Region One
Vegetation Classification, Mapping, Inventory and Analysis Report

$$\bar{x} = \frac{\sum x}{n}$$

Numbered Report 11-10 **June, 2011**

The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products

Jim Barber[1]
Renate Bush[2]
Doug Berglund[3]

USDA Forest Service, Region 1
[1]Engineering Staff, [2]Renewable Resource Management Staff, 200 E. Broadway, Missoula, MT 59802
[3]RedCastle Resources Inc,644 E 17th Ave., Salt Lake City, UT 84103

1. Changes from the April, 2009 document

This 2011 update of the 2009 document includes expanded descriptions of the current existing vegetation dominance type classification system and a more thorough description of the legacy classifications delivered in 2004. Although the 2004 classification algorithms have been revised, improved, and phased out of R1-VMap products, there has been a variety of analyses that used these classifications, including Forest Plan revision documents for Westside planning zones. Therefore, they are still available in Region 1 analysis tools using inventory data and archived R1-VMap products. A comparison of these former and revised algorithms is included in appendix D.

2. Introduction

Vegetation is the primary natural resource managed by US Forest Service Region 1. The agency is responsible for managing vegetation for a variety of uses while maintaining the integrity of ecosystem components and processes at multiple levels (i.e., scales of analysis). One of the fundamental information needs is consistent and continuous existing vegetation data of sufficient accuracy and precision to address resource planning, analysis, and monitoring objectives. These analyses rely on data and associated models produced from vegetation classification, mapping, and/or inventory processes. For an overview of the multi-level relationships of these processes, see *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (Berglund and others, 2009).

The Region 1 existing vegetation classification system describes the logic for grouping entities by similarities in their floristic characteristics. The system was designed to allow consistent applications between regional inventory and map products within the Region 1 Classification, Mapping, Inventory, and Analysis framework. This has been an iterative process in Region 1 for many years as different classification schemes have been tested and evaluated for their utility by end users. This paper describes the system (i.e., methodology and algorithms) developed and accepted by the Region 1 Vegetation Council for classifying and mapping existing vegetation including tree dominance types, tree canopy cover, tree diameter, and tree vertical structure. The Region 1 Vegetation Council is a consortium representing multiple resources at all organizational levels (Regional Office, Supervisor's Office, and Ranger District) of the Region and research foresters who use vegetation data to meet information needs.

The Region 1 existing vegetation mapping program (R1-VMap) utilizes this classification and a portion of this document describes how vegetation classification units comprise mappable features at different levels of the mapping hierarchy (broad, mid, and base-levels). As a result, there is a direct link between classification units and map labels. In many situations, a classification unit and a map label are synonymous. Portions of this document also describe how this existing vegetation classification is applied to inventory data. Additional information can be found in the appendices including a description of two legacy classification systems that have been used in Region 1 and lookup tables for classification aggregations.

The Region 1 existing vegetation classification system meets, and in many cases exceeds, the requirements of an existing vegetation system as defined in the USDA Forest Service *Existing Vegetation Classification and Mapping Technical Guide* (Brohman and Bryant, 2005) and the *National Vegetation Classification Standard* (FGDC NVC, 2008). Appendix A compares the Region 1 existing vegetation classification system to these national guiding documents. Although this version of this document deals primarily with coniferous forest vegetation, descriptions of grassland, shrubland, and riparian vegetation types will be added when those systems are completed. At that point, the system will be exhaustive across all vegetation types found in Region 1.

3. List of Acronyms

BA: Basal area.

CC: Canopy cover.

DOM_BRD: Dominance broad groups which are classified by aggregating DOM_GRP_6040 classes.

DOM_ELE_SC: Elemental dominance type which uses tree lifeform subclass if a 3-species mix cannot be classified. This replaces the 2004 elemental dominance type classification.

DOM_GRP_04: Dominance group used from 2004-2009. This has been replaced by DOM_GRP_6040.

DOM_GRP_6040: Dominance group 6040.

DOM_MID_40: Dominance group 40% plurality which are classified by aggregating DOM_GRP_6040 classes.

DOM_MID_60: Dominance group 60% plurality which are classified by aggregating DOM_GRP_6040 classes.

DOM1: Elemental dominance type used from 2004-2009. This has been replaced by DOM_ELE_SC.

FGDC: Federal geographic data committee.

HMIX: Hardwood mix tree lifeform subclass.

IMIX: Shade-intolerant mix tree lifeform subclass.

IMXS: Shade-Intolerant mix class used in the DOM_TYPE_04 classification.

LF: Lifeform.

NVC: National Vegetation Classification (FGDC, 2008).

***PLANTS*:** Database containing codes (i.e., symbols) for tree species found in Region 1. http://plants.usda.gov/index.html

R1-CMIA: Region 1 classification, mapping, inventory, and analysis system.

R1-ExVeg: Region 1 existing vegetation classification system.

R1-VMap: Region 1 existing vegetation mapping products.

TLSC: Tree lifeform subclass.

TASH: Tolerant mix of subalpine fir, spruce, hemlock used in the DOM_TYPE_04 classification.

TGCH: Tolerant mix of grand fir, cedar, hemlock, and Pacific yew used in the DOM_TYPE_04 classification.

TMIX: Shade-tolerant mix tree lifeform subclass.

TPA: Trees per acre.

XXXX: Four letter species code from the *PLANTS* database (table 3).

Table 1. Acronym and/or label used for classification attribute names in various R1 databases and applications (N/A = not Applicable).

Classification Name	Acronym and/or Label Used		
	R1-VMap	R1 Summary Database and FSVeg Reports	FVS Classifier
Elemental Dominance type	N/A	DOM_ELE_SC	DOM_ELE_SC_FVS
Dominance Group 6040	DOM_GRP_6040	Dom_GRP_6040_INV	Dom_GRP_6040_FVS
Dominance 60% Plurality	DOM_MID_60	DOM_MID_60_INV	DOM_MID_60_FVS
Dominance 40% Plurality	DOM_MID_40	DOM_MID_40_INV	DOM_MID_40_FVS
Dominance Broad	DOM_BRD	DOM_BROAD_INV	DOM_BROAD_FVS
2004 Elemental Dominance Type***	N/A	DOMINANCE_TYPE	N/A
2004 Dominance Group***	DOM4	DOMINANCE_GROUP	DOM_GRP_04_FVS
Tree Canopy Cover	N/A	FVS_CANOPY_COVER	N/A
Tree Canopy Cover Class	TREECANOPY	FVS_CANCOV_CL	N/A
Tree Size	N/A	BA_WTD_DBH	BA_WTD_DBH_FVS
Tree Size Class – National	TREESIZE	SIZE_CLASS_NTG	SIZE_CLASS_NTG_FVS

Classification Name	Acronym and/or Label Used		
	R1-VMap	R1 Summary Database and FSVeg Reports	FVS Classifier
Technical Guide			
Tree Size Class - Traditional	N/A	SIZE_CLASS _TRAD	SIZE_CLASS _TRAD_FVS
Tree Vertical Structure	N/A	STRUCTURE_CLASS	STRUCTURE_CLASS _FVS

***Legacy classification described in appendix D but not currently supported

4. Definition of Terms

The following is a description of terms with respect to how they are used in this document.

Abundance: A measure of the amount of trees in a setting. Abundance is determined by canopy cover, basal area, or trees per acre of a particular lifeform or tree species. The attribute that determines abundance is based upon data source and size and number of trees.

Classification: Classification is the process of grouping similar entities into named types or classes based on shared characteristics. Vegetation classification defines and describes vegetation types and/or structural characteristics. In other words vegetation classification answers the question "what is it?" To be most useful, classifications need to be hierarchical, mutually exclusive, exhaustive, and mappable, if a spatial depiction is needed.

Canopy Cover: The proportion of ground covered by the vertical projection of the outermost perimeter of the natural spread of foliage of plants usually expressed as a percentage. Small openings within the canopy are included (FGDC NVC, 2008). Cover can be described as either 'absolute' or 'relative'.

- **Absolute cover:** An estimate of the total canopy cover. For the purpose of R1 classification and mapping, no overlap between strata (lifeform or species) is considered and cover values cannot exceed 100%. Absolute canopy cover is the proportion of the forest floor covered by the vertical projection of crowns for the strata of interest. Do not double-count overlapping crowns within the strata of interest. While canopy cover is often described as conditions "viewed from above", canopy cover estimates can be made from either ground-based field measurements or from airborne remote sensors or photography.
- **Relative cover:** Relative cover is typically used to determine species dominance within a lifeform. In this context, it is the proportion of an individual species' contribution to total lifeform "absolute" cover. The sum of all the component estimates of relative cover always equals 100%. For example in a given setting: canopy cover is 30% PSME, 15% PICO, 10% ABLA and 5% PIEN; for a total of 60% "absolute" cover for the tree lifeform. The relative cover of PSME is 30/60 or 50%, PICO is 15/60 or 25%, ABLA is 10/60 or 17% and PIEN is 5/60 or 8%.

Note that 50% + 25% + 17% + 8% = 100%. As with “absolute cover” no overlap between species is considered. The estimates are strictly based on conditions as “viewed from above”. This means, using the example above, that the portion of crowns of small ABLA that are hidden beneath the vertical projections of the crowns of larger PSME as seen from above, are not considered in the estimate of cover.

Dominance: The extent to which a given species has an influence in a setting or map feature because of its size, abundance, or coverage. In Region 1, canopy cover, basal area, or trees per acre are used to determine dominance.

Dominance types: Determined by the species with the greatest abundance of canopy cover, basal area, or trees per acre within a setting or map feature. The species that determine the dominance type are always of the same lifeform. Therefore it is first necessary to identify the dominant lifeform and tree lifeform subclass before determining dominance type.

Hardwood: Hardwood refers to all deciduous tree species that seasonally shed their leaves. Region 1 hardwood trees include aspen, cottonwood, poplar, green ash, and paper birch. Region 1 hardwood trees do not include western larch or alpine larch.

Level: Level refers to classification, mapping, and analysis levels as described in the *Forest Service Existing Vegetation Classification and Mapping Technical Guide* (Brohman and Bryant, 2005). For further discussion of levels and how they are supported in Region 1, see *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (Berglund and others, 2009)

- **Base-level:** Generally provides information for project-level planning and decision making.
- **Mid-level:** Generally provides information for Forest-wide analysis or large landscapes such as mountain ranges and 4^{th}-code hydrologic units.
- **Broad-level:** Generally provides information for Regional, state-wide, or multi-Forest analysis.

Lifeform: A classification of plants based on their size, morphology, habit, life span, and woodiness (FGDC 2008). In the Region 1 existing vegetation classification system, valid lifeforms include: tree, shrub, herbaceous, and sparsely vegetated.

Mapping: Vegetation mapping determines the geographic distribution, extent, and patterns of vegetation types and/or structural characteristics. The process entails the spatial delineation of vegetation patches and assigning attribute labels to those patches. This process is most useful in the Region 1 classification, mapping, inventory, and analysis framework if it produces a map that is consistently derived and attributed.

Map Feature: A spatial depiction of a vegetation patch. In vegetation mapping, this is typically a polygon feature in GIS but can also be represented as a raster region of pixels with the same map unit label.

Map Unit: The conceptual collection of map features with the same map label. A map feature is typically a member of numerous map units depending on the attribute of interest (e.g., dominance type, tree size class). A map unit is typically given a single label (such as PSME) but usually comprises a range of characteristics due to ecological complexity and mapping errors.

Plurality: Plurality refers to the plant species that has the most canopy cover, basal area, or trees per acre in a setting.

Resolution: The description of the individual elements within a map product and can be either 'spatial' or 'thematic'.

- **Spatial Resolution:** Describes the statistics associated with map features in a map product. These generally refer to feature size: minimum, mean, median, etc. In general, feature size statistics increase through the mapping hierarchy from base-, to mid-, to broad-level map products.
- **Thematic Resolution:** Identifies the smallest classification grouping(s) of a map product. For example, a simple forest/non-forest map might provide a sufficient description of vegetation for some uses. However, resource managers require a higher thematic resolution of vegetation cover, thereby expanding the classification to include species, age, stocking level and other characteristics. Generally, the numbers of thematic classes decrease from base- to mid- to broad-level within the mapping hierarchy.

Setting: The geographic area over which inventory data is collected. A setting may be a plot, cluster of plots, or a polygon.

Shade-tolerant: Plant species that can grow and reproduce under the canopy of other species.

Shade-intolerant: Plant species that are relatively incapable of developing and growing normally in the shade of other species.

Tree lifeform subclass: A classification of tree species based on their status as a hardwood species or if conifer, their affiliation to shade-tolerance or intolerance labels.

Type: A classification label (e.g., dominance type).

5. Lifeform

Lifeform is a classification of plants based on their size, morphology, habit, life span, and woodiness (FGDC NVC, 2008). In the Region1 existing vegetation classification system, valid lifeforms include: tree, shrub, herbaceous, sparsely vegetated, and non-vegetated. When tree lifeform is derived from inventory data, abundance of the tree lifeform is determined using either basal area or trees per acre. For inventory data to be classified as tree lifeform, the setting must have at least 20 square feet of BA per acre or at least 100 TPA. For a detailed description of how the classification algorithms are applied to inventory data, see *Region 1 Existing Vegetation Classification Software Program* (Bush and others, 2010). When lifeform is classified (key 1) from photo/image interpretation (PI), abundance is determined using species canopy cover. To be classified as tree lifeform, the setting or map feature must have at least 10% absolute canopy cover of trees.

Key 1. Lifeform classification.

Step	Source	Condition	Lifeform
1a	PI	Tree lifeform absolute CC $\geq$ 10%, otherwise proceed to Step 2	Tree
1b	INV	Tree BA $\geq$ 20ft^2 or TPA $\geq$100, otherwise proceed to Step 2	Tree
2	PI, INV	Shrub lifeform absolute CC $\geq$ 10% otherwise proceed to Step 3	Shrub
3	PI, INV	Herbaceous lifeform absolute CC $\geq$ 10% otherwise proceed to Step 4	Herbaceous
4	PI, INV	Combined absolute CC of trees, shrubs, and herbs $\geq$ 1% otherwise proceed to Step 5	Sparsely vegetated
5	PI, INV	Combined absolute CC of trees, shrubs, and herbs < 1%	Non-vegetated

When the setting is classified as a tree lifeform from key 1, the classification attribute needs to be determined. The classification attribute determines the dominance of each subclass and each species. Key 2 provides the logic for determining the classification attribute and table 2 provides some examples from different sources.

Key 2. Determining classification attribute for tree lifeform.

Step	Source	Condition	Classification Attribute
1a	PI		Canopy Cover
1b	INV	Total BA $\geq$ 20.0 ft^2, otherwise proceed to Step 2	Basal Area
2	INV	Total BA of the setting < 20.0 ft^2 and total TPA $\geq$ 100	Trees Per Acre

Table 2. Examples of classification attribute being determined for tree lifeform.

Example	Data Source	Trees Per Acre	Basal Area	Canopy Cover	Classification Attribute
1	PI	-	-	45%	Canopy Cover
2	INV	75	132	-	Basal Area
3	INV	200	5	-	Trees Per Acre

Once the lifeform of Tree (key 1) has been determined, then tree lifeform subclass can be classified. Key 3 uses a hardwood, shade-intolerant, or shade-tolerant tree type assignment for use in classifying tree lifeform subclass. Table 3 contains the tree species found in Region 1 and their tree type assignment. Table 4 provides some examples of classifying a setting or map feature to tree lifeform subclass.

Table 3. Region 1 tree species and their assignment as hardwood, shade intolerant conifer, or shade-tolerant conifer for use in determining tree lifeform subclass.

Species Common Name	Plants Species Code	Tree Type Assignment
Aspen	POTR5	Hardwood
cottonwood and poplar	POPUL – includes POBAT, POAN3, PODEM, POBA2	
green ash	FRPE	
paper birch	BEPA	
alpine larch	LALY	Shade-intolerant conifer
Douglas-fir	PSME	
Juniper	JUNIP – includes JUOC, JUOS, JUSC2	
limber pine	PIFL2	
lodgepole pine	PICO	
mountain mahogany	CELE3	
ponderosa pine	PIPO	
western larch	LAOC	
western white pine	PIMO3	
whitebark pine	PIAL	
Englemann spruce	PIEN	Shade-tolerant conifer
grand fir	ABGR	
mountain hemlock	TSME	
pacific yew	TABR2	
subalpine fir	ABLA	
western hemlock	TSHE	
western redcedar	THPL	

Key 3. Tree lifeform subclass classification.

Step	Condition	Description	Tree Lifeform Subclass
1	Abundance of all hardwood trees $\geq$ 40% total tree abundance otherwise proceed to Step 2	Hardwood tree	HMIX
2	Abundance of all hardwood and shade-intolerant conifer trees $\geq$ 50% total tree abundance otherwise proceed to Step 3	Shade-intolerant tree	IMIX
3	Abundance of all hardwood and shade-intolerant conifer trees < 50% total tree abundance	Shade-tolerant tree	TMIX

Table 4. Examples of tree lifeform subclass classification.

% Species Composition					Tree Lifeform Subclass	Logic
ABLA	PICO	PIEN	PSME	POPUL		
5	25	5	65	0	IMIX	Hardwood species are < 40%, intolerant and hardwood species comprise ≥ 50% of the total tree abundance.
15	0	30	10	45	HMIX	Hardwoods (POPUL) are ≥ 40% of the total tree abundance
40	0	30	10	20	TMIX	Hardwood species are < 40%, intolerant and hardwood species are < 50%, tolerant species ≥ 50% of the total tree abundance

6. Dominance Types

Dominance types are determined by the species with the greatest abundance of canopy cover, basal area, or trees per acre within a setting or map feature. Dominance types can be determined using inventory data, when collecting walk-through information, or from photo/image interpretation. The species that determine the dominance type are of the dominant lifeform (as determined in key 1). For example, only tree species are used to determine dominance in settings or map features that classify as a tree lifeform. Tree dominance types are classified using the relative abundance of individual tree species. Key 2 (above) shows the algorithm for determining the classification attribute used to calculate relative tree abundance.

Several dominance type classifications are presented here and are available for use depending on the thematic resolution (i.e., number of classes) needed for the management question of interest. Table 5 gives an overview of these classifications.

Table 5. Dominance type classifications used at various levels of analysis.

Dominance Type Classification	Number of classes found in Region 1	Level of analysis	How it is derived
Elemental Dominance Type	842	Base	Classified from tree list data
Dominance Group 6040	79	Base-Mid	Classified from tree list data, walk-through data, or photo/image interpretation methods

Dominance Type Classification	Number of classes found in Region 1	Level of analysis	How it is derived
Dominance 40% Plurality	22	Mid	Aggregated from Dominance Group 6040
Dominance 60% Plurality	22	Mid	Aggregated from Dominance Group 6040
Dominance Broad	10	Broad	Aggregated from Dominance Group 6040

The current Region 1 existing vegetation classification for various levels of dominance type is a modification of an earlier classification system developed by Brewer and others (2004) which is described in appendix C for comparison. The classification described in section 6 allows for more consistent aggregations of dominance types for various levels of classification, mapping, and analysis.

6.1. Tree dominance group 6040 classes

Tree dominance group 6040 is based on two thresholds of tree abundance: 60% and 40%. If the single most abundant tree species comprises at least 60% of the total abundance of the classification attribute, the class assigned is the species' *PLANTS* code (e.g., ABLA, PIPO). If the most abundant species comprises less than 60% and at least 40% of the classification attribute, the class assigned is the species *PLANTS* code with a suffix of the tree lifeform subclass, such as PICO-TMIX or PICO-IMIX. It is important to note that the lifeform subclass suffix is based upon all trees within the setting, including the most abundant species. It does not describe only the 'other' trees besides the dominant listed. If the abundance of the single most abundant species comprises less than 40% of the classification attribute, the class assigned is the tree lifeform subclass; HMIX, IMIX, or TMIX. Key 4 provides the logic and table 6 provides classification examples of dominance group 6040.

There are 79 dominance group 6040 classes supported in Region 1 (see Appendix D). However, many of these types are rare and do not comprise significant acres across Region 1. Dominance group 6040 is the highest thematic resolution (i.e., number of classes) supplied in the Region 1 existing vegetation map (VMap) databases. There is no published accuracy for this map product, however, and it is recommended that dominance group 6040 only be used for mid- and base-level mapping analysis applications when dominance mid-level plurality classes (DOM_MID_40 or DOM_MID_60) are insufficient or when thematic resolution is more important than map accuracy. Dominance group 6040 is also an attribute in reports and applications derived from FSVeg data (FIA, intensified grid inventory, stand exams) and maintained by Region 1. For further information on Region 1 reports and utilities see http://fsweb.r1.fs.fed.us/forest/inv/fsveg/index.htm . For detailed information on how these algorithms are applied to inventory applications see *Region 1 Existing Vegetation Classification Software Program* (Bush and others, 2010).

Key 4. Tree dominance group 6040 classification. Note: XXXX = current Region 1 preferred *PLANTS* code for a tree species (table 3), TLSC = tree lifeform subclass (key 2).

Step	Condition	Description	Tree Dominance Group 6040
1	Abundance of single most abundant tree species ≥ 60% of total tree abundance	Single species dominance group	XXXX
2	Abundance of single most abundant tree species < 60% and ≥ 40% of total tree abundance	Dominant species – tree lifeform subclass dominance group	XXXX-TLSC
3	Abundance of single most abundant tree species < 40% of total tree abundance	Tree lifeform subclass dominance group	TLSC

Note, if two or more species have the same abundance, the dominant species is based on the following tie-breaking criteria (in this order): largest basal area weighted average diameter calculated for each dominant species; largest basal area weighted average height; or alphabetical based on PLANTS species code.

Table 6. Examples of tree dominance group 6040 classification.

% Species Composition						Dominance Group 6040	Logic
ABLA	PICO	PIEN	PSME	POPUL	POTR5		
5	25	5	65	0	0	PSME	PSME comprises ≥ 60% of the attribute
15	0	30	10	45	0	POPUL - HMIX	POPUL comprises ≥ 40% but < 60% of the attribute and all hardwood species comprise ≥ 40% of the attribute making it a HDWD tree lifeform subclass
40	0	30	10	20	0	ABLA-TMIX	ABLA comprises ≥ 40% but < 60% of the attribute and all hardwood and shade-intolerant species are < 50% of total tree abundance making it a TMIX tree lifeform subclass
25	0	30	10	20	15	TMIX	No species are ≥ 40% of the attribute, hardwood species are < 40%, and all hardwood and shade-intolerant species are < 50% of total tree abundance making it a TMIX tree lifeform subclass

Appendix B contains summary charts of all FIA plots/primary sampling units in Region 1 for several common dominance type 6040 classes. These charts graphically show differences in average species composition between pure types (PSME) from the mix types (PSME-IMIX, PSME-TMIX) within a species group (e.g., Douglas fir).

6.2. Tree dominance mid-level plurality classes.

Tree dominance plurality classes are created by combining dominance group 6040 into two mid-level plurality classes. Dominance plurality classes are used for most mid-level analysis needs and are attributes in R1-VMap databases.

Dominance 60% plurality classes include only single-species classes and tree lifeform subclasses. This creates a map or inventory compilation with classes that are based on greater than or equal to 60% abundance of the classification attribute of an individual species and three heterogeneous mixed species classes. All single species classes are retained. All of the mixed species classes are re-labeled as their lifeform subclass. For example all XXXX-TMIX, XXXX-IMIX, or XXXX-HMIX dominance group 6040 classes are aggregated into their lifeform subclass; TMIX, IMIX, or HMIX respectively. Dominance 60% plurality classes are useful when the management question of interest requires relatively pure single-species vegetation types such as determining distribution of potential habit for a wildlife species that requires pure stands of ponderosa pine or to determine where insect damage will be most extreme.

Dominance 40% plurality classes aggregate all single species classes and species-lifeform subclass dominance group 6040 classes together based on the dominant species present. To aggregate dominance group 6040 classes into dominance 40% plurality classes, all XXXX, XXXX-TMIX, XXXX-IMIX, or XXXX-HMIX types are aggregated into their respective dominant species, XXXX. For example, ABGR, ABGR-IMIX, and ABGR-TMIX are combined into MX-ABGR. To avoid confusion with dominance group 6040 single-species types, the 'MX' prefix is added. This creates a map or inventory compilation with MX-XXXX classes that are based on at least 40% abundance for the species XXXX. The mixed types (HMIX, IMIX, TMIX) are not aggregated. Dominance 40% plurality classes are useful when the management question of interest requires the knowledge of the dominant species present such as in determining plurality.

The aggregation logic for each mid-level plurality class is shown below in table 7 and an exhaustive look-up table is provided in appendix C. Appendix C is also available in MS Access database format at the Region 1, Forest and Rangeland Management, Inventory intranet website (http://fsweb.r1.fs.fed.us/forest/inv/classify/index.htm).

Table 7a. Aggregations of tree dominance group 6040 into dominance 40% plurality classes. Note: XXXX = Region 1 preferred *PLANTS* code for a tree species (table 3).

Dominance Group 6040	Dominance 40% Plurality

XXXX	MX-XXXX
XXXX-HMIX	
XXXX-IMIX	
XXXX-TMIX	
HMIX	HMIX
IMIX	IMIX
TMIX	TMIX

Table 7b. Aggregations of tree dominance group 6040 into dominance 60% plurality classes. Note: XXXX = Region 1 preferred *PLANTS* code for a tree species (table 3).

Dominance Group 6040	Dominance 60% Plurality
XXXX	XXXX
XXXX-HMIX	HMIX
HMIX	
XXXX-TMIX	TMIX
TMIX	
XXXX-IMIX	IMIX
IMIX	

6.3. Tree dominance broad classes

A broad-level tree dominance classification, derived by combining dominance group 6040 classes, is based on a variable rule set. This generalized classification is used for very large landscapes (multiple Forests) or region-wide analyses. For the dominance broad classification, lodgepole pine (PICO) and Douglas fir (PSME) single species classes are retained because they are relatively abundant. Also, western larch (LAOC), ponderosa pine (PIPO), and western white pine (PIMO3) single species classes are retained because of their relative ecological importance. All single species hardwood types (e.g., POPUL, POTR5), single species-hardwood mix types (e.g., PIPO-HMIX, PSME-HMIX), and hardwood mix (HMIX) types are combined into the hardwood tree lifeform subclass, HMIX, to reflect their relative ecological importance. All other dominance group 6040 classes are combined into MESIC, shade-intolerant montane (IMON), or COLD classes based on general knowledge of relative tree species similarities in shade tolerance, temperature, and moisture regimes. Table 8 contains dominance broad class assignments from dominance group 6040 classes for those types that do not retain their dominance group 6040 single species label. Appendix C contains an exhaustive table used to collapse dominance group 6040 classes into the dominance broad classes.

Table 8. Dominance group 6040 assignments to dominance broad classes.

<table>
<tr><th rowspan="2"></th><th colspan="5">Dominance Broad</th></tr>
<tr><th>MESIC</th><th>IMON</th><th>COLD</th><th>HMIX</th><th>COLD-MESIC</th></tr>
<tr><td rowspan="8">Dominance Group 6040</td><td>ABGR
ABGR-TMIX
ABGR-IMIX</td><td>JUNIP
JUNIP-TMIX
JUNIP-IMIX</td><td>ABLA
ABLA-IMIX
ABLA-TMIX</td><td>BEPA
BEPA-IMIX
BEPA-TMIX
BEPA-HMIX</td><td>TMIX</td></tr>
<tr><td>THPL
THPL-IMIX
THPL-TMIX</td><td>PIFL2
PIFL2-IMIX
PIFL2-TMIX</td><td>LALY
LALY-IMIX
LALY-TMIX</td><td>POPUL
POPUL-IMIX
POPUL-TMIX
POPUL-HMIX</td><td rowspan="7"></td></tr>
<tr><td>TSHE
TSHE-IMIX
TSHE-TMIX</td><td>LAOC-IMIX
LAOC-TMIX</td><td>PIAL
PIAL-IMIX
PIAL-TMIX</td><td>POTR5
POTR5-IMIX
POTR5-TMIX
POTR5-HMIX</td></tr>
<tr><td rowspan="5"></td><td>PICO-IMIX
PICO-TMIX</td><td>PIEN
PIEN-IMIX
PIEN-TMIX</td><td rowspan="4">ABGR-HMIX
THPL-HMIX
TSHE-HMIX
JUNIP-HMIX
PIFL2-HMIX
LAOC-HMIX
PICO-HMIX
PIMO3-HMIX
PIPO-HMIX
PSME-HMIX
ABLA-HMIX
LALY-HMIX
PIEN-HMIX
TSME-HMIX</td></tr>
<tr><td>PIMO3-IMIX
PIMO3-TMIX</td><td rowspan="4">TSME
TSME-IMIX
TSME-TMIX</td></tr>
<tr><td>PIPO-IMIX
PIPO-TMIX</td></tr>
<tr><td>PSME-IMIX
PSME-TMIX</td></tr>
<tr><td>IMIX</td><td>HMIX</td></tr>
</table>

No biophysical information such as elevation, aspect, slope or potential vegetation data are used when collapsing dominance group 6040 into dominance broad groups. Therefore, users are cautioned that these classification names may not always reflect the context of actual conditions. For example, while sub-alpine fir and Engelmann spruce are typically found in COLD settings, they can also be found on what may be considered relatively MESIC valley-bottom settings. Also, some shade-intolerant mix settings with low amounts of whitebark pine or alpine larch (<40%) may be classified as shade-intolerant montane (IMON). These same settings would be classified as COLD if they had greater amounts of whitebark pine or alpine larch. Dominance group 6040 shade-tolerant mix class,TMIX, is assigned COLD-MESIC because of uncertainty in the complete species composition for this class based solely on the label. If it is possible to examine the elemental dominance type (described in section 6.4) of a setting, then a distinction between COLD or MESIC is possible. Otherwise, additional information such as potential vegetation type will need to be used to assign a COLD or MESIC classification label for the shade-tolerant mix class.

6.4. Tree elemental dominance types

Elemental dominance type is the finest thematic resolution that can be depicted in the Region 1 existing vegetation classification system and provides the most detailed information about species composition in a setting or map feature. In order to classify as a single-species elemental dominance type, one species must comprise at least 60% abundance of the classification attribute of the total abundance. If not classified as a single-species type, and two species comprise at least 80% of the relative abundance with each species comprising more than 20%, the setting is classified a two-species type. If a setting does not meet the criteria for a single-species or two-species type, and three species comprise at least 80% of the abundance and each of those three species has at least 20%, the setting is classified a three-species type. If none of these conditions are met, the setting is classified based on the abundance of tolerant and intolerant tree species. This classification of elemental dominance type is a modification of an earlier classification scheme developed by Brewer and others (2004) which is described in appendix D for comparison.

Although it is feasible to classify inventory data to elemental dominance type, it is not feasible to map it using remote sensing techniques and when it is needed, it is typically mapped manually. There are currently over 840 coniferous forest elemental dominance types identified in Region 1. Therefore, they are not listed in this document.

Key 5 describes the elemental dominance type classes and table 9 provides several examples. It is important to note that elemental dominance types cannot be aggregated into dominance group 6040 classes but must be re-classified using the algorithm in key 3.

Key 5. Tree elemental dominance type classification. Note: XXXX, YYYY, ZZZZ = Region 1 preferred *PLANTS* code for a tree species (table 2), TLSC = tree lifeform subclass (key 2).

Step	Argument - Based on Relative Abundance (i.e., canopy cover, basal area, or trees per acre)	Elemental Dominance Type
1	Abundance of single most abundant tree species ≥ 60% of total tree abundance otherwise proceed to Step 2	XXXX
2	Abundance of two most abundant tree species (X and Y) ≥ 80% of total tree abundance, each individually > 20% of total tree abundance otherwise proceed to Step 3	XXXX-YYYY in order of abundance
3	Abundance of three most abundant tree species (X, Y, and Z) ≥ 80% of total tree abundance, each individually > 20% of total tree abundance otherwise proceed to Step 4	XXXX-YYYY-ZZZZ in order of abundance
4	Abundance of three most abundant tree species <	TLSC

Step	Argument - Based on Relative Abundance (i.e., canopy cover, basal area, or trees per acre)	Elemental Dominance Type
	80% of total tree abundance	

Note, if more than one species has the same abundance, then the species chosen is based on the following tie-breaking criteria (in this order): largest basal area weighted average diameter calculated for each species; largest basal area weighted average height; or alphabetical based on Region 1 preferred *PLANTS* species code.

Table 9. Examples of assigning elemental dominance type.

% Species Composition						Elemental Dominance Type	Logic
ABLA	PICO	PIEN	PSME	POPUL	POTR5		
5	25	5	65	0	0	PSME	PSME comprises ≥ 60% of the attribute
10	32	10	48	0	0	PSME-PICO	PSME + PICO comprise ≥80% of the attribute with each species contributing >20% of the total, PSME is most dominant
7	57	6	30	0	0	PICO-PSME	PSME + PICO comprise ≥80% of the attribute with each species contributing >20% of the total, PICO is most dominant
30	29	10	31	0	0	PSME-ABLA-PICO	PSME, PICO, and ABLA comprise ≥80% of the attribute with each individual contributing > 20% of the total. Ordered by abundance.
15	0	30	10	45	0	HMIX	Does not meet 1, 2 or 3 species dominance type rules. Hardwood species ≥ 40%
15	20	10	25	0	30	IMIX	Does not meet 1, 2 or 3 species dominance type rules. Hardwood species < 40% but Hardwood species and Shade-intolerant species ≥ 50%
25	0	30	10	20	15	TMIX	Does not meet 1, 2 or 3 species dominance type rules. Hardwood species and Shade-intolerant species < 50%

7. Tree Canopy Cover

In the Region 1 existing vegetation classification system, the term canopy cover is used to describe the proportion of the forest floor covered by the vertical projection of the tree crowns. The term canopy closure is used to describe the proportion of the sky hemisphere obscured by vegetation when viewed from a single point on the ground. This differentiation between terms is not universal and many publications use the terms interchangeably. Figures 1 and 2 illustrate that canopy closure and canopy cover are not synonymous. However, the term "canopy from above" (USDA FSDD, 2008) is used synonymously with canopy cover in this document. For further discussion, see *Comparison of Canopy Cover and Closure* (Berglund, 2011).

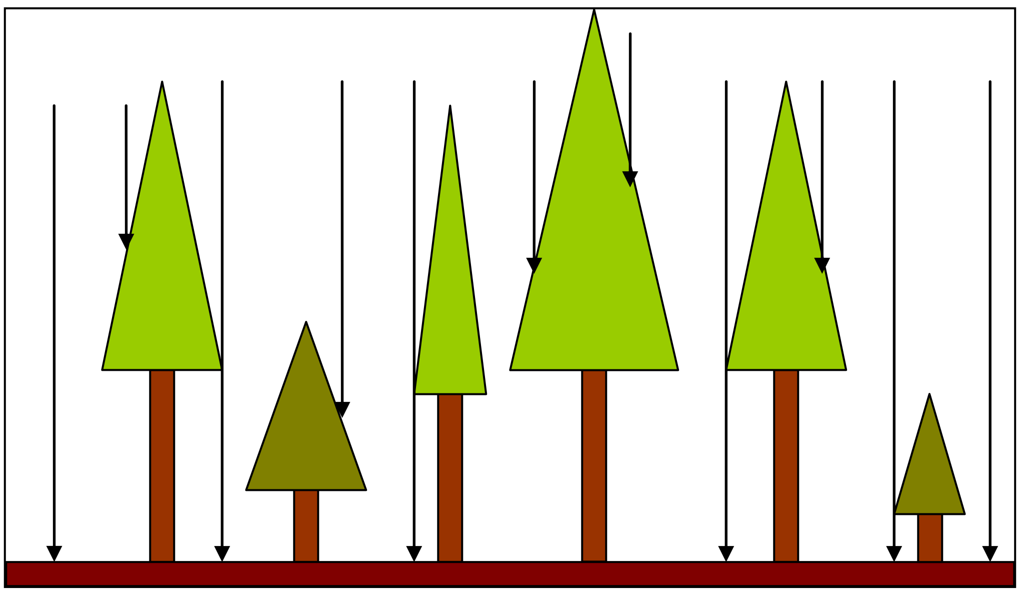


Figure 1. Illustration of canopy cover measured from aerial photography or satellite-based remote sensing imagery (adapted from Jennings and others 1999).

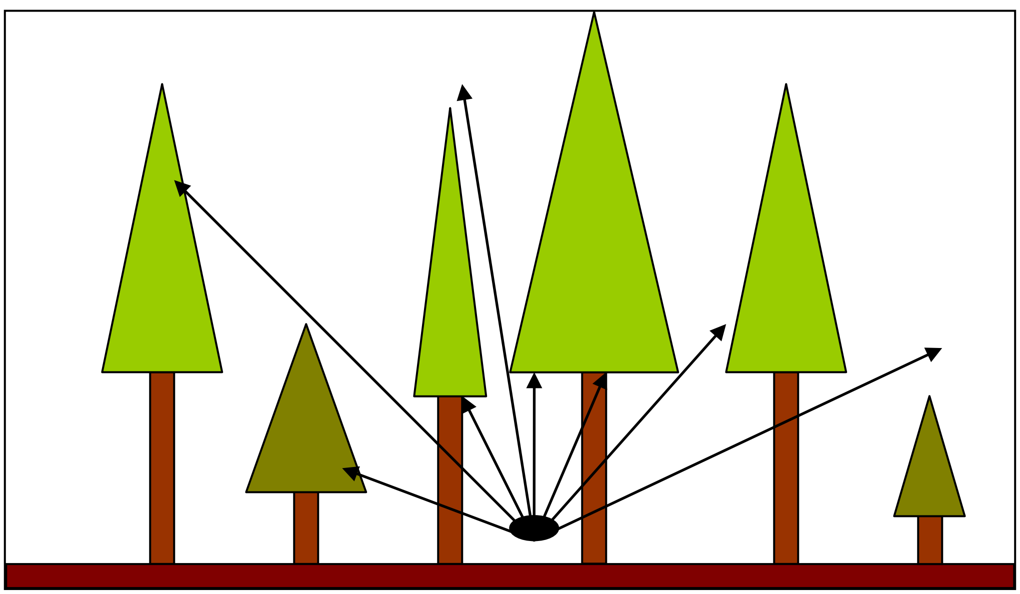


Figure 2. Illustration of canopy closure (adapted from Jennings and others, 1999).

In the Region 1 existing vegetation classification system, canopy cover can be reported differently when using either inventory data or map products. When classifying tree canopy cover from inventory data, cover is determined as a continuous variable with a range of 0-100%. Cover can then be aggregated into classes if needed for analysis and reporting. Tree canopy cover is available in the VMap databases as classes (table 10). These classes are a slight modification from national guiding documents which contain conflicting groups; the *National Vegetation Classification (NVC) System* (FGDC NVC, 2008) and the *Forest Service Existing Vegetation Classification and Mapping Technical Guide* (Brohman and Bryant, 2005). Brohman and Bryant (2005) use a system with 10-percent class breaks, while NVC has a break at 25%. R1-Vmap applications have chosen to adopt the 25% break as it best meets Region 1 business needs. Also, Brohman and Bryant's (2005) guidelines range from 0% to 100%, using 10-percent breaks. It is very uncommon to find canopy cover in excess of 70% in Region 1 and therefore the Region 1classes reflect that condition. Deciduous tree canopy cover classes are also presented in table 10 but are rarely used in Region 1.

Table 10. Tree canopy cover classes used in the VMap database at different levels of mapping.

<table>
<tr><th>Base-level Canopy Cover Classes</th><th>Mid-level Coniferous Tree Canopy Cover Classes</th><th>Mid-level Deciduous Tree Canopy Cover Classes</th><th>Broad-level Canopy Cover Classes</th></tr>
<tr><td>0–9.9%</td><td>Not mapped as tree lifeform</td><td>Not mapped as tree lifeform</td><td rowspan="8">Not mapped</td></tr>
<tr><td>10–24.9%</td><td>10.0-24.9%</td><td rowspan="2">10.0-39.9%</td></tr>
<tr><td>25–39.9%</td><td>25.0-39.9%</td></tr>
<tr><td>40–49.9%</td><td rowspan="2">40.0-59.9%</td><td rowspan="4">>= 40%</td></tr>
<tr><td>50–59.9%</td></tr>
<tr><td>60–69.9%</td><td rowspan="2">>= 60%</td></tr>
<tr><td>70–100%</td></tr>
</table>

8. Tree Size

Tree size is a classification of the predominant diameter class of live trees within a setting. It is defined in the *Existing Vegetation Classification and Mapping Technical Guide* (Brohman and Bryant, 2005) as a classification of the mean diameter at breast height calculated as either quadratic mean diameter or basal area-weighted average diameter. Quadratic mean diameter is the diameter of a tree with the average basal area. Basal area weighted average diameter is the average diameter of the live trees weighted by their basal area. Basal area weighted average diameter is less influenced by small trees than QMD. Although QMD is larger than the arithmetic mean diameter of a stand, it is less than basal area weighted average diameter. Table 11 compares quadratic mean diameter with basal area weighted average diameter for 3 settings. Notice the influence that numerous small trees have on quadratic mean diameter, but not on basal area-weighted average diameter.

Table 11. Comparison of Quadratic Mean Diameter and Basal Area Weighted Average Diameter when calculating average tree size.

Trees per acre (TPA)	**Diameter Breast Height (DBH)**	Basal Area (BA) [(DBH^2 * 0.005454) * TPA]	BA* DBH	TPA * DBH^2	**Quadratic Mean Diameter** [SQRT (Total TPA * DBH^2 / Total TPA)]	**Basal Area Weighted Average Diameter** [Sum(Tree BA*DBH)/ Total BA]
Example 1:						
1000	1	5.5	5.5	1000.0		
0	5	0.0	0.0	0.0		
0	10	0.0	0.0	0.0		
100	15	122.7	1840.7	22500.0		
0	20	0.0	0.0	0.0		
0	25	0.0	0.0	0.0		
1100		128.2	1846.2	23500.0	4.6	14.4
Example 2:						
100	1	0.5	0.5	100.0		
0	5	0.0	0.0	0.0		
0	10	0.0	0.0	0.0		
100	15	122.7	1840.7	22500.0		
0	20	0.0	0.0	0.0		
0	25	0.0	0.0	0.0		
200		123.3	1841.3	22600.0	10.6	14.9
Example 3:						
0	1	0.0	0.0	0.0		
500	5	68.2	340.9	12500.0		
0	10	0.0	0.0	0.0		
0	15	0.0	0.0	0.0		
0	20	0.0	0.0	0.0		
20	25	68.2	1704.4	12500.0		
520		136.4	2045.3	25000.0	6.9	15.0

Since management questions typically are concerned with the larger, dominant and co-dominant trees in a setting, and basal area-weighted average diameter is influenced, to a greater extent, by larger trees, it was selected by the R1 Vegetation Council to be used in the Region 1 existing vegetation classification system. Although basal area-weighted average diameter is used when assessing tree size on inventory data, canopy cover-weighted average diameter estimates are used when assessing tree size by photo/image interpretation methods. The tree size classification works best in single-story settings (see Tree Vertical Structure, section 9). Settings that have continuous or two stories could have a tree size assigned that are not found for trees in the setting. This can be seen in example 3, table 11 above.

Similarly to tree canopy cover, tree size can be reported differently when using either inventory data or map products. When classifying tree size from inventory data, basal area weighted diameter is determined as a continuous variable in units of inches. Tree size can then be binned into classes, if needed, for analysis and reporting. Tree size is mapped in the VMap databases as classes (table 12).

Table 12. Tree size classes used in the VMap database at different levels of mapping.

<table>
<tr><th>Base-level Tree Size Class</th><th>Mid-level Tree Size Class</th><th>Broad-level Tree Size Class</th></tr>
<tr><td>0.0–4.9"</td><td>0.1–4.9"</td><td rowspan="6">Not mapped</td></tr>
<tr><td>5.0–9.9"</td><td>5.0–9.9"</td></tr>
<tr><td>10.0–14.9"</td><td>10.0–14.9"</td></tr>
<tr><td>15.0–19.9"</td><td rowspan="3">>= 15.0"</td></tr>
<tr><td>20.0–24.9"</td></tr>
<tr><td>25.0"+</td></tr>
</table>

9. Tree Vertical Structure

Vertical structure depicts the number of vertical layers of tree lifeform present in a setting. The structure algorithm is a custom algorithm developed by Region 1 based on field review and validation by the R1 Vegetation Council. At this point, it is only applied to inventory data and is not currently depicted on Region 1 map products. There are 5 vertical structure classes: single story (1), two-story (2), three-story (3), continuous vertical structure (C), and NONE, which indicates not enough trees are present to assess structure.

In order for vertical structure to be derived from inventory data, the setting must have at least 20 square feet of basal area or 100 trees per acre. Otherwise, the vertical structure is labeled as NONE. If a setting has less than 20 square feet of basal area but at least 100 trees per acre, a single story class is assigned. Initially, every setting with greater than or equal to 20 square feet of basal area is classified as having 1 layer of vertical structure. Additional vertical structure classes are then potentially assigned to the setting based on the percent of the total basal area found in each of the following diameter classes: 0-4.9”, 5.0-9.9”, 10.0-14.9”, 15.0-19.9”, 20.0-24.9”, 25.0”+. The structure algorithm is performed in the following rule order and tables 13, 14, and 15 and figures 4, 5, and 6 give examples of how these rules are applied:

1. For any 3 consecutive diameter classes ordered largest to smallest, if the first (largest) and third (smallest) diameter class each have at least 2% of the total basal area, and if the percent of basal area in the first and third diameter class are at least 1.8 times larger than the proportion of basal area in the middle diameter class then, add a layer.
2. For any 4 consecutive diameter classes ordered from largest to smallest, if the middle 2 diameter class proportions are within 10% of each other, and the

smallest and largest diameter classes each have at least 2% of the basal area, and each have at least 90% of the sum of the middle 2 diameter classes proportions then, add a layer.

3. If layer still equals 1 and at least 5 consecutive classes have $\geq$ 2% of the total basal area, then vertical structure is continuous.
4. If layer equals 1 and the 3 smallest (0-4.9, 5.0-9.9, 10.0-14.9) diameter classes have $\geq$ 2% of the total basal area, then vertical structure is continuous.

Table 13. Vertical structure example 1.

Percent Live Basal Area by Diameter Class					
25+"	**20-25"**	**15-20"**	**10-15"**	**5-10"**	**0-5"**
0	0	0	50	50	0

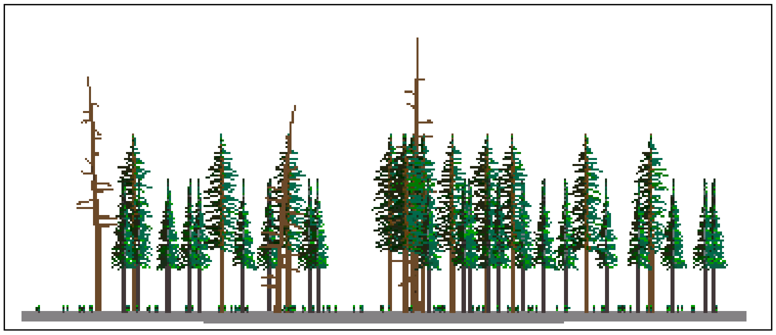


Figure 4. Stand visualization of table 13 data.

Since the vertical structure algorithm only assess live tree structure, the presence of large snags in example 1 does not affect the determination of structural class. This example does not qualify for any of the vertical structure class rules and therefore it is classified as a single layer (1) setting.

Table 14. Vertical structure example 2.

Percent Live Basal Area by Diameter Class					
25+"	**20-25"**	**15-20"**	**10-15"**	**5-10"**	**0-5"**
0	25	0	0	50	25

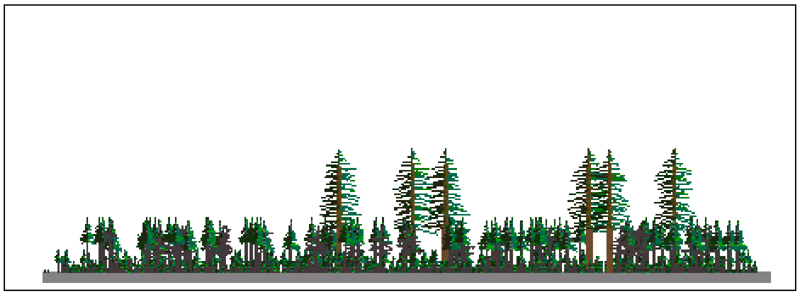


Figure 5. Stand visualization of table 14 data.

In this example, the middle 2 diameter classes both have a percent of basal area within 10% of each other (they are both zero). The class with the largest diameter (20-25" at

25%) and the class with the smallest diameter (5-10” at 50%) both have a percent basal area greater than 90% of the two middle classes (90% of zero equals zero). Therefore this stand is classified as a two layered (2) setting.

Table 15. Vertical structure example 3.

Percent Live Basal Area by Diameter Class					
25+”	**20-25”**	**15-20”**	**10-15”**	**5-10”**	**0-5”**
0	7	20	42	27	4

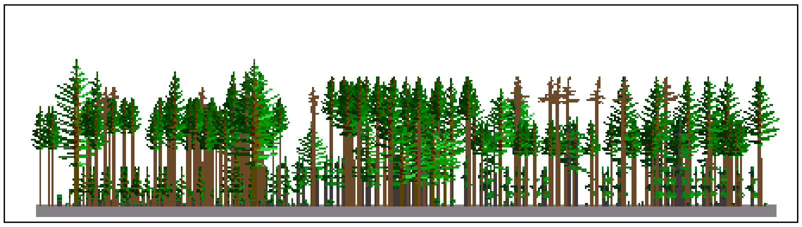


Figure 6. Stand visualization of table 15 data.

In example 3, five consecutive diameter classes have greater than or equal to 2% of the total basal area. Therefore this stand is classified as continuous (C).

Literature Cited

Berglund, D., 2011. Comparison of Canopy Cover and Closure. USDA Forest Service, Northern Region, CMIA Numbered Report 11-08 v1.0. http://fsweb.r1.fs.fed.us/forest/inv/classify/Canopy_cover_6_11.pdf

Berglund, Doug, R. Bush, R. Lundberg. 2005. Region One Vegetation Council Existing Vegetation Classification System and Adaptations to Mapping Projects. USDA Forest Service, Northern Region, Vegetation Classification, Mapping, Inventory, and Analysis Report 05-01, 2009. http://fsweb.r1.fs.fed.us/forest/inv/classify/index.htm.

Berglund, Doug, R. Bush, J. Barber, M. Manning. 2009. R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System. USDA Forest Service, Northern Region, Vegetation Classification, Mapping and Inventory Report, 09-01 v2.0. http://fsweb.r1.fs.fed.us/forest/inv/classify/cmia_r1.pdf

Brewer, Kenneth C., D. Berglund, J. Barber, R. Bush. 2004. Northern Region Vegetation Mapping Project Summary Report and Spatial Datasets Version 042, November 2004. http://www.fs.fed.us/r1/gis/vmap_v06.htm.

Brohman, R. and L. Bryant, eds. 2005. Existing Vegetation Classification and Mapping Technical Guide. Gen. Tech. Rep. WO–67. Washington, DC: U.S. Department of Agriculture Forest Service, Ecosystem Management Coordination Staff. 305 p. http://www.fs.fed.us/emc/rig/documents/integrated_inventory/FS_ExistingVEG_classif_mapping_TG_05.pdf

Bush, Renate and R. Lundberg. 2009. Region 1 Existing Vegetation Software Program. USDA Forest Service, Northern Region, Vegetation Classification, Mapping, Inventory, and Analysis Report 09-07. http://fsweb.r1.fs.fed.us/forest/inv/classify/index.htm.

FGDC NVC. 2008. Federal Geographic Data Committee National Vegetation Classification. FGDC-STD-005-2008 (Version 2). Federal Geographic Data Committee, U.S. Geological Survey, Reston, Virginia, USA. http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/standards/projects/vegetation/

Jennings, S.B., Brown, N.D., and Sheil, D. 1999. Assessing forest canopies and understory illumination: canopy closure, canopy cover and other measures. Forestry 72(1): 59-73.

USDA-FSDD. 2008. United States Department of Agriculture, Forest Service National GIS Data Dictionary. http://fsweb.datamgt.fs.fed.us/current_data_dictionary/index.shtml

Appendix A. Comparison of the Region 1 existing vegetation classification system to the National Vegetation Classification standard and the Forest Service Existing Vegetation Classification and Mapping Technical Guide.

Dominance types have been identified as an interim strategy by *National Vegetation Classification (NVC) System* (FGDC NVC, 2008) and the *Forest Service Existing Vegetation Classification and Mapping Technical Guide* (Brohman and Bryant, 2005) pending a formal floristic classification of plant communities by alliances and associations. Table A.1 shows the relationship between the NVC and the Region 1 existing vegetation classification system.

Table A.1. Relationship between the National Vegetation Classification and the Region 1 classification hierarchies.

National Vegetation Classification	Region 1 Hierarchy
Formation class	Lifeform
Formation subclass	Lifeform subclass
Formation	Not identified
Division	Dominance broad classes
Macrogroup	Dominance mid-level plurality classes
Group	Dominance group 6040
Alliance	Elemental dominance type
Association	Identified locally

In the Region 1 existing vegetation classification system, tree canopy cover classes used in VMap are a slight modification from Brohman and Bryant (2005) and the NVC. Brohman and Bryant (2005) use a system with 10-percent class breaks (e.g., 10-19.9, 10-29.9%, etc.) while NVC has a break at 25%. We have chosen to adopt the 25% break as it best meets Region 1 business needs. Table A.2 shows the hierarchical tree canopy cover classes used in multiple levels of the Region 1 existing vegetation classification system.

Table A.2. Tree canopy cover classes used in the VMap database at different levels of mapping.

<table>
<tr><th>Base-level Canopy Cover Classes</th><th>Mid-level Coniferous Tree Canopy Cover Classes</th><th>Mid-level Deciduous Tree Canopy Cover Classes</th><th>Broad-level Canopy Cover Classes</th></tr>
<tr><td>0–9.9%</td><td>Not mapped as tree lifeform</td><td>Not mapped as tree lifeform</td><td rowspan="8">Not mapped</td></tr>
<tr><td>10–24.9%</td><td>10.0-24.9%</td><td rowspan="2">10.0-39.9%</td></tr>
<tr><td>25–39.9%</td><td>25.0-39.9%</td></tr>
<tr><td>40–49.9%</td><td rowspan="2">40.0-59.9%</td><td rowspan="4">>= 40%</td></tr>
<tr><td>50–59.9%</td></tr>
<tr><td>60–69.9%</td><td rowspan="2">>= 60%</td></tr>
<tr><td>70–100%</td></tr>
</table>

In the Region 1 existing vegetation classification system, tree size classes are a slight modification from Brohman and Bryant (2005). Brohman and Bryant (2005) use a system with 5-inch increments from 0 inches to 50+ inches. It is very uncommon to find a setting with tree size in excess of 25 inches in Region 1. Therefore the Region 1 existing vegetation classification system tree size classes reflect that condition. There is no NVC standard for tree size and there is no NVC or Brohman and Bryant (2005) standard for tree vertical structure.

Appendix B. Species composition for several common dominance group 6040 types in Region 1.

Fig B.1 Average percent of total basal area of several species for three PSME Dominance Group 6040 groups – PSME, PSME-IMIX and PSME-TMIX. Compiled using IW FIA subplot data for entire region.

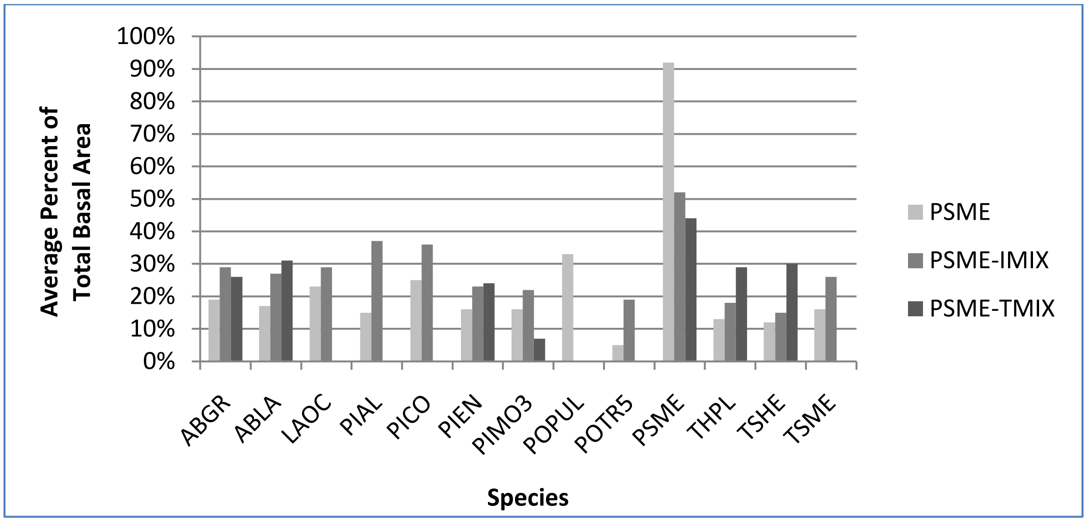


Fig B.2 Average percent of total basal area of several species for three PICO Dominance Group 6040 groups – PICO, PICO-IMIX and PICO-TMIX. Compiled using IW FIA subplot data for entire region.

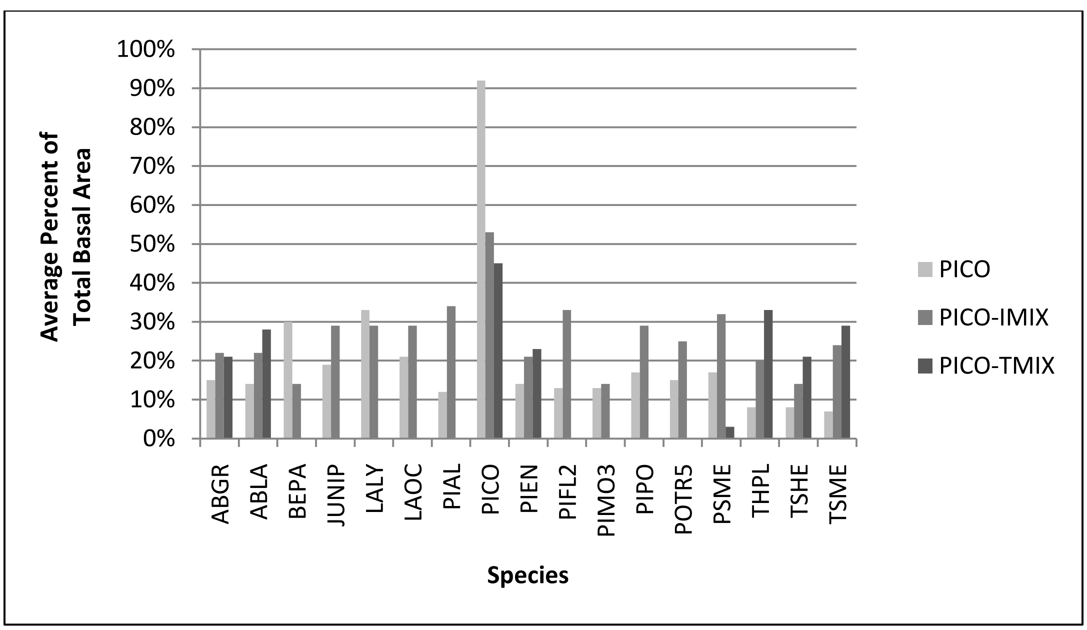
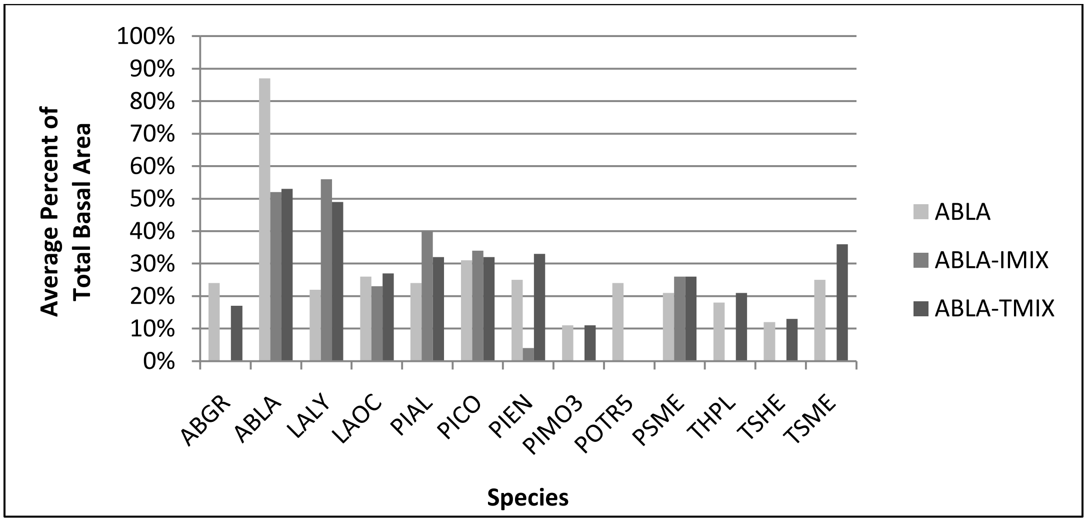


Fig B.3 Average percent of total basal area of several species for three ABLA Dominance Group 6040 groups – ABLA, ABLA -IMIX and ABLA -TMIX. Compiled using IW FIA subplot data for entire region.



Appendix C. Aggregations of dominance group 6040 to dominance plurality classes and dominance broad classes.

Appendix C is also available in MS Access database format at the Region 1, Forest and Rangeland Management, Inventory intranet website (http://fsweb.r1.fs.fed.us/forest/inv/classify/index.htm) under the *Region One look-up Tables* link (04_LUT_DOMINANCE_6040 table in R1_LUT.mdb).

Dominance Group 6040	Dominance 60% Plurality	Dominance 40% Plurality	Dominance Broad
ABGR	ABGR	MX-ABGR	MESIC
ABGR-IMIX	IMIX	MX-ABGR	MESIC
ABGR-TMIX	TMIX	MX-ABGR	MESIC
ABGR-HMIX	HMIX	MX-ABGR	HDWD
ABLA	ABLA	MX-ABLA	COLD
ABLA-IMIX	IMIX	MX-ABLA	COLD
ABLA-TMIX	TMIX	MX-ABLA	COLD
ABLA-HMIX	HMIX	MX-ABLA	HDWD
BEPA	BEPA	MX-BEPA	HDWD
BEPA-IMIX	IMIX	MX-BEPA	HDWD
BEPA-TMIX	TMIX	MX-BEPA	HDWD
BEPA-HMIX	HMIX	MX-BEPA	HDWD
FRPE	FRPE	MX-FRPE	HDWD
FRPE-IMIX	IMIX	MX-FRPE	HDWD
FRPE-TMIX	TMIX	MX-FRPE	HDWD
FRPE-HMIX	HMIX	MX-FRPE	HDWD
JUNIP	JUNIP	MX-JUNIP	IMON
JUNIP-IMIX	IMIX	MX-JUNIP	IMON
JUNIP-TIMIX	TMIX	MX-JUNIP	IMON
JUNIP-HMIX	HMIX	MX-JUNIP	HDWD
LALY	LALY	MX-LALY	COLD
LALY-IMIX	IMIX	MX-LALY	COLD
LALY-TMIX	TMIX	MX-LALY	COLD
LALY-HMIX	HMIX	MX-LALY	HDWD
LAOC	LAOC	MX-LAOC	LAOC
LAOC-IMIX	IMIX	MX-LAOC	IMON
LAOC-TMIX	TMIX	MX-LAOC	IMON
LAOC-HMIX	HMIX	MX-LAOC	HDWD
PIAL	PIAL	MX-PIAL	COLD
PIAL-IMIX	IMIX	MX-PIAL	COLD
PIAL-TMIX	TMIX	MX-PIAL	COLD
PIAL-HMIX	HMIX	MX-PIAL	HDWD
PICO	PICO	MX-PICO	PICO
PICO-IMIX	IMIX	MX-PICO	IMON
PICO-TMIX	TMIX	MX-PICO	IMON
PICO-HMIX	HMIX	MX-PICO	HDWD
PIEN	PIEN	MX-PIEN	COLD

Dominance Group 6040	Dominance 60% Plurality	Dominance 40% Plurality	Dominance Broad
PIEN-IMIX	IMIX	MX-PIEN	COLD
PIEN-TMIX	TMIX	MX-PIEN	COLD
PIEN-HMIX	HMIX	MX-PIEN	HDWD
PIFL2	PIFL2	MX-PIFL2	IMON
PIFL2-IMIX	IMIX	MX-PIFL2	IMON
PIFL2-TMIX	TMIX	MX-PIFL2	IMON
PIFL2-HMIX	HMIX	MX-PIFL2	HDWD
PIMO3	PIMO3	MX-PIMO3	PIMO3
PIMO3-IMIX	IMIX	MX-PIMO3	IMON
PIMO3-TMIX	TMIX	MX-PIMO3	IMON
PIMO3-HMIX	HMIX	MX-PIMO3	HDWD
PIPO	PIPO	MX-PIPO	PIPO
PIPO-IMIX	IMIX	MX-PIPO	IMON
PIPO-TMIX	TMIX	MX-PIPO	IMON
PIPO-HMIX	HMIX	MX-PIPO	HDWD
POPUL	POPUL	MX-POPUL	HDWD
POPUL-IMIX	IMIX	MX-POPUL	HDWD
POPUL-TMIX	TMIX	MX-POPUL	HDWD
POPUL-HMIX	HMIX	MX-POPUL	HDWD
POTR5	POTR5	MX-POTR5	HDWD
POTR5-IMIX	IMIX	MX-POTR5	HDWD
POTR5-TMIX	TMIX	MX-POTR5	HDWD
POTR5-HMIX	HMIX	MX-POTR5	HDWD
PSME	PSME	MX-PSME	PSME
PSME-IMIX	IMIX	MX-PSME	IMON
PSME-TMIX	TMIX	MX-PSME	IMON
PSME-HMIX	HMIX	MX-PSME	HDWD
THPL	THPL	MX-THPL	MESIC
THPL-IMIX	IMIX	MX-THPL	MESIC
THPL-TMIX	TMIX	MX-THPL	MESIC
THPL-HMIX	HMIX	MX-THPL	HDWD
TSHE	TSHE	MX-TSHE	MESIC
TSHE-IMIX	IMIX	MX-TSHE	MESIC
TSHE-TMIX	TMIX	MX-TSHE	MESIC
TSHE-HMIX	HMIX	MX-TSHE	HDWD
TSME	TSME	MX-TSME	COLD
TSME-IMIX	IMIX	MX-TSME	COLD
TSME-TMIX	TMIX	MX-TSME	COLD
TSME-HMIX	HMIX	MX-TSME	HDWD
IMIX	IMIX	IMIX	IMON
TMIX	TMIX	TMIX	COLD-MESIC
HMIX	HMIX	HMIX	HDWD

Appendix D. Legacy classifications and mapping applications used in Region 1.

D.1. Elemental dominance type differences between 2004 and 2009 versions.

Elemental dominance type was classified very similarly in 2004 (key D.1) as it is in the 2009 (key 4, section 6) classification system. Differences occur only in the labeling of the mix species classes for settings which do not meet the 3-species criteria. The 2004 classification separated the tolerant mix species into two classes based on the abundance of grand fir/cedar/western hemlock/Pacific yew (ABGR, THPL, TSHE, TABR2) versus subalpine fir/spruce/mountain hemlock (ABLA, PIEN, TSME). The 2004 classification also lumped hardwood and intolerant species together in the intolerant mix class of IMXS where the 2009 elemental dominance type uses the tree lifeform subclass assignment (key 3, section 6) if a 3-species dominance type cannot be assigned. Also note in key D.1.1 and table D.1.2 that the 4 character code for intolerant mix is different for the 2004 classification than the tree lifeform subclasses used in the 2009 classification.

Key D.1.1. Tree elemental dominance type from the 2004 classification system. Note: XXXX, YYYY, ZZZ = current Region 1 preferred *PLANTS* code for a tree species (table 2).

Step	Argument - Based on Relative Abundance (i.e., canopy cover, basal area, or trees per acre)	2004 Elemental Dominance Type
1	Abundance of single most abundant tree species ≥ 60% of total tree abundance	XXXX
2	Abundance of two most abundant tree species ≥ 80% of total tree abundance, each individually > 20% of total tree abundance	XXXX-YYYY in order of abundance
3	Abundance of three most abundant tree species ≥ 80% of total tree abundance, each individually > 20% of total tree abundance	XXXX-YYYY-ZZZZ in order of abundance
4	Shade intolerant and hardwood species total abundance ≥ shade tolerant species abundance (see table 2)	IMXS
5	ABGR+ THPL+ TSHE+TABR2 abundance ≥ ABLA+ PIEN+ TSME abundance	TGCH
6	ABGR+ THPL+ TSHE+TABR2 abundance < ABLA+ PIEN+ TSMEabundance	TASH

Table D.1.2 Comparison of settings with mixed species in the 2004 elemental dominance type and 2009 tree lifeform subclass classifications.

% Species Composition	2004 Elemental Dominance	2009 Tree Lifeform

ABLA	ABGR	PICO	PIEN	PSME	POTR5	THPL	Type	Subclass
15	0	15	15	20	35	0	IMXS	IMIX
10	0	10	5	35	40	0	IMXS	HMIX
15	15	20	20	25	5	0	IMXS	IMIX
25	15	0	30	15	0	15	TASH	TMIX
20	20	15	20	0	0	25	TGCH	TMIX

D.2. Constructing 2004 dominance type groups from the 2004 elemental dominance types

In the 2004 classification, dominance type groups were constructed from elemental dominance types for analysis in R1 FIA summary database applications and R1-VMap training data collection. This grouping process retained all single-species elemental dominance types and mixed species types (i.e., IMXS, TASH, TGCH) with their 2004 elemental dominance type label. Two species elemental dominance types were grouped based on the most abundant species within the setting or map feature and labels were assigned for that species *PLANTS* code with a '-1MIX' suffix. For example, ABGR-PSME, ABGR-PICO and ABGR-THPL were grouped together into ABGR-1MIX.

D.3. R1-VMap 2004 and 2006 map unit design

To create map labels in the Westside R1-VMap 2004 and 2006 release, the 2004 dominance groups were collapsed into base-level dominance map units. A frequency distribution of of those base-level dominance map units was made from R1 FIA data for each 2004 R1-VMap model area. If either the single-species or the single-species -1MIX map units comprised less than 1% of the total number of plots, they were collapsed into a single-species "mega-mix" [XXXX-MMIX]. None of the '-2MIX' groups exceeded 1% and all were collapsed into the three mixed species classes: TASH (shade-tolerant sub-alpine fir, Englemann spruce, mountain hemlock), TCGH (shade-intolerant cedar, grand fir, western hemlock), or IMXS (shade-intolerant mixed species). Table D.3.1 is an example from R1-VMap model areas 1-4 showing the count and percent of FIA-PSUs by 2004 dominance groups and resulting base-level dominance map unit assignment. Note that the aggregation of dominance types into map units varies slightly by VMap model area based on the 1% threshold found in the FIA data. For example, LAOC could be mapped as LAOC (models 2 & 3), LAOC-MMIX (model 1), or IMXS (model 4) depending on the abundance of LAOC and LAOC-1MIX within that model.

Table D.3.1. Examples of 2004 dominance group (DOM4) assignments to base-level dominance map units (DOM4M) for VMap model areas 1 through 4.

DOM4	Total #	Total%	1	%	DOM4M	2	%	DOM4M	3	%	DOM4M	4	%	DOM4M
ABGR	204	6.3%		0.0%	TGCH		0.0%	TGCH	26	6.9%	ABGR		0.0%	TGCH
ABGR-1MIX	76	2.3%		0.0%	TGCH		0.0%	TGCH	11	2.9%	ABGR		0.0%	TGCH
ABLA	308	9.5%	75	23.0%	ABLA	8	8.1%	ABLA	12	3.2%	ABLA	37	15.3%	ABLA
ABLA-1MIX	120	3.7%	22	6.7%	ABLA-1MIX	4	4.0%	ABLA-1MIX	8	2.1%	ABLA-1MIX	13	5.4%	ABLA-1MIX
BEPA	2	0.1%		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS
LALY	4	0.1%		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS	3	1.2%	LALY-MMIX
LALY-1MIX	3	0.1%		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS		0.0%	LALY-MMIX
LAOC	51	1.6%	4	1.2%	LAOC-MMIX	6	6.1%	LAOC	4	1.1%	LAOC		0.0%	IMXS
LAOC-1MIX	38	1.2%	3	0.9%	LAOC-MMIX	5	5.1%	LAOC-1MIX	4	1.1%	LAOC-1MIX	2	0.8%	IMXS
PIAL	22	0.7%	10	3.1%	PIAL		0.0%	IMXS	2	0.5%	IMXS	6	2.5%	PIAL-MMIX
PIAL-1MIX	6	0.2%	5	1.5%	PIAL-1MIX		0.0%	IMXS		0.0%	IMXS	1	0.4%	PIAL-MMIX
PICO	363	11.2%	49	15.0%	PICO	11	11.1%	PICO	58	15.3%	PICO	41	16.9%	PICO
PICO-1MIX	75	2.3%	8	2.5%	PICO-1MIX	4	4.0%	PICO-1MIX	7	1.8%	PICO-1MIX	9	3.7%	PICO-1MIX
PIEN	79	2.4%	17	5.2%	PIEN	3	3.0%	PIEN	6	1.6%	PIEN	5	2.1%	PIEN
PIEN-1MIX	71	2.2%	13	4.0%	PIEN-1MIX	2	2.0%	PIEN-1MIX	8	2.1%	PIEN-1MIX	5	2.1%	PIEN-1MIX
PIMO3	2	0.1%		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS
PIMO3-1MIX	4	0.1%		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS		0.0%	IMXS

In order to achieve acceptable mid-level map accuracy in the published 2004/2006 R1-VMap datasets, mid-level dominance map units were constructed from the base-level dominance map units. Single species types (when they exceeded the 1% threshold) were kept pure but all base-level single-species-1MIX and single-species-MMIX types were collapsed into IMXS, TASH or TGCH, based on the most abundant single-species (table D.3.2).

Table D.3.2. 2004/2006 R1-VMap base-level map unit assignments to mid-level map units.

2004/2006 Base-level Dominance Type Map Units	2004/2006 Mid-level Dominance Type Map Units
ABGR	ABGR
ABGR-1MIX & MMIX	TGCH
ABLA	ABLA
ABLA-1MIX & MMIX	TASH
LAOC	LAOC
LOAC-1MIX & MMIX	IMXS
PIAL	PIAL
PIAL-1MIX & MMIX	IMXS
PIEN	PIEN
PIEN-1MIX & MMIX	TASH
PICO	PICO
PICO-1MIX & MMIX	IMXS
PIPO	PIPO
PIPO-1MIX & MMIX	IMXS
PSME	PSME
PSME-1MIX & MMIX	IMXS
THPL	THPL
THPL-1MIX & MMIX	TGCH
TSME	TSME
TSME-1MIX & MMIX	TASH

2004/2006 Base-level Dominance Type Map Units	2004/2006 Mid-level Dominance Type Map Units
TSHE	TSHE
TSHE-1MIX & MMIX	TGCH

A complete discussion of the dominance grouping process and map unit design, along with a complete list of 2004/2006 R1-VMap map units can be found in the *Northern Region Existing Vegetation Mapping Project (version 042) Summary Report* and *Appendix A: Map Unit Design* (Brewer and others, 2004) found at http://www.fs.fed.us/r1/gis/vmap_v06.htm.

D.4. Shortcomings with the 2004 dominance type groups.

Many users did not like how the 2004 dominance group ruleset distinguished between the '-1MIX' types and the mixed species (TASH, TGCH, IMXS) groups. This was based on situations where an individual species is "moderately" abundant (canopy cover, basal area, or trees per acre less than 60% and greater than or equal to 20%) and therefore not a single-species label, and the classification assignment was influenced by the presence or absence of other "moderately" abundant associated tree species. Depending on the number and abundance of the associated tree species present, the classification could be a two-species, three-species or a "mixed type", while the abundance of the most abundant species remained unchanged.

By rule in the 2004 dominance group classification, if the most abundant single-species together with one other species, comprised more than 80% of the attribute, the condition was labeled the most abundant species code and a '-1MIX' suffix. If however, there were no two species that exceeded the 80% threshold, that setting was labeled TASH, TGCH, or IMXS depending on the species mix. As shown in table D.4.1, PSME comprises 45% of the setting and is the most dominant species. However, based on its associates, it could be classified 4 different ways.

Table D.4.1. Example of shortcomings with collapsing 2004 elemental dominance types into the 2004 dominance type group classification.

Example	PSME	PICO	ABLA	ABGR	2004 Elemental Dominance Type	2004 Dominance Type Group
1	45	40	10	15	PSME-PICO	PSME-1MIX
2	45		40	15	PSME-ABLA	PSME-1MIX
3	45	30	25		PSME-PICO-ABLA	IMXS
4	45		25	30	PSME-ABGR-ABLA	TGCH
5	45		30	25	PSME-ABLA-ABGR	TASH

While the mixed groups (i.e., TASH, TGCH, IMXS) likely provide a more accurate map, the specificity needed to model wildlife habitat, predict insect and pathogen hazard, develop silvicultural prescriptions, and estimate timber growth and yield is diminished. The 2009 dominance group 6040 was developed in order to avoid these problems. Table D.4.2 contains the same data as in table D.4.1 but shows how the 2009 dominance group 6040 classification has avoided the problems associated with the 2004 dominance group.

Table D.4.2. Assignment of 2009 elemental dominance type and dominance group 6040 classifications with the same examples as in table D.4.1.

Example	PSME	PICO	ABLA	ABGR	Elemental Dominance Type	Dominance Group 6040
1	45	40	10	15	PSME-PICO	PSME-IMIX
2	45		40	15	PSME-ABLA	PSME-TMIX
3	45	30	25		PSME-PICO-ABLA	PSME-IMIX
4	45		25	30	PSME-ABGR-ABLA	PSME-TMIX
5	45		30	25	PSME-ABLA-ABGR	PSME-TMIX

Another shortcoming resulting from the 2004 dominance group label was when a TASH or TGCH type was assigned even though there was a more abundant IMXS species present. In examples 4 and 5 of table D.4.1, PSME-ABGR-ABLA would be classified as TGCH and PSME-ABLA-ABGR would be classified as TASH, even though PSME is more abundant than either ABGR or ABLA. As shown in examples 4 and 5 in table D.4.2, both PSME-ABGR-ABLA and PSME-ABLA-ABGR would be classified as PSME-TMIX in the dominance group 6040 classification.

It would be easy to assume that since elemental dominance type is the base-level classification, it would have the most information content and moving to dominance group 6040 classification, for most analysis purposes, would result in a loss of information. This is true in most cases (i.e., 1-species, 2-species and 3-species classes). However, this is not always the case when comparing the 2004 elemental dominance type mixes of TASH and TGCH with dominance group 6040. Of 3423 forested FIA settings in Region 1, 94 are TASH and 107 are TGCH (2.75% and 3.13% of the total respectively) according to its 2004 elemental dominance type classification. As seen in table D.4.3, there is more information content in dominance group 6040, and its derivative dominance 40% plurality, than in the 2004 elemental dominance type class for 64 of the 94 cases of TASH (such as ABLA-TMIX, PICO-TMIX, etc). Similar results are found with TGCH. Of 107 settings, 65 have more information content in dominance group 6040 than in its 2004 elemental dominance type class.

Table D.4.3. Comparison of 2004 elemental dominance type with dominance group 6040 and dominance 40% and 60% plurality classes

2004 Elemental Dominance Type	Dominance Group 6040	Dominance 40% Plurality	Dominance 60% Plurality
TASH	PSME-TMIX	MX-PSME	TMIX
TASH	PIMO3-TMIX	MX-PIMO3	TMIX
TASH	LAOC-TMIX	MX-LAOC	TMIX
TASH	PICO-TMIX	MX-PICO	TMIX
TASH	TSME-TMIX	MX-TSME	TMIX
TASH	PIEN-TMIX	MX-PIEN	TMIX
TASH	ABLA-TMIX	MX-ABLA	TMIX
TASH	TMIX	TMIX	TMIX
TGCH	PIMO3-TMIX	MX-PIMO3	TMIX
TGCH	LAOC-TMIX	MX-LAOC	TMIX
TGCH	TSHE-TMIX	MX-TSHE	TMIX
TGCH	THPL-TMIX	MX-THPL	TMIX
TGCH	ABGR-TMIX	MX-ABGR	TMIX
TGCH	TMIX	TMIX	TMIX

D.5. Timber Stand Measurement Record Sysytem (TSMRS) Classification and Map Units

The following are excerpts (in Times New Roman font) from the Region 1 Forest Service Handbook, Chapter 100-Timber Stand Management Record System (TSMRS), Amendment Number R1 2409.21e-2002-1. This text allows a comparison of the Region 1 existing vegetation classification system to those attributes stored in TSMRS. The TSMRS classifications were used to both classify inventory data as well as spatially depict map units (i.e., stands) using photo interpretation methods. However, no explicit documentation describes the photo interpretation procedures. This handbook can be found on the intranet at http://fsweb.r1.fs.fed.us/directives/html/fsh2000.html#2400. Although TSMRS was a very competent system for Region 1 business needs at the time, the 2009 Region 1 existing vegetation classification system provides much greater flexibility and integration opportunities across multiple resource disciplines to meet Region 1's business needs of today.

FSH 2409.21e - TIMBER MANAGEMENT CONTROL HANDBOOK
R1 AMENDMENT 2409.21e-96-1
EFFECTIVE August 5, 1996

Chapter 141.13 - Forest Type.

The standard forest type is based on plurality of tree numbers up to 5.0 inches dbh and on basal area over 5.0 inches dbh. The average dbh is derived from the total live component. The 0-1 dbh class is not used in the calculation of average dbh for the total live component. If an area is nonstocked, enter the forest type anticipated for the area in the prescription. If there is no prescription, enter the last forest type which occupied the area.

Code		Forest Type Definition
DF	Douglas-fir	Stands in which Douglas-fir comprises a plurality of the stocking. Common associates include western hemlock, western redcedar, grand fir, ponderosa pine, and larch.
PP	Ponderosa Pine	Stands in which ponderosa pine comprises a plurality of the stocking. Common associates include Douglas-fir and larch.
WP	Western White Pine	Stands in which white pine comprises a plurality of the stocking. Common associates are western redcedar, larch, grand fir, Engelmann spruce, and lodgepole pine.
SAF	Spruce-Subalpine Fir	Stands in which Engelmann spruce and/or subalpine fir, singly or in combination, comprise a plurality of the stocking. Common associates are mountain hemlock, whitebark pine, and lodgepole pine.
C MAF WH	Western Redcedar Mountain Hemlock-Subalpine Fir Western Hemlock	Stands in which western redcedar or hemlock comprise a plurality of the stocking. Common associates include Douglas-fir and grand fir.
L GF	Larch Grand Fir	Stands in which western larch or grand fir comprise a plurality of the stocking.
LP WLP	Lodgepole Pine Whitebark-Limber Pines	Stands in which lodgepole pine comprises the plurality of the stocking. Common associates are subalpine fir, western white pine, whitebark pine, Engelmann spruce, western larch, and sometimes aspen.
BGA ASP CW	Birch-Green Ash, Boxelder, Red Alder Aspen Cottonwood	Stands in which hardwoods comprise the plurality of the stocking. Region 1 hard- woods are aspen, black cottonwood, birch, red alder, green ash, and boxelder.
J WSL	Juniper, Whitebark-Limber Pines, Subalpine Larch	Stands in which juniper, whitebark pine, limber pine, or subalpine larch, singly or in combination comprise a plurality of the stocking.

Nonforest lands — Lands that have never had or that are incapable of having 10 percent or more of the area occupied by forest trees; or previously having such cover and currently developed for nonforest use.

Chapter 141.32 - Stand Size Class.
A classification of forest lands based on live trees in the stockable portion of the stand. The basic stand size classification can be further defined using descriptive adjectives as shown under the acceptable code list.

Sawtimber Stands. Stands at least 10 percent stocked with growing stock trees 5 inches diameter breast height (dbh) and larger, in which the stocking of trees 9 inches dbh and larger is at least equal to the stocking of trees 5 to 8.9 inches dbh.

Poletimber Stands. Stands at least 10 percent stocked with growing stock trees 5 inches dbh and larger, in which the stocking of trees 5 to 8.9 inches dbh exceeds the stocking of trees 9 inches dbh and larger.

Seedling - Sapling Stands. Stands at least 10 percent stocked with growing stock trees of all sizes, in which the stand size class is not poletimber or sawtimber. Saplings are generally 1.0 to 4.9 inches dbh and seedlings are generally less than 1.0 inch dbh.

Nonstocked. Forest land less than 10 percent stocked with growing stock trees.

Code	Description
SAWT	Sawtimber
MHRS	Mature High Risk
MLRS	Mature Low Risk
IMSA	Immature
POLE	Poletimber
MHRP	Mature High Risk
MLRP	Mature Low Risk
IPOL	Immature Pole
SAPL	Saplings
OSAP	Overtopped with Brush
SEED	Seedlings
OSEE	Overtopped with Brush
MULS	Multisized - 2 age classes.
MULT	Multisized - 3 or more age classes.
NONS	Nonstocked
HGHB	High Brush Occupying Site
LOWB	Low Brush Occupying Site
SOD	Sod Occupying Site
DUFF	Duff Occupying Site
DEB	Debris Occupying Site
BARE	Bare Soil

NA Not Applicable - Use when forest type is nonforest.

Stocking is the degree of occupancy of land by trees measured by basal area and/or number of trees.

Mature is defined as the stage at which an even-aged stand has attained full development, particularly height and stand density. This usually occurs when a stand reaches 95 percent of culmination mean annual increment (CMAI).

High risk is defined as generally the point in time when at least 40 percent of the stand, as measured by basal area, is affected by damaging disease or insects.

Multisized stands contain more than one age class (usually at least three age classes) intermingled intimately on the same area, and the difference in age between the oldest and youngest trees exceeds 20 percent of the length of the rotation. Use code MULS for stands containing two age classes. Use code MULT for stands containing at least three age classes. Stand size class year of origin, 2111, should be entered when the stand size class is either MULS or MULT.