WHITE PAPER

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Stand Density Conditions for Umatilla National Forest: A Range of Variation Analysis

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INTRODUCTION

Umatilla National Forest adopted a program-of-work (POW) process in February 2013 involving three criteria:

1. Values at risk, including human infrastructure (Johnson 2013).
2. Subwatersheds where existing stand density exceeds a range of variation for stand density.
3. Unique habitats such as old-growth forests, aspen clones, riparian habitat conservation areas, and meadows (Archuleta 2013).

This white paper describes a process used to assess stand density conditions for Umatilla National Forest. A Forest-wide, stand-density assessment was completed to meet project planning needs associated with criterion #2 of a POW process.

This assessment uses an analytical technique called the range of variation (RV), defined as a range of conditions likely to have occurred in the Blue Mountains prior to Euro-American settlement in mid-1800s.

A white paper (WP Silv-3) provides concepts, principles, and methods relating to range of variation (Powell 2019) – that white paper provides more information about RV.

Briefly, a stand-density assessment involved 4 steps: (1) compiling a dataset characterizing stand density conditions for Umatilla NF, (2) stratifying density data by biophysical environment, (3) completing an RV analysis by using subwatersheds as landscape units, and (4) summarizing results while also accounting for land-use restrictions.

[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.

METHODS

A stand-density assessment was completed for the entire Umatilla National Forest by using an 8-step process.

1. Most Similar Neighbor (MSN) imputation (Crookston et al. 2002) was used to prepare two datasets, one for Heppner and North Fork John Day ranger districts, combined (south end), and a second for Pomeroy and Walla Walla ranger districts, combined (north end).
   [Note that MSN uses canonical correlation analysis to derive a similarity function, and then selects a most similar stand by comparing detailed attributes (local variables) and lower-resolution indicator attributes (global variables). A most similar stand is selected by using a similarity function to maintain multivariate relationships between global and local variables (Crookston et al. 2002, Moeur and Stage 1995, Stage and Crookston 2007).]

2. MSN datasets include an estimate of potential vegetation for each polygon, whether forested or not. Potential vegetation is recorded by using an ecoclass code, which designates a plant association, plant community type, or plant community assigned to a polygon (collectively, these three units are referred to as potential vegetation types). More than 500 potential vegetation types have been described for the Blue Mountains since early 1970s (Powell et al. 2007).
   [Potential vegetation (PV) functions as a biophysical template because it reflects an integrated influence of geology, soils, and climate on vegetation conditions. PV indicates a site's 'carrying capacity' for stand density – moist sites have ecological capacity to support more tree density than dry sites. PV also controls the rate at which forests produce and accumulate density (biomass) – how fast existing trees grow, and how quickly new trees get established.]

3. Since potential vegetation controls how much stand density can be sustained on a biophysical environment, an Ecoclass code is used to assign each forest polygon to a potential vegetation group (PVG). Appendix 1 provides cross-walk tables showing how PVG assignments are made. At the conclusion of this step, *a forest polygon is assigned to one, and only one, of three biophysical environments (PVGs)*: Dry Upland Forest, Moist Upland Forest, or Cold Upland Forest.
   [PVGs are used as biophysical environments for analyses described in this white paper. PVGs are used for stratification because criteria for assessing stand density status, for each forest polygon, vary by PVG, as described in item 4.]

4. MSN data provides an estimate of stand density index (SDI) for each forest polygon.
   [Note that information in MSN datasets used for these analyses are assumed to reflect vegetation conditions for the Umatilla NF as of mid-2012.]
   SDI information is used to assign each forest polygon to one of three stand density classes – high, moderate, or low.
   As described for step 3, SDI ranges associated with three stand-density classes vary with PVG, and they are shown below in table 1.

Table 1: Stand density index ranges for three stand density classes, and varying with PVG.

	SDI by Stand Density Class		
PVG	**Low**	**Moderate**	**High**
Dry UF	< 81	81-121	> 121
Moist UF	< 163	163-244	> 244
Cold UF	< 132	132-197	> 197

Sources/Notes: SDI, stand density index, expresses a relationship between number of trees per acre and quadratic mean diameter (QMD). SDI is indexed to a QMD of 10 inches (Reineke 1933). PVG is potential vegetation group (Powell et al. 2007). UF is upland forest, a physiognomic class (Powell et al. 2007).

In table 1, threshold values separating low, moderate, and high stand density classes correspond to important stand-development benchmarks.

a. SDI values associated with a low stand-density class (e.g., 81, 163, and 132) are referred to as a 'lower limit of full site occupancy' (Long 1985; figure 1) or a 'lower limit of management zone' (LLMZ) (Cochran et al. 1994, Powell 1999).
b. SDI values associated with a high stand-density class (e.g., 121, 244, and 197) are referred to as a 'lower limit of self-thinning zone' (Long 1985; figure 1) or an 'upper limit of management zone' (ULMZ) (Cochran et al. 1994, Powell 1999).

Stand density thresholds are described in figure 1.

5. Stocking capacity varies not only with PVG, but with tree species. SDI values in an 'SDI by Stand Density Class' (table 1 above) are average stocking levels representing a mixed species composition for each PVG, as follows (Powell 2013):
Dry UF: 70% ponderosa pine; 20% Douglas-fir; 10% grand fir.
Moist UF: 30% Douglas-fir; 20% western larch; 20% lodgepole pine; 30% grand fir.
Cold UF: 10% Douglas-fir; 10% western larch; 50% lodgepole pine; 20% Engelmann spruce; 10% subalpine fir.

   Mixed-species calculation methodology: the Dry UF SDI value for low stand-density class, in table 1, is 81; this value is a weighted average where 70% of an LLMZ SDI value for ponderosa pine for Dry UF PVG sites, is added to 20% of an LLMZ SDI value for Douglas-fir for Dry UF PVG sites, and this result is added to 10% of an LLMZ SDI value for grand fir for Dry UF PVG sites.

   Note: Mathematical calculations, by tree species, for each PVG utilized potential vegetation type (PVT)-based SDI values for PVTs assigned to a PVG (see Powell et al. 2007) and *associated with the Umatilla NF* (see Powell 1999). PVT assignments to PVG are exclusive – each PVT occurring in Blue and Ochoco Mountains (Johnson and Clausnitzer 1992) is assigned to one, and only one, PVG.

   SDI averages by PVG and stocking level (such as LLMZ or ULMZ) can vary by geographical scope (Umatilla NF vs. whole Blues) or stand structure (even-aged, etc.).

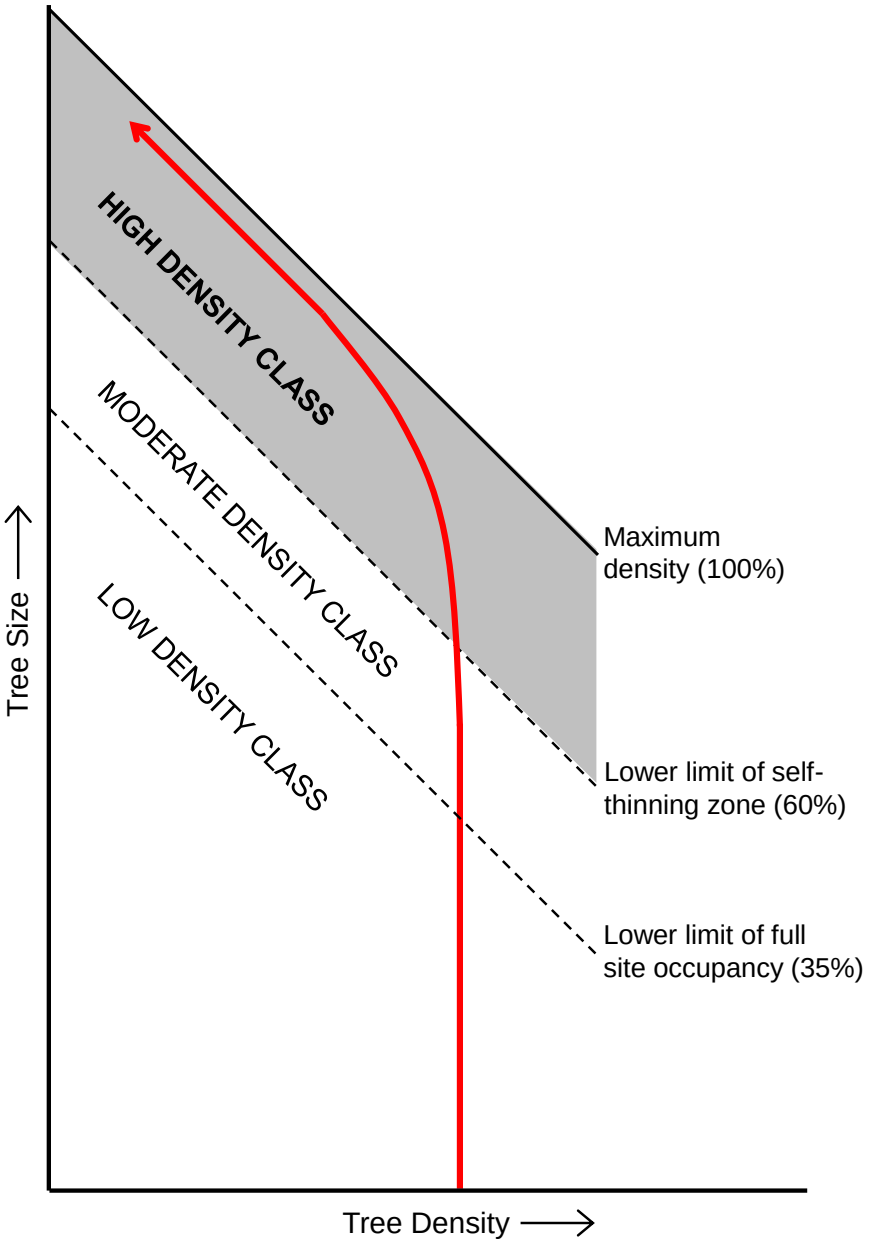

Figure 1 – Generalized stand development trajectory for an even-aged forest stand, with maximum density used as a reference level. Stand density levels below the lower limit of full site occupancy are assumed to be low, so this threshold value is used to establish an upper limit for a low stand density class (table 1). Stand density levels between the lower limit of full site occupancy and the lower limit of a self-thinning zone are assumed to be moderate, so these threshold values are used to establish upper and lower limits of a moderate stand density class. Stand density levels above the lower limit of a self-thinning zone are assumed to be high, so this threshold value is used to establish the lower limit of a high stand density class. Gray shading shows a self-thinning zone where trees experience full effects of intertree competition; in a self-thinning zone, a tree can only increase in size after neighboring trees relinquish their growing space by dying. Maximum density is shown as a solid line because it is an absolute value; tree growth bends sharply to the left because a maximum density threshold will not be breached during stand development.

6. *Historically, each upland-forest PVG supported differing amounts of each stand density class*. Not all lands assigned to the Dry UF PVG, for example, were in a low-density condition at one time – some areas supported moderate levels of stand density, and others supported low or high levels.

   The amount of variation in stand density condition depends on disturbance history and forest succession processes – dry-forest areas recently thinned by surface fire or western pine beetle had low or moderate density; other areas 'skipped' by these agents had moderate or high density.

   Historical proportions of a large landscape (at least 15,000-35,000 acres in size) occupied by each stand density class (low, moderate, high) is provided in table 2 (Martin 2010); note that ranges differ by PVG, just as SDI and tree species composition varied by PVG (items 4 and 5).

Table 2: Range of variation (RV) percentages for three stand density classes and varying with PVG.

	RV Percent by Stand Density Class		
PVG	**Low**	**Moderate**	**High**
Dry UF	40-85%	15-30%	5-15%
Moist UF	20-40%	25-60%	15-30%
Cold UF	15-30%	20-40%	25-60%

Sources/Notes: 'RV Percent' values show how much of each PVG would have supported each stand density class, as a range of percentages, for large landscapes (at least 15,000-35,000 acres) believed to be in synchrony with their historical disturbance regime. PVG is potential vegetation group. UF is upland forest, a physiognomic class (see Powell et al. 2007).

7. As described for item 6, *an RV analysis needs to be completed for a large landscape*, which is defined as an area of 15,000 to 35,000 acres (but areas larger than 35,000 acres are acceptable, and preferred, for an RV analysis).

   For analysis described in this white paper, a hydrologic unit called subwatershed is used as a landscape unit. Only National Forest System (NFS) lands (lands administered by USDA Forest Service) within a subwatershed are included.

   A total of 161 subwatersheds occur within Umatilla NF's proclaimed boundary, in whole or in part, and they are included in the analysis. These subwatersheds contain approximately 1,403,466 NFS acres, with individual subwatersheds ranging from a minimum of 1.4 acres of NFS lands (Pow Wah Kee Gulch) to a maximum of 30,038 acres of NFS lands (North Fork Meacham Creek).

   Umatilla NF has a letter directing how an RV analysis is to be conducted (Martin 2010); it refers analysts to a white paper (see Powell 2019) for specifics not provided in the letter. The white paper states that if less than 1,000 acres of a biophysical environment (PVG) occurs in an analysis area, then the biophysical environment is to be ignored, and an RV analysis is not to be completed for it.

This ‘minimum acreage’ requirement is followed for stand density RV analysis – if less than 1,000 acres of Cold UF, Moist UF, or Dry UF occurs in a subwatershed, individually, then an RV analysis is not completed for that PVG.

But note that each PVG stands on its own – if a subwatershed has more than 1,000 acres of Moist UF and Dry UF, individually, and less than 1,000 acres of Cold UF, then Moist UF and Dry UF acreages are included in an RV analysis, whereas Cold UF acreage in that subwatershed is ignored.

8. Not all forested land within Umatilla National Forest is available for timber management – some areas are reserved from timber harvest (such as wilderness areas, and Forest Plan management allocations (USDA Forest Service 1990) that did not authorize timber harvest), while other areas have restrictions limiting timber harvest (such as roadless areas and riparian habitat conservation areas).

   One concern about stand density is whether opportunities exist to utilize active management practices to reduce density when a density class (particularly the high-density class) exceeds its range of variation.

   Mechanical, density-management treatments that must be implemented with a timber sale contract (because trees to be removed are too large to safely kill with prescribed fire) cannot be accomplished for reserved or restricted portions of the Forest’s land base, or they cannot be implemented without amending the Forest Plan.

   Land-use categories, and their influence on whether density-management treatments can be implemented to address high stand-density conditions on the Forest, are provided in table 3 on the next page.

Methods Maps. Maps displaying some items described in this Methods section are provided next. Figures 2 and 3 are maps displaying distribution of land-use designations/categories for Umatilla National Forest, as described in table 3; figure 2 pertains to north end of the Forest, and figure 3 relates to south end of the Forest.

Figure 4 is a map displaying distribution of potential vegetation groups (PVGs) for Umatilla National Forest; PVGs are discussed throughout this Methods section because they are an integral analysis factor.

Figure 5 is a map displaying distribution of roadless and Wilderness areas for Umatilla National Forest; roadless areas are a primary Restricted land-use category for the Forest, and Wilderness areas are a primary Reserves land-use category for the Forest.

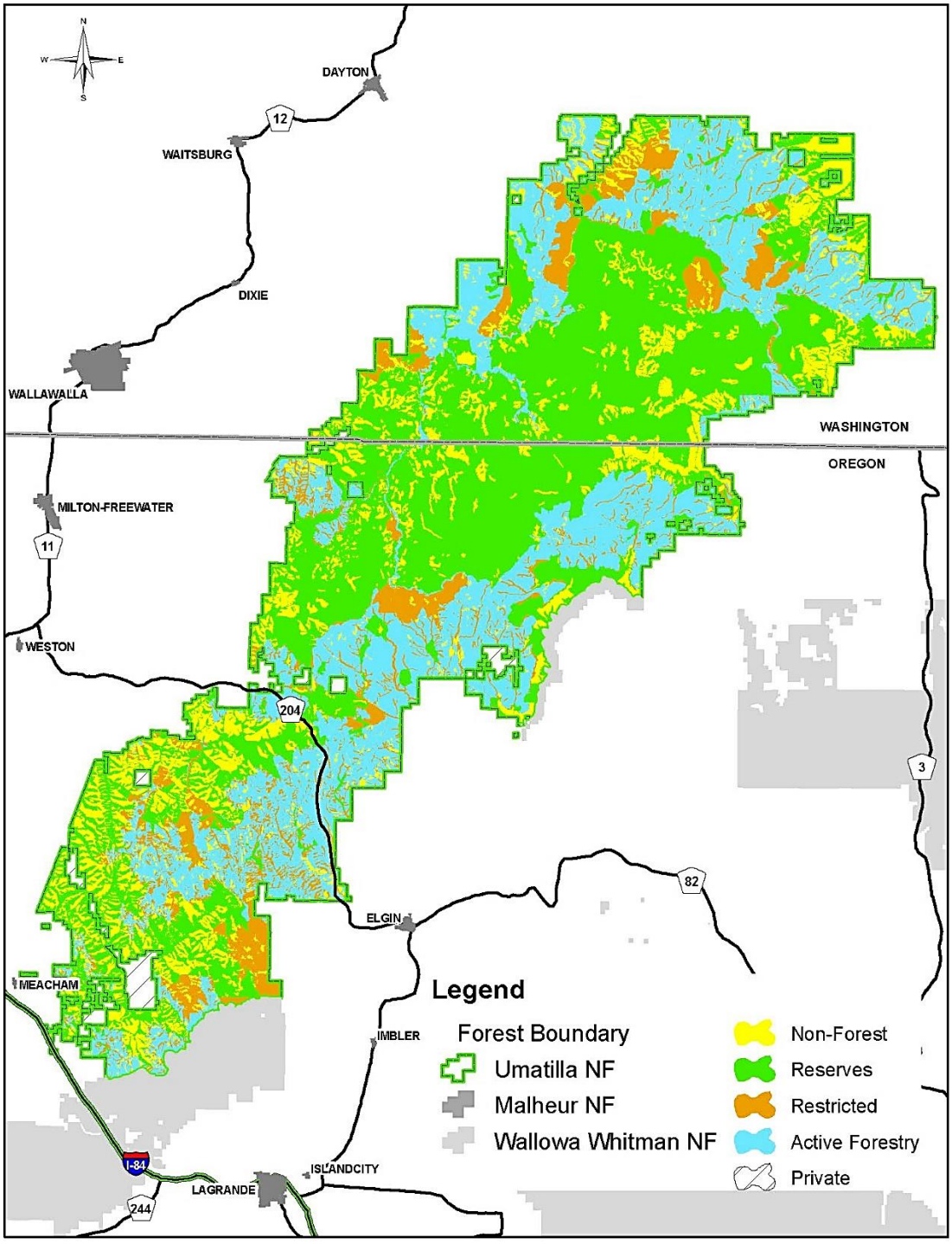

Figure 2 – Distribution of land-use categories for north end of the Umatilla National Forest. Land-use categories, and how they were determined, are explained in a Methods section of this white paper, and in Table 3.

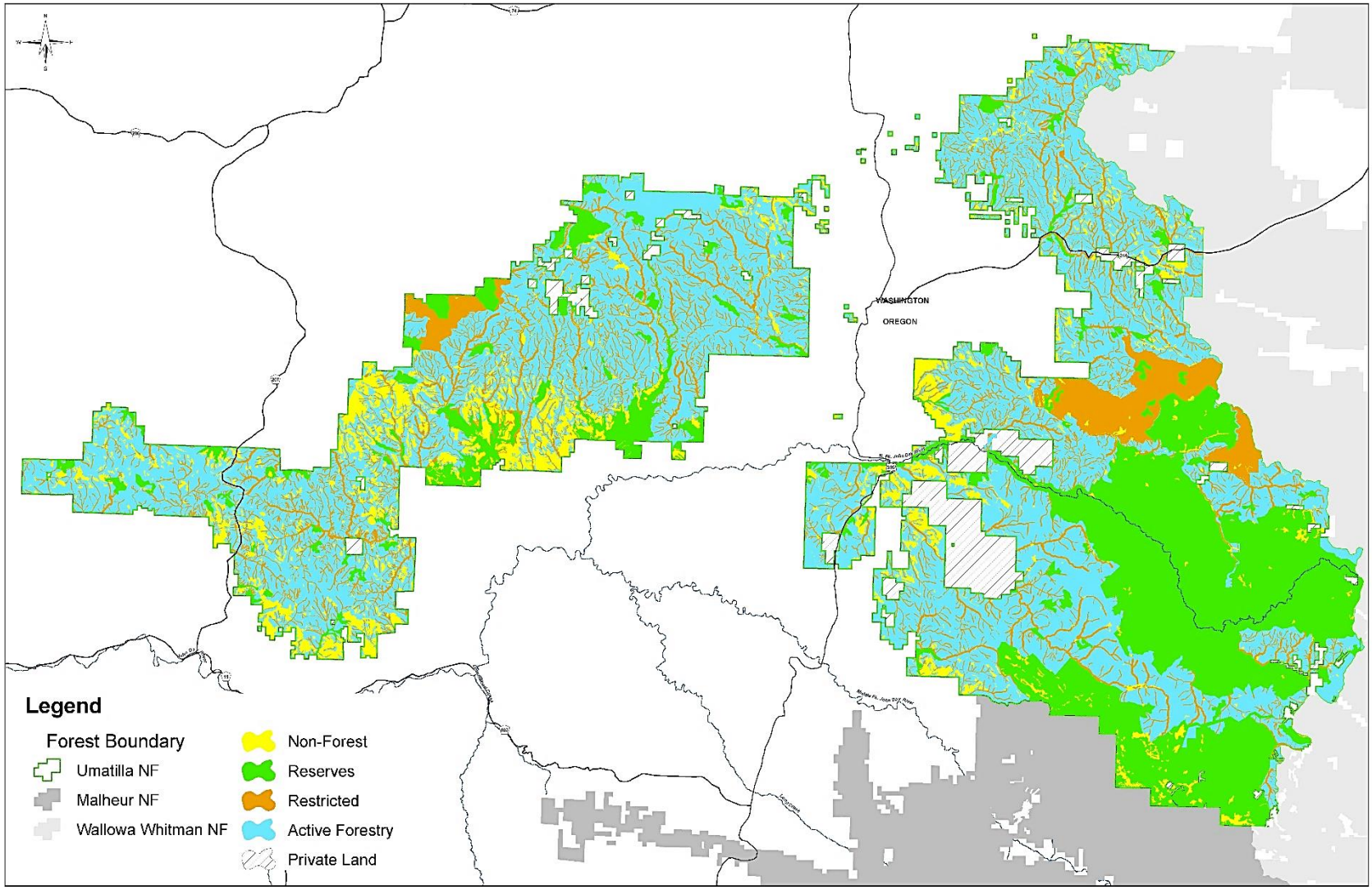

Figure 3 – Distribution of land-use categories for south end of Umatilla National Forest. Land-use categories, and how they were determined, are explained in a Methods section of this white paper, and in Table 3.

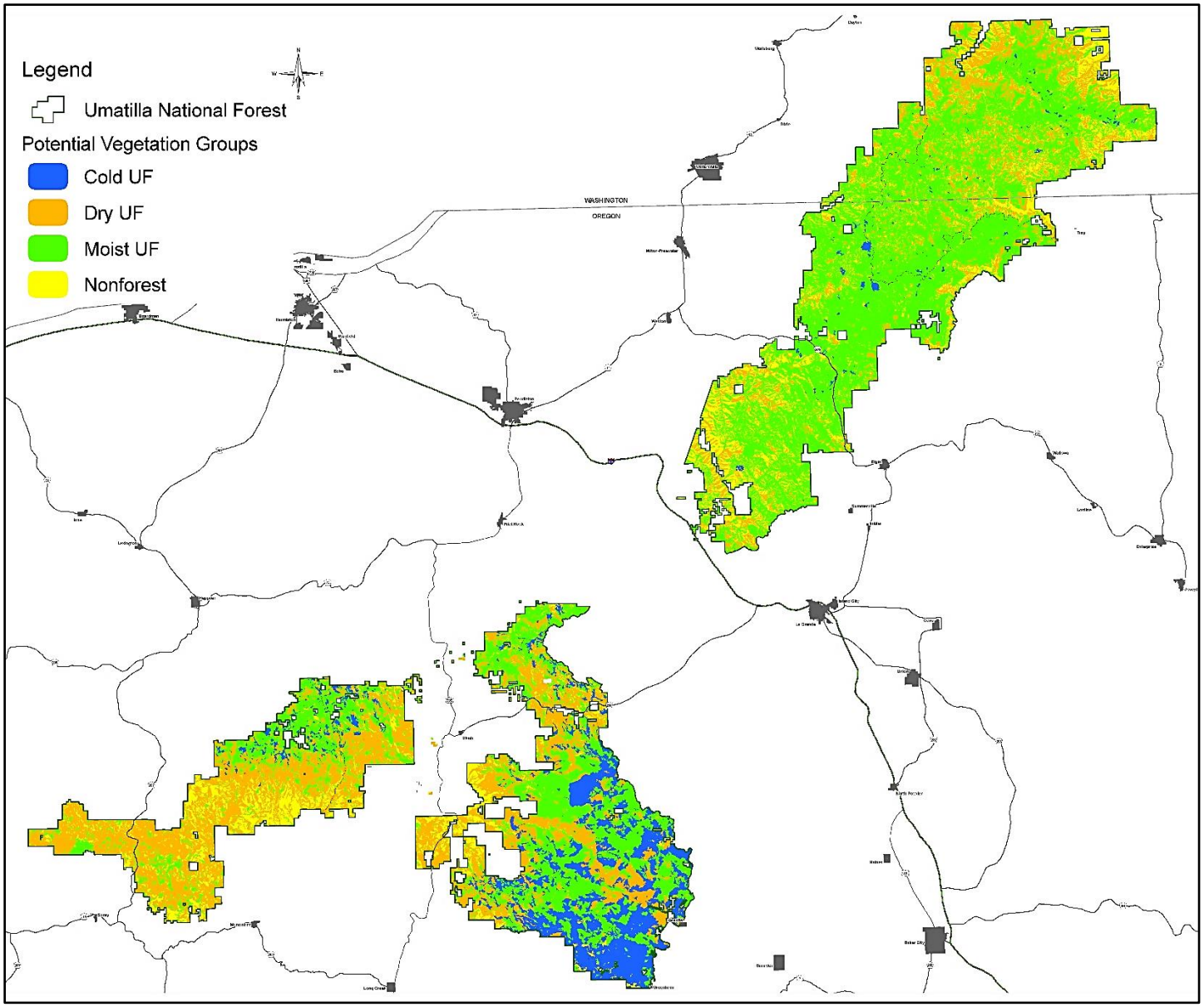

Figure 4 – Potential vegetation groups for Umatilla National Forest.

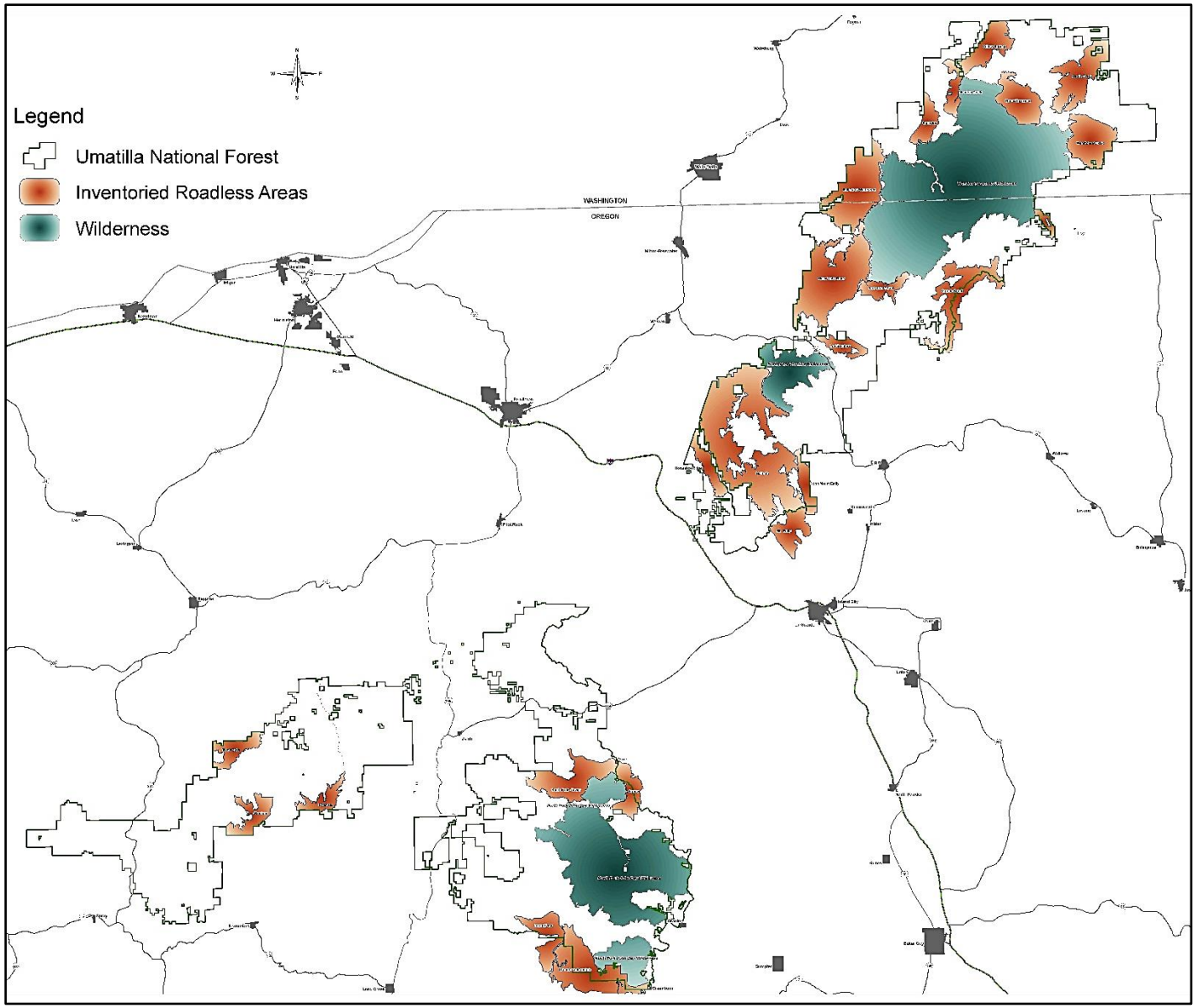

Figure 5 – Distribution of roadless and Wilderness areas for Umatilla National Forest.

Table 3: Land use designations (allocations) from Umatilla NF Forest Plan, and their assignment to land-use categories for this stand-density assessment effort.

Land Use Designation	Land Use Category
Nonforest (climax or permanent nonforest)	Nonforest
Management Area A1: Nonmotorized dispersed recreation	Reserves
Management Area A2: Motorized dispersed recreation	Reserves
Management Area A6: Developed recreation	Reserves
Management Area A7: Wild & scenic rivers: wild river segments	Reserves
Management Area A8: Scenic area	Reserves
Management Area A9: Special interest area	Reserves
Management Area B1: Wilderness	Reserves
Management Area B2: Wilderness (RNA in Wilderness)	Reserves
Management Area B7: Wilderness (Wild/scenic rivers in Wilderness)	Reserves
Management Area C1: Dedicated old growth	Reserves
Management Area C3A: Sensitive big game winter range	Reserves
Management Area C7: Special fish area: inside riparian zone	Reserves
Management Area C8: Grass-tree mosaic	Reserves
Management Area D2: Research natural area (RNA)	Reserves
Management Area F2: Mill Creek watershed: undeveloped	Reserves
Management Area F4: Walla Walla River watershed: unroaded	Reserves
Management Area P: Private inholdings	Reserves
Designated roadless areas from Forest Plan	Restricted
PACFISH (riparian habitat conservation areas for stream classes 1-4)	Restricted
Management Area A3: Viewshed 1	Active Forestry
Management Area A4: Viewshed 2	Active Forestry
Management Area A5: Roaded natural	Active Forestry
Management Area A7: Wild & scenic rivers: scenic/recreation	Active Forestry
Management Area A10: Wenaha-Tucannon special area	Active Forestry
Management Area C2: Managed old growth	Active Forestry
Management Area C3: Big game winter range	Active Forestry
Management Area C4: Wildlife habitat	Active Forestry
Management Area C5: Riparian and wildlife	Active Forestry
Management Area C7: Special fish area: outside riparian zone	Active Forestry
Management Area E1: Timber and forage	Active Forestry
Management Area E2: Timber and big game	Active Forestry
Management Area F3: High Ridge evaluation area	Active Forestry
Management Area F4A: Walla Walla River watershed: roaded	Active Forestry

Sources/Notes: This table shows how Forest Plan land-use designations were assigned to four land-use categories (gray lines separate land-use categories). Land-use categories are the same as those used for a Blue Mountains timber availability assessment (Rainville et al. 2008). Land-use categories are arranged in same order of precedence used for a stand density RV analysis described in this white paper: nonforest areas are removed first (note that 'ephemeral' nonforest – recent regeneration cuttings and stand-replacing wildfires – are not handled as nonforest). Active forestry includes forested lands remaining after nonforest, reserves, and restricted are removed. **Land-use categories had no influence on a stand density RV analysis** – stand density is analyzed for all forested land regardless of land-use status. Land-use categories are reported by subwatershed (table 12) to indicate whether RV analysis results can be addressed by utilizing active forestry treatments such as thinning.

RESULTS OF STAND DENSITY RV ANALYSIS

Table 9, a wide-format table provided on pages 22-28, presents stand density RV analysis results for dry upland forest PVG. It shows that:

- 82 of 161 subwatersheds (51%) have 1,000 or more acres of Dry Upland Forest PVG (Dry UF), so an RV analysis was completed for them.
- Of 82 subwatersheds for which a Dry UF RV analysis was completed, **72 of them (88%) are above a range of variation for high stand-density class** (e.g., high stand-density class is over-represented).
- Of 72 subwatersheds where the percentage of high stand-density class exceeds a range of variation, **45 of them (63%) have 50% or more of forest acreage available for active forestry treatments** to reduce stand density.
- Of 72 subwatersheds where the percentage of high stand-density class exceeds a range of variation, **46 of them (64%) exceed an upper limit of high stand-density class range by a substantial amount** (e.g., existing percentage of high stand-density class for 46 subwatersheds is greater than 50%, which is substantially above an upper range limit of 15%).
- Of 46 subwatersheds that exceed an upper limit of a range of variation by a substantial amount, **30 of them (65%) have 50% or more of forest acreage available for active forestry treatments** to reduce stand density. Spatial location of these 30 subwatersheds is depicted in figures 6 and 7. Box 1 and table 6 describe how dry-forest mapping (figs. 6-7) was completed.

Table 10, a wide-format table provided on pages 29-35, presents stand density RV analysis results for moist upland forest PVG. It shows that:

- 97 of 161 subwatersheds (60%) have 1,000 or more acres of Moist Upland Forest PVG (Moist UF), so an RV analysis was completed for them.
- Of 97 subwatersheds for which a Moist UF RV analysis was completed, **85 of them (88%) are above a range of variation for high stand-density class** (e.g., high stand-density class is over-represented).
- Of 85 subwatersheds where the percentage of high stand-density class exceeds a range of variation, **41 of them (48%) have 50% or more of forest acreage available for active forestry treatments** to reduce stand density.
- Of 85 subwatersheds where the percentage of high stand-density class exceeds a range of variation, **54 of them (64%) exceed an upper limit of high stand-density class range by a substantial amount** (e.g., existing percentage of high stand-density class for 54 subwatersheds is greater than 60%, which is substantially above an upper range limit of 30%).
- Of 54 subwatersheds that exceed an upper limit of a range of variation by a substantial amount, **26 of them (48%) have 50% or more of forest acreage available for active forestry treatments** to reduce stand density. Spatial location of these 26 subwatersheds is depicted in figures 6 and 7. Box 1 and table 7 describe how moist-forest mapping (figs. 6-7) was completed.

Table 11, a wide-format table provided on pages 36-42, presents stand density RV analysis results for cold upland forest PVG. It shows that:

- 28 of 161 subwatersheds (17%) have 1,000 or more acres of Cold Upland Forest (Cold UF), so an RV analysis was completed for them.
- Of 28 subwatersheds for which a Cold UF RV analysis was completed, **5 of them (18%) are above a range of variation for high stand-density class** (e.g., high stand-density class is over-represented).
- Of 5 subwatersheds where the percentage of high stand-density class exceeds a range of variation, **4 of them (80%) have 50% or more of forest acreage available for active forestry treatments** to reduce stand density. Spatial location of these 4 subwatersheds is depicted in figures 6 and 7. Box 1 and table 8 describe how cold-forest mapping (figs. 6-7) was completed.

Table 12, a wide-format table provided on pages 43-49, presents land-use status for 161 subwatersheds included in an RV analysis. It shows that:

- About **81% of Umatilla NF is forested** (e.g., tree canopy cover is 10% or more), and the remainder (19%) is either nonforest (grassland, shrubland, herbland) or nonvegetated (rock, water).
- Of forested lands, about **37% is in reserves** (defined as Forest Plan management areas with no scheduled timber harvest, such as Wilderness).
- Of forested lands, about **15% is in areas where mechanical treatments are restricted** (such as roadless areas and riparian habitat conservation areas).
- Of forested lands, about **47% is in areas where mechanical active-management treatments are permissible** to reduce high levels of stand density and bring it back within a range of variation.
- **95 of 161 subwatersheds (59%) have 50% or more of forest acreage available** for active forestry activity.

IMPLICATIONS AND CONCLUSIONS

When summarizing stand density conditions for entire Umatilla NF (e.g., when acreage is not stratified by subwatershed or land-use category), we find that 31% of total forest acreage exists in a low stand-density class, 12% exists in a moderate stand-density class, and the remainder (57%) exists in a high stand-density class. A Forest-wide summary of stand density condition is provided in table 4.

Table 4: Stand density conditions for Umatilla National Forest.

	Acres by Stand Density Class			
PVG	**Low**	**Moderate**	**High**	**Total**
Dry UF	156,241	56,756	194,305	407,302
Moist UF	164,025	67,015	404,010	635,050
Cold UF	38,440	9,494	48,734	96,668
Total	358,706	133,265	647,049	1,139,020

Sources/Notes: Forest polygons were assigned to a stand density class by using their stand density index value (see item 4 in Methods section). PVG is potential vegetation group (fig. 4), and UF is upland forest, a physiognomic class described in Powell et al. (2007).

Stand density was last assessed for entire Umatilla NF in 2001 during a watershed prioritization process (USDA Forest Service 2002). In 2001, 46% of Umatilla NF was found to be in a high-density condition (Powell 2001), although a stand density assessment protocol used in 2001 was less detailed than our current methodology.

[Methods, analysis protocols, and results of a 2001 watershed-based restoration assessment are described, for upland forest environments, in this document: "Restoration Opportunities for Upland Forest Environments of Umatilla National Forest," white paper F14-SO-WP-Silv-51.]

Stand-density assessment results reported in this white paper suggest that high stand-density conditions may have increased for Umatilla NF between 2001 and 2012 (progressing from 46% in 2001 to 57% currently).

When summarizing stand density conditions for just the Active Forestry portion of Umatilla NF's land base, we find that 30% of Active Forestry acreage exists in a low stand-density class, 14% exists in a moderate stand-density class, and the remainder (56%) exists in a high stand-density class.

As described above for table 4, about 47% of Umatilla NF's land base is in the Active Forestry category. These lands qualify for active management treatments (mechanical thinnings implemented with a timber-sale contract, etc.) designed specifically for reducing stand density and bringing it back within a stand density range of variation.

The Active Forestry summary of stand density conditions is provided in table 5.

Table 5: Stand density conditions for the Active Forestry land-use category, Umatilla National Forest.

	Acres by Stand Density Class			
PVG	**Low**	**Moderate**	**High**	**Total**
Dry UF	83,792	34,318	117,619	235,729
Moist UF	65,703	33,036	159,925	258,664
Cold UF	12,608	7,070	24,444	44,122
Total	162,103	74,424	301,988	538,515

Sources/Notes: Forest polygons were assigned to a stand density class by using their stand density index value (see item 4 in Methods section). PVG is potential vegetation group, and UF is upland forest, a physiognomic class described in Powell et al. (2007). Tables 3 and 12 describe the Active Forestry land-use category in more detail.

A Forest-wide summary for Active Forestry acreage (table 5) indicates that existing stand density conditions for Active Forestry acreage (as of 2012) are similar to existing stand density conditions for all forest acreage – high stand density, for example, comprises 57% of all forest acreage and 56% of Active Forestry acreage.

CAUTIONS AND CAVEATS

No analysis can anticipate every contingency or scenario. Please consider these potential limitations when considering analysis results described in this white paper.

1. A stand-density analysis utilized two broad-scale datasets pertaining to halves of Umatilla NF (item 1 in Methods section). Statistics associated with these MSN datasets are acceptable for broad-scale use, but they are not suitable for project-level analysis.

   So, it is likely that results reported here would differ somewhat from stand density characterizations included in a dataset prepared for project planning purposes.

2. 'Answers' from a classification protocol are only as good as parent information from which they are derived. When using Most Similar Neighbor (MSN) software to compile a vegetation database (item 1 in Methods section), errors in stand-density characterization can be propagated throughout a database because MSN software assigns information from reference stands to other similar stands (their nearest neighbors) during an imputation process.

   This means that if a reference stand is mischaracterized, most likely due to errors in a stand examination being used to derive attributes for it, then mischaracterizations could be propagated to dozens of other stands (nearest neighbors for a reference stand) in a database.

3. As a corollary to item 2, if an adequate number of reference stands are not available to characterize stand density conditions for a full gamut of forest cover types and size classes present in an analysis area (entire Umatilla NF in this instance), then we would expect imputation results to be flawed to a similar extent as reference stands are viewed as not being representative of on-the-ground conditions.

4. In a similar vein as item 3, if reference stands being used are unacceptable because they no longer represent current conditions (a stand exam is older, for example, and occurs in an area where fire, insect defoliation, timber harvest, or another disturbance process changed vegetation conditions substantially after an exam was completed), then we would expect imputation results to be flawed for any polygons for which unacceptable reference stands were used.

   [For a scenario involving reference stands with unrepresentative characteristics, obsolete exams should be archived so they are not accessible for MSN purposes.]

Box 1: Development of Stand Density RV Maps

This box summarizes a step-down process used to determine which Umatilla National Forest subwatersheds appear on high-priority stand-density maps included as figure 6 (north end) and figure 7 (south end) in this white paper.

This example pertains to dry forests only (e.g., any map legend combination with a DRY label).

Note that Dry may appear on the map by itself (yellow color), or as a couplet with Moist or Cold; this map-legend labeling scheme shows whether one, two, or three PVGs have a stand-density concern for any subwatershed.

This same prioritization process was used for Moist UF and Cold UF PVG mapping, except that threshold values (such as a 15% upper range limit for Dry UF below) were specific to each PVG.

161	**Total subwatersheds (SWS) intersecting Umatilla National Forest.**
- 79	Subwatersheds with less than 1,000 acres of Dry UF (each PVG stands on its own; if less than 1,000 acres of Cold UF, Moist UF, or Dry UF exists in a subwatershed, then that specific PVG was not included in a stand density RV analysis. All PVGs within a subwatershed that do have at least 1,000 acres were included in an analysis).
82	**Subwatersheds for which a Dry UF RV analysis was completed.**
- 10	Subwatersheds where high stand-density class is not above RV.
72	**Subwatersheds where high stand-density class exceeds upper limit of its RV range (instances where moderate- or low-density classes exceed their upper limits were ignored).**
- 26	Subwatersheds where high stand-density class exceeds upper limit of its RV range (15% for Dry UF), and the actual percentage falls between 15% and 50% (note: since upper limit of RV range for Dry UF is 15%, this means that historically, no more than 15% of a dry-forest landscape would have been in a high stand density condition at any point in time).
46	**Subwatersheds where high stand density % exceeds upper limit at > 50% (think of these SWS as 'worst of the worst' in a high stand density context).**
- 16	Subwatersheds with substantial overstocking (high stand density exceeds upper limit of RV range (15% for Dry UF), and actual percentage is > 50%), but less than 50% of subwatershed acreage is in Active Forestry land-use category (my choice of 50% as an Active Forestry threshold is arbitrary, but certainly not capricious!).
30	**Subwatersheds with substantial overstocking (high stand density class exceeds 50% of total Dry UF acreage) and greater than 50% of total forested acreage is in Active Forestry land-use category (these Dry UF subwatersheds appear in maps included in this white paper as figures 6 and 7). Tables 6-8, which immediately follow this Box, summarize the subwatersheds included in figures 6-7.**

Table 6: Umatilla NF subwatersheds for which existing percentage of high stand-density class, for Dry Upland Forest PVG, substantially exceeds upper limit of a range of variation for high stand density.

Subwatershed Number	Subwatershed Name	Dry Forest Area (Acres)
170601030202	Lick Creek	1,613
170601030203	South Fork Asotin Creek	1,591
170601030204	Charley Creek	3,076
170601030206	Upper George Creek	1,065
170601041002	Little Lookingglass Creek	1,016
170601060103	Elbow Creek	1,105
170601070501	Headwaters Pataha Creek	2,818
170701020303	Wolf Creek	1,249
170702020402	Upper Desolation Creek	1,235
170702020404	Lower Desolation Creek	2,272
170702020604	Upper Fivemile Creek	8,126
170702020605	Pine Creek	2,170
170702020606	Wilkins Creek-Camas Creek	4,446
170702020607	Lower Fivemile Creek	4,722
170702020608	Bridge Creek	3,226
170702020701	East Fork Meadow Brook	6,543
170702020702	West Fork Meadow Brook	5,171
170702020703	Deerhorn Creek-North Fork John Day River	3,419
170702020705	Matlock Creek-Stony Creek	9,825
170702020707	Potamus Creek	6,578
170702020708	Mallory Creek	6,700
170702020709	Ditch Creek	4,316
170702020801	Swale Creek	5,845
170702020803	Skookum Creek-Little Wall Creek	11,336
170702020805	Upper Big Wall Creek	14,128
170702020806	Lower Big Wall Creek	10,011
170702021003	Cupper Canyon-North Fork John Day River	1,063
170702040101	Bologna Canyon	5,939
170702040103	Upper Kahler Creek	12,207
170702041105	Buckhorn Creek	5,962
Total	All subwatersheds combined	148,773

Sources/Notes: this table includes subwatersheds for which existing percentage of high stand density class is greater than 50%, substantially exceeding an upper limit of a range of variation of 15% for high stand density, and the subwatershed has more than 50% of its forested acreage (all PVGs combined) in an Active Forestry land-use category.

Table 7: Umatilla NF subwatersheds for which existing percentage of high stand-density class, for Moist Upland Forest PVG, substantially exceeds upper limit of a range of variation for high stand density.

Subwatershed Number	Subwatershed Name	Moist Forest Area (Acres)
170601030203	South Fork Asotin Creek	6,601
170601030206	Upper George Creek	6,285
170601040801	Dry Creek	5,954
170601041001	Upper Lookingglass Creek	12,363
170601041002	Little Lookingglass Creek	18,919
170601041004	Lower Lookingglass Creek	6,331
170601041101	Phillips Creek	13,894
170601041102	Gordon Creek	3,624
170601041104	Cabin Creek	3,980
170701020202	Middle Mill Creek	5,763
170701020305	West Patit Creek	1,563
170701030101	Thomas Creek	8,830
170701030202	East Meacham Creek	7,574
170701030901	Johnson Creek-Butter Creek	3,220
170702020402	Upper Desolation Creek	12,892
170702020403	Middle Desolation Creek	9,438
170702020404	Lower Desolation Creek	2,335
170702020604	Upper Fivemile Creek	6,300
170702020605	Pine Creek	1,838
170702020607	Lower Fivemile Creek	1,196
170702020706	Ellis Creek-Potamus Creek	5,727
170702020707	Potamus Creek	2,342
170702020708	Mallory Creek	1,855
170702020709	Ditch Creek	5,004
170702020801	Swale Creek	2,877
170702020803	Skookum Creek-Little Wall Creek	3,522
Total	All subwatersheds combined	160,227

Sources/Notes: this table includes subwatersheds for which existing percentage of high stand-density class is greater than 60%, substantially exceeding an upper limit of a range of variation of 30% for high stand density, and the subwatershed has more than 50% of its forested acreage (all PVGs combined) in an Active Forestry land-use category.

Table 8: Umatilla NF subwatersheds for which existing percentage of high stand-density class, for Cold Upland Forest PVG, exceeds upper limit of a range of variation for high stand density.

Subwatershed Number	Subwatershed Name	Cold Forest Area (Acres)
170702020604	Upper Fivemile Creek	3,691
170702020605	Pine Creek	1,000
170702020701	East Fork Meadow Brook	1,663
170702020706	Ellis Creek-Potamus Creek	2,984
Total	All subwatersheds combined	9,338

Sources/Notes: this table includes subwatersheds for which existing percentage of high stand-density class is greater than 60%, exceeding an upper limit of a range of variation for high stand density, and the subwatershed has more than 50% of its forested acreage (all PVGs combined) in an Active Forestry land-use category.

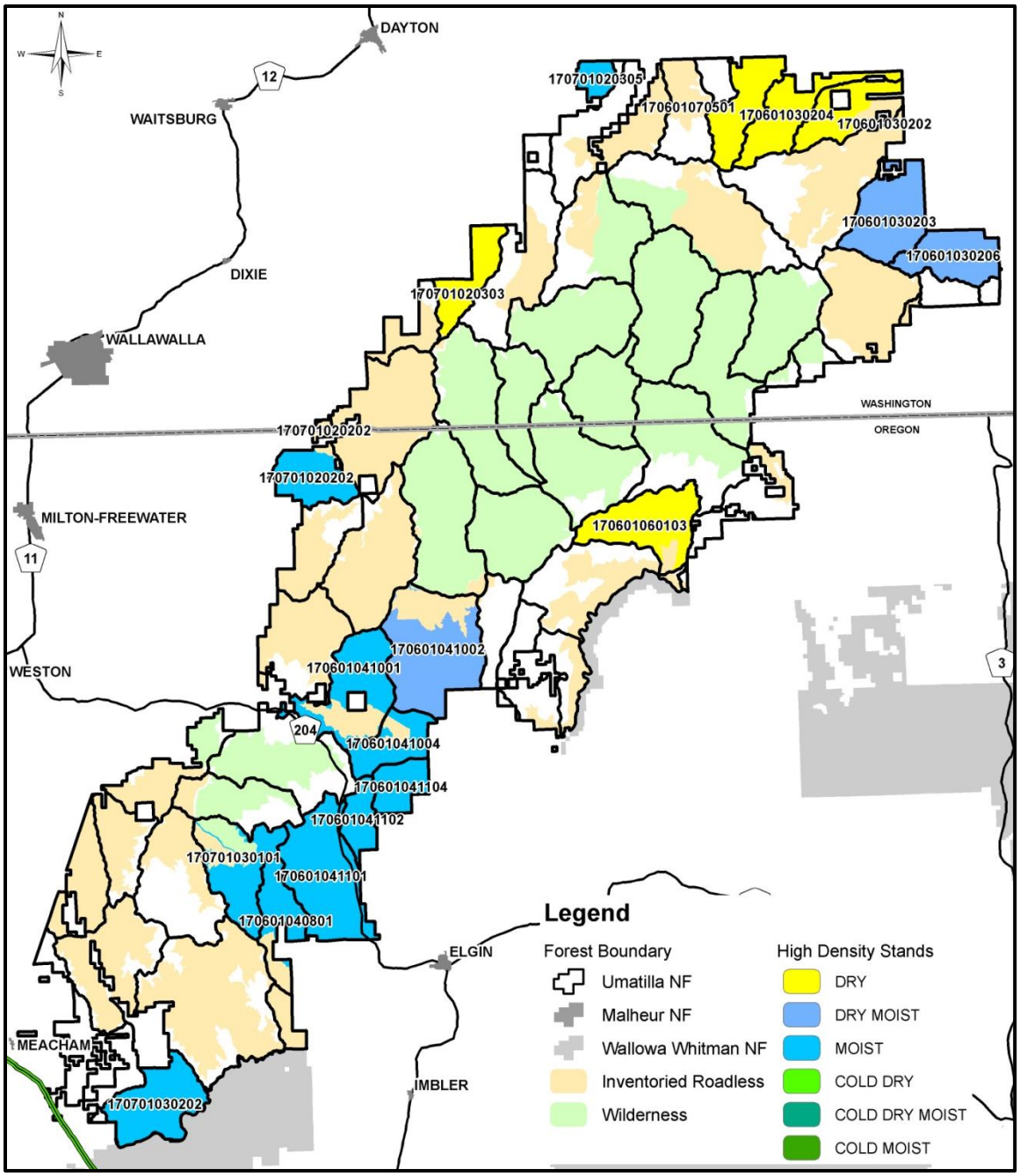

Figure 6: High priority subwatersheds for addressing high stand density for north end of Umatilla NF. This map shows subwatersheds exceeding an upper limit of a range of variation for high stand density by a substantial amount, and they have 50% or more of their forest acreage available for Active Forestry treatments, such as mechanical thinnings to reduce stand density and bring it back within its range of variation. Colors referring to more than one PVG (e.g., Dry Moist) include subwatersheds where high stand density substantially exceeds an upper limit of a range of variation for more than one of three PVGs used for this analysis (e.g., Dry Upland Forest, Moist Upland Forest, Cold Upland Forest).

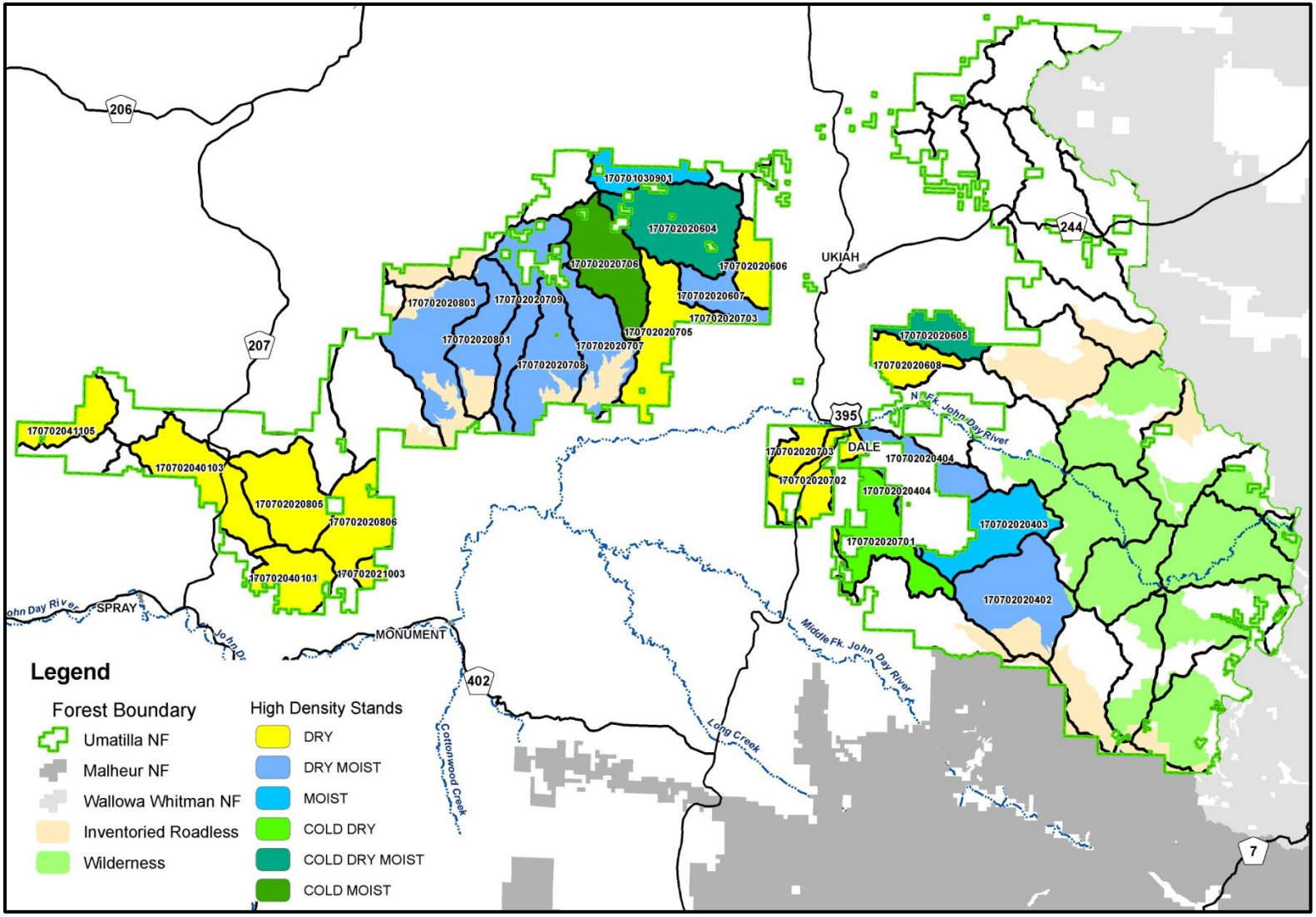

Figure 7: High priority subwatersheds for addressing high stand density for south end of Umatilla NF. This map shows subwatersheds exceeding an upper limit of a range of variation for high stand density by a substantial amount, and they have 50% or more of their forest acreage available for Active Forestry treatments (mechanical thinnings, etc.). Colors referring to more than one PVG (e.g., Dry Moist) are subwatersheds where high stand density substantially exceeds an upper limit of a range of variation for more than one of three PVGs used for this analysis.

Table 9: Results from a stand density range of variation analysis for Dry Upland Forest biophysical environment (Dry UF potential vegetation group), organized by subwatershed.

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170502020101													0.0
170601030201	178.8	6%	40-85%	Below	758.7	24%	15-30%	Within	2257.3	71%	5-15%	Above	3194.8
170601030202	92.6	6%	40-85%	Below	288.0	18%	15-30%	Within	1232.0	76%	5-15%	Above	1612.6
170601030203	148.3	9%	40-85%	Below	406.7	26%	15-30%	Within	1036.3	65%	5-15%	Above	1591.3
170601030204	144.6	5%	40-85%	Below	277.5	9%	15-30%	Below	2653.7	86%	5-15%	Above	3075.8
170601030205													0.0
170601030206	64.2	6%	40-85%	Below	214.9	20%	15-30%	Within	786.1	74%	5-15%	Above	1065.3
170601040105	9.0								1.5				10.5
170601040106	5.1												5.1
170601040107													0.0
170601040201	343.6								5.2				348.8
170601040202	26.8												26.8
170601040203	4.4												4.4
170601040401													0.0
170601040402	2.7				0.0								2.7
170601040403					15.1				2.6				17.7
170601040801	44.2				8.6				12.1				64.9
170601040802													0.0
170601041001	54.3				52.4				231.1				337.8
170601041002	255.2	25%	40-85%	Below	76.8	8%	15-30%	Below	683.8	67%	5-15%	Above	1015.8
170601041003	52.9				63.6				380.6				497.1
170601041004	247.0				89.1				33.6				369.7
170601041101	207.6				35.4				98.3				341.3
170601041102	90.3								72.5				162.8
170601041104	457.1				15.3				13.5				485.8
170601060101	118.9	7%	40-85%	Below	719.5	45%	15-30%	Above	755.3	47%	5-15%	Above	1593.7

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170601060102	97.7				33.2				220.0				350.9
170601060103	110.1	10%	40-85%	Below	285.4	26%	15-30%	Within	709.4	64%	5-15%	Above	1104.9
170601060104	146.2	14%	40-85%	Below	387.1	38%	15-30%	Above	484.9	48%	5-15%	Above	1018.2
170601060106	5.6				123.2				128.5				257.3
170601060301	158.1				202.6				555.4				916.1
170601060302	106.4				274.2				552.3				932.9
170601060303	224.5	12%	40-85%	Below	459.8	25%	15-30%	Within	1121.8	62%	5-15%	Above	1806.1
170601060304	99.7				252.6				559.4				911.6
170601060305	81.3	6%	40-85%	Below	500.9	34%	15-30%	Above	881.8	60%	5-15%	Above	1464.0
170601060306	205.7	5%	40-85%	Below	1010.3	26%	15-30%	Within	2668.7	69%	5-15%	Above	3884.6
170601060307	36.9	2%	40-85%	Below	456.4	23%	15-30%	Within	1470.2	75%	5-15%	Above	1963.5
170601060308	92.2	4%	40-85%	Below	344.8	16%	15-30%	Within	1691.2	79%	5-15%	Above	2128.1
170601060309	42.2	1%	40-85%	Below	1508.0	35%	15-30%	Above	2769.3	64%	5-15%	Above	4319.4
170601060310	103.2	4%	40-85%	Below	558.3	24%	15-30%	Within	1679.2	72%	5-15%	Above	2340.6
170601060311	77.2	3%	40-85%	Below	730.2	27%	15-30%	Within	1856.1	70%	5-15%	Above	2663.6
170601060312	36.7				298.5				463.1				798.3
170601060701					28.7				247.5				276.3
170601060702					30.7				318.8				349.5
170601060704	139.9	11%	40-85%	Below	244.2	20%	15-30%	Within	855.5	69%	5-15%	Above	1239.6
170601060706									13.8				13.8
170601060708									7.5				7.5
170601060709									68.9				68.9
170601070103													0.0
170601070501	253.8	9%	40-85%	Below	253.9	9%	15-30%	Below	2310.6	82%	5-15%	Above	2818.2
170601070601	448.5	7%	40-85%	Below	2036.2	30%	15-30%	Within	4330.2	64%	5-15%	Above	6814.9
170601070602	939.6	28%	40-85%	Below	456.8	14%	15-30%	Below	1954.5	58%	5-15%	Above	3351.0
170601070603	3931.6	69%	40-85%	Within	743.9	13%	15-30%	Below	1063.2	19%	5-15%	Above	5738.7
170601070604	851.9	42%	40-85%	Within	288.6	14%	15-30%	Below	884.5	44%	5-15%	Above	2025.0

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170601070605	122.9				26.3				264.7				413.8
170701020101	249.0	16%	40-85%	Below	256.4	16%	15-30%	Within	1063.8	68%	5-15%	Above	1569.2
170701020102					175.6				95.4				271.0
170701020103					5.2								5.2
170701020104									283.4				283.4
170701020201	79.2	5%	40-85%	Below	1029.6	61%	15-30%	Above	589.6	35%	5-15%	Above	1698.4
170701020202					6.1				298.6				304.8
170701020203													0.0
170701020301	248.8	7%	40-85%	Below	742.2	22%	15-30%	Within	2339.2	70%	5-15%	Above	3330.2
170701020302					91.1				427.4				518.4
170701020303	141.5	11%	40-85%	Below	164.6	13%	15-30%	Below	943.0	75%	5-15%	Above	1249.1
170701020304	1.3				117.7				384.9				503.9
170701020305	192.2								432.6				624.9
170701020306	17.0								48.9				65.9
170701030101	105.5				29.7				89.5				224.8
170701030102	19.1				20.0				208.4				247.5
170701030103	8.3				24.4				56.4				89.0
170701030104	163.7				42.2				236.7				442.6
170701030105	5.9								35.5				41.4
170701030106	0.3				135.5				191.2				326.9
170701030202	81.3				152.4				43.1				276.8
170701030203													0.0
170701030204	26.6								18.0				44.6
170701030205					53.0				44.5				97.5
170701030206									6.0				6.0
170701030301													0.0
170701030601	5851.7	90%	40-85%	Above	193.0	3%	15-30%	Below	444.8	7%	5-15%	Within	6489.5
170701030602	1228.5	100%	40-85%	Above		0%	15-30%	Below	4.3	0%	5-15%	Below	1232.8

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170701030603	340.8								0.0				340.9
170701030604	884.7	76%	40-85%	Within		0%	15-30%	Below	274.6	24%	5-15%	**Above**	1159.4
170701030606	3282.8	88%	40-85%	Above	41.2	1%	15-30%	Below	394.4	11%	5-15%	Within	3718.4
170701030901	1245.7	73%	40-85%	Within	121.3	7%	15-30%	Below	333.5	20%	5-15%	**Above**	1700.5
170701030902	150.4				4.3				127.1				281.8
170701040101	717.6	45%	40-85%	Within	216.8	14%	15-30%	Below	660.9	41%	5-15%	**Above**	1595.4
170701040301	47.6				107.5				214.5				369.7
170701040302	15.1				147.5				15.1				177.7
170701040303													0.0
170702020102	204.6												204.6
170702020103	373.0								606.9				979.8
170702020104	1096.5	67%	40-85%	Within	232.3	14%	15-30%	Below	319.4	19%	5-15%	**Above**	1648.2
170702020105	5587.8	66%	40-85%	Within		0%	15-30%	Below	2935.7	34%	5-15%	**Above**	8523.5
170702020201	11.3				36.6				419.3				467.2
170702020203									5.3				5.3
170702020204	1405.3	34%	40-85%	Below	671.9	16%	15-30%	Within	1997.9	49%	5-15%	**Above**	4075.1
170702020205	3954.9	71%	40-85%	Within	498.8	9%	15-30%	Below	1149.8	21%	5-15%	**Above**	5603.5
170702020206	1452.1	36%	40-85%	Below	369.9	9%	15-30%	Below	2158.9	54%	5-15%	**Above**	3980.9
170702020301	4971.1	83%	40-85%	Within	125.2	2%	15-30%	Below	863.7	14%	5-15%	Within	5959.9
170702020302	6742.1	75%	40-85%	Within	442.4	5%	15-30%	Below	1759.7	20%	5-15%	**Above**	8944.2
170702020303	5586.3	57%	40-85%	Within	11.9	0%	15-30%	Below	4247.1	43%	5-15%	**Above**	9845.2
170702020304	5334.9	57%	40-85%	Within	375.4	4%	15-30%	Below	3641.0	39%	5-15%	**Above**	9351.2
170702020305	4514.3	72%	40-85%	Within		0%	15-30%	Below	1721.3	28%	5-15%	**Above**	6235.6
170702020306	3183.2	56%	40-85%	Within	823.9	14%	15-30%	Below	1700.0	30%	5-15%	**Above**	5707.1
170702020401	2201.2	47%	40-85%	Within	9.1	0%	15-30%	Below	2517.6	53%	5-15%	**Above**	4727.9
170702020402	536.5	43%	40-85%	Within	24.2	2%	15-30%	Below	673.9	55%	5-15%	**Above**	1234.6
170702020403	92.3	7%	40-85%	Below	708.6	52%	15-30%	**Above**	571.0	42%	5-15%	**Above**	1371.9
170702020404	378.4	17%	40-85%	Below	740.9	33%	15-30%	**Above**	1153.1	51%	5-15%	**Above**	2272.4

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170702020501	3219.8	83%	40-85%	Within		0%	15-30%	Below	664.1	17%	5-15%	**Above**	3883.9
170702020502	11653.2	89%	40-85%	Above		0%	15-30%	Below	1486.2	11%	5-15%	Within	13139.4
170702020503	3642.3	70%	40-85%	Within	94.0	2%	15-30%	Below	1496.2	29%	5-15%	**Above**	5232.5
170702020504	8144.5	89%	40-85%	Above	48.4	1%	15-30%	Below	991.9	11%	5-15%	Within	9184.7
170702020505	4099.5	84%	40-85%	Within	27.5	1%	15-30%	Below	736.0	15%	5-15%	Within	4863.0
170702020601	1946.3	84%	40-85%	Within	78.1	3%	15-30%	Below	288.6	12%	5-15%	Within	2313.1
170702020602	4293.4	94%	40-85%	Above		0%	15-30%	Below	267.0	6%	5-15%	Within	4560.5
170702020603	450.0				9.2				269.5				728.7
170702020604	2403.7	30%	40-85%	Below	1128.7	14%	15-30%	Below	4593.3	57%	5-15%	**Above**	8125.7
170702020605	796.9	37%	40-85%	Below	104.3	5%	15-30%	Below	1268.7	58%	5-15%	**Above**	2169.9
170702020606	870.4	20%	40-85%	Below	209.3	5%	15-30%	Below	3366.3	76%	5-15%	**Above**	4446.0
170702020607	572.1	12%	40-85%	Below	144.4	3%	15-30%	Below	4005.7	85%	5-15%	**Above**	4722.2
170702020608	320.0	10%	40-85%	Below	868.9	27%	15-30%	Within	2037.2	63%	5-15%	**Above**	3226.1
170702020609													0.0
170702020701	443.2	7%	40-85%	Below	2057.9	31%	15-30%	**Above**	4041.5	62%	5-15%	**Above**	6542.6
170702020702	738.7	14%	40-85%	Below	990.6	19%	15-30%	Within	3441.9	67%	5-15%	**Above**	5171.3
170702020703	498.3	15%	40-85%	Below	365.8	11%	15-30%	Below	2555.2	75%	5-15%	**Above**	3419.3
170702020704	48.3				75.6				636.7				760.6
170702020705	2897.7	29%	40-85%	Below	393.1	4%	15-30%	Below	6533.8	67%	5-15%	**Above**	9824.6
170702020706	1914.1	36%	40-85%	Below	1497.9	28%	15-30%	Within	1894.8	36%	5-15%	**Above**	5306.8
170702020707	1573.3	24%	40-85%	Below	885.3	13%	15-30%	Below	4119.4	63%	5-15%	**Above**	6578.0
170702020708	1365.3	20%	40-85%	Below	561.9	8%	15-30%	Below	4772.3	71%	5-15%	**Above**	6699.5
170702020709	1358.9	31%	40-85%	Below	258.6	6%	15-30%	Below	2698.8	63%	5-15%	**Above**	4316.4
170702020710	205.5				20.7				23.3				249.4
170702020711	139.8								42.8				182.5
170702020801	1564.4	27%	40-85%	Below	1316.2	23%	15-30%	Within	2964.7	51%	5-15%	**Above**	5845.4
170702020802	4066.6	29%	40-85%	Below	3386.3	24%	15-30%	Within	6371.3	46%	5-15%	**Above**	13824.2
170702020803	3327.6	29%	40-85%	Below	1701.2	15%	15-30%	Within	6307.1	56%	5-15%	**Above**	11335.8

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170702020804	2911.2	25%	40-85%	Below	3156.7	27%	15-30%	Within	5747.5	49%	5-15%	**Above**	11815.4
170702020805	2383.7	17%	40-85%	Below	2261.1	16%	15-30%	Within	9482.7	67%	5-15%	**Above**	14127.5
170702020806	1625.4	16%	40-85%	Below	2717.7	27%	15-30%	Within	5668.2	57%	5-15%	**Above**	10011.3
170702021003	159.1	15%	40-85%	Below	191.0	18%	15-30%	Within	712.4	67%	5-15%	**Above**	1062.5
170702021006	228.7				217.4				224.2				670.3
170702030201					0.2				2.3				2.5
170702030203	164.3								3.0				167.2
170702030204	235.0								27.9				262.9
170702030302	373.5				1.7				189.9				565.1
170702030303	2231.5	27%	40-85%	Below	2232.9	27%	15-30%	Within	3892.8	47%	5-15%	**Above**	8357.1
170702030305	27.9				408.1				437.8				873.8
170702030501	325.4				18.7				149.5				493.6
170702030502									10.9				10.9
170702040101	412.3	7%	40-85%	Below	894.2	15%	15-30%	Within	4632.8	78%	5-15%	**Above**	5939.3
170702040103	1952.8	16%	40-85%	Below	2085.8	17%	15-30%	Within	8168.0	67%	5-15%	**Above**	12206.6
170702040104	1533.8	98%	40-85%	Above	8.5	1%	15-30%	Below	28.6	2%	5-15%	Below	1570.9
170702040105	67.2				142.0				390.8				600.1
170702040107	2.1				0.0				0.1				2.2
170702040108	3612.3	75%	40-85%	Within	172.2	4%	15-30%	Below	1039.2	22%	5-15%	**Above**	4823.7
170702041101	125.4				90.8				686.1				902.3
170702041104					21.2				2.4				23.5
170702041105	902.0	15%	40-85%	Below	1251.4	21%	15-30%	Within	3808.7	64%	5-15%	**Above**	5962.2
170702041106	823.5	21%	40-85%	Below	1155.5	29%	15-30%	Within	1991.7	50%	5-15%	**Above**	3970.6
Grand Total	156,240.9				56,755.9				194,304.6				407,301.4

Sources/Notes: Subwatershed is a standard, 12-digit numeric code identifying subwatershed numbers; table 12 provides names for subwatershed numbers shown in this table. 'Low' columns provide an acreage, percentage, range, and RV result for a low stand-density class. 'Mod' columns provide an acreage, percentage, range, and RV result for a moderate stand-density class. 'High' columns provide an acreage, percentage, range, and RV result for a high stand-density class.

‘Total Acres’ column shows total acreage of Dry Upland Forest occurring within a subwatershed. Total Acres columns with gray shading show subwatersheds with more than 1,000 acres of Dry Upland Forest – an RV analysis was completed for subwatersheds with 1,000 or more acres of Dry Upland Forest. An RV analysis was not completed for subwatersheds where a Total Acres column was less than 1,000 acres, and these subwatersheds do not have Total Acres columns containing gray shading.

‘High Result’ columns with orange shading show subwatersheds where high stand-density class was above RV (i.e., the high stand-density class is over-represented for subwatersheds with orange shading in High Result column); subwatersheds with orange shading in High Result column represent excellent candidates for active forestry treatments (mechanical thinnings implemented with a timber-sale contract, etc.) to reduce stand density and bring it back within a range of variation.

Note: ‘Above’ text shown in High Result column occurs with two colors – when ‘Above’ text is white (on a dark orange background), then high stand-density class exceeds an upper limit of a range of variation by a substantial amount (i.e., existing percentage of high stand-density class is greater than 50%, substantially exceeding an upper range limit of 15%).

When ‘Above’ text is black rather than white (on a dark orange background), then high stand-density class exceeds an upper limit of a range of variation (15%), and the actual percentage of high stand-density class occurs between 16% and 50%.

Note: some subwatersheds have light orange shading in ‘Mod Result’ column; for Dry UF stocking-level evaluations, these subwatersheds are also good candidates for active forestry treatments (mechanical thinnings implemented with a timber-sale contract, etc.) to reduce stand density and bring it back within a range of variation.

Note: subwatershed numbers (first column) with gray shading are those where 50% or more of **forested acreage** is Active Forestry, which is acreage available for mechanical treatments (thinnings implemented with a timber-sale contract, etc.) to address stand density issues (table 12 summarizes Active Forestry percentages by subwatershed).

Table 10: Results from a stand density range of variation analysis for Moist Upland Forest biophysical environment (e.g., Moist UF potential vegetation group), organized by subwatershed.

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170502020101									36.6				36.6
170601030201	5459.3	41%	20-40%	Above	1543.7	12%	25-60%	Below	6268.1	47%	15-30%	**Above**	13271.1
170601030202	1509.7	57%	20-40%	Above	477.1	18%	25-60%	Below	666.7	25%	15-30%	Within	2653.5
170601030203	1414.6	21%	20-40%	Within	454.5	7%	25-60%	Below	4732.3	72%	15-30%	**Above**	6601.4
170601030204	2573.2	60%	20-40%	Above	275.8	6%	25-60%	Below	1432.2	33%	15-30%	**Above**	4281.1
170601030205													0.0
170601030206	1043.4	17%	20-40%	Below	322.3	5%	25-60%	Below	4919.0	78%	15-30%	**Above**	6284.7
170601040105	2.3				0.1								2.3
170601040106									26.6				26.6
170601040107	0.7												0.7
170601040201	103.4												103.4
170601040202													0.0
170601040203	7.7												7.7
170601040401	38.3								44.3				82.6
170601040402	61.4				1.2				242.9				305.5
170601040403	5.9								9.6				15.5
170601040801	395.2	7%	20-40%	Below	395.4	7%	25-60%	Below	5163.4	87%	15-30%	**Above**	5954.0
170601040802	38.1	2%	20-40%	Below	179.8	10%	25-60%	Below	1576.2	88%	15-30%	**Above**	1794.2
170601041001	1157.3	9%	20-40%	Below	1247.5	10%	25-60%	Below	9958.1	81%	15-30%	**Above**	12362.9
170601041002	2179.5	12%	20-40%	Below	1843.2	10%	25-60%	Below	14896.4	79%	15-30%	**Above**	18919.2
170601041003	1100.7	20%	20-40%	Within	1255.1	22%	25-60%	Below	3267.4	58%	15-30%	**Above**	5623.2
170601041004	886.9	14%	20-40%	Below	1259.7	20%	25-60%	Below	4184.6	66%	15-30%	**Above**	6331.1
170601041101	1542.4	11%	20-40%	Below	1499.1	11%	25-60%	Below	10852.5	78%	15-30%	**Above**	13893.9
170601041102	566.2	16%	20-40%	Below	271.9	8%	25-60%	Below	2785.5	77%	15-30%	**Above**	3623.6
170601041104	861.7	22%	20-40%	Within	532.9	13%	25-60%	Below	2585.4	65%	15-30%	**Above**	3980.0
170601060101	1474.5	26%	20-40%	Within	1172.3	21%	25-60%	Below	3029.3	53%	15-30%	**Above**	5676.1

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170601060102	677.5	18%	20-40%	Below	964.0	25%	25-60%	Within	2180.6	57%	15-30%	**Above**	3822.1
170601060103	3079.8	30%	20-40%	Within	3090.2	30%	25-60%	Within	4151.1	40%	15-30%	**Above**	10321.1
170601060104	3952.3	37%	20-40%	Within	2896.4	27%	25-60%	Within	3879.8	36%	15-30%	**Above**	10728.4
170601060106	1033.0	48%	20-40%	Above	686.9	32%	25-60%	Within	410.8	19%	15-30%	Within	2130.7
170601060301	2061.3	15%	20-40%	Below	760.1	5%	25-60%	Below	11346.0	80%	15-30%	**Above**	14167.3
170601060302	1355.5	11%	20-40%	Below	1158.7	10%	25-60%	Below	9456.6	79%	15-30%	**Above**	11970.8
170601060303	3881.2	36%	20-40%	Within	1013.7	9%	25-60%	Below	5808.7	54%	15-30%	**Above**	10703.6
170601060304	1447.6	21%	20-40%	Within	486.0	7%	25-60%	Below	4961.0	72%	15-30%	**Above**	6894.7
170601060305	3842.2	29%	20-40%	Within	1476.2	11%	25-60%	Below	7921.8	60%	15-30%	**Above**	13240.2
170601060306	4418.9	46%	20-40%	Above	769.5	8%	25-60%	Below	4387.6	46%	15-30%	**Above**	9576.0
170601060307	3137.6	43%	20-40%	Above	521.8	7%	25-60%	Below	3686.4	50%	15-30%	**Above**	7345.8
170601060308	3943.5	31%	20-40%	Within	2469.8	20%	25-60%	Below	6111.9	49%	15-30%	**Above**	12525.3
170601060309	4938.4	50%	20-40%	Above	902.3	9%	25-60%	Below	4075.0	41%	15-30%	**Above**	9915.6
170601060310	2452.3	39%	20-40%	Within	901.0	14%	25-60%	Below	3010.8	47%	15-30%	**Above**	6364.1
170601060311	2505.0	30%	20-40%	Within	1070.8	13%	25-60%	Below	4656.4	57%	15-30%	**Above**	8232.2
170601060312	1767.9	47%	20-40%	Above	1110.1	29%	25-60%	Within	905.8	24%	15-30%	Within	3783.8
170601060701	137.2				176.9				499.4				813.5
170601060702	545.5	35%	20-40%	Within	60.9	4%	25-60%	Below	961.6	61%	15-30%	**Above**	1568.0
170601060704	2324.4	31%	20-40%	Within	256.5	3%	25-60%	Below	4963.2	66%	15-30%	**Above**	7544.1
170601060706	171.6	12%	20-40%	Below	4.9	0%	25-60%	Below	1209.5	87%	15-30%	**Above**	1386.0
170601060708	11.0								383.8				394.8
170601060709	17.8								172.0				189.7
170601070103													0.0
170601070501	2058.1	40%	20-40%	Within	718.2	14%	25-60%	Below	2331.4	46%	15-30%	**Above**	5107.8
170601070601	7626.9	57%	20-40%	Above	777.3	6%	25-60%	Below	5058.1	38%	15-30%	**Above**	13462.3
170601070602	5476.6	56%	20-40%	Above	418.3	4%	25-60%	Below	3839.7	39%	15-30%	**Above**	9734.5
170601070603	3670.9	68%	20-40%	Above	474.8	9%	25-60%	Below	1284.9	24%	15-30%	Within	5430.5
170601070604	3482.7	75%	20-40%	Above	401.4	9%	25-60%	Below	769.9	17%	15-30%	Within	4653.9

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170601070605	890.9	47%	20-40%	Above	154.7	8%	25-60%	Below	846.2	45%	15-30%	Above	1891.8
170701020101	802.2	7%	20-40%	Below	786.9	7%	25-60%	Below	9924.0	86%	15-30%	Above	11513.1
170701020102	579.3	6%	20-40%	Below	1035.7	10%	25-60%	Below	8823.6	85%	15-30%	Above	10438.6
170701020103	1.5				4.3				118.5				124.3
170701020104	944.6	13%	20-40%	Below	1091.2	15%	25-60%	Below	5195.3	72%	15-30%	Above	7231.0
170701020201	1010.7	9%	20-40%	Below	1281.4	11%	25-60%	Below	8894.7	80%	15-30%	Above	11186.8
170701020202	1065.9	18%	20-40%	Below	629.2	11%	25-60%	Below	4068.1	71%	15-30%	Above	5763.1
170701020203	5.0								28.6				33.7
170701020301	5018.7	55%	20-40%	Above	305.2	3%	25-60%	Below	3780.4	42%	15-30%	Above	9104.4
170701020302	148.8								717.9				866.7
170701020303	1759.8	38%	20-40%	Within	454.9	10%	25-60%	Below	2401.1	52%	15-30%	Above	4615.8
170701020304	253.9	8%	20-40%	Below	277.9	8%	25-60%	Below	2773.5	84%	15-30%	Above	3305.3
170701020305	333.7	21%	20-40%	Within	7.1	0%	25-60%	Below	1221.9	78%	15-30%	Above	1562.7
170701020306	89.5				58.7				119.4				267.6
170701030101	632.4	7%	20-40%	Below	747.6	8%	25-60%	Below	7450.3	84%	15-30%	Above	8830.3
170701030102	1146.9	10%	20-40%	Below	820.3	7%	25-60%	Below	9213.9	82%	15-30%	Above	11181.2
170701030103	669.8	10%	20-40%	Below	826.6	12%	25-60%	Below	5393.6	78%	15-30%	Above	6890.0
170701030104	998.0	8%	20-40%	Below	1328.2	10%	25-60%	Below	10380.3	82%	15-30%	Above	12706.5
170701030105	479.4	12%	20-40%	Below	87.3	2%	25-60%	Below	3407.6	86%	15-30%	Above	3974.2
170701030106	435.9	9%	20-40%	Below	503.9	11%	25-60%	Below	3831.5	80%	15-30%	Above	4771.2
170701030202	934.8	12%	20-40%	Below	262.6	3%	25-60%	Below	6376.9	84%	15-30%	Above	7574.2
170701030203	54.7	1%	20-40%	Below	219.7	4%	25-60%	Below	5289.4	95%	15-30%	Above	5563.7
170701030204	451.2	2%	20-40%	Below	1529.6	8%	25-60%	Below	16407.7	89%	15-30%	Above	18388.4
170701030205	337.9	5%	20-40%	Below	304.5	4%	25-60%	Below	6639.5	91%	15-30%	Above	7281.9
170701030206	16.4	1%	20-40%	Below	83.3	3%	25-60%	Below	2728.5	96%	15-30%	Above	2828.3
170701030301									593.8				593.8
170701030601	2264.6	98%	20-40%	Above		0%	25-60%	Below	54.4	2%	15-30%	Below	2318.9
170701030602	788.3								6.7				795.0

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170701030603	57.8												57.8
170701030604	302.5								4.4				306.9
170701030606	338.0								81.8				419.8
170701030901	326.7	10%	20-40%	Below	124.4	4%	25-60%	Below	2768.9	86%	15-30%	Above	3220.1
170701030902	82.4								574.7				657.1
170701040101	457.5	11%	20-40%	Below	65.8	2%	25-60%	Below	3601.9	87%	15-30%	Above	4125.1
170701040301	59.0	3%	20-40%	Below		0%	25-60%	Below	1729.8	97%	15-30%	Above	1788.9
170701040302	9.3	0%	20-40%	Below	150.3	7%	25-60%	Below	1979.0	93%	15-30%	Above	2138.7
170701040303					20.4				9.7				30.0
170702020102													0.0
170702020103	252.7								84.7				337.4
170702020104	869.1	26%	20-40%	Within	145.5	4%	25-60%	Below	2311.9	69%	15-30%	Above	3326.5
170702020105	1541.5	24%	20-40%	Within	925.3	14%	25-60%	Below	4000.6	62%	15-30%	Above	6467.4
170702020201	9.5				242.2				653.6				905.3
170702020203	3.9												3.9
170702020204	3554.0	53%	20-40%	Above	210.7	3%	25-60%	Below	2998.0	44%	15-30%	Above	6762.7
170702020205	1000.1	43%	20-40%	Above	4.2	0%	25-60%	Below	1306.1	57%	15-30%	Above	2310.5
170702020206	202.9	2%	20-40%	Below	636.2	8%	25-60%	Below	7283.5	90%	15-30%	Above	8122.5
170702020301	855.1	21%	20-40%	Within	459.0	12%	25-60%	Below	2671.0	67%	15-30%	Above	3985.1
170702020302	2678.3	41%	20-40%	Above	2345.8	36%	25-60%	Within	1568.5	24%	15-30%	Within	6592.6
170702020303	3160.8	72%	20-40%	Above	666.7	15%	25-60%	Below	536.4	12%	15-30%	Below	4363.8
170702020304	1495.7	34%	20-40%	Within	906.6	20%	25-60%	Below	2042.2	46%	15-30%	Above	4444.4
170702020305	3557.0	71%	20-40%	Above	177.2	4%	25-60%	Below	1304.1	26%	15-30%	Within	5038.3
170702020306	1386.1	34%	20-40%	Within	1224.4	30%	25-60%	Within	1435.3	35%	15-30%	Above	4045.8
170702020401	1377.1	43%	20-40%	Above	162.3	5%	25-60%	Below	1659.6	52%	15-30%	Above	3199.0
170702020402	1006.3	8%	20-40%	Below	227.0	2%	25-60%	Below	11658.7	90%	15-30%	Above	12892.0
170702020403	300.7	3%	20-40%	Below	780.0	8%	25-60%	Below	8357.2	89%	15-30%	Above	9437.9
170702020404	60.6	3%	20-40%	Below	411.6	18%	25-60%	Below	1862.7	80%	15-30%	Above	2334.9

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170702020501	2879.5	84%	20-40%	Above	23.4	1%	25-60%	Below	529.3	15%	15-30%	Within	3432.3
170702020502	5125.6	73%	20-40%	Above	699.9	10%	25-60%	Below	1176.2	17%	15-30%	Within	7001.7
170702020503	3612.4	54%	20-40%	Above	484.1	7%	25-60%	Below	2655.5	39%	15-30%	Above	6752.0
170702020504	5446.0	76%	20-40%	Above	302.4	4%	25-60%	Below	1396.1	20%	15-30%	Within	7144.5
170702020505	2579.1	64%	20-40%	Above	2.9	0%	25-60%	Below	1473.3	36%	15-30%	Above	4055.4
170702020601	210.9								175.9				386.8
170702020602	796.7	67%	20-40%	Above	4.3	0%	25-60%	Below	389.4	33%	15-30%	Above	1190.4
170702020603	30.7								334.6				365.3
170702020604	477.8	8%	20-40%	Below	270.7	4%	25-60%	Below	5551.3	88%	15-30%	Above	6299.8
170702020605	531.4	29%	20-40%	Within	192.5	10%	25-60%	Below	1113.6	61%	15-30%	Above	1837.5
170702020606	45.2				51.2				698.3				794.7
170702020607	35.4	3%	20-40%	Below	120.5	10%	25-60%	Below	1040.1	87%	15-30%	Above	1196.0
170702020608	251.1				238.9				311.2				801.2
170702020609													0.0
170702020701	202.3	10%	20-40%	Below	780.5	39%	25-60%	Within	1016.2	51%	15-30%	Above	1999.0
170702020702	162.6				132.9				119.0				414.5
170702020703	130.6				10.3				127.5				268.4
170702020704	66.0								5.6				71.6
170702020705	267.6				133.0				547.3				947.9
170702020706	149.3	3%	20-40%	Below	803.5	14%	25-60%	Below	4773.8	83%	15-30%	Above	5726.6
170702020707	78.3	3%	20-40%	Below	288.5	12%	25-60%	Below	1974.7	84%	15-30%	Above	2341.5
170702020708	58.5	3%	20-40%	Below	367.8	20%	25-60%	Below	1429.1	77%	15-30%	Above	1855.4
170702020709	508.9	10%	20-40%	Below	217.2	4%	25-60%	Below	4277.6	85%	15-30%	Above	5003.7
170702020710													0.0
170702020711	3.5												3.5
170702020801	130.4	5%	20-40%	Below	644.1	22%	25-60%	Below	2102.5	73%	15-30%	Above	2877.1
170702020802	28.6								14.6				43.2
170702020803	95.4	3%	20-40%	Below	673.2	19%	25-60%	Below	2753.7	78%	15-30%	Above	3522.3

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170702020804	7.9								103.2				111.0
170702020805					81.1				219.9				301.0
170702020806					19.0				148.0				167.0
170702021003													0.0
170702021006													0.0
170702030201									25.5				25.5
170702030203	43.3				10.1				105.8				159.2
170702030204	41.1				1.5				20.8				63.4
170702030302	17.2				21.5				370.7				409.5
170702030303	462.9	15%	20-40%	Below	1155.2	37%	25-60%	Within	1503.8	48%	15-30%	**Above**	3121.9
170702030305					2.7				73.6				76.3
170702030501									48.2				48.2
170702030502													0.0
170702040101									88.3				88.3
170702040103					99.9				268.4				368.3
170702040104													0.0
170702040105													0.0
170702040107													0.0
170702040108													0.0
170702041101	1.7				8.0				518.5				528.2
170702041104									31.0				31.0
170702041105					73.9				55.9				129.8
170702041106	49.5				115.2				169.5				334.2
Grand Total	164,025.2				67,014.6				404,009.9				635,049.7

Sources/Notes: Subwatershed is a standard, 12-digit numeric code identifying subwatershed numbers; table 12 provides names for subwatershed numbers shown in this table. 'Low' columns provide an acreage, percentage, range, and RV result for low stand-density class. 'Mod' columns provide an acreage, percentage, range, and RV result for moderate stand-density class. 'High' columns provide an acreage, percentage, range, and RV result for high stand-density class.

'Total Acres' column shows total acreage of Moist Upland Forest occurring within a subwatershed. Total Acres columns with gray shading show subwatersheds with more than 1,000 acres of Moist Upland Forest – an RV analysis was completed for subwatersheds with 1,000 or more acres of Moist Upland Forest. An RV analysis was not completed for any subwatershed where a Total Acres column was less than 1,000 acres, and these subwatersheds do not have Total Acres columns containing gray shading.

'High Result' columns with green shading show subwatersheds where high stand-density class was above RV (i.e., the high stand-density class is over-represented for subwatersheds with green shading in High Result column); subwatersheds with green shading in High Result column represent excellent candidates for active forestry treatments (mechanical thinnings implemented with a timber-sale contract, etc.) to reduce stand density and bring it back within a range of variation.

Note: 'Above' text shown in High Result column occurs with two colors – when 'Above' text is white (on a green background), then high stand-density class exceeds an upper limit of a range of variation by a substantial amount (i.e., existing percentage of high stand-density class is greater than 60%, substantially exceeding an upper range limit of 30%).

When 'Above' text is black rather than white (on a green background), then high stand-density class exceeds an upper limit of a range of variation (30%), and the actual percentage of high stand-density class occurs between 31 and 60%.

Note: subwatershed numbers (first column) with gray shading are those where 50% or more of **forested acreage** is Active Forestry, which is acreage available for mechanical treatments (thinnings implemented with a timber-sale contract, etc.) to address stand density issues (table 12 summarizes Active Forestry percentages by subwatershed).

Table 11: Results from a stand density range of variation analysis for Cold Upland Forest biophysical environment (e.g., Cold UF potential vegetation group), organized by subwatershed.

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170502020101	0.2												0.2
170601030201	186.6	11%	15-30%	Below	619.7	37%	20-40%	Within	849.8	51%	25-60%	Within	1656.0
170601030202									91.7				91.7
170601030203	21.3								390.6				411.9
170601030204									78.5				78.5
170601030205													0.0
170601030206	11.1												11.1
170601040105	1.2								3.3				4.4
170601040106													0.0
170601040107									16.2				16.2
170601040201	321.6				14.6								336.2
170601040202													0.0
170601040203					9.5								9.5
170601040401													0.0
170601040402													0.0
170601040403													0.0
170601040801													0.0
170601040802													0.0
170601041001													0.0
170601041002									22.0				22.0
170601041003									77.1				77.1
170601041004													0.0
170601041101													0.0
170601041102													0.0
170601041104													0.0
170601060101									0.0				0.0

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170601060102													0.0
170601060103									96.2				96.2
170601060104									58.4				58.4
170601060106													0.0
170601060301					10.7				15.6				26.3
170601060302													0.0
170601060303													0.0
170601060304									44.6				44.6
170601060305					8.3				47.4				55.7
170601060306									5.8				5.8
170601060307					3.9				12.5				16.4
170601060308									20.5				20.5
170601060309					47.4				169.0				216.4
170601060310					4.5				130.5				135.0
170601060311									17.8				17.8
170601060312									34.4				34.4
170601060701													0.0
170601060702													0.0
170601060704					0.2				0.3				0.6
170601060706													0.0
170601060708													0.0
170601060709													0.0
170601070103													0.0
170601070501					24.3				344.3				368.6
170601070601					158.8				196.4				355.2
170601070602					18.5				330.5				349.0
170601070603					0.3								0.3
170601070604	26.0								113.1				139.1

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170601070605									47.2				47.2
170701020101													0.0
170701020102													0.0
170701020103													0.0
170701020104													0.0
170701020201													0.0
170701020202													0.0
170701020203													0.0
170701020301	23.3				44.9				24.9				93.1
170701020302													0.0
170701020303	28.0				44.5				107.0				179.4
170701020304									23.3				23.3
170701020305	46.5												46.5
170701020306													0.0
170701030101													0.0
170701030102													0.0
170701030103													0.0
170701030104									11.8				11.8
170701030105													0.0
170701030106													0.0
170701030202													0.0
170701030203													0.0
170701030204													0.0
170701030205													0.0
170701030206													0.0
170701030301													0.0
170701030601	727.2	66%	15-30%	Above	15.0	1%	20-40%	Below	352.5	32%	25-60%	Within	1094.7
170701030602	517.6												517.6

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170701030603	6.1												6.1
170701030604	237.7								77.2				314.9
170701030606	839.1	74%	15-30%	Above	54.0	5%	20-40%	Below	241.1	21%	25-60%	Below	1134.3
170701030901	93.1				246.4				183.9				523.4
170701030902									212.7				212.7
170701040101	303.6				54.1				416.4				774.0
170701040301	47.1				140.0				273.5				460.7
170701040302	1.2				74.1				264.5				339.8
170701040303					89.7								89.7
170702020102									13.4				13.4
170702020103									778.7				778.7
170702020104	297.0								666.1				963.1
170702020105	1710.9	47%	15-30%	Above		0%	20-40%	Below	1901.2	53%	25-60%	Within	3612.2
170702020201	9.0								548.5				557.5
170702020203	0.5								0.1				0.6
170702020204	4030.3	66%	15-30%	Above	51.0	1%	20-40%	Below	2062.5	34%	25-60%	Within	6143.8
170702020205	2284.6	64%	15-30%	Above		0%	20-40%	Below	1286.4	36%	25-60%	Within	3571.1
170702020206	1345.3	24%	15-30%	Within	62.1	1%	20-40%	Below	4089.8	74%	25-60%	**Above**	5497.2
170702020301	1333.0	45%	15-30%	Above	81.2	3%	20-40%	Below	1546.6	52%	25-60%	Within	2960.8
170702020302	2394.9	49%	15-30%	Above	1.6	0%	20-40%	Below	2456.8	51%	25-60%	Within	4853.4
170702020303	2403.4	75%	15-30%	Above	145.5	5%	20-40%	Below	662.3	21%	25-60%	Below	3211.2
170702020304	2214.9	50%	15-30%	Above	164.1	4%	20-40%	Below	2010.4	46%	25-60%	Within	4389.4
170702020305	2417.2	87%	15-30%	Above	103.7	4%	20-40%	Below	245.8	9%	25-60%	Below	2766.8
170702020306	315.4								438.3				753.7
170702020401	4677.1	75%	15-30%	Above	111.3	2%	20-40%	Below	1443.1	23%	25-60%	Below	6231.5
170702020402	1902.9	30%	15-30%	Within	918.5	15%	20-40%	Below	3471.2	55%	25-60%	Within	6292.5
170702020403	718.5	32%	15-30%	Above	575.0	25%	20-40%	Within	961.5	43%	25-60%	Within	2255.0
170702020404	456.2				274.3				239.7				970.2

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170702020501	576.2								112.2				688.5
170702020502	1339.9	48%	15-30%	Above	76.4	3%	20-40%	Below	1400.9	50%	25-60%	Within	2817.2
170702020503	882.4	41%	15-30%	Above		0%	20-40%	Below	1293.9	59%	25-60%	Within	2176.3
170702020504	601.6	45%	15-30%	Above	15.1	1%	20-40%	Below	715.4	54%	25-60%	Within	1332.2
170702020505	567.1								223.5				790.6
170702020601	129.6								35.6				165.2
170702020602	112.6								59.7				172.3
170702020603									132.9				132.9
170702020604	229.8	6%	15-30%	Below	196.1	5%	20-40%	Below	3265.0	88%	25-60%	**Above**	3690.9
170702020605	20.4	2%	15-30%	Below	101.9	10%	20-40%	Below	878.0	88%	25-60%	**Above**	1000.3
170702020606					28.3				116.3				144.6
170702020607	16.5								365.3				381.8
170702020608									285.8				285.8
170702020609													0.0
170702020701	33.0	2%	15-30%	Below	224.7	14%	20-40%	Below	1405.1	85%	25-60%	**Above**	1662.9
170702020702									108.3				108.3
170702020703	1.4				14.8				75.9				92.2
170702020704									9.0				9.0
170702020705	40.3				145.0				738.9				924.3
170702020706	117.6	4%	15-30%	Below	681.6	23%	20-40%	Within	2185.2	73%	25-60%	**Above**	2984.4
170702020707	0.3	0%	15-30%	Below	902.8	41%	20-40%	Above	1297.2	59%	25-60%	Within	2200.3
170702020708	3.7	0%	15-30%	Below	827.6	58%	20-40%	Above	598.9	42%	25-60%	Within	1430.2
170702020709	153.5	11%	15-30%	Below	716.3	53%	20-40%	Above	473.0	35%	25-60%	Within	1342.9
170702020710													0.0
170702020711													0.0
170702020801	46.3	4%	15-30%	Below	493.1	42%	20-40%	Above	640.6	54%	25-60%	Within	1180.0
170702020802									0.2				0.2
170702020803	417.5	26%	15-30%	Within	222.6	14%	20-40%	Below	978.2	60%	25-60%	Within	1618.3

Subwatershed	Low Acres	Low Pct.	Low Range	Low Result	Mod Acres	Mod Pct.	Mod Range	Mod Result	High Acres	High Pct.	High Range	High Result	Total Acres
170702020804													0.0
170702020805													0.0
170702020806													0.0
170702021003													0.0
170702021006													0.0
170702030201	10.1								17.3				27.4
170702030203	146.7								83.4				230.1
170702030204	90.6								17.9				108.5
170702030302	55.6				173.1				209.5				438.2
170702030303	783.2	41%	15-30%	Above	413.8	22%	20-40%	Within	719.2	38%	25-60%	Within	1916.2
170702030305													0.0
170702030501													0.0
170702030502													0.0
170702040101													0.0
170702040103									13.4				13.4
170702040104													0.0
170702040105													0.0
170702040107													0.0
170702040108													0.0
170702041101	113.6				89.2				53.1				255.9
170702041104													0.0
170702041105													0.0
170702041106													0.0
Grand Total	38,439.6				9,494.4				48,733.9				96,667.9

Sources/Notes: Subwatershed is a standard, 12-digit numeric code identifying subwatershed numbers; table 12 provides names for subwatershed numbers shown in this table. ‘Low’ columns provide an acreage, percentage, range, and RV result for low stand-density class. ‘Mod’ columns provide an acreage, percentage, range, and RV result for moderate stand-density class. ‘High’ columns provide an acreage, percentage, range, and RV result for high stand-density class.

'Total Acres' column shows total acreage of Cold Upland Forest occurring within a subwatershed. Total Acres columns with gray shading show subwatersheds with more than 1,000 acres of Cold Upland Forest – an RV analysis was completed for subwatersheds with 1,000 or more acres of Cold Upland Forest. An RV analysis was not completed for subwatersheds where a Total Acres column was less than 1,000 acres, and these subwatersheds do not have Total Acres columns containing gray shading.

'High Result' columns with blue shading show subwatersheds where high stand-density class was above RV (i.e., the high stand-density class is over-represented for subwatersheds with blue shading in High Result column); subwatersheds with blue shading in High Result column represent excellent candidates for active forestry treatments (mechanical thinnings implemented with a timber-sale contract, etc.) to reduce stand density and bring it back within a range of variation.

Note: subwatershed numbers (first column) with gray shading are those where 50% or more of **forested acreage** is Active Forestry, which is acreage available for mechanical treatments (thinnings implemented with a timber-sale contract, etc.) to address stand density issues (table 12 summarizes Active Forestry percentages by subwatershed).

Table 12: Summary information for subwatersheds included in a stand density range of variation analysis for dry, moist, and cold upland forest biophysical environments, organized by subwatershed.

Subwatershed	Subwatershed Name	Total Acres	Forest Acres	Nonforest Acres	Reserves	Restricted	Active Forestry	AF Pct.
170502020101	Upper North Fork Burnt River	46.5	36.8	9.7	36.8			0%
170601030201	North Fork Asotin Creek	24960.4	18121.9	6838.5	5833.6	4561.0	7727.2	43%
170601030202	Lick Creek	8257.7	4357.7	3900.0	1320.3	389.2	2648.3	61%
170601030203	South Fork Asotin Creek	11929.1	8604.6	3324.5	1116.0	1003.9	6484.6	75%
170601030204	Charley Creek	9240.7	7435.4	1805.3	544.3	668.3	6222.9	84%
170601030205	Middle Asotin Creek	4.8	0.0	4.8				0%
170601030206	Upper George Creek	8721.0	7361.0	1360.0	286.7	917.7	6156.6	84%
170601040105	Sheep Creek	17.3	17.2	0.1		0.1	17.2	100%
170601040106	Little Fly Creek	31.6	31.6		5.1	17.0	9.6	30%
170601040107	Upper Fly Creek	17.0	17.0				17.0	100%
170601040201	Upper Meadow Creek	866.5	788.4	78.1		49.1	739.3	94%
170601040202	Middle Meadow Creek	41.1	26.8	14.3		2.7	24.1	90%
170601040203	Upper McCoy Creek	22.7	21.6	1.1			21.6	100%
170601040401	Upper Five Points Creek	131.4	82.6	48.9	0.5	12.4	69.6	84%
170601040402	Pelican Creek	323.6	308.2	15.4		56.3	251.9	82%
170601040403	Lower Five Points Creek	57.8	33.2	24.6		3.2	30.1	91%
170601040801	Dry Creek	7188.0	6018.9	1169.1	352.6	2679.7	2986.6	50%
170601040802	Upper Willow Creek	2579.5	1794.2	785.3		1786.9	7.2	0%
170601041001	Upper Lookingglass Creek	13829.8	12700.6	1129.2	3486.2	1029.1	8185.3	64%
170601041002	Little Lookingglass Creek	20571.6	19957.0	614.6	1635.7	6562.6	11758.7	59%
170601041003	Jarboe Creek	6589.3	6197.4	392.0	30.6	1326.9	4839.9	78%
170601041004	Lower Lookingglass Creek	6943.1	6700.9	242.2	495.2	1748.2	4457.5	67%
170601041101	Phillips Creek	17374.0	14235.3	3138.7	325.3	3658.1	10251.9	72%
170601041102	Gordon Creek	4230.8	3786.3	444.5	301.2	546.0	2939.2	78%
170601041104	Cabin Creek	5082.9	4465.8	617.1		801.0	3664.8	82%
170601060101	Sheep Creek	7881.6	7269.8	611.8	547.3	784.9	5937.5	82%

Subwatershed	Subwatershed Name	Total Acres	Forest Acres	Nonforest Acres	Reserves	Restricted	Active Forestry	AF Pct.
170601060102	Grande Ronde River-Clear Creek	5589.1	4173.0	1416.0	1202.1	386.4	2584.5	62%
170601060103	Elbow Creek	12390.6	11522.2	868.4	747.5	1114.7	9660.0	84%
170601060104	Grande Ronde River-Bear Creek	15866.0	11805.1	4060.9	4213.2	1058.1	6533.8	55%
170601060106	Grande Ronde River-Slickfoot Creek	2523.9	2388.0	135.8	83.9	164.4	2139.8	90%
170601060301	Upper South Fork Wenaha River	20345.2	15109.8	5235.4	13759.9	855.6	494.3	3%
170601060302	Lower South Fork Wenaha River	14791.3	12903.8	1887.6	12591.2	18.8	293.8	2%
170601060303	North Fork Wenaha River	17579.2	12509.7	5069.5	11778.9	159.6	571.2	5%
170601060304	Beaver Creek	9458.4	7850.9	1607.4	7481.8	10.6	358.5	5%
170601060305	Wenaha River-Rock Creek	17442.4	14759.9	2682.5	12222.0	49.7	2488.3	17%
170601060306	Upper Butte Creek	16850.5	13466.4	3384.1	12763.9	119.4	583.1	4%
170601060307	Lower Butte Creek	11803.6	9325.7	2477.9	9325.7			0%
170601060308	Wenaha River-Cross Canyon	19411.8	14673.9	4738.0	7999.9	385.8	6288.1	43%
170601060309	Upper Crooked Creek	18940.9	14451.4	4489.5	14451.4			0%
170601060310	First Creek	13627.9	8839.7	4788.2	8122.6	149.1	568.0	6%
170601060311	Lower Crooked Creek	16576.6	10913.6	5663.0	10404.8	14.5	494.4	5%
170601060312	Lower Wenaha River	6137.1	4616.6	1520.5	683.7	618.4	3314.6	72%
170601060701	Bear Creek-Hunt Spring	1463.5	1089.7	373.8	415.8	69.6	604.4	55%
170601060702	Grouse Creek	2917.1	1917.5	999.6	990.6	112.4	814.6	42%
170601060704	Menatchee Creek	16534.4	8784.3	7750.1	7534.1	385.0	865.3	10%
170601060706	Cottonwood Creek	3213.9	1399.8	1814.1	1313.7	0.9	85.3	6%
170601060708	Rattlesnake Creek	955.9	402.2	553.7	393.4		8.8	2%
170601060709	Grande Ronde River-Cougar Creek	508.8	258.6	250.3	258.6			0%
170601070103	Pow Wah Kee Gulch	1.4	0.0	1.4				0%
170601070501	Headwaters Pataha Creek	8869.0	8294.6	574.5	196.7	910.6	7187.3	87%
170601070601	Headwaters Tucannon River	24491.2	20632.5	3858.7	11793.9	4263.0	4575.6	22%
170601070602	Panjab Creek	16254.2	13434.5	2819.7	6795.5	3182.9	3456.1	26%
170601070603	Little Tucannon River	16313.8	11169.5	5144.3	1375.8	4843.8	4949.9	44%
170601070604	Cummings Creek	8690.8	6818.1	1872.7	750.1	2821.6	3246.5	48%

Subwatershed	Subwatershed Name	Total Acres	Forest Acres	Nonforest Acres	Reserves	Restricted	Active Forestry	AF Pct.
170601070605	Tumalum Creek	2638.5	2352.8	285.7	20.9	226.4	2105.5	89%
170701020101	Upper South Fork Walla Walla River	17885.9	13082.3	4803.6	12070.6	606.7	405.0	3%
170701020102	Middle South Fork Walla Walla River	14072.7	10709.6	3363.1	7738.6	612.1	2358.9	22%
170701020103	Lower South Fork Walla Walla River	252.2	129.5	122.8		128.7	0.8	1%
170701020104	North Fork Walla Walla River	9324.5	7514.4	1810.1	5284.2	621.9	1608.3	21%
170701020201	Upper Mill Creek	19602.3	12885.2	6717.1	12764.7	23.2	97.3	1%
170701020202	Middle Mill Creek	8042.2	6067.9	1974.3	276.6	1680.7	4110.5	68%
170701020203	Blue Creek	34.0	33.7	0.3	6.3	0.0	27.3	81%
170701020301	Upper North Fork Touchet River	15558.1	12527.7	3030.5	4961.0	2818.2	4748.4	38%
170701020302	Middle North Fork Touchet River	1794.2	1385.1	409.1		146.3	1238.7	89%
170701020303	Wolf Creek	6795.1	6044.3	750.8	372.2	865.6	4806.5	80%
170701020304	South Fork Touchet River	4674.7	3832.5	842.2	293.8	2902.2	636.5	17%
170701020305	West Patit Creek	2521.9	2234.0	287.9		302.3	1931.8	86%
170701020306	North Patit Creek	338.7	333.5	5.2		37.2	296.2	89%
170701030101	Thomas Creek	12231.7	9055.1	3176.6	1258.6	3051.0	4745.5	52%
170701030102	South Fork Umatilla River	16005.1	11428.7	4576.4	2220.7	3615.8	5592.2	49%
170701030103	Buck Creek	10194.7	6979.0	3215.7	4270.5	493.7	2214.8	32%
170701030104	North Fork Umatilla River	17490.5	13160.8	4329.7	7004.7	499.0	5657.1	43%
170701030105	Ryan Creek	7912.3	4015.6	3896.7	2244.6	627.9	1143.1	28%
170701030106	Bear Creek	8730.6	5098.2	3632.4	3094.2	1438.8	565.2	11%
170701030202	East Meacham Creek	11326.4	7851.1	3475.3	2623.0	1126.1	4102.0	52%
170701030203	Butcher Creek	9842.0	5563.7	4278.3	3715.9	326.8	1521.0	27%
170701030204	North Fork Meacham Creek	30038.2	18433.0	11605.2	11182.5	3554.6	3696.0	20%
170701030205	Camp Creek	15773.4	7379.5	8393.9	5736.5	392.2	1250.8	17%
170701030206	Boston Canyon	8086.1	2834.2	5251.9	2776.9	52.5	4.8	0%
170701030301	Iskuulpa Creek	1512.9	593.8	919.2	540.5	24.9	28.3	5%
170701030601	Pearson Creek	10950.7	9903.1	1047.6	641.9	2308.8	6952.5	70%
170701030602	Upper East Birch Creek	3004.9	2545.4	459.5	309.6	200.1	2035.7	80%

Subwatershed	Subwatershed Name	Total Acres	Forest Acres	Nonforest Acres	Reserves	Restricted	Active Forestry	AF Pct.
170701030603	Lower East Birch Creek	501.3	404.8	96.5		82.3	322.5	80%
170701030604	Bear Creek-West Birch Creek	1903.1	1781.2	121.9		367.7	1413.4	79%
170701030606	West Birch Creek	6047.4	5272.5	775.0	568.9	902.8	3800.8	72%
170701030901	Johnson Creek-Butter Creek	5706.1	5444.0	262.0	555.0	776.4	4112.7	76%
170701030902	East Fork Butter Creek	1655.7	1151.6	504.2		133.3	1018.2	88%
170701040101	Headwaters Willow Creek	6634.8	6494.5	140.3	2742.2	714.5	3037.8	47%
170701040301	Wilson Creek-Rhea Creek	2619.7	2619.2	0.5	1009.2	706.4	903.6	34%
170701040302	Thorn Creek-Rhea Creek	2673.2	2656.2	17.0	890.1	1763.5	2.6	0%
170701040303	Balm Canyon	121.2	119.7	1.5		119.6	0.2	0%
170702020102	Trail Creek	218.0	218.0		22.4	34.0	161.7	74%
170702020103	Onion Creek-North Fork John Day River	2173.1	2096.0	77.1	1760.4	45.5	290.1	14%
170702020104	Trout Creek	6455.8	5937.8	518.0	3390.6	147.6	2399.7	40%
170702020105	Crane Creek-North Fork John Day River	18880.1	18603.0	277.1	18486.0	13.5	103.5	1%
170702020201	Upper Granite Creek	2002.4	1929.9	72.5	450.9	223.9	1255.1	65%
170702020203	Beaver Creek	15.4	9.8	5.6		1.1	8.7	89%
170702020204	Clear Creek	17661.0	16981.5	679.4	12626.8	900.3	3454.4	20%
170702020205	Lake Creek	11883.2	11485.1	398.1	7547.4	554.5	3383.1	29%
170702020206	Lower Granite Creek	17947.8	17600.6	347.2	8942.9	1676.6	6981.1	40%
170702020301	Glade Creek-North Fork John Day River	12969.8	12905.8	64.0	12677.0	1.3	227.5	2%
170702020302	Meadow Creek	20642.7	20390.2	252.5	8489.7	4718.4	7182.0	35%
170702020303	Big Creek	17689.2	17420.3	269.0	14482.3	1484.0	1454.0	8%
170702020304	Corral Creek-North Fork John Day River	18342.1	18185.1	157.0	17266.5	39.6	878.9	5%
170702020305	Oriental Creek-North Fork John Day River	14320.1	14040.6	279.5	4659.7	1677.4	7703.5	55%
170702020306	Texas Bar Creek-North Fork John Day River	12824.8	10506.6	2318.2	418.1	2142.3	7946.2	76%
170702020401	Headwaters Desolation Creek	14875.4	14158.5	716.9	7488.1	1006.9	5663.4	40%
170702020402	Upper Desolation Creek	21075.5	20419.1	656.4	5902.4	2240.2	12276.5	60%
170702020403	Middle Desolation Creek	13317.0	13064.8	252.1	772.7	1943.8	10348.3	79%
170702020404	Lower Desolation Creek	6746.0	5577.6	1168.5	13.4	715.1	4849.2	87%

Subwatershed	Subwatershed Name	Total Acres	Forest Acres	Nonforest Acres	Reserves	Restricted	Active Forestry	AF Pct.
170702020501	Dry Camas Creek-Camas Creek	10249.8	8004.6	2245.2	322.7	1488.4	6193.5	77%
170702020502	Bowman Creek-Camas Creek	25001.5	22958.3	2043.2	737.8	4753.2	17467.3	76%
170702020503	Hidaway Creek	14900.8	14160.9	739.9	956.2	6176.7	7027.9	50%
170702020504	Cable Creek	18319.4	17661.4	658.0	768.7	11473.4	5419.2	31%
170702020505	Lane Creek-Camas Creek	10773.1	9709.0	1064.1	566.7	2131.1	7011.2	72%
170702020601	Snipe Creek	3424.4	2865.1	559.3	1.6	458.7	2404.8	84%
170702020602	Upper Owens Creek	6408.6	5923.1	485.5	326.3	1142.0	4454.9	75%
170702020603	Lower Owens Creek	1784.8	1227.0	557.8	328.6	126.2	772.1	63%
170702020604	Upper Fivemile Creek	19929.0	18116.4	1812.6	334.7	3036.6	14745.0	81%
170702020605	Pine Creek	6229.2	5007.6	1221.6	328.0	788.9	3890.7	78%
170702020606	Wilkins Creek-Camas Creek	5845.2	5385.4	459.9	275.4	687.1	4422.8	82%
170702020607	Lower Fivemile Creek	6664.7	6300.0	364.7	676.1	924.9	4699.0	75%
170702020608	Bridge Creek	6593.1	4313.1	2280.0	267.4	904.4	3141.3	73%
170702020609	Stover Canyon-Camas Creek	123.2	0.0	123.2				0%
170702020701	East Fork Meadow Brook	13033.9	10204.4	2829.5	0.0	1666.5	8537.9	84%
170702020702	West Fork Meadow Brook	8527.8	5694.1	2833.7	315.2	827.1	4551.9	80%
170702020703	Deerhorn Creek-North Fork John Day River	4902.4	3779.9	1122.5	72.3	539.3	3168.4	84%
170702020704	Jericho Creek-North Fork John Day River	1296.4	841.3	455.1	322.7	53.0	465.6	55%
170702020705	Matlock Creek-Stony Creek	13563.9	11696.8	1867.1	822.0	1998.7	8876.0	76%
170702020706	Ellis Creek-Potamus Creek	14937.7	14017.9	919.8	734.0	2623.2	10660.7	76%
170702020707	Potamus Creek	13869.9	11119.8	2750.1	2608.3	1273.5	7238.0	65%
170702020708	Mallory Creek	15899.3	9985.1	5914.2	603.0	2110.0	7272.0	73%
170702020709	Ditch Creek	12340.6	10662.9	1677.6	790.4	1764.7	8107.9	76%
170702020710	Wrightman Canyon-North Fork John Day River	388.4	249.4	139.0	249.4			0%
170702020711	Cabin Creek-North Fork John Day River	810.8	186.0	624.8		29.8	156.2	84%
170702020801	Swale Creek	13147.4	9902.5	3244.9	832.9	2354.1	6715.5	68%
170702020802	Little Wall Creek	19651.9	13867.6	5784.3	1625.4	2564.8	9677.4	70%
170702020803	Skookum Creek-Little Wall Creek	20538.7	16476.4	4062.3	2619.0	4490.6	9366.7	57%

Subwatershed	Subwatershed Name	Total Acres	Forest Acres	Nonforest Acres	Reserves	Restricted	Active Forestry	AF Pct.
170702020804	Wilson Creek	14885.4	11926.5	2958.9	831.3	2230.4	8864.8	74%
170702020805	Upper Big Wall Creek	15630.8	14428.5	1202.3	353.8	2801.2	11273.5	78%
170702020806	Lower Big Wall Creek	11729.5	10178.2	1551.2	720.4	2049.0	7408.9	73%
170702021003	Cupper Canyon-North Fork John Day River	1593.4	1062.5	530.9		231.2	831.3	78%
170702021006	Birch Creek-North Fork John Day River	1900.8	670.3	1230.5		146.5	523.8	78%
170702030201	Vinegar Creek-Middle Fork John Day River	370.8	55.4	315.4	55.4			0%
170702030203	Granite Boulder Creek-Middle Fork JD River	684.6	556.6	128.1	556.6			0%
170702030204	Big Boulder Creek	695.3	434.9	260.5	434.9			0%
170702030302	Big Creek	1500.6	1412.8	87.8	1407.8		5.0	0%
170702030303	Indian Creek-Middle Fork John Day River	15796.5	13395.2	2401.3	2491.3	1869.1	9034.9	67%
170702030305	Granite Creek-Middle Fork John Day River	1162.6	950.1	212.5	0.7	56.9	892.5	94%
170702030501	Rush Creek-Middle Fork John Day River	549.2	541.8	7.3		33.6	508.2	94%
170702030502	Eight Mile Creek	34.9	10.9	24.1			10.9	100%
170702040101	Bologna Canyon	9099.5	6027.6	3071.9	385.8	869.0	4772.9	79%
170702040103	Upper Kahler Creek	14947.6	12588.2	2359.3	695.1	2157.2	9735.9	77%
170702040104	Lower Kahler Creek	1584.0	1570.9	13.1	8.3	126.3	1436.3	91%
170702040105	Haystack Creek-John Day River	1807.8	600.1	1207.8	241.6	72.8	285.7	48%
170702040107	Lake Creek	2.2	2.2				2.2	100%
170702040108	Alder Creek	5221.8	4823.7	398.1	329.5	587.4	3906.7	81%
170702041101	Chapin Creek-Rock Creek	1853.1	1686.4	166.7	379.2	224.3	1083.0	64%
170702041104	Juniper Creek	72.5	54.6	18.0			54.6	100%
170702041105	Buckhorn Creek	6987.2	6091.9	895.3	326.6	680.6	5084.7	83%
170702041106	Brown Creek	5175.5	4304.8	870.7	320.4	301.7	3682.7	86%
Grand Total		1,403,466.3	1,139,019.0	264,447.2	425,563.7	174,939.8	538,515.6	47%

Sources/Notes: Subwatershed is a standard, 12-digit numeric code identifying subwatershed numbers. 'Subwatershed Name' column provides an accepted name for a subwatershed number shown in column 1.

'Total Acres' column provides total acreage of National Forest System (NFS) lands in a subwatershed.

‘Forest Acres’ column provides acreage of NFS lands in a subwatershed with a forested site potential (they are either forested now or were forested historically).

‘Nonforest Acres’ column provides acreage of NFS lands in a subwatershed with a nonforest site potential (these areas do not have an ecological site potential to support tree cover and did not support trees historically).

‘Reserves’ column shows NFS lands within a subwatershed that have been reserved from timber harvest (lands such as designated Wilderness, along with other Forest Plan management allocations for which forested lands were designated unsuitable and scheduled timber harvest was not permitted.

‘Restricted’ column shows NFS lands within a subwatershed that have restrictions on timber harvest (forested areas occurring within designated roadless areas and riparian habitat conservation areas).

‘Active Forestry’ and ‘AF Pct.’ columns show NFS acres within a subwatershed for which active management activities (mechanical thinnings implemented with a timber-sale contract, etc.) would be permitted to address stand density RV results disclosed by this analysis.

Note: Active Forestry percentage is percentage of **forested acreage** in an Active Forestry land-use category, which means this acreage is available for mechanical treatments to address stand density issues. A computed Active Forestry percentage value would be different if it had been calculated by using all acreage (including nonforest), but total acreage was not used for these calculations because nonforest areas do not have an ecological site potential to support stand density (in other words, it does not make sense to include nonforest acreage in stand-density percentage calculations *because stand density pertains only to forested lands*).

Note: subwatershed numbers (first column) with gray shading are those where 50% or more of **forested acreage** is Active Forestry, which is acreage available for mechanical treatments (thinnings implemented with a timber-sale contract, etc.) to address stand density issues identified by an RV analysis.

APPENDIX 1: Upland forest potential vegetation groups and plant association groups (source: Powell et al. 2007)

PVG	PAG	PVT Code	PVT Common Name	Ecoclass
Cold Upland Forest	Cold Moist	ABLA2/MEFE	subalpine fir/fool's huckleberry	CES221
		ABLA2/RHAL	subalpine fir/white rhododendron	CES214
		ABLA2-PIEN/LEGL	subalpine fir-Engelmann spruce/Labrador tea	CES612
		ABLA2-PIEN/MEFE	subalpine fir-Engelmann spruce/fool's huckleberry	CES2
		ABLA2-PIEN/RHAL	subalpine fir-Engelmann spruce/white rhododendron	CES215
		ABLA2-PIEN/SETR	subalpine fir-Engelmann spruce/arrowleaf groundsel	CEF336
	Cold Dry	ABGR/ARCO	grand fir/heartleaf arnica	CWF444
		ABGR/VASC	grand fir/grouse huckleberry	CWS811
		ABLA2/CAGE	subalpine fir/elk sedge	CAG111
		ABLA2/FEVI	subalpine fir/green fescue	CEG411
		ABLA2/JUDR	subalpine fir/Drummond's rush	CEG412
		ABLA2/JUPA (AVALANCHE)	subalpine fir/Parry's rush (avalanche)	CEG414
		ABLA2/JUTE	subalpine fir/slender rush	CEG413
		ABLA2/POPH	subalpine fir/fleeceflower	CEF511
		ABLA2/POPU	subalpine fir/skunkleaved polemonium	CEF411
		ABLA2/STOC	subalpine fir/western needlegrass	CAG4
		ABLA2/VASC	subalpine fir/grouse huckleberry	CES411
		ABLA2/VASC-PHEM	subalpine fir/grouse huckleberry-pink mountainheath	CES428
		ABLA2/VASC/POPU	subalpine fir/grouse huckleberry/skunkleaved polemonium	CES415
		ABLA2-PIAL/ARAC2	subalpine fir-whitebark pine/prickly sandwort	CAF324
		ABLA2-PIAL/CAGE	subalpine fir-whitebark pine/elk sedge	CAG133
		ABLA2-PIAL/FEVI	subalpine fir-whitebark pine/green fescue	CAG222
		ABLA2-PIAL/JUCO6	subalpine fir-whitebark pine/common juniper	CAS424
		ABLA2-PIAL/JUCO6-ARNE	subalpine fir-whitebark pine/ common juniper-pinemat manzanita	CAS423
		ABLA2-PIAL/JUDR	subalpine fir-whitebark pine/Drummond's rush	CAG3
		ABLA2-PIAL/JUPA-STLE2	subalpine fir-whitebark pine/Parry's rush-Lemmon's needlegrass	CAG132
		ABLA2-PIAL/POPH	subalpine fir-whitebark pine/fleeceflower	CAF2
		ABLA2-PIAL/POPU	subalpine fir-whitebark pine/skunkleaved polemonium	CAF0
		ABLA2-PIAL/RIMO2/POPU	subalpine fir-whitebark pine/mountain gooseberry/skunkleaved polemonium	CAS611
		ABLA2-PIAL/VASC/ARAC2	subalpine fir-whitebark pine/grouse huckleberry/prickly sandwort	CAS623
		ABLA2-PIAL/VASC/ARCO	subalpine fir-whitebark pine/grouse huckleberry/heartleaf arnica	CAS621
		ABLA2-PIAL/VASC/CARO	subalpine fir-whitebark pine/grouse huckleberry/Ross sedge	CAS622
		ABLA2-PIAL/VASC/FEVI	subalpine fir-whitebark pine/grouse huckleberry/green fescue	CAS625
		ABLA2-PIAL/VASC/LECOW	subalpine fir-whitebark pine/grouse huckleberry/Wallowa Lewisia	CAS627
		ABLA2-PIAL/VASC/OREX	subalpine fir-whitebark pine/grouse huckleberry/little ricegrass	CAS626
		ABLA2-PIAL/VASC-PHEM	subalpine fir-whitebark pine/grouse huckleberry-pink mountainheath	CAS624
		ABLA2-PIEN/LUHI	subalpine fir-Engelmann spruce/smooth woodrush	CEG131
		ABLA2-PIEN/POPU	subalpine fir-Engelmann spruce/skunkleaved polemonium	CEF426
		ABLA2-PIEN/VASC-PHEM	subalpine fir-Engelmann spruce/grouse huckleberry-pink mountainheath	CES427
		PIAL/ARAC2	whitebark pine/prickly sandwort	CAF322
		PIAL/CAGE	whitebark pine/elk sedge	CAG131
		PIAL/FEVI	whitebark pine/green fescue	CAG221
		PIAL/JUCO6-ARNE	whitebark pine/common juniper-pinemat manzanita	CAS422

APPENDIX 1: Upland forest potential vegetation groups and plant association groups (source: Powell et al. 2007)

PVG	PAG	PVT Code	PVT Common Name	Ecoclass
Cold Upland Forest (cont.)	Cold Dry (cont.)	PIAL/LUAR3	whitebark pine/silvery lupine	CAF323
		PIAL/RIMO2/POPU	whitebark pine/mountain gooseberry/skunkleaved polemonium	CAS512
		PIAL/VASC/ARAC2	whitebark pine/grouse huckleberry/prickly sandwort	CAS313
		PIAL/VASC/ARCO	whitebark pine/grouse huckleberry/heartleaf arnica	CAS312
		PIAL/VASC/LUHI	whitebark pine/grouse huckleberry/smooth woodrush	CAS311
		PICO(ABGR)/VASC/CARU	lodgepole pine(grand fir)/grouse huckleberry/pinegrass	CLS417
		PICO(ABLA2)/CAGE	lodgepole pine(subalpine fir)/elk sedge	CLG322
		PICO(ABLA2)/STOC	lodgepole pine(subalpine fir)/western needlegrass	CLG11
		PICO(ABLA2)/VASC	lodgepole pine(subalpine fir)/grouse huckleberry	CLS418
		PICO(ABLA2)/VASC/POPU	lodgepole pine(subalpine fir)/grouse huckleberry/polemonium	CLS415
		PIFL2/JUCO6	limber pine/common juniper	CAS511
		PSME/RIMO2/POPU	Douglas-fir/mountain gooseberry/skunkleaved polemonium	CDS911
		TSME/VAME	mountain hemlock/big huckleberry	CMS231
		TSME/VASC	mountain hemlock/grouse huckleberry	CMS131
	Cool Dry	ABGR/COOC2	grand fir/goldthread	CWF511
		ABLA2/ARNE/ARAC2	subalpine fir/pinemat manzanita/prickly sandwort	CES429
		ABLA2/CARU	subalpine fir/pinegrass	CEG312
		ABLA2/XETE	subalpine fir/beargrass	CEF111
		ABLA2-PIMO/CHUM	subalpine fir-western white pine/princes pine	CES8
		PICO/CARU	lodgepole pine/pinegrass	CLS416
		PICO(ABGR)/ARNE	lodgepole pine(grand fir)/pinemat manzanita	CLS57
		PICO(ABGR)/CARU	lodgepole pine(grand fir)/pinegrass	CLG21

APPENDIX 1: Upland forest potential vegetation groups and plant association groups (source: Powell et al. 2007)

PVG	PAG	PVT Code	PVT Common Name	Ecoclass
Moist Upland Forest	Cool Wet	ABGR/TABR/CLUN	grand fir/Pacific yew/queencup beadlily	CWC811
		ABGR/TABR/LIBO2	grand fir/Pacific yew/twinflower	CWC812
		ABLA2/STAM	subalpine fir/twisted stalk	CEF311
	Cool Very Moist	ABGR/GYDR	grand fir/oakfern	CWF611
		ABGR/POMU-ASCA3	grand fir/sword fern-ginger	CWF612
		ABGR/TRCA3	grand fir/false bugbane	CWF512
		PICO(ABGR)/ALSI	lodgepole pine(grand fir)/Sitka alder	CLS58
		POTR/CAGE	quaking aspen/elk sedge	HQG112
	Cool Moist	ABGR/CLUN	grand fir/queencup beadlily	CWF421
		ABGR/LIBO2	grand fir/twinflower	CWF311
		ABGR/VAME	grand fir/big huckleberry	CWS211
		ABGR/VASC-LIBO2	grand fir/grouse huckleberry-twinflower	CWS812
		ABGR-CHNO/VAME	grand fir-Alaska yellow cedar/big huckleberry	CWS232
		ABLA2/ARCO	subalpine fir/heartleaf arnica	CEF435
		ABLA2/CLUN	subalpine fir/queencup beadlily	CES131
		ABLA2/LIBO2	subalpine fir/twinflower	CES414
		ABLA2/TRCA3	subalpine fir/false bugbane	CEF331
		ABLA2/VAME	subalpine fir/big huckleberry	CES311
		ABLA2-PIEN/ARCO	subalpine fir-Engelmann spruce/heartleaf arnica	CEF436
		ABLA2-PIEN/CLUN	subalpine fir-Engelmann spruce/queencup beadlily	CEF437
		ABLA2-PIEN/LIBO2	subalpine fir-Engelmann spruce/twinflower	CEF2
		ABLA2-PIEN/TRCA3	subalpine fir-Engelmann spruce/false bugbane	CEF425
		PICO(ABGR)/LIBO2	lodgepole pine(grand fir)/twinflower	CLF211
		PICO(ABGR)/VAME	lodgepole pine(grand fir)/big huckleberry	CLS513
		PICO(ABGR)/VAME/CARU	lodgepole pine(grand fir)/big huckleberry/pinegrass	CLS512
		PICO(ABGR)/VAME/PTAQ	lodgepole pine(grand fir)/big huckleberry/bracken	CLS519
		PICO(ABLA2)/VAME	lodgepole pine(subalpine fir)/big huckleberry	CLS514
		PICO(ABLA2)/VAME/CARU	lodgepole pine(subalpine fir)/big huckleberry/pinegrass	CLS516
	Warm Very Moist	ABGR/ACGL	grand fir/Rocky Mountain maple	CWS912
	Warm Moist	ABGR/ACGL-PHMA	grand fir/Rocky Mountain maple-mallow ninebark	CWS412
		ABGR/BRVU	grand fir/Columbia brome	CWG211
		PSME/ACGL-PHMA	Douglas-fir/Rocky Mountain maple-mallow ninebark	CDS722
		PSME/ACGL-SYOR	Douglas-fir/Rocky Mountain maple-mountain snowberry	CDS725
		PSME/HODI	Douglas-fir/oceanspray	CDS611

APPENDIX 1: Upland forest potential vegetation groups and plant association groups (source: Powell et al. 2007)

PVG	PAG	PVT Code	PVT Common Name	Ecoclass
Dry Upland Forest	Warm Dry	ABGR/CAGE	grand fir/elk sedge	CWG111
		ABGR/CARU	grand fir/pinegrass	CWG112
		ABGR/SPBE	grand fir/birchleaf spiraea	CWS321
		JUSC2/CELE	Rocky Mountain juniper/mountain mahogany	CJS5
		PIPO/CAGE	ponderosa pine/elk sedge	CPG222
		PIPO/CARU	ponderosa pine/pinegrass	CPG221
		PIPO/CELE/CAGE	ponderosa pine/mountain mahogany/elk sedge	CPS232
		PIPO/ELGL	ponderosa pine/blue wildrye	CPM111
		PIPO/PUTR/CAGE	ponderosa pine/bitterbrush/elk sedge	CPS222
		PIPO/PUTR/CARO	ponderosa pine/bitterbrush/Ross sedge	CPS221
		PIPO/SPBE	ponderosa pine/birchleaf spiraea	CPS523
		PIPO/SYAL	ponderosa pine/common snowberry	CPS522
		PIPO/SYOR	ponderosa pine/mountain snowberry	CPS525
		PSME/ARNE/CAGE	Douglas-fir/pinemat manzanita/elk sedge	CDS664
		PSME/CAGE	Douglas-fir/elk sedge	CDG111
		PSME/CARU	Douglas-fir/pinegrass	CDG121
		PSME/CELE/CAGE	Douglas-fir/mountain mahogany/elk sedge	CDSD
		PSME/PHMA	Douglas-fir/mallow ninebark	CDS711
		PSME/SPBE	Douglas-fir/birchleaf spiraea	CDS634
		PSME/SYAL	Douglas-fir/common snowberry	CDS622
		PSME/SYOR	Douglas-fir/mountain snowberry	CDS625
		PSME/SYOR/CAGE	Douglas-fir/mountain snowberry/elk sedge	CDS642
		PSME/VAME	Douglas-fir/big huckleberry	CDS812
		PSME-PIPO-JUOC/FEID	Douglas-fir-ponderosa pine-western juniper/Idaho fescue	CDG333
	Hot Moist	PIPO/ARAR	ponderosa pine/low sagebrush	CPS61
	Hot Dry	PIPO/AGSP	ponderosa pine/bluebunch wheatgrass	CPG111
		PIPO/ARTRV/CAGE	ponderosa pine/mountain big sagebrush/elk sedge	CPS132
		PIPO/ARTRV/FEID-AGSP	ponderosa pine/mountain big sagebrush/Idaho fescue-wheatgrass	CPS131
		PIPO/CELE/FEID-AGSP	ponderosa pine/mountain mahogany/Idaho fescue-bluebunch wheatgrass	CPS234
		PIPO/CELE/PONE	ponderosa pine/mountain mahogany/Wheeler's bluegrass	CPS233
		PIPO/FEID	ponderosa pine/Idaho fescue	CPG112
		PIPO/PERA3	ponderosa pine/squaw apple	CPS8
		PIPO/PUTR/AGSP	ponderosa pine/bitterbrush/bluebunch wheatgrass	CPS231
		PIPO/PUTR/FEID-AGSP	ponderosa pine/bitterbrush/Idaho fescue-bluebunch wheatgrass	CPS226
		PIPO/RHGL	ponderosa pine/sumac	CPS9

Sources/Notes: Adapted from table 2 in Powell et al. (2007). PVG is potential vegetation group; PAG is plant association group; PVT is potential vegetation type; Ecoclass is a code used to record potential vegetation type determinations on field forms and in computer databases.

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APPENDIX 2: SILVICULTURE WHITE PAPERS

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

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

White papers are designed to address a variety of objectives:

(1) They guide how a methodology, model, or procedure is used by practitioners on the Umatilla National Forest (to ensure consistency from one unit, or project, to another).
(2) Papers are often prepared to address ongoing and recurring needs; some papers have existed for more than 20 years and still receive high use, indicating that the need (or issue) has long standing – an example is white paper #1 describing the Forest's big-tree program, which has operated continuously for 25 years.
(3) Papers are sometimes prepared to address emerging or controversial issues, such as management of moist forests, elk thermal cover, or aspen forest in the Blue Mountains. These papers help establish a foundation of relevant literature, concepts, and principles that continuously evolve as an issue matures, and hence they may experience many iterations through time. [But also note that some papers have not changed since their initial development, in which case they reflect historical concepts or procedures.]
(4) Papers synthesize science viewed as particularly relevant to geographical and management contexts for the Umatilla National Forest. This is considered to be the Forest's self-selected 'best available science' (BAS), realizing that non-agency commenters would generally have a different conception of what constitutes BAS – like beauty, BAS is in the eye of the beholder.
(5) The objective of some papers is to locate and summarize the science germane to a particular topic or issue, including obscure sources such as master's theses or Ph.D. dissertations. In other instances, a paper may be designed to wade through an overwhelming amount of published science (dry-forest management), and then synthesize sources viewed as being most relevant to a local context.
(6) White papers function as a citable literature source for methodologies, models, and procedures used during environmental analysis – by citing a white paper,

specialist reports can include less verbiage describing analytical databases, techniques, and so forth, some of which change little (if at all) from one planning effort to another.

(7) White papers are often used to describe how a map, database, or other product was developed. In this situation, the white paper functions as a 'user's guide' for the new product. Examples include papers dealing with historical products: (a) historical fire extents for the Tucannon watershed (WP Silv-21); (b) an 1880s map developed from General Land Office survey notes (WP Silv-41); and (c) a description of historical mapping sources (24 separate items) available from the Forest's history website (WP Silv-23).

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

Paper #	Title
1	Big tree program
2	Description of composite vegetation database
3	Range of variation recommendations for dry, moist, and cold forests
4	Active management of Blue Mountains dry forests: Silvicultural considerations
5	Site productivity estimates for upland forest plant associations of Blue and Ochoco Mountains
6	Blue Mountains fire regimes
7	Active management of Blue Mountains moist forests: Silvicultural considerations
8	Keys for identifying forest series and plant associations of Blue and Ochoco Mountains
9	Is elk thermal cover ecologically sustainable?
10	A stage is a stage is a stage…or is it? Successional stages, structural stages, seral stages
11	Blue Mountains vegetation chronology
12	Calculated values of basal area and board-foot timber volume for existing (known) values of canopy cover
13	Created opening, minimum stocking, and reforestation standards from Umatilla National Forest Land and Resource Management Plan
14	Description of EVG-PI database
15	Determining green-tree replacements for snags: A process paper
16	Douglas-fir tussock moth: A briefing paper
17	Fact sheet: Forest Service trust funds
18	Fire regime condition class queries
19	Forest health notes for an Interior Columbia Basin Ecosystem Management Project field trip on July 30, 1998 (handout)
20	Height-diameter equations for tree species of Blue and Wallowa Mountains
21	Historical fires in headwaters portion of Tucannon River watershed
22	Range of variation recommendations for insect and disease susceptibility
23	Historical vegetation mapping
24	How to measure a big tree

Paper #	Title
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
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

Paper #	Title
56	Vegetation polygon mapping and classification standards: Malheur, Umatilla, and Wallowa-Whitman National Forests
57	State of vegetation databases for Malheur, Umatilla, and Wallowa-Whitman National Forests
58	Seral status for tree species of Blue and Ochoco Mountains

REVISION HISTORY

June 2013: This white paper was prepared originally as a guide describing how a Forest-wide assessment of stand density was completed in support of a new program-of-work (POW) process.

A stand density, range of variation analysis was completed for the Umatilla NF as the second of three criteria involved in a POW process – other two criteria involve values at risk (including wildland-urban interface areas), and unique habitats such as old-growth areas, aspen stands, riparian habitat conservation areas, and meadows.

A June 2013 revision involved minor formatting and editing changes, and Box 1 and tables 5-7 were added to describe how prioritization mapping (figs. 2-3) was completed.