush/Sandberg’s bluegrass	PA	SD9221	Hot Dry US	Dry US
ARCA/DECE	silver sagebrush/tufted hairgrass	PA	SW6111	Hot Moderate SM RS	Moderate SM RS
ARCA/POCU	silver sagebrush/Cusick’s bluegrass	PCT	SW6114	Hot Low SM RS	Low SM RS
ARCA/POPR	silver sagebrush/Kentucky bluegrass	PCT	SW6112	Hot Low SM RS	Low SM RS
ARRI/POSA3	stiff sagebrush/Sandberg’s bluegrass	PCT	SD9111	Hot Dry US	Dry US
ARTRV/BRCA	mountain big sagebrush/mountain brome	PCT	SS4914	Warm Moist US	Moist US
ARTRV/CAGE	mountain big sagebrush/elk sedge	PA	SS4911	Cold Moist US	Cold US
ARTRV/FEID-AGSP	mountain big sagebrush/Idaho fescue-bluebunch wheatgrass	PA	SD2911	Warm Moist US	Moist US
ARTRV/POCU	mountain big sagebrush/Cusick’s bluegrass	PA	SW6113	Hot Low SM RS	Low SM RS
ARTRV/STOC	mountain big sagebrush/western needlegrass	PCT	SS4915	Cool Dry US	Cold US
ARTRV-PUTR/FEID	mountain big sagebrush-bitterbrush/Idaho fescue	PCT	SD2916	Hot Moist US	Moist US
ARTRV-SYOR/BRCA	mountain big sagebrush-mountain snowberry/mountain brome	PCT	SD2917	Warm Moist US	Moist US
BEOC/MESIC FORB	water birch/mesic forb	PCT	SW3112	Warm Moderate SM RS	Moderate SM RS
BEOC/WET SEDGE	water birch/wet sedge	PCT	SW3113	Warm High SM RS	High SM RS
CAAM	bigleaved sedge	PA	MM2921	Warm High SM RH	High SM RH
CAAQ	aquatic sedge	PA	MM2914	Warm High SM RH	High SM RH
CACA	bluejoint reedgrass	PA	GM4111	Warm Moderate SM RH	Moderate SM RH
CACA4	silvery sedge	PCT	MS3113	Warm Moderate SM RH	Moderate SM RH
CACU (SEEP)	Cusick’s camas (seep)	PCT	FW3911	Warm Very Moist UH	Moist UH
CACU2	Cusick’s sedge	PA	MM2918	Warm High SM RH	High SM RH
CAGE (ALPINE)	elk sedge (alpine)	PCT	GS3911	Cold Dry UH	Cold UH
CAGE (UPLAND)	elk sedge (upland)	PCT	GS39	Cool Dry UH	Cold UH
CAHO	Hood’s sedge	PCT	GS3912	Cool Moist UH	Cold UH
CALA	smoothstemmed sedge	PC	MW2913	Cold High SM RH	High SM RH
CALA3	woolly sedge	PA	MM2911	Warm Moderate SM RH	Moderate SM RH
CALA4	slender sedge	PC	MM2920	Warm High SM RH	High SM RH
CALEL2	densely tufted sedge	PA	MM2919	Warm Moderate SM RH	Moderate SM RH

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
CALU	woodrush sedge	PA	MM2916	Cold High SM RH	High SM RH
CAMU2	star sedge	PCT	MS3112	Warm Moderate SM RH	Moderate SM RH
CANE	Nebraska sedge	PCT	MM2912	Hot Moderate SM RH	Moderate SM RH
CANU4	torrent sedge	PCT	MM2922	Hot High SM RH	High SM RH
CAPR5	clustered field sedge	PCT	MW2912	Cold High SM RH	High SM RH
CASC5	Holm's sedge	PA	MS3111	Cold High SM RH	High SM RH
CASH	Sheldon's sedge	PCT	MM2932	Hot Moderate SM RH	Moderate SM RH
CASI2	shortbeaked sedge	PCT	MM2915	Warm High SM RH	High SM RH
CAST	sawbeak sedge	PCT	MW1926	Warm High SM RH	High SM RH
CAUT	bladder sedge	PA	MM2917	Warm High SM RH	High SM RH
CAVEV	inflated sedge	PA	MW1923	Warm High SM RH	High SM RH
CELE/CAGE	mountain mahogany/elk sedge	PCT	SD40	Hot Moist US	Moist US
CELE/FEID-AGSP	mountain mahogany/Idaho fescue-bluebunch wheatgrass	PA	SD4111	Hot Moist US	Moist US
CERE2/AGSP	netleaf hackberry/bluebunch wheatgrass	PA	SD5611	Hot Moist US	Moist US
CEVE	snowbrush ceanothus	PCT	SM33	Warm Moist US	Moist US
CILA2	drooping woodreed	PC	MW2927	Cold High SM RH	High SM RH
COST	redosier dogwood	PA	SW5112	Hot Moderate SM RS	Moderate SM RS
COST/SAAR4	redosier dogwood/brook saxifrage	PCT	SW5118	Warm High SM RS	High SM RS
CRDO	Douglas hawthorne	PCT	SW3111	Hot Low SM RS	Low SM RS
DECE	tufted hairgrass	PA	MM1912	Warm Moderate SM RH	Moderate SM RH
ELBE	delicate spikerush	PC	MS4111	Cold High SM RH	High SM RH
ELCI	basin wildrye	PA	GB7111	Hot Very Moist UH	Moist UH
ELPA	creeping spikerush	PA	MW4912	Hot High SM RH	High SM RH
ELPA2	fewflowered spikerush	PCT	MW4911	Cold High SM RH	High SM RH
EQAR	common horsetail	PA	FW4212	Warm Moderate SM RH	Moderate SM RH
ERDO-POSA3	Douglas buckwheat/Sandberg's bluegrass	PCT	FM9111	Hot Dry UH	Dry UH
ERIOG/PHOR	buckwheat/Oregon bladderpod	PA	SD9322	Hot Dry UH	Dry UH
ERST2-POSA3	strict buckwheat/Sandberg's bluegrass	PCT	FM9112	Hot Dry UH	Dry UH
ERUM (RIDGE)	sulphurflower (ridge)	PCT	FM9113	Hot Dry UH	Dry UH
FEID (ALPINE)	Idaho fescue (alpine)	PCT	GS12	Cold Moist UH	Cold UH
FEID-AGSP	Idaho fescue-bluebunch wheatgrass	PA	GB59	Warm Moist UH	Moist UH
FEID-AGSP (RIDGE)	Idaho fescue-bluebunch wheatgrass (ridge)	PCT	GB5915	Warm Moist UH	Moist UH
FEID-AGSP-BASA	Idaho fescue-bluebunch wheatgrass-balsamroot	PA	GB5917	Warm Moist UH	Moist UH
FEID-AGSP-LUSE	Idaho fescue-bluebunch wheatgrass-silky lupine	PA	GB5916	Warm Moist UH	Moist UH
FEID-AGSP-PHCO2	Idaho fescue-bluebunch wheatgrass-Snake River phlox	PA	GB5918	Warm Moist UH	Moist UH
FEID-CAGE	Idaho fescue-elk sedge	PCT	GB5922	Warm Moist UH	Moist UH
FEID-CAHO	Idaho fescue-Hood's sedge	PA	GB5921	Warm Moist UH	Moist UH
FEID-DAIN-CAREX	Idaho fescue-timber oatgrass-sedge	PA	GB5920	Warm Very Moist UH	Moist UH
FEID-KOCR (HIGH)	Idaho fescue-prairie junegrass (high)	PA	GB5913	Cool Moist UH	Cold UH
FEID-KOCR (LOW)	Idaho fescue-prairie junegrass (low)	PA	GB5914	Warm Moist UH	Moist UH

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
FEID-KOCR (MOUND)	Idaho fescue-prairie junegrass (mound)	PA	GB5912	Cool Moist UH	Cold UH
FEID-KOCR (RIDGE)	Idaho fescue-prairie junegrass (ridge)	PA	GB5911	Cool Moist UH	Cold UH
FEVI	green fescue	PCT	GS11	Cold Moist UH	Cold UH
FEVI-CAHO	green fescue-Hood's sedge	PCT	GS1111	Cold Moist UH	Cold UH
FEVI-LULA2	green fescue-spurred lupine	PA	GS1112	Cold Moist UH	Cold UH
GLEL	tall mannagrass	PA	MM2925	Warm High SM RH	High SM RH
GLNE/AGSP	spiny greenbush/bluebunch wheatgrass	PA	SD65	Hot Dry US	Dry US
JUBA	Baltic rush	PCT	MW3912	Hot Moderate SM RH	Moderate SM RH
JUOC/ARAR	western juniper/low sagebrush	PCT	CJS1	Hot Dry UW	Dry UW
JUOC/ARRI	western juniper/stiff sagebrush	PCT	CJS8	Hot Dry UW	Dry UW
JUOC/ARTRV	western juniper/mountain big sagebrush	PCT	CJS2	Hot Moist UW	Moist UW
JUOC/ARTRV/FEID-AGSP	western juniper/mountain big sagebrush/fescue-wheatgrass	PA	CJS211	Hot Moist UW	Moist UW
JUOC/CELE/CAGE	western juniper/mountain mahogany/elk sedge	PCT	CJS42	Hot Moist UW	Moist UW
JUOC/CELE/FEID-AGSP	western juniper/mountain mahogany/fescue-wheatgrass	PCT	CJS41	Hot Moist UW	Moist UW
JUOC/FEID-AGSP	western juniper/Idaho fescue-bluebunch wheatgrass	PA	CJG111	Hot Moist UW	Moist UW
JUOC/PUTR/FEID-AGSP	western juniper/bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	CJS321	Hot Moist UW	Moist UW
LECOW	Wallowa Lewisia	PCT	FX4111	Hot Dry UH	Dry UH
METR	buckbean	PC	FW6111	Warm High SM RH	High SM RH
PERA3-SYOR	squaw apple-mountain snowberry	PCT	SD30	Hot Moist US	Moist US
PHLE2 (TALUS)	syringa bordered strips (talus)	PCT	NTS111	Hot Very Moist US	Moist US
PHMA-SYAL	ninebark-common snowberry	PA	SM1111	Warm Moist US	Moist US
PICO(ABGR)/ALSI	lodgepole pine(grand fir)/Sitka alder	PCT	CLS58	Cool Very Moist UF	Moist UF
PICO(ABGR)/ARNE	lodgepole pine(grand fir)/pinemat manzanita	PCT	CLS57	Cool Dry UF	Cold UF
PICO(ABGR)/CARU	lodgepole pine(grand fir)/pinegrass	PCT	CLG21	Cool Dry UF	Cold UF
PICO(ABGR)/LIBO2	lodgepole pine(grand fir)/twinflower	PCT	CLF211	Cool Moist UF	Moist UF
PICO(ABGR)/VAME	lodgepole pine(grand fir)/big huckleberry	PCT	CLS513	Cool Moist UF	Moist UF
PICO(ABGR)/VAME/CARU	lodgepole pine(grand fir)/big huckleberry/pinegrass	PCT	CLS512	Cool Moist UF	Moist UF
PICO(ABGR)/VAME/PTAQ	lodgepole pine(grand fir)/big huckleberry/bracken	PCT	CLS519	Cool Moist UF	Moist UF
PICO(ABGR)/VASC/CARU	lodgepole pine(grand fir)/grouse huckleberry/pinegrass	PCT	CLS417	Cold Dry UF	Cold UF
PICO(ABLA2)/CAGE	lodgepole pine(subalpine fir)/elk sedge	PCT	CLG322	Cold Dry UF	Cold UF
PICO(ABLA2)/STOC	lodgepole pine(subalpine fir)/western needlegrass	PCT	CLG11	Cold Dry UF	Cold UF
PICO(ABLA2)/VAME	lodgepole pine(subalpine fir)/big huckleberry	PCT	CLS514	Cool Moist UF	Moist UF
PICO(ABLA2)/VAME/CARU	lodgepole pine(subalpine fir)/big huckleberry/pinegrass	PCT	CLS516	Cool Moist UF	Moist UF
PICO(ABLA2)/VASC	lodgepole pine(subalpine fir)/grouse huckleberry	PCT	CLS418	Cold Dry UF	Cold UF
PICO(ABLA2)/VASC/POPU	lodgepole pine(subalpine fir)/grouse huckleberry/polemonium	PCT	CLS415	Cold Dry UF	Cold UF
PICO/ALIN/MESIC FORB	lodgepole pine/mountain alder/mesic forb	PC	CLM511	Cold Moderate SM RF	Moderate SM RF
PICO/CAAQ	lodgepole pine/aquatic sedge	PA	CLM114	Cold High SM RF	High SM RF
PICO/CACA	lodgepole pine/bluejoint reedgrass	PC	CLM117	Cold Moderate SM RF	Moderate SM RF
PICO/CALA3	lodgepole pine/woolly sedge	PC	CLM116	Cold Moderate SM RF	Moderate RF
PICO/CARU	lodgepole pine/pinegrass	PA	CLS416	Cool Dry UF	Cold UF

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
PICO/DECE	lodgepole pine/tufted hairgrass	PA	CLM115	Cold Moderate SM RF	Moderate SM RF
PICO/POPR	lodgepole pine/Kentucky bluegrass	PCT	CLM112	Cold Low SM RF	Low SM RF
PIEN/ATFI	Engelmann spruce/ladyfern	PCT	CEF334	Cold High SM RF	High SM RF
PIEN/BRVU	Engelmann spruce/Columbia brome	PCT	CEM125	Cold Low SM RF	Low SM RF
PIEN/CADI	Engelmann spruce/softleaved sedge	PA	CEM121	Cold High SM RF	High SM RF
PIEN/CILA2	Engelmann spruce/drooping woodreed	PC	CEM126	Cold Moderate SM RF	Moderate SM RF
PIEN/COST	Engelmann spruce/redosier dogwood	PA	CES511	Cold Moderate SM RF	Moderate SM RF
PIEN/EQAR	Engelmann spruce/common horsetail	PA	CEM211	Cold Moderate SM RF	Moderate SM RF
PIEN/SETR	Engelmann spruce/arrowleaf groundsel	PCT	CEF335	Cold High SM RF	High SM RF
PIMO/DECE	western white pine/tufted hairgrass	PCT	CQM111	Warm Moderate SM RF	Moderate SM RF
PIPO/AGSP	ponderosa pine/bluebunch wheatgrass	PA	CPG111	Hot Dry UF	Dry UF
PIPO/ARAR	ponderosa pine/low sagebrush	PCT	CPS61	Hot Moist UF	Dry UF
PIPO/ARTRV/CAGE	ponderosa pine/mountain big sagebrush/elk sedge	PCT	CPS132	Hot Dry UF	Dry UF
PIPO/ARTRV/FEID-AGSP	ponderosa pine/mountain big sagebrush/fescue-wheatgrass	PA	CPS131	Hot Dry UF	Dry UF
PIPO/CAGE	ponderosa pine/elk sedge	PA	CPG222	Warm Dry UF	Dry UF
PIPO/CARU	ponderosa pine/pinegrass	PA	CPG221	Warm Dry UF	Dry UF
PIPO/CELE/CAGE	ponderosa pine/mountain mahogany/elk sedge	PA	CPS232	Warm Dry UF	Dry UF
PIPO/CELE/FEID-AGSP	ponderosa pine/mountain mahogany/fescue-wheatgrass	PA	CPS234	Hot Dry UF	Dry UF
PIPO/CELE/PONE	ponderosa pine/mountain mahogany/Wheeler’s bluegrass	PA	CPS233	Hot Dry UF	Dry UF
PIPO/ELGL	ponderosa pine/blue wildrye	PA	CPM111	Warm Dry UF	Dry UF
PIPO/FEID	ponderosa pine/Idaho fescue	PA	CPG112	Hot Dry UF	Dry UF
PIPO/PERA3	ponderosa pine/squaw apple	PCT	CPS8	Hot Dry UF	Dry UF
PIPO/POPR	ponderosa pine/Kentucky bluegrass	PCT	CPM112	Hot Low SM RF	Low SM RF
PIPO/PUTR/AGSP	ponderosa pine/bitterbrush/bluebunch wheatgrass	PCT	CPS231	Hot Dry UF	Dry UF
PIPO/PUTR/CAGE	ponderosa pine/bitterbrush/elk sedge	PA	CPS222	Warm Dry UF	Dry UF
PIPO/PUTR/CARO	ponderosa pine/bitterbrush/Ross sedge	PA	CPS221	Warm Dry UF	Dry UF
PIPO/PUTR/FEID-AGSP	ponderosa pine/bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	CPS226	Hot Dry UF	Dry UF
PIPO/RHGL	ponderosa pine/sumac	PCT	CPS9	Hot Dry UF	Dry UF
PIPO/SPBE	ponderosa pine/birchleaf spiraea	PCT	CPS523	Warm Dry UF	Dry UF
PIPO/SYAL	ponderosa pine/common snowberry	PA	CPS522	Warm Dry UF	Dry UF
PIPO/SYAL (FLOODPLAIN)	ponderosa pine/common snowberry (floodplain)	PA	CPS511	Hot Low SM RF	Low SM RF
PIPO/SYOR	ponderosa pine/mountain snowberry	PA	CPS525	Warm Dry UF	Dry UF
POFR/DECE	shrubby cinquefoil/tufted hairgrass	PA	SW5113	Warm Moderate SM RS	Moderate SM RS
POFR/POPR	shrubby cinquefoil/Kentucky bluegrass	PCT	SW5114	Warm Low SM RS	Low SM RS
POPR (DEGEN BENCH)	Kentucky bluegrass (degenerated bench)	PCT	MD3112	Cool Moist UH	Cold UH
POPR (MEADOW)	Kentucky bluegrass (meadow)	PCT	MD3111	Warm Low SM RH	Low SM RH
POSA3-DAUN	Sandberg’s bluegrass-onespike oatgrass	PA	GB9111	Hot Dry UH	Dry UH
POTR/ALIN-COST	quaking aspen/mountain alder-redosier dogwood	PCT	HQS222	Warm Moderate SM RF	Moderate SM RF
POTR/ALIN-SYAL	quaking aspen/mountain alder-common snowberry	PCT	HQS223	Warm Moderate SM RF	Moderate SM RF
POTR/CAAQ	quaking aspen/aquatic sedge	PCT	HQM212	Warm High SM RF	High SM RF

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
POTR/CACA	quaking aspen/bluejoint reedgrass	PCT	HQM123	Warm Moderate SM RF	Moderate SM RF
POTR/CALA3	quaking aspen/woolly sedge	PA	HQM211	Warm Moderate SM RF	Moderate SM RF
POTR/MESIC FORB	quaking aspen/mesic forb	PCT	HQM511	Warm Moderate SM RF	Moderate SM RF
POTR/POPR	quaking aspen/Kentucky bluegrass	PCT	HQM122	Hot Low SM RF	Low SM RF
POTR/SYAL	quaking aspen/common snowberry	PCT	HQS221	Hot Moderate SM RF	Moderate SM RF
POTR2/ACGL	black cottonwood/Rocky Mountain maple	PCT	HCS114	Warm Moderate SM RF	Moderate SM RF
POTR2/ALIN-COST	black cottonwood/mountain alder-redosier dogwood	PA	HCS113	Warm Moderate SM RF	Moderate SM RF
POTR2/SALA2	black cottonwood/Pacific willow	PA	HCS112	Hot Moderate SM RF	Moderate SM RF
POTR2/SYAL	black cottonwood/common snowberry	PCT	HCS311	Hot Moderate SM RF	Moderate SM RF
PSME/ACGL-PHMA	Douglas-fir/Rocky Mountain maple-mallow ninebark	PA	CDS722	Warm Moist UF	Moist UF
PSME/ACGL-PHMA (FLOODPLAIN)	Douglas-fir/Rocky Mountain maple-mallow ninebark (floodplain)	PA	CDS724	Warm Moderate SM RF	Moderate SM RF
PSME/CAGE	Douglas-fir/elk sedge	PA	CDG111	Warm Dry UF	Dry UF
PSME/CARU	Douglas-fir/pinegrass	PA	CDG121	Warm Dry UF	Dry UF
PSME/CELE/CAGE	Douglas-fir/mountain mahogany/elk sedge	PCT	CDSD	Warm Dry UF	Dry UF
PSME/HODI	Douglas-fir/oceanspray	PA	CDS611	Warm Moist UF	Moist UF
PSME/PHMA	Douglas-fir/ninebark	PA	CDS711	Warm Dry UF	Dry UF
PSME/SPBE	Douglas-fir/birchleaf spiraea	PA	CDS634	Warm Dry UF	Dry UF
PSME/SYAL	Douglas-fir/common snowberry	PA	CDS622	Warm Dry UF	Dry UF
PSME/SYAL (FLOODPLAIN)	Douglas-fir/common snowberry (floodplain)	PA	CDS628	Warm Low SM RF	Low SM RF
PSME/SYOR	Douglas-fir/mountain snowberry	PA	CDS625	Warm Dry UF	Dry UF
PSME/TRCA3	Douglas-fir/false bugbane	PCT	CDF313	Warm Moderate SM RF	Moderate SM RF
PSME/VAME	Douglas-fir/big huckleberry	PA	CDS812	Warm Dry UF	Dry UF
PUPA	weak alkaligrass	PA	MM2926	Warm High SM RH	High SM RH
PUTR/AGSP	bitterbrush/bluebunch wheatgrass	PA	SD3112	Hot Moist US	Moist US
PUTR/FEID-AGSP	bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	SD3111	Warm Moist US	Moist US
RHAL2/MESIC FORB	alderleaved buckthorn/mesic forb	PCT	SW5117	Warm Moderate SM RS	Moderate SM RS
RHGL/AGSP	smooth sumac/bluebunch wheatgrass	PA	SD6121	Hot Dry US	Dry US
RIBES/CILA2	currants/drooping woodreed	PCT	SW5111	Warm High SM RS	High SM RS
RIBES/GLEL	currants/tall mannagrass	PCT	SW5116	Warm High SM RS	High SM RS
RIBES/MESIC FORB	currants/mesic forb	PCT	SW5115	Warm Moderate SM RS	Moderate SM RS
SAAR4	brook saxifrage	PCT	FW6113	Warm High SM RH	High SM RH
SACO2/CAPR5	undergreen willow/clustered field sedge	PC	SW1128	Cold High SM RS	High SM RS
SACO2/CASC5	undergreen willow/Holm's sedge	PA	SW1121	Cold High SM RS	High SM RS
SACO2/CAUT	undergreen willow/bladder sedge	PCT	SW1127	Cold High SM RS	High SM RS
SAEA-SATW/CAAQ	Eastwood willow-Tweedy willow/aquatic sedge	PC	SW1129	Warm High SM RS	High SM RS
SAEX	coyote willow	PA	SW1117	Hot Moderate SM RS	Moderate SM RS
SALIX/CAAQ	willow/aquatic sedge	PA	SW1114	Warm High SM RS	High SM RS
SALIX/CACA	willow/bluejoint reedgrass	PC	SW1124	Warm Moderate SM RS	Moderate SM RS
SALIX/CALA3	willow/woolly sedge	PA	SW1112	Warm Moderate SM RS	Moderate SM RS
SALIX/CAUT	willow/bladder sedge	PA	SW1123	Warm High SM RS	High SM RS

PVT CODE	PVT COMMON NAME	STATUS	ECOCLASS	PAG	PVG
SALIX/MESIC FORB	willow/mesic forb	PCT	SW1125	Warm Moderate SM RS	Moderate SM RS
SALIX/POPR	willow/Kentucky bluegrass	PCT	SW1111	Warm Low SM RS	Low SM RS
SARI	rigid willow	PCT	SW1126	Hot Moderate SM RS	Moderate SM RS
SASC/ELGL	Scouler willow/blue wildrye	PC	SW1130	Cool Moist US	Cold US
SCMI	smallfruit bulrush	PA	MM2924	Warm High SM RH	High SM RH
SETR	arrowleaf groundsel	PA	FW4211	Warm High SM RH	High SM RH
SPCR (RIVER TERRACE)	sand dropseed (river terrace)	PA	GB1211	Hot Dry UH	Dry UH
STOC	western needlegrass	PCT	GS10	Cool Moist UH	Cold UH
SYAL/FEID-AGSP-LUSE	common snowberry/fescue-wheatgrass-silky lupine	PCT	GB5121	Warm Moist US	Moist US
SYAL/FEID-KOCR	common snowberry/Idaho fescue-prairie junegrass	PCT	GB5919	Warm Moist US	Moist US
SYAL-ROSA	common snowberry-rose	PCT	SM3111	Warm Moist US	Moist US
SYOR	mountain snowberry	PCT	SM32	Warm Moist US	Moist US
TSME/VAME	mountain hemlock/big huckleberry	PA	CMS231	Cold Dry UF	Cold UF
TSME/VASC	mountain hemlock/grouse huckleberry	PA	CMS131	Cold Dry UF	Cold UF
TYLA	common cattail	PCT	MT8121	Hot High SM RH	High SM RH
VEAM	American speedwell	PA	FW6112	Warm High SM RH	High SM RH
VERAT	false hellebore	PC	FW5121	Warm Moderate SM RH	Moderate SM RH

[1] This appendix is organized alphabetically by PVT code. Column descriptions are:

PVT CODE provides an alphanumeric code for each of 296 potential vegetation types described for Blue Mountains section.

PVT COMMON NAME provides a common name for each potential vegetation type.

STATUS provides classification status of each potential vegetation type: PA is Plant Association; PCT is Plant Community Type; PC is Plant Community.

ECOCLASS codes are used to record potential vegetation type determinations.

PAG (Plant Association Group) and PVG (Potential Vegetation Group) are two levels of a mid-scale potential vegetation hierarchy; PAG and PVG codes use the following abbreviations: SM is Soil Moisture, UF is Upland Forest physiognomic class, UW is Upland Woodland physiognomic class, US is Upland Shrubland physiognomic class, UH is Upland Herbland physiognomic class, RF is Riparian Forest physiognomic class, RS is Riparian Shrubland physiognomic class, and RH is Riparian Herbland physiognomic class.

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 level, 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 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: minor formatting and editing changes were made; an appendix was added describing a white paper system, including a list of available white papers.