# An Exploratory Assessment of Soil Moisture Regime Delineations in the Pacific Northwest

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Allison J. Harvey

Major Professor: Mark Kimsey, Ph.D.
Committee Members: Paul McDaniel, Ph.D.; Ronald Robberecht Ph.D.
Department Administrator: Jodi Johnson-Maynard, Ph.D.

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# Authorization to Submit Thesis

This thesis of Allison J. Harvey, submitted for the degree of Master of Science with a major in Soil and Land Resources and titled "An Exploratory Assessment of Soil Moisture Regime Delineations in the Pacific Northwest," has been reviewed in final form.  Permission, as indicated by the signatures and dates given below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor: ______________________________ Date__________
Mark Kimsey, Ph.D

Committee
Members: ______________________________ Date__________
Ronald Robberecht, Ph.D

______________________________ Date__________
Paul McDaniel, Ph.D

Department
Administrator: ______________________________ Date__________
Jodi Johnson-Maynard, Ph.D

# Abstract

Created concurrent with Great Plains cropping systems along a shallow precipitation gradient, translating soil moisture regimes (SMRs) to the Western United States may not account for the latter's variable precipitation distribution and natural vegetation. While this was noted shortly after the regimes' genesis, Western land managers were still left to infer SMRs along vegetative communities using Great Plains definitions and field knowledge alone. To ground truth these vegetative associations, four transects of five monitoring sites each were placed along gradients of increasing precipitation to capture respective transitions from aridic to xeric and xeric to udic SMRs within relevant plant communities and land uses of Major Land Resource Areas (MLRA) 2 & 3, 10, 12, and 43A. MLRA 10 was predicted to traverse aridic and xeric SMRs while the remaining transects would represent the transition from xeric to udic. Sites representing MLRAs 2 & 3 and 10 were all measured as having a udic SMR. MLRA 12 was the most diverse, containing ustic, aridic, and udic SMRs at sites 1 and 2, 3 and 4, and 5, respectively. Finally, MLRA 43A was measured as having a udic SMR at sites 2-5 and an ustic SMR at site 1. Though 10 years of data is necessary for official regime assignment, the misalignment of predicted and actual SMRs indicates that either regime definitions do not adequately reflect changes in Western vegetation as depicted by local land managers, or vegetative delineations need to adjust in order to fit instated regime definitions. Considering the former, when setting the volumetric soil moisture threshold to 10% instead of the current wilting point, there was a closer relationship between predicted and amended SMRs. Regardless, continued monitoring precedes definitive action.

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# Dedication

To Nic Jelinski, who is ever an inspiration for those interested in soils, or for those that aren’t; I was once the latter.

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# Introduction

In 1951, the United States Soil Conservation Service commissioned Guy Smith to create an official Soil Taxonomy from the already developing, yet disconnected, zonal and series-based systems (Smith, 1986). The transition catalyzed a nationwide taxonomic language overhaul, forcing Soil Conservation Service staff members to ground-truth definitions based on comprehensive lab and field data. Soil temperature and moisture regimes arose from two lines of thought within this movement. To begin, Smith believed successful taxonomic classifications made the largest number of important statements about soil behavior and genesis with the least amount of bifurcations (Smith, 2003). Soil moisture and temperature drive several chemical, physical, and biological soil properties such as the presence of solutes, weathering intensity, and humification. These similarities translate to soil behavior, creating interpretable soil groups for land management. In addition, Guy Smith's commission coincided with soils being mapped in nearly every county of the United States, meaning his team simultaneously created new definitions as old ones were being applied. Since climatic zones were already prevalent in taxonomy, instating moisture and temperature regimes maintained continuity with previous classification systems by disrupting as little series as possible (Smith, 2003).

The established series and zones typically followed delineated and mapped crop boundaries, meaning Smith's regimes also mimicked cropping pattern distributions by shaping definitions around mean annual temperatures, maximum seasonal differences, permafrost, and organic matter contents (Smith, 2003). Creating definitions from land use also illustrated Smith's conviction that Soil Taxonomy should suit applicable purposes rather than act as an arbitrary truth (Smith, 2003). Hyperthermic, the warmest soil temperature regime (STR), developed around seasonal moisture differences rather than temperature, dictating plant growth - as reflected by the production of citrus and winter vegetables (Smith, 2003). The next boundary, between thermic and mesic, delineated crop production from cotton to corn, cotton to winter wheat, and sorghum to wheat while also capturing changes from 'Gray-brown' and 'Red-yellow' Podzolic soils and 'Red' and 'Gray' Desert soils of previous classifications (Smith, 2003). Reflecting the conceptual transition from moisture to temperature controlled growing seasons, the change from mesic to frigid STRs also illustrated the shift from corn to small grains and corn to silage cropping systems while maintaining boundaries between Dystrochrepts and Spodosols in the northeast US (Smith, 2003).

Using dryland stations extending from Texas to North Dakota, soil moisture regimes (SMRs) followed suit in using cropping practices to formulate definitions. Smith's team delineated aridic, aridic subgroups of ustic, ustic, and udic SMRs across the Great Plains by changes in crop production and soil properties (Smith, 2003). The aridic SMR, characterized by soluble salt accumulation and minimal leaching, reflected growing seasons controlled by moisture rather than temperature and coincided with the use of irrigation. Conversely, temperature, rather than moisture, controlled udic SMR growing seasons. This SMR was characterized by alternating corn and soybean production, the absence of calcium carbonates, and occurrence in humid climates with well-distributed rainfall where precipitation exceeds evaporation. The ustic SMR acted as an intergrade between the two, where moisture, albeit limited, enabled more plant growth during warmer temperatures. This was marked by yearly cultivation of wheat and sorghum without irrigation and the adoption of fallow practices within ustic's aridic subgroup. While the ustic SMR slightly curbed plant growth by partially adopting both temperature and moisture limitations of udic and aridic SMRs, respectively, the xeric SMR fully adopted both restrictions, allocating enough moisture, but only during temperatures inadequate for crop growth. In cropped regions, subsequent growth during adequate temperatures utilized this stored moisture. Finally, the aquic SMR represented a saturated, reducing environment virtually free of dissolved oxygen while above biotic zero (Soil Survey Staff, 1999).

Originally, Smith left intentional gaps between moisture regime definitions to encourage the formation of more stringent ones from observation rather than arbitrary thresholds, arising from his support of a dynamic and continuously scrutinized classification system (Smith, 2003). However, as the definitions evolved, an issue arose in the Western United States, where, instead of the Great Plain's cropped vegetation and shallow moisture gradient, native vegetation and contrasting moisture conditions characterize the landscape. At the time, Smith recognized this dichotomy:

> When you are working in mountainous regions and you do not have this very gradual change in climate as you have on the Great Plains, then the location of the boundaries is going to be largely a matter of inference. You should know which plants are characteristic of which moisture regimes (Smith, 2003).

Smith’s solution is an argument distilled from years of scientific work linking climate with soil moisture and its subsequent effects on plant communities, especially in water-limited environments. As a balance between exchanged heat and moisture at the earth’s surface, climate most directly impacts critical plant growth and reproductive processes of evapotranspiration and photosynthesis via precipitation, radiation, humidity, temperature, sunlight, and wind (Critchfield, 1960). Of these, though acting in conjunction with other physiographic, edaphic, and biotic environmental requirements, precipitation and temperature primarily infuence vegetation distributions in the Western United States through competition for water as a function of elevation and topographic-moisture gradients (Chabot and Mooney, 1985; Barbour and Billings, 2000; Bonan, 2002). However, solely creating vegetative community models from associated elevations and moisture gradients fails to acount for the effects of surficial geology, soil physical properties, and local hydrology.  With these ammendments, soil moisture becomes the best proxy for plant available water (Critchfield, 1960; Soil Survey Staff, 1999; Barbour and Billings, 2000; Smith, 2003; Schaetzl and Anderson, 2005).

Exacerbating the effects of elevation and topography, plant available water limitations in the Western United States drive adaptive drought tolerance or avoidance, resulting in the development of moisture tolerance thresholds and increasingly minute species distributions (Chabot and Mooney, 1985). Delaying stomatal closure as a means of regulating turgor pressure characterizes drought tolerance, enabling species to actively photosynthesize and grow at a reduced rate during lower needle water potentials (Chabot and Mooney, 1985). While this avoids the stress associated with significantly reduced photosynthesis, it also risks dropping plant below the permanent wilting point (Chabot and Mooney, 1985). Using a different method, drought avoidance, perennial grasses develop most of their above-ground tissues during the narrow window of adequate soil moisture in late spring and early summer (Barbour and Billings, 2000). Both of these drought adaptations dictate plant community distributions across the landscape by making species more or less competative in utilizing soil moisture. For example, within dry environments such as high desert, competition for vernal moisture drives the selective distribution of sage brush taxa (Barbour & Billings, 2000).  Habitat boundaries between dry and mesic environments, such as grasslands and forests or shrublands, are commonly maintained by infrequent droughts (Chabot & Mooney, 1985). Within Pacific Northwest forests, the correlation between species distribution and measured osmotic potential range indicates the capacity of a species’ drought response and its effect on successful generation (Chabot and Mooney, 1985). For example, species that photosynthesize at lower osmotic potentials by delaying stomatal closure typically have higher drought resistances and occur at lower elevations, while those that photosynthesize at higher osmotic potentials have inverse resistances and elevation occurrences *(Figure 1.1)*.

The close coupling of plant distributions with soil moisture allows their relationship to be traced over the landscape, a fact that Guy Smith recognized and that many land management agencies have utilized to understand the latter's distribution, being infeasible to directly measure soil moisture over large tracts of mountainous land. In western Oregon, current field understanding proposes that *Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii* (PSMEM) stands with no *Tsuga heterophylla* (Raf.) Sarg. (TSHE) regeneration in the understory have a xeric SMR (J. Martin, personal communication, 2019). However, TSHE regeneration in the understory indicates a udic SMR (J. Martin, personal communication, 2019) *(Table 1.1)*. In central Oregon, SMRs are assigned based on the dominance of *Festuca idahoensis* Elmer (FEID) and *Artemisia tridentata* Nutt. ssp. *vaseyana* (Rydb.) Beetle (ARTRV), which indicate a xeric SMR, and *Pseudoroegneria spicata* (Pursh) Á. Löve (PSSP6) and *Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle & Young (ARTRW8), which indicate an aridic AMR (K. Moffitt, personal communication, 2019) *(Table 1.1)*. In eastern Idaho, the xeric to udic boundary is determined by the transition from *Cercocarpus ledifolius* Nutt. (CELE3) to *Calamagrostis rubescens* Buckley (CARU) under *Pseudotsuga menziesii* (Mirb.) Franco var. *glauca* (Beissn.) Franco (PSMEG) (C. Rebernak, personal communication, 2019) *(Table 1.1)*. Meanwhile, northern Idaho land managers delineate between xeric and udic under *Abies grandis* (Douglas ex D. Don) Lindl. (ABGR) canopies with the transition from *Linnaea borealis* L. (LIBO3) to *Clintonia uniflora* (Menzies ex Schult. & Schult. f.) Kunth (CLUN2) in the understory, respectively (B. Gardner, personal communication, 2019) *(Table 1.1)*.

Though Smith encouraged the utilization of plant communities to infer SMRs, he also held that soil should be classified on its own properties, not on presumed or adjacent ones. Thus, he introduced a fine balance between over-analysis, which would subvert Soil Taxonomy's viability by overburdening resources, and conjecture, which would undermine Soil Taxonomy's ability to accurately inform interpretations and standardize definitions. He struck the balance with this: selecting criteria that, after laboratory measurement, could be benchmarked from combined knowledge in soil genesis, climatology, botany, geology, geomorphology, etc. However, over 50 years later, Soil Taxonomy has failed to scientifically ground truth SMR data to specific plant communities in the Western United States. Rather, lone agencies, scientists, and land managers have drawn fragmented boundaries based on personal experience to aid sustainable land management and Taxonomic continuity.

This study provides the laboratory measurements needed to begin confidently associating vegetative communities with SMRs in the Pacific Northwest by measuring soil moisture across the previously outlined plant communities of Oregon and Idaho to determine if current associations are correct. Analyzing this relationship will have one of two outcomes, either the instated vegetative boundaries correctly fit current taxonomic definitions and no changes need to be made, or the delineated SMRs do not align with Soil Taxonomy. While the vegetative delineations may or may not actually reflect SMR transitions, land managers considered SMR definitions in conjunction with local climates and land management schemes and drew meaningful boundaries. Misaligned boundaries would more than likely result in the following, as stated in *Soil Taxonomy*:

> “The definitions of soil moisture regimes that follow were fitted to the boundaries. If future studies show that the classifications of the soils are not in agreement with these definitions, we are more likely to change the definitions than the classifications. Over time, changes in both will doubtless be made.”

This is a continuation of Smith’s conviction that Soil Taxonomy should suit different applicable purposes rather than act as an arbitrary truth (Smith, 2003).

# Methods

## Study Area

Three geographically distinct Land Resource Regions primarily dominate the Pacific Northwest within the contiguous United States. Together, Regions A, B, and E comprise a landscape where windward orographic precipitation creates areas reaching over 1,525 mm mean annual precipitation, contrasting sharply with leeward plains and plateaus receiving as little as 150 mm (Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, 2006). Within Major Land Resource Areas (MLRA) 2, 3, 10, 12, and 43A of these Land Resource Regions, four transects of five monitoring sites each were placed along gradients of increasing precipitation to capture respective transitions from aridic to xeric and xeric to udic SMRs. Site selection was performed in conjunction with Natural Resource Conservation Service (NRCS) mapping projects while representing prevalent plant communities and land use.

Sites selected in the Middle Cascade Mountains represent MLRAs 2 and 3, illustrating the transition from gently sloping flood plains and lacustrine deposits to isolated volcanic cones and steep, glaciated mountains (Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, 2006). Site elevations range from 201 to 547 m above sea level, with mean annual precipitation varying from 1213 to 2027 mm and mean annual temperature ranging from 9.5 to 11.2°C (PRISM Climate Group, 2019) *(Table 1.2, Figure 1.2)*. Formed in colluvium and colluvium over igneous residuum, the sites traverse hillslopes and landslides of foothills and collapsed mountains and are influenced by volcanic ash at higher elevations. The sites represent Inceptisols and Ultisols with mesic STRs. The two lowest elevation sites are predicted to have xeric SMRs, while the highest three are predicted to have udic SMRs.

Sites selected in the Ochoco Mountain foothills represent MLRA 10, characterized by gently rolling to steep hills, plateaus, and low mountains. The lowest site, at 1059 m above sea level, is the warmest and driest, with an mean annual temperature of 8.6°C and 328 mm mean annual precipitation (PRISM Climate Group, 2019). The highest site, at 1455m above sea level, is the coolest and wettest, with an mean annual temperature of 6.6°C and 541 mm mean annual precipitation (PRISM Climate Group, 2019) *(Table 1.2, Figure 1.3)*. Colluvium-influenced alluvial fans underlie the two lowest sites, changing to residuum overlain by ash and eventually colluvium with increasing elevation in the foothills. Though all Mollisols with predicted to be xeric SMRs, the lowest three sites have mesic STRs and the highest two have frigid STRs.

Sites selected in the Lost River Range represent MLRA 12, the Lost River Valleys and Mountains, characterized by deeply dissected mountain uplands and intermontane basins lined with broad alluvial fans extending to stream terraces (Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, 2006). The lowest site, the warmest and driest at 2113 m above sea level, receives 394 mm mean annual precipitation with an mean annual temperature of 2.8°C (PRISM Climate Group, 2019). To contrast, the highest site, the coolest and wettest at 2617 m above sea level, receives 560 mm mean annual precipitation and an mean annual temperature of 1.3°C (PRISM Climate Group, 2019) *(Table 1.2, Figure 1.4)*. The two lowest sites are formed on an alluvial fan, the next are formed on a colluvial mountain slope, while the highest is formed from colluvium over till on a cirque’s lateral moraine. Representing Mollisols and Inceptisols, all the sites are predicted to have a xeric SMR, though it is suspected that the 5th may have a udic SMR.

Sites selected in the Palouse Range represent MLRA 43A, an area of deep canyons cut by steep-gradient rivers into rugged and glaciated thrust-and-block fault mountains of layered sedimentary bedrock, though the sites themselves reside on an unglaciated batholith (Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, 2006). Site elevations range from 968 to 1,127 m above sea level. The lowest elevation site receives 781 mm mean annual precipitation at 7.6°C mean annual temperature, while other sites receive as much as 923 mm mean annual precipitation and have annual mean temperatures as low as 6.8°C (PRISM Climate Group, 2019) *(Table 1.2, Figure 1.5)*. These Alfisol and Mollisol intergrades formed in ash and loess over granite and have frigid STRs, except the lowest, which has a mesic STR (PRISM Climate Group, 2019). Sites 1-3 are predicted to have a xeric SMR, while sites 4-5 are predicted to be udic.

### Site Installation

Site profiles were described and classified by NRCS Soil Scientists (Soil Survey Staff, 1999; Schoeneberger, Wysocki, *et al.*, 2012). After description, ten METER EC-5 soil moisture sensors were installed in two columns spaced roughly 30 cm apart at depths of 10, 20, 30, 60, and 90 cm. Four RT-1 Soil Temperature Sensors were installed in two columns spaced roughly 30 cm apart at depths of 10 and 50 cm (METER Group, 2019a, 2019b). Soil moisture and temperature sensor installation depths were determined from soil moisture control section boundaries and soil moisture and temperature regime definitions as outlined in Soil Taxonomy(Soil Survey Staff, 1999). Soil pits were systematically backfilled using similar material to that which was removed. Readings were taken at all depths every six hours using Em5b Analog Data Loggers (Em5b Data Collection System, 2014).

## Vegetation Assessment

### *Quantitative*

At sites representing MLRA 2 & 3, 12, and 43A, using modified line point intercept (LPI), two 25 m transects were ran parallel north to south on each side of respective sites, within 10 m of the center (Herick, Van Zee, *et al*., 2017). If the north-south declination moved the transects beyond the bounds of the habitat type measured at the immediate site due to changes in aspect, hillslope position, etc., the transects were resituated east to west. Measurements were taken every meter. At sites 1, 3, and 4 representing MLRA 10, vegetation was recorded using an intersecting design of two, 50 m transects situated N-E-S-W.  At sites 2 and 5, only one transect was used.

Within forested environments, overstory and understory were treated separately with respective ‘Top’ and ‘Lower Layers.’ Overstory was considered vegetation more than 3 m above the ground surface. Percent foliar cover and vegetative composition were calculated using methods found in the *Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems* (Herick, Van Zee, *et al*., 2017).

### *Qualitative*

Each site’s vegetation was categorized by NRCS Soil Scientists using regional plant community assessment protocols. Sites representing MLRA 2 & 3 were assessed using *The Field Guide to the Forested Plant Associations of the Westside Central Cascades of Northwest Oregon* (McCain and Diaz, 2002). In MLRA 10, a draft Provisional Ecosite workload was used for the lower four sites, and the *Forest Service Plant Associations of the Blue and Ochoco Mountains* was used for the fifth site (Powell, 2011). *Forest Habitat Types of Northern Idaho* and *Forest Habitat Types of Eastern Idaho* were used for sites within MLRA 43A and 12, respectively(Steele, Cooper, *et al*., 1983; Cooper, Neiman, *et al*., 1991).

## Data Analysis

### *Soil Moisture Control Section*

The Natural Resources Conservation Service's Kellogg Soil Survey Laboratory (KSSL) performed particle-size analysis to determine the texture of each described horizon (Soil Survey Staff, 2014). These laboratory textures, in conjunction with profile descriptions, determined the control section for differentiation of soil series, which informed the family particle-size class and subsequent soil moisture control section for each site (Soil Survey Staff, 1999).

### *Matric Potential to Volumetric Water Content*

The volumetric water content at -1.5 MPa of the respective horizons containing the upper and lower limits of the moisture control section was determined using the *approxfun* function to interpolate between at least three WP4 measurements following METER protocol (HYPROP Data Evaluation Software, 2011; WP4C Manual, 2019). This was repeated for each site profile.

### *Soil Moisture Data*

Retaining data from soil moisture sensors at the upper and lower soil moisture control section boundaries, daily values were calculated by averaging volumetric soil moisture data collected every six hours. These values were averaged across column depths to create one daily value per depth, then multiplied by the fine-earth fraction of their contained horizon, as described by NRCS soil scientists. Using the volumetric water content at -1.5 MPa, classifications were assigned to daily soil moisture content values at respective upper and lower boundaries per taxonomic specifications which state that values at or above the volumetric water content at -1.5 MPa signify moist soil and values below the volumetric water content at -1.5 MPa signify dry soil. Using the moisture control section boundary classifications, moisture control sections with both moist upper and lower boundaries were considered moist in all parts. Conversely, control sections with both dry upper and lower limits were considered dry in all parts. Profiles with moist upper but dry lower boundaries, or the inverse, were considered both dry and moist in some parts. Sub-setting the data to 10/22/2018-10/21/2019, the dplyr package's mutate function combined soil moisture control section conditions to produce "dry in all or some parts" and "moist in all or some parts," as well as calculated soil moisture control section conditions coinciding with specific soil temperatures at 50 cm (Package ‘ dplyr ’: A Grammar of Data Manipulation, 2020). The transform function, included in base R, counted consecutive daily soil moisture control section conditions during specific soil temperatures at 50 cm or during outlined time frames, per Soil Taxonomy soil moisture regime definitions. Soil moisture regimes were calculated using the cumulative and/or consecutive occurrences of these conditions within specified mean annual temperatures and seasonal temperature differences, per Soil Taxonomy (Soil Survey Staff, 1999).

The above steps were repeated using 10% volumetric water content, rather than the volumetric water content at -1.5 MPa, to assign daily “moist” or “dry” classifications to respective upper and lower moisture control section boundaries. This threshold most closely reflected predicted SMRs when applied across all sites, as compared to other percent thresholds. Outlined above, these classifications were then used to assign daily moisture control section conditions which were summed cumulatively and consecutively to determine respective SMRs per Soil Taxonomy.

### *Soil Temperature Data*

Retaining data from soil temperature sensors at 50 cm, daily values were calculated by averaging soil temperature data collected every six hours, then these values were averaged across columns to create one daily value (Soil Survey Staff, 1999). Using these values to calculate mean annual temperature and seasonal differences, the latter were used to calculate SMRs per site.

# Results

## MLRA 2 & 3 – Western Oregon

### *Habitat Categorization*

Site 1 (predicted xeric SMR) is classified as PSMEM / *Corylus cornuta* Marshall (COCO6) - *Symphoricarpos mollis* Nutt. (SYMO) / *Polystichum munitum* (Kaulf.) C. Presl (POMU). Site 2 (predicted xeric SMR) is classified as ABGR/COCO6 /*Vancouveria hexandra* (Hook.) C. Morren & Decne. (VAHE). Site 3 (predicted udic) is classified as TSHE/POMU. Site 5 (predicted udic) is classified as TSHE / *Escobaria minima* (Baird) D.R. Hunt (MANE2) – POMU *(Table 1.5, Figure 1.7, Figure 1.8)*.

### *Soil Moisture Regimes*

None of the sites were dry in all or some parts, regardless of temperature or time of year. All sites were moist in all parts every day in the four months following winter solstice. All sites were moist in all or some parts every day the soil temperature was above 5°C and 6°C. When the soil temperature was above 8°C, site 1 was moist in all or some parts 205 consecutive days, site 2 was moist in all or some parts 202 consecutive days, site 3 was moist in all or some parts 185 consecutive days, and site 5 was moist in all or some parts 188 consecutive days. All sites representing MLRAs 2 & 3 have a udic soil moisture regime, as indicated by having less than 45 consecutive days dry in all parts after the summer solstice and less than 90 cumulative days dry in all or some parts *(Table 1.3, Figure 1.6)*.

### *Soil Temperature Regimes*

The mean annual soil temperature (MAST) for site 1 was 11.3°C, while its seasonal difference (SD) was 11.6°C. Site 2 had an MAST of 10.4°C and an SD of 13.0°C. Site 3 had an MAST of 9.7°C and an SD of 10.8°C. Site 5 had an MAST of 9.8°C and an SD of 16.6°C. All sites have a mesic STR, as predicted by land managers *(Table 1.4)*.

## MLRA 10 – Central Oregon

### *Habitat Categorization*

Ecological sites are classified in increasing site order as R010XY120OR - LOAMY FAN 9-12 PZ (predicted aridic SMR), R010XB034OR - JD LOAMY 9-12 PZ (predicted aridic SMR), R010XB027OR - JD CLAYEY 12-16 PZ (predicted xeric SMR),

R010XB085OR - JD MOUNTAIN NORTH 12-16 PZ (predicted xeric SMR), and CPG222 - *Pinus ponderosa* Lawson & C. Lawson (PIPO) / *Carex garberi* Fernald (CAGA3) (predicted xeric SMR) *(Table 1.5, Figure 1.7 , Figure 1.8)*.

### *Soil Moisture Regimes*

None of the sites were dry in all parts any day in the four months following summer solstice and all the sites were moist in all parts in the four months following winter solstice. Sites 1-4 were not dry in all parts any days when the soil temperature was above 5°C, being moist in all or some parts every day the soil temperature was above 5°C and 6°C. Site 5 was dry in all parts 19 days when above 5°C and moist in all or some parts 195 of the 214 days above 5°C and 176 of the 193 days when soil temperature was above 6°C. Sites 1, 3, and 5 were dry in all or some parts 27, 21, and 69 cumulative days, respectively. Sites 2 and 4 were not dry in any parts during the year, regardless of temperature or timeframe. Sites 1-5 were moist in all or some parts 188, 188, 182, 170, and 147 consecutive days, respectively, when the soil temperature was above 8°C. All sites have a udic soil moisture regime as indicated by having less than 45 consecutive days dry in all parts after summer solstice and less than 90 cumulative days dry in all or some parts *(Table 1.3, Figure 1.9)*.

### *Soil Temperature Regimes*

In increasing site order, the mean annual soil temperature was 11.8°C, 11.2°C, 9.7°C, 8.6°C, and 7.6°C, respectively, with respective seasonal differences of 23.1°C, 22°C, 19.3°C, 16°C, and 13.4°C. All sites except site 5, which has a frigid soil temperature regime, are mesic *(Table 1.4)*. This is slightly different than the field prediction, which called site 4 frigid as well.

## **MLRA 12 – Eastern Idaho**

### *Habitat Categorization*

Sites 1 and 2 are categorized as *Artemisia arbuscula* Nutt. ssp. *longiloba* (Osterh.) L.M. Shultz (ARARL) / FEID (predicted xeric SMR), site 3 is categorized as PSMEG / *Symphoricarpos oreophilus* A. Gray (SYOR2) (predicted xeric SMR), and sites 4 and 5 are categorized as PSMEG / *Juniperus communis* L. (JUCO6) (predicted xeric and udic, respectively) *(Table 1.5, Figure 1.7, Figure 1.8)*.

### *Soil Moisture Regimes*

Sites 1-4 were not moist in all parts any days within the four months following winter solstice and were dry in all parts at least 55, 4, 105, and 52 consecutive days, respectively, within the four months following summer solstice. Site 1 was moist in all or some parts 127 days of the 205 days above 5°C, 120 of the 196 days above 6°C, and 76 consecutive days when the soil temperature was above 8°C. The site was dry in all parts 78 of the 205 days above 5°C and dry in all or some parts every day of the year. Site 2 was moist in all or some parts 175 of the 198 days above 5°C, 152 of the 170 days above 6°C, and 101 consecutive days when the soil temperature was above 8°C. The site was dry in all parts 23 of the 198 days above 5°C and dry in all or some parts every day of the year. Site 3 was moist in all or some parts 23 of the 109 days above 5°C, 7 of the 90 days above 6°C, and was never moist when the soil temperature was above 8°C. The site was dry in all parts 86 of the 109 days above 5°C and dry in all or some parts 362 days. Site 4 was moist in all or some parts 39 of the 90 days above 5°C, 23 of the 74 days above 6°C, and 3 consecutive days when the soil temperature was above 8°C. The site was dry in all parts 51 of the 90 days above 5°C and dry in all or some parts every day of the year. Site 5 was not dry in all or some parts for any temperature or timeframe and was moist in all parts every day during the four months following winter solstice. The site was moist in all or some parts every day that the soil temperature was above 5°C and 6°C, and 8 consecutive days when the soil temperature was above 8°C.

Sites 1 and 2 have an ustic soil moisture regime, being moist in all or some parts half or more of the cumulative days when the soil temperature was above 5°C and dry in all or some parts 90 or more days. Site 2 also qualifies as ustic following summer solstice specifications. Sites 3 and 4 have an aridic soil moisture regime due to being dry in all parts more than half the cumulative days when the soil temperature was above 5°C and moist in all or some parts less than 90 consecutive days when the soil temperature was greater than 8°C. Site 5 has a udic soil moisture regime, indicated by being dry in all parts less than 45 consecutive days following summer solstice and dry in all or some parts less than 90 cumulative days *(Table 1.3, Figure 1.10)*.

### *Soil Temperature Regimes*

The mean annual soil temperature was 7.0°C, 6.0°C, 3.5°C, and 1.7°C for sties 1 through 5, respectively, along with seasonal differences of 18.9°C, 17.7°C, 9.6°C, 9.08°C, and 10.7°C. Sites 1 and 2, with respective 14.7°C and 13.3°C mean summer soil temperatures, are within the 15°C mean summer soil temperature cryic threshold for soils with no organic horizons. Sites 3-5, and their mean summer soil temperatures, 6.9°C, 6.4°C, and 5.6°C, respectively, are below the 8°C cryic threshold for soils with organic surficial horizons. Therefore, all sites have a cryic STR, though land managers originally predicted sites 1 and 2 as having a frigid STR. Sites 3 and 4, with an aridic SMR, do not qualify as anhydrous because their mean annual temperatures were above 0°C *(Table 1.4)*.

## MLRA 43A – North Central Idaho

### *Habitat Categorization*

Site vegetation is categorized as *PIPO* / *Symphoricarpos albus* (L.) S.F. Blake (SYAL) for site 1 (predicted xeric SMR), PSMEG / *Physocarpus malvaceus* (Greene) Kuntze (PHMA) for site 2 (predicted xeric SMR), ABGR/PHMA for site 3 (predicted xeric SMR), ABGR/CLUN2 for site 4 (predicted udic SMR), and *Thuja plicata* Donn ex D. Don (THPL)/CLUN2 (predicted udic SMR) for site 5 *(Table 1.5, Figure 1.7, Figure 1.8)*.

### *Soil Moisture Regimes*

None of the sites were dry in all parts any days following summer solstice. Only 1 wasn't moist in all parts for the entire duration of four months after winter solstice, with 114 consecutive days moist in all parts. Site 1 was dry in all parts 52 of the 272 days above 5°C. Sites 1 and 2 were dry in all or some parts 136 and 16 days, respectively. All other sites were not dry in all or some parts during any temperature or time frame. Site 1 was moist in all or some parts 220 of 272 days above 5°C, 190 days of 241 days above 6°C, and 170 consecutive days when the soil temperature was above 8°C. Sites 2-5 were moist in all or some parts all the days above 5°C and 6°C. They were moist in all or some parts 168, 161, 145, and 144 consecutive days, respectively, when the soil temperature was above 8°C. Site 1 has an ustic soil moisture regime due to being dry in all or some parts more than 90 cumulative days, as well as being moist in all parts more than 45 consecutive days following winter solstice. Sites 2-5 have a udic soil moisture regime, indicated by being dry in all or some parts less than 90 cumulative days *(Table 1.3, Figure 1.11)*.

### *Soil Temperature Regimes*

In increasing site order, the mean annual soil temperature was 9.3°C, 8.4°C, 7.4°C, 7.3°C, and 10.2°C, respectively, with respective seasonal differences of 13.8°C, 14°C, 11.7°C, 11.7°C, and 10.2°C. Sites 1 and 2 have a mesic soil temperature regime, while the remaining sites have a frigid soil temperature regime *(Table 1.4)*. This aligns with predictions.

### Adjusted Volumetric Water Threshold

Substituting 10% volumetric water content in exchange for the wilting point volumetric water content changes the assigned soil moisture regimes for sites in MLRA 10, 12, and 43A. Sites in MLRA 10 change from being assigned a udic SMR at all sites to having an aridic SMR at sites 1 and 2, an ustic SMR at sites 3 and 5, and a udic SMR at site 4. All sites within MLRA 12 convert to having an aridic SMR. Site 1 within MLRA 43A changes from having an ustic SMR to aridic, while sites 2, 3, and 5 change to having an ustic SMR *(Table 1.6, Figure 1.12, Figure 1.13, Figure 1.14, Figure 1.15)*.

# Discussion

## MLRA 2 & 3 – Western Oregon

The predicted and measured SMRs did not align and the conditions required for TSHE regeneration were not captured by a change in SMR. Given the absence of TSHE in sites 1 and 2, these sites were predicted to have a xeric soil moisture regime, while the remaining sites with TSHE were predicted to have a udic soil moisture regime. However, all the sites were measured as udic as defined by having less than 90 cumulative days dry in all or some parts and less than 45 consecutive days dry in all parts during the four months following summer solstice (Soil Survey Staff, 1999). Though a minimum of 10 years of data are needed to assign a definitive soil moisture regime, annual precipitation was within one standard deviation of the 10-year mean for a majority of the year and could be considered 'normal' *(Figure 1.2)* (PRISM Climate Group, 2019). This window into soil moisture behavior across MLRAs 2 & 3 indicates that current vegetative delineations may not reflect soil moisture regimes as currently defined by Soil Taxonomy. Though all sites were within the udic soil moisture regime as currently defined, sites 1 and 2 showed marked differences from sites 3 and 4. In both upper and lower boundaries, sites 1 and 2 illustrated a decrease in volumetric soil moisture beginning at the end of four months after winter solstice and did not show a restorative flux of soil moisture until the following winter solstice. To contrast, sites 3 and 5 did not begin a sustained decrease in soil moisture until the beginning of summer solstice and experienced soil moisture inputs starting roughly in September. As such, the latter sites experience two additional months of sustained soil moisture in the spring and three additional months in the fall. Though the soil moisture control section is never dry in all or some parts for all sites, this trend may point towards the importance of sustaining a certain percent of maximum annual volumetric water content in TSHE regeneration, as reflected by the specie's presence in sites 4 and 5.

## MLRA 10 – Central Oregon

The predicted and measured SMRs did not align and the transition from FEID to PSSP6 was not captured by a change in SMR. All the sites were predicted to have a xeric soil moisture regime, though it was thought sites 1 and 2 may have an aridic soil moisture regime due to the absence of FEID as a xeric soil moisture regime indicator species. However, all sites were measured to have a udic soil moisture regime. Though 10 years of data is necessary to definitively assign a soil moisture regime, annual precipitation was within one standard deviation of the 10-year mean for a majority of the year and could be considered ‘normal,’ therefore these measurements illustrate that the sites are not as dry as predicted *(Figure 1.3)* (PRISM Climate Group, 2019). Though all measured as udic, sites 1 and 2 behaved differently. In these sites, volumetric soil moisture did not increase in the upper boundary until at least February and in the lower boundary until late March. To contrast, sites 3-5 experienced a flux of volumetric soil moisture in the upper boundary beginning in early December and an increase in soil moisture no later than February in the lower boundary. This means that sites 3-5 have an additional two months of increased volumetric soil moisture within their upper boundaries and an additional month of increased volumetric soil moisture within their lower boundaries. In addition, sites 3-5 had at least 11-28% more maximum volumetric soil moisture at their lower boundaries and sites 3 and 4 had at least 13% more maximum volumetric soil moisture in their upper boundaries. Though site 5’s upper boundary resembles site 2, differences in soil temperature regime may drive plant community distributions, in addition to the former retaining more soil moisture at its lower boundary. This pattern suggests that although all sites are udic, the absence of FEID at sites 1 and 2 may be due to a smaller window of sustained percent maximum volumetric soil moisture with less overall volumetric soil moisture throughout the annum.

### MLRA 12 – Eastern Idaho

The predicted and measured SMRs did not align; however, the transition from CELE3 to CARU was captured by different SMRs. All sites were predicted to be xeric. However, sites 1 and 2 were measured to have an ustic soil moisture regime, sites 3 and 4 have an aridic soil moisture regime, and site 5 has a udic soil moisture regime. Given the proximity of each site’s daily volumetric soil moisture measurements to the volumetric soil moisture content at wilting point, as well as the low seasonal differences in soil moisture across all sites, additional site monitoring to complete the decade required of soil moisture regime assignment is recommended. However, annual precipitation was within one standard deviation of the 10-year mean for a majority of the year and could be considered ‘normal,’ therefore the measured volumetric soil moisture stands as a suitable substitute for the 10 years of data necessary to assign an SMR *(Figure 1.4)* (PRISM Climate Group, 2019). The presence of forest vegetation may be a potential vegetative delineation between ustic and aridic soil moisture regimes, while the udic SMR may occur in understories with the presence of SYAL (noted in ocular estimates). However, as noted in a study of the Caribou

National Forest, the aridic soil moisture regime has appeared in montane rangelands within southeastern Idaho, therefore the presence of forest may be a poor indicator (Jensen, 1984). If these sites do have an aridic soil moisture regime, the pairing of aridic and cryic, though unusual, was also noted in this study (Jensen, 1984). Addressed during Soil Taxonomy's genesis, the combination of aridic and cryic was considered unlikely, given the effects of orographic precipitation and limited evapotranspiration due to reduced temperatures (Smith, 2003). If this a reality, as noted by the Caribou National Forest study's author, it is most likely an extensive reality within MLRA 12.

### MLRA 43A – North Central Idaho

The predicted and measured SMRs did not align and the transition from LIBO3 to CLUN2 was not captured by a change in SMR. Sites 4 and 5 were predicted to be udic due to the presence of CLUN2 under ABGR, while the remaining sites were predicted to be xeric. However, sites 2-5 were measured to be udic and site 1 was ustic. Though 10 years of data is needed to officially assign a soil moisture regime, annual precipitation was within one standard deviation of the 10-year mean for the majority of the year and could be considered 'normal,' therefore the current data suggests that the presence of PHMA under both PSME and ABGR may indicate a udic soil moisture regime *(Figure 1.5)* (PRISM Climate Group, 2019). It may also illustrate that predominately graminoid understories dominated by CARU indicate a udic soil moisture regime while predominately graminoid understories with equal proportions of CARU and PSSP6 indicate an ustic soil moisture regime. Though sites 2-5 were measured as udic and sites 3-5 were never dry in all or some parts within their respective moisture control sections, sites 4 and 5 contained 10% more maximum volumetric soil moisture, on average, in their upper boundaries and 5% more in their lower boundaries as compared to other sites. The difference in overall soil moisture volume, though temporally similar, may be the reason behind the presence of CLUN2 at these sites.

### Considering Definitions

Considering vegetative community patterns, overall volumetric water content and duration of sustained percent maximum volumetric water content better reflected vegetative delineations than the current soil moisture regime definitions. Given the selection of vegetative delineations from land managers with years of combined experience and the original tenant of Soil Taxonomy to create interpretable soil groups for land management from shared soil moisture and temperature regimes, the misalignment between land management categorizations and associated SMRs in the Pacific Northwest is under the responsibility of adapting soil moisture regime definitions. Though exact in deciding the portion of the profile to be represented, the threshold above which to consider the soil moist, and the duration of moisture content by both time and temperature, it may be in this specificity that the original intent of SMRs is lost. For example, as stated before, in the udic soil moisture regime, plant growth was meant to be limited by temperature while the aridic soil moisture regime was meant to be limited by moisture. However, under the given definitions, MLRA 10, an area dominated by forestry, rangeland, and irrigated floodplains, is categorized as udic. Not only is this misleading for land management, but it completely undercuts our understanding of soil morphology and genesis. Staying within MLRA 10, sites 1, 3, and 4 have over 30 cm of pedogenic calcium carbonates, respectively, a characteristic whose absence originally helped define the udic SMR.

### *Dry / Moist Threshold*

In the name of accessibility and accuracy, reassessing SMR definitions to better fit vegetative patterns by capturing the duration and volume of soil moisture is a recommended course of action. One example would be to assign the soil moisture threshold to 10% volumetric water content rather than the current volumetric water content at wilting point. This simple adjustment better reflects current soil moisture regime vegetative delineations. With this change, sites 1 and 2 of MLRA 10 change to aridic, which is justified by the use of rangeland and irrigation. With increased elevation, the sites move to ustic and udic, which is supported by the occurrence of prairie and forest. All the sites of MLRA 12 change to aridic, which is in accordance with the study of the Caribou National forest, though, with continued monitoring, site 5 may prove to be ustic. Within MLRA 43A, site 4, having the highest mean annual precipitation, changes to having a udic SMR and site 1 changes to having an aridic SMR, with the rest having an ustic SMR as a gradation in-between the two. While the presence of an aridic SMR at site 1 of MLRA 43A could be seen as anomalous for the area, these sites are adjacent to a region characterized by alternating fallow with wheat production, a qualification for the aridic subgroup of ustic. While changing the moisture threshold is not an all-encompassing solution, it does illustrate the effect of creating more relevant solutions with simple and accessible changes. In this way, definitions could be interpreted directly from volumetric soil moisture, rather than a wilting point determined by laboratory analysis.

### *Xeric*

One question in exploring western soil moisture regime distributions was the overapplication of the xeric SMR given the wide variety of vegetative communities contained within it. For example, sites ranging from ARTRW8 to PIPO within MLRA 10 were both considered to have a xeric SMR, joined by A CMA3 present in sites within MLRA 2 & 3 and ABGR present in MLRA 43A. Between these sites containing diverse species within the same SMR, the mean annual mean precipitation ranged from 328.4 mm to 1326.5 with MAST ranging from 2.1°C to 11.2°C. With this reality, xeric was either being overused or its definition was irrelevant to plant communities. While all sites experienced less moisture during temperatures adequate for plant growth, most notable in sites representing MLRA 2 & 3 and MLRA 43A, this did not translate to the measured volumetric moisture content meeting xeric SMR definitions. If this is the case, then what vegetative communities best represent the xeric SMR? Should future studies explore their distribution or do sites in MLRA 2 & 3 and 43A best capture the intent behind the xeric SMR concept? If so, how can its definitions best fit these environments?

# Conclusion

Albeit not the 10 years required for soil moisture regime assignment, the data was collected during a normal precipitation year, indicating that current vegetative communities used to delineate soil moisture regimes do not appear to reflect regime transitions as currently defined by Soil Taxonomy. If soil moisture regimes are to have significance in the Pacific Northwest, either vegetative delineations need to change in order to distinguish between soil moisture regimes, or soil moisture definitions need to change for the benefit of reflecting vegetative communities. If the former, definitions should work towards inclusivity and accessibility in order to align with Soil Taxonomy's original mission. Given the importance of soil moisture regimes in predicting soil properties, failing to act or questioning the role of soil moisture in soil genesis, morphology, and land management would be failing to uphold the belief that successful taxonomic classifications make the largest number of important statements about soil behavior and genesis with the least amount of bifurcations. Regardless of approach, each solution is a large endeavor best backed by continued site monitoring.

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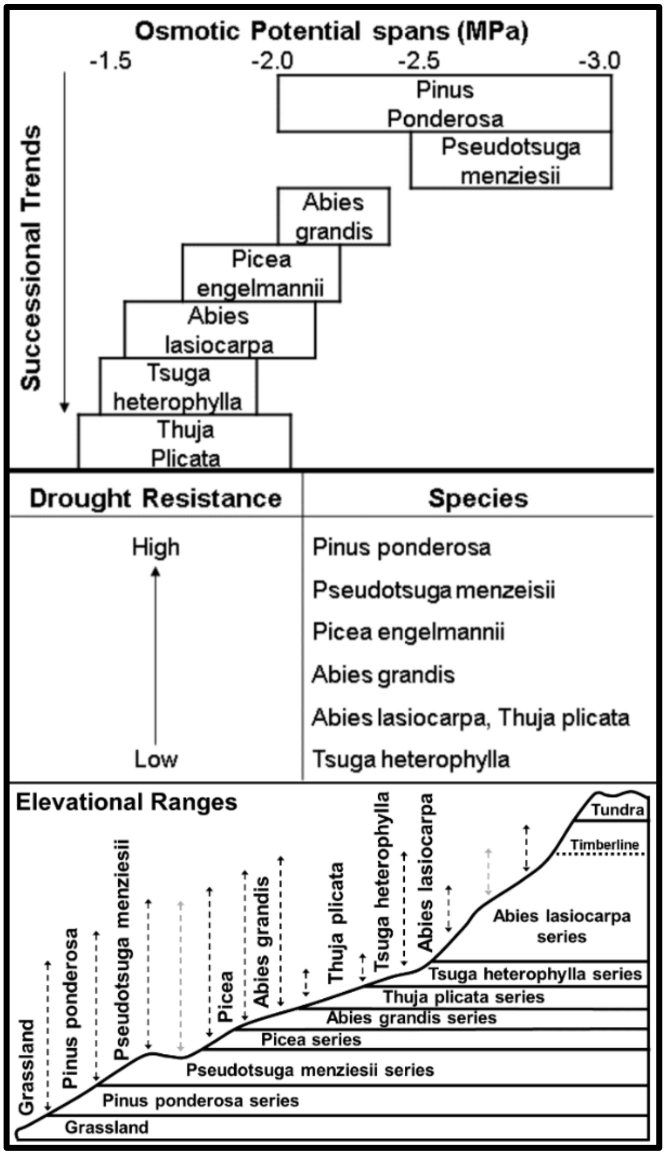
# Figure 1.1: Osmotic Potential and Species Distributions

*Figure 1.1* Adapted from Barbour and Billings, minimum osmotic potential values, the points at which stomata close and photosynthesis halts, have an inverse relationship with drought resistance, which translates to species establishment along an elevation gradient due to orographic precipitation (Barbour and Billings, 2000).



## Figure 1.2: MLRA 2 & 3 Annual versus Decade Precipitation Trends

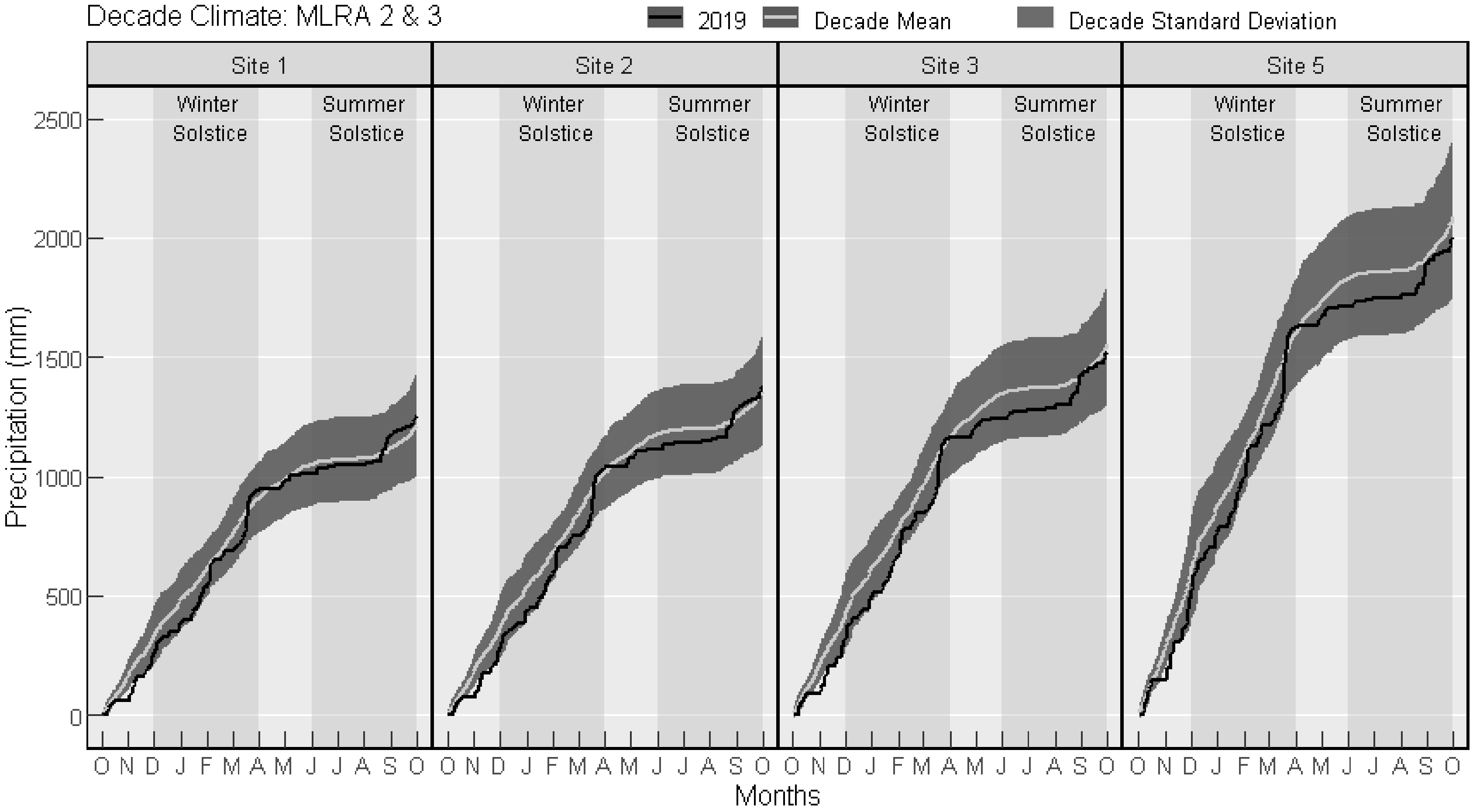


*Figure 1.2* The distribution of MLRA 2 & 3 site precipitation years 2009-2019 plotted along the soil moisture year beginning October 22nd (PRISM Climate Group, 2019).

## Figure 1.3: MLRA 10 Annual versus Decade Precipitation Trends

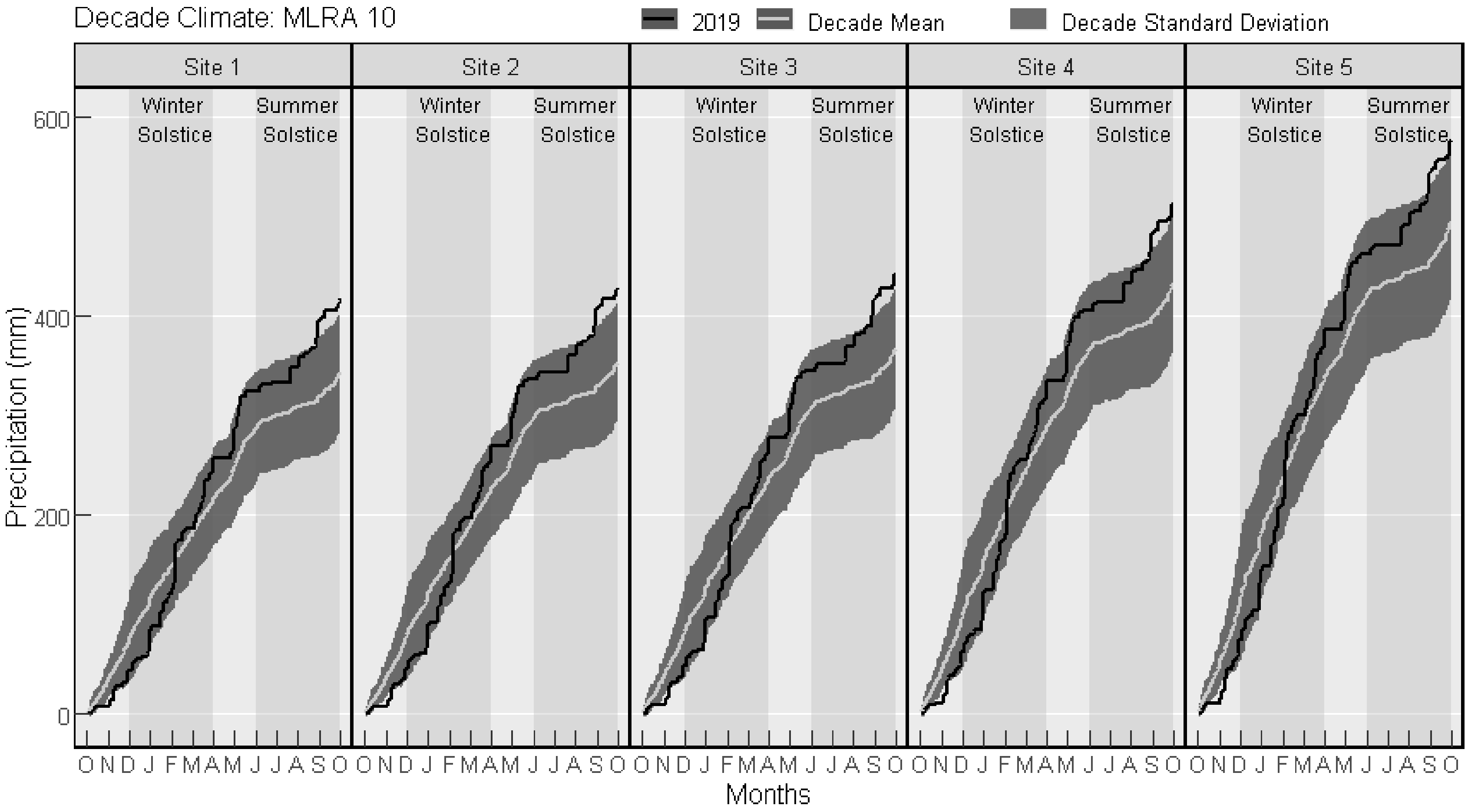


*Figure 1.3* The distribution of MLRA 10 site precipitation years 2009-2019 plotted along the soil moisture year beginning October 22nd (PRISM Climate Group, 2019).

## Figure 1.4: MLRA 12 Annual versus Decade Precipitation Trends

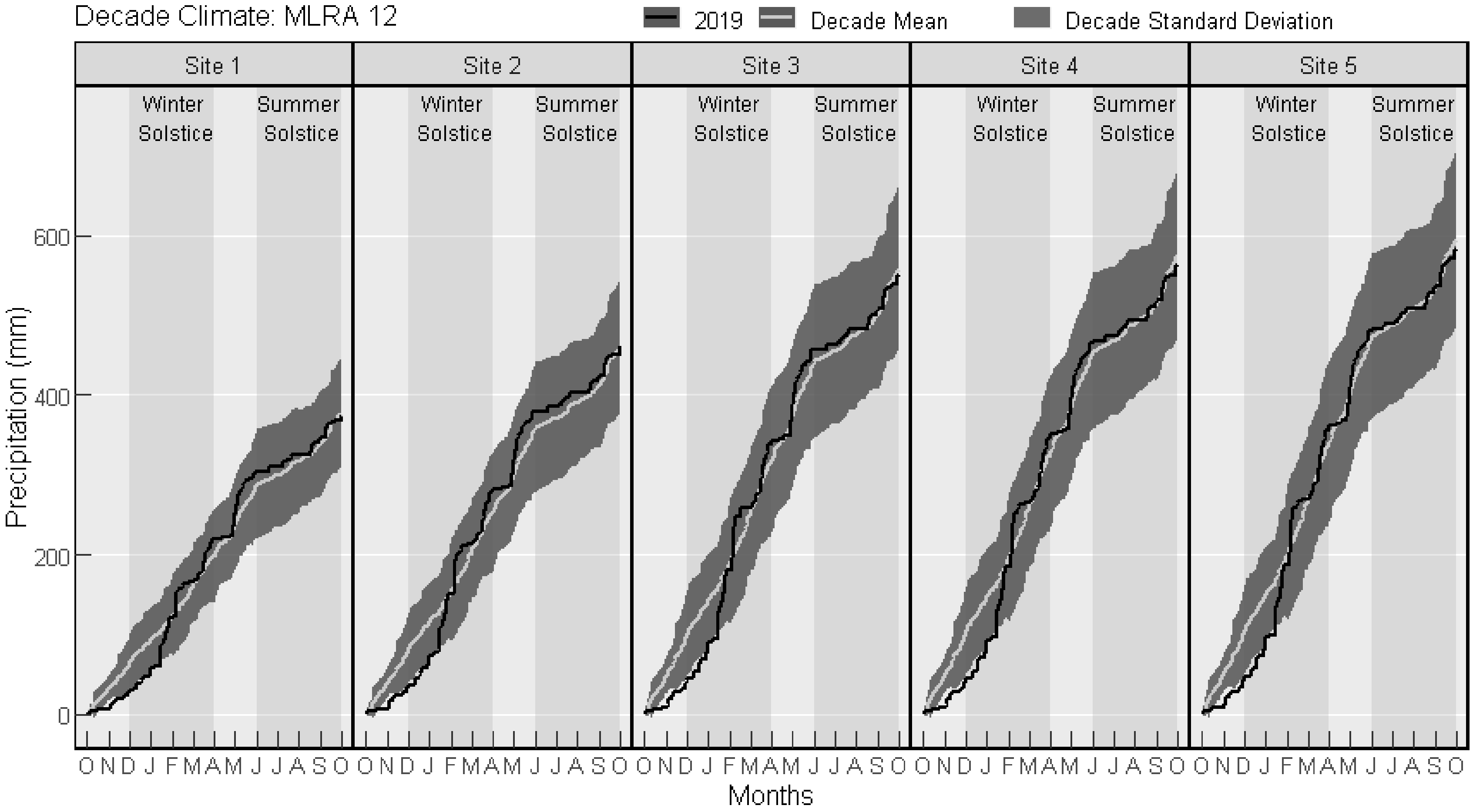


*Figure 1.4* The distribution of MLRA 12 site precipitation years 2009-2019 plotted along the soil moisture year beginning October 22nd (PRISM Climate Group, 2019).

## Figure 1.5: MLRA 43A Annual versus Decade Precipitation Trends

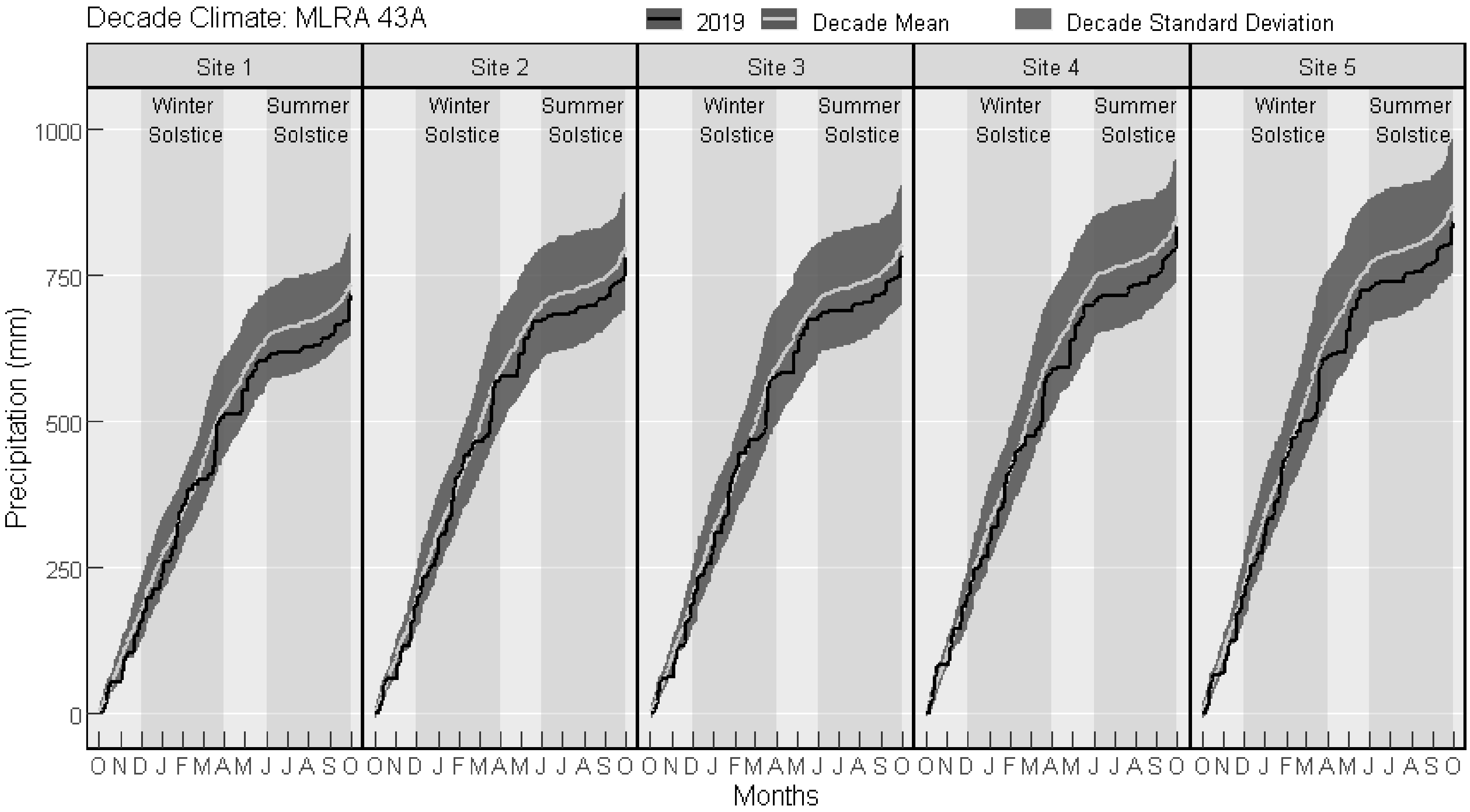


*Figure 1.5* The distribution of MLRA 43A site precipitation years 2009-2019 plotted along the soil moisture year beginning October 22nd (PRISM Climate Group, 2019).

## Figure 1.6: MLRA 2 & 3 Soil Moisture Annual Distribution

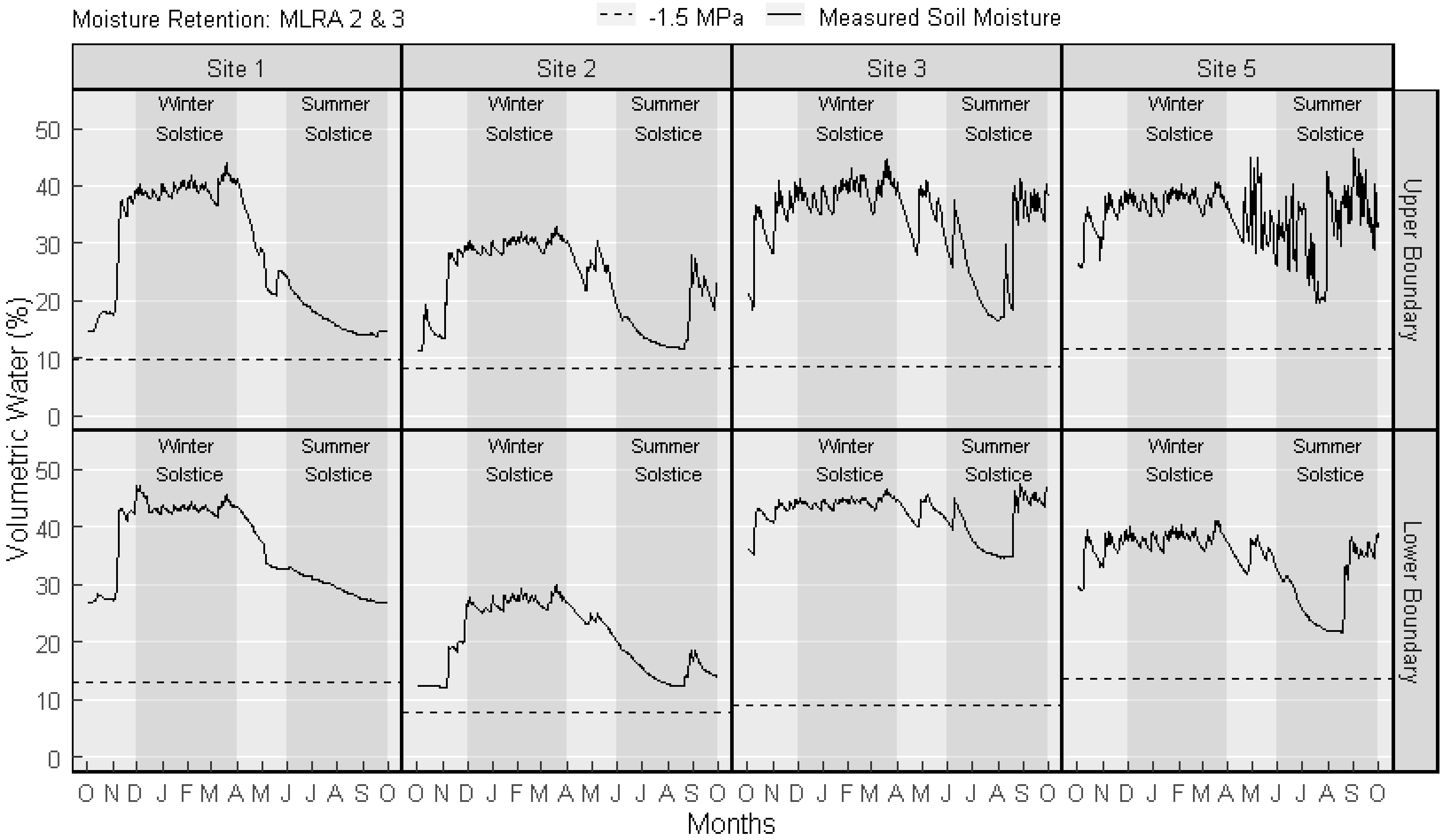


*Figure 1.6* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 2 & 3 during the 2018-2019 year beginning October 22$^{nd}$. The dashed line represents volumetric water at -1.5 MPa.

## Figure 1.7: Overstory Species Composition

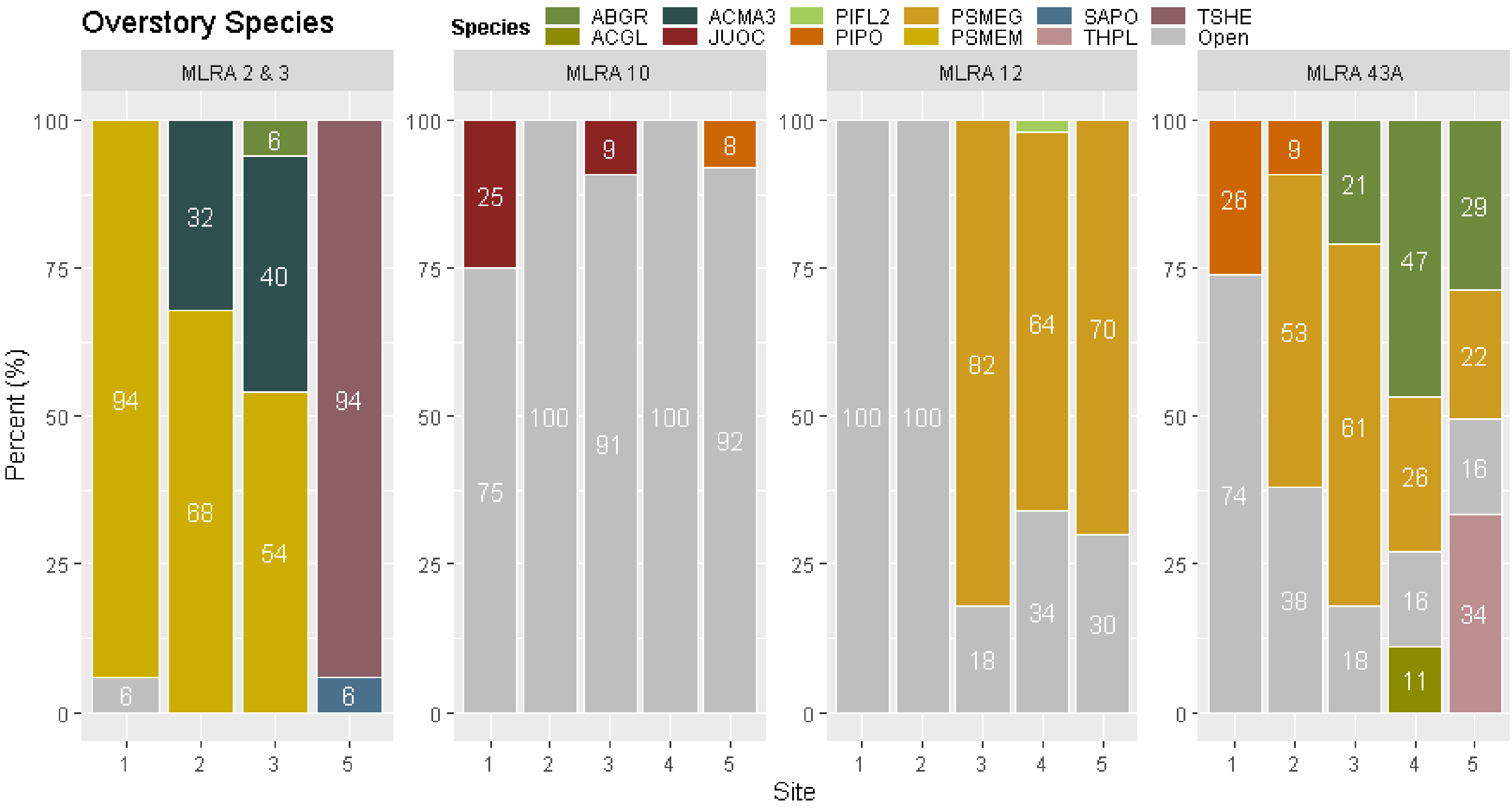


*Figure 1.7* Overstory species composition across MLRA transects as measured using line point intersect. Overstory species consist of vegetative growth over three meters.

## Figure 1.8: Understory Species Composition

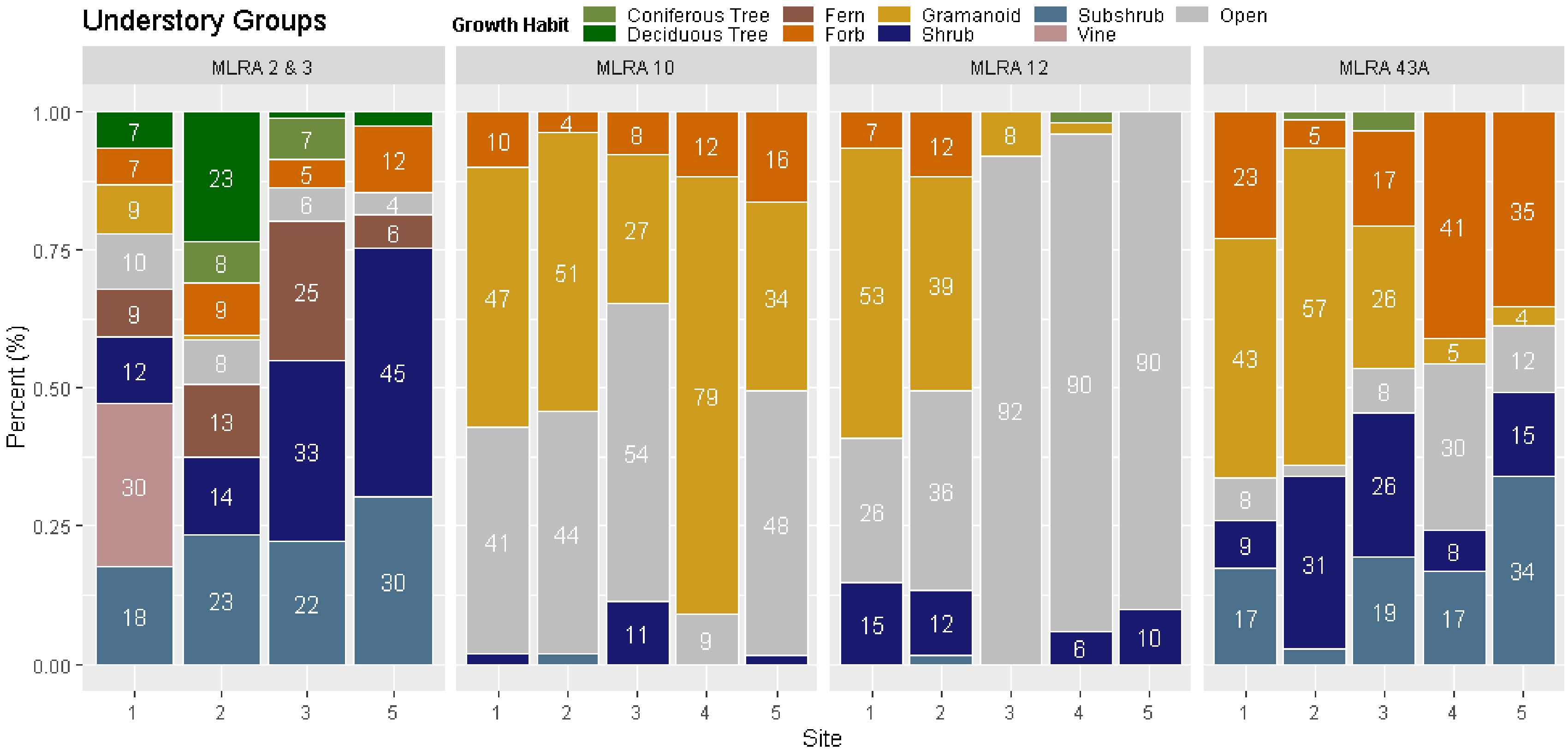


*Figure 1.8* Understory species composition across MLRA transects as measured using line point intersect. Understory species consist of vegetative growth under three meters.

## Figure 1.9 MLRA 10 Soil Moisture Annual Distribution

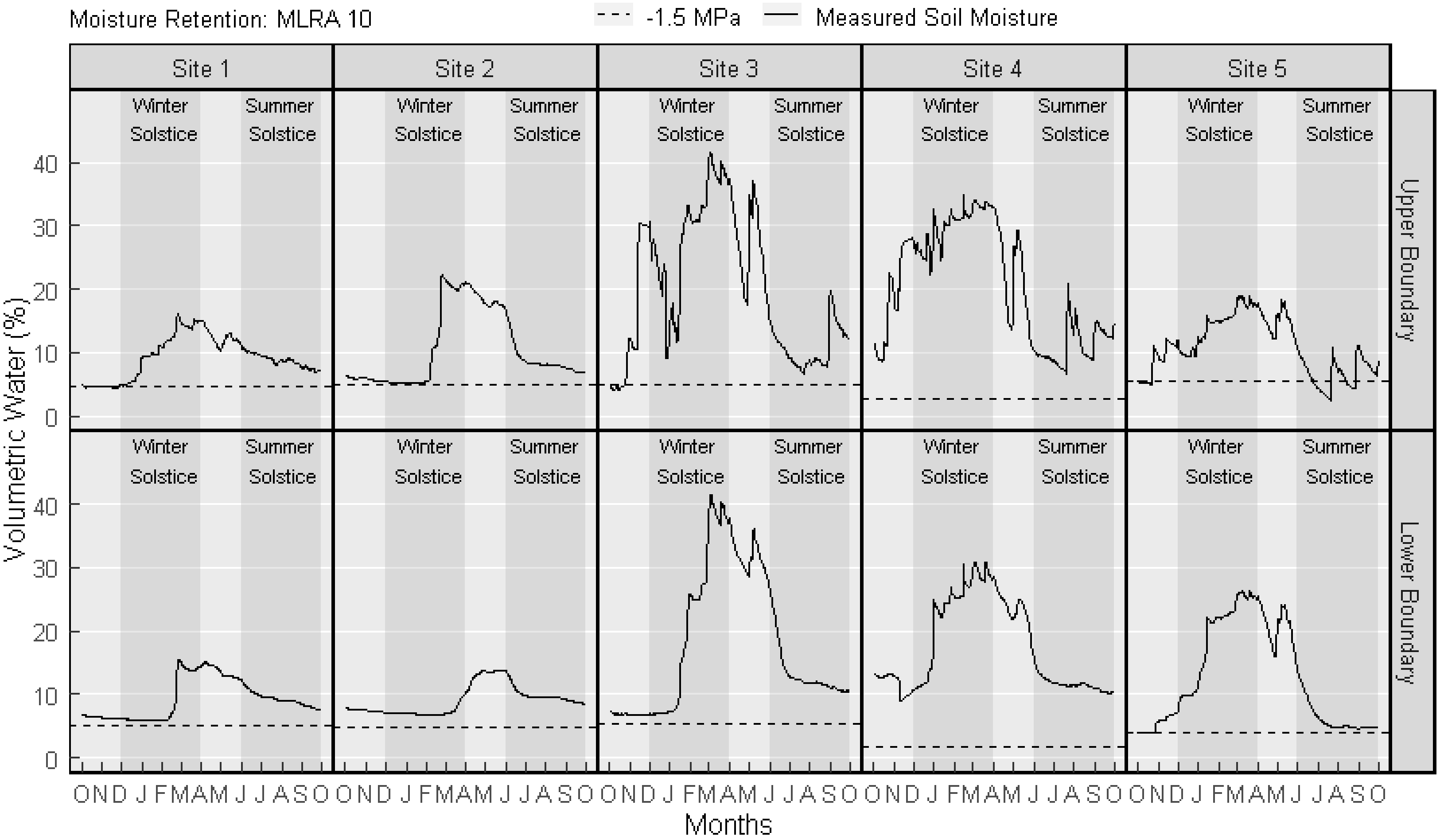


*Figure 1.9* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 10 during the 2018-2019 year beginning October 22nd. The dashed line represents volumetric water at -1.5 MPa.

## Figure 1.10 MLRA 12 Soil Moisture Annual Distribution

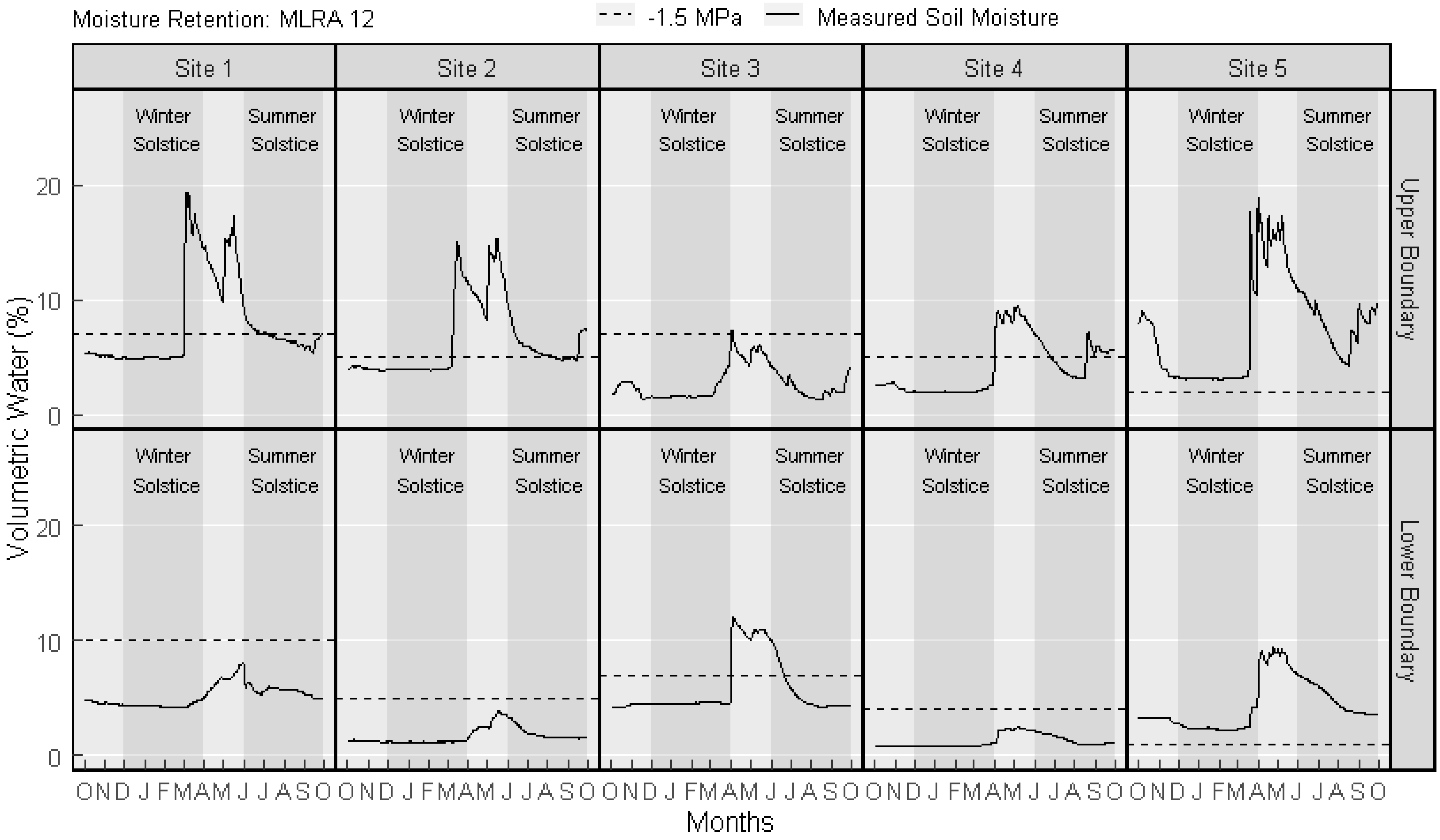


*Figure 1.10* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 12 during the 2018-2019 year beginning October 22nd. The dashed line represents volumetric water at -1.5 MPa.

## Figure 1.11: MLRA 43A Soil Moisture Annual Distribution

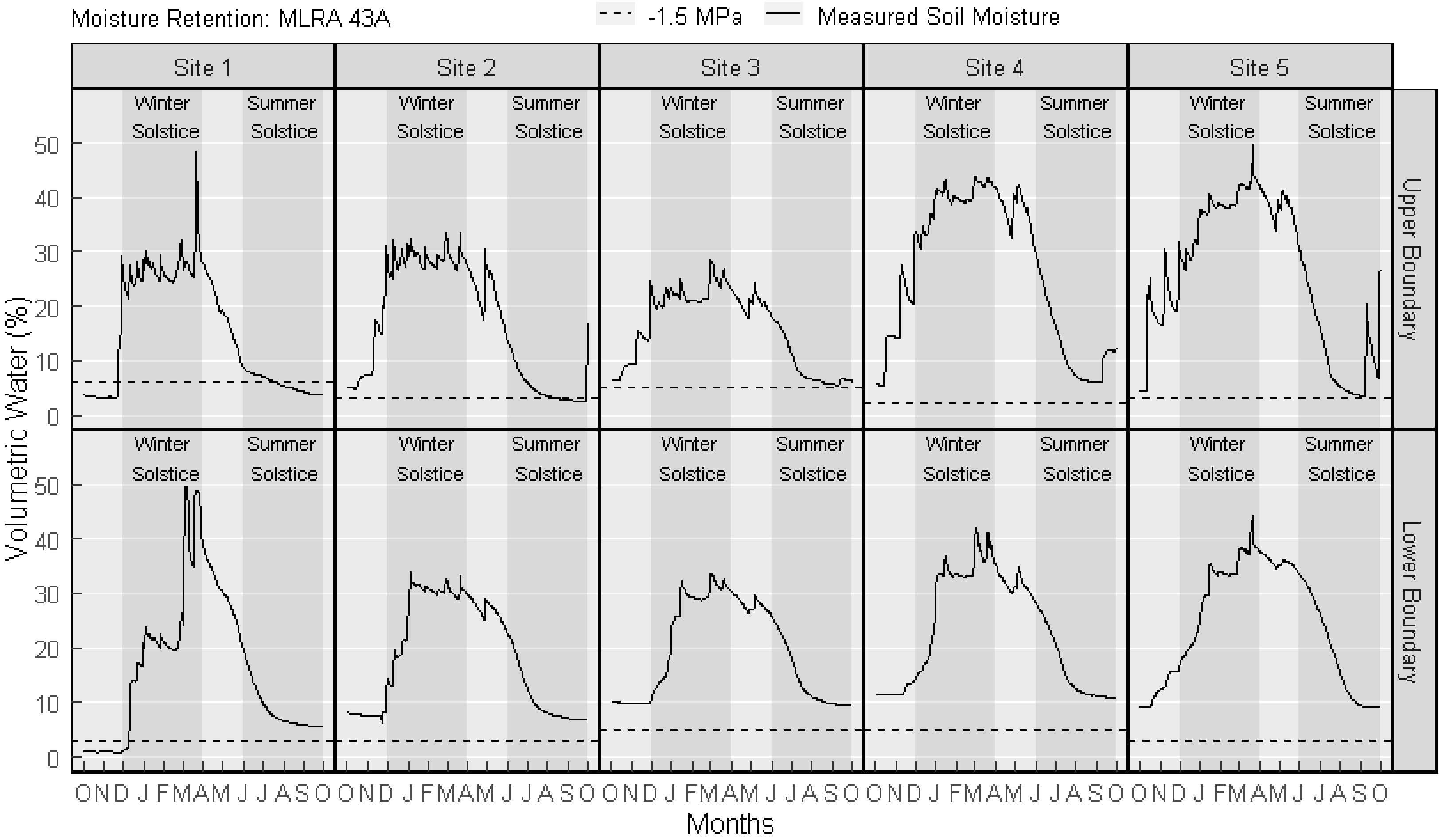


*Figure 1.11* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 43A during the 2018-2019 year beginning October 22nd. The dashed line represents volumetric water at -1.5 MPa.

## Figure 1.12: MLRA 2 & 3 Adjusted Threshold Annual Soil Moisture Distribution

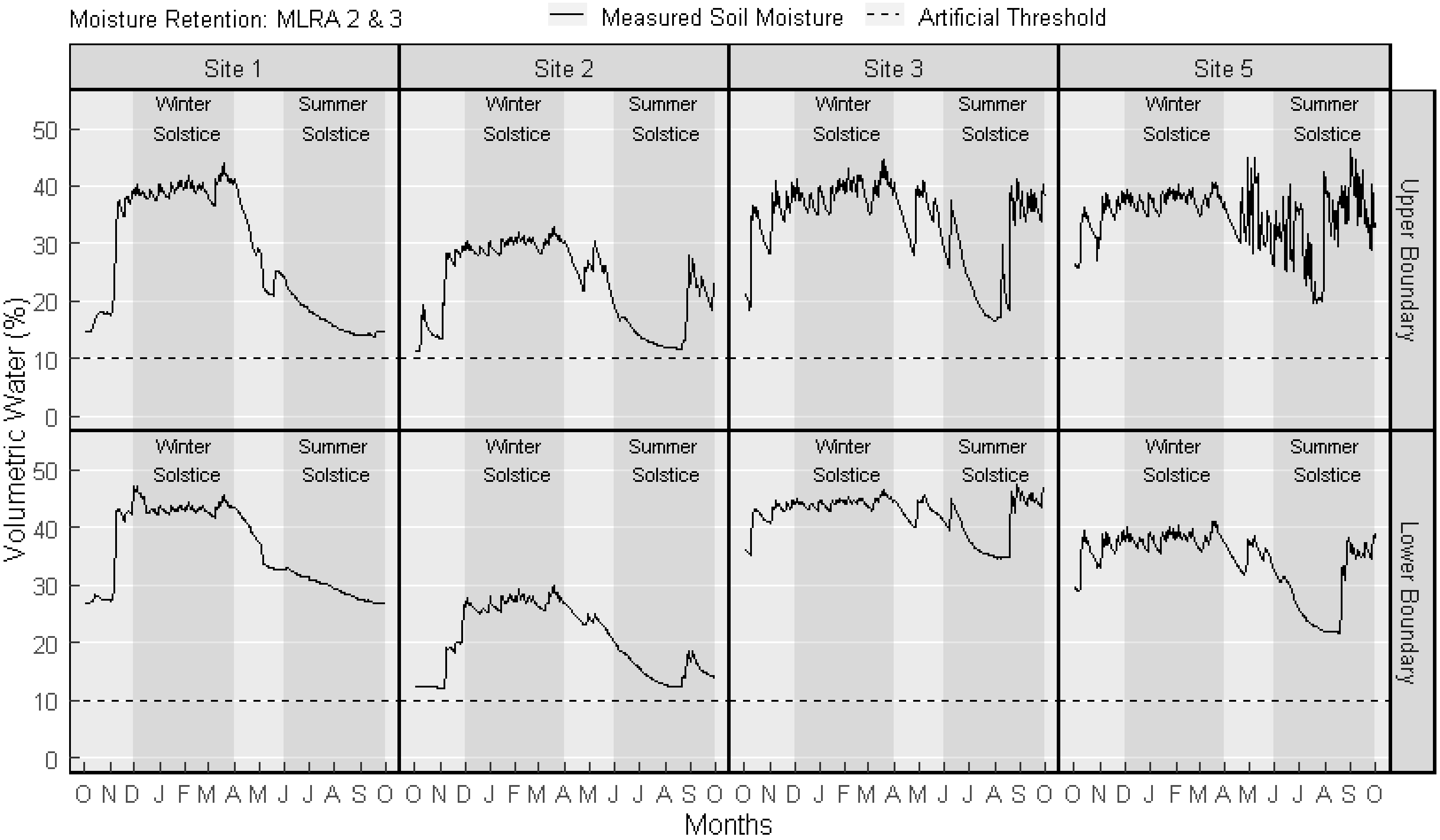


*Figure 1.12* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 2 & 3 during the 2018-2019 year beginning October 22nd. The dashed line represents 10% volumetric water.

## Figure 1.13: MLRA 10 Adjusted Threshold Annual Soil Moisture Distribution

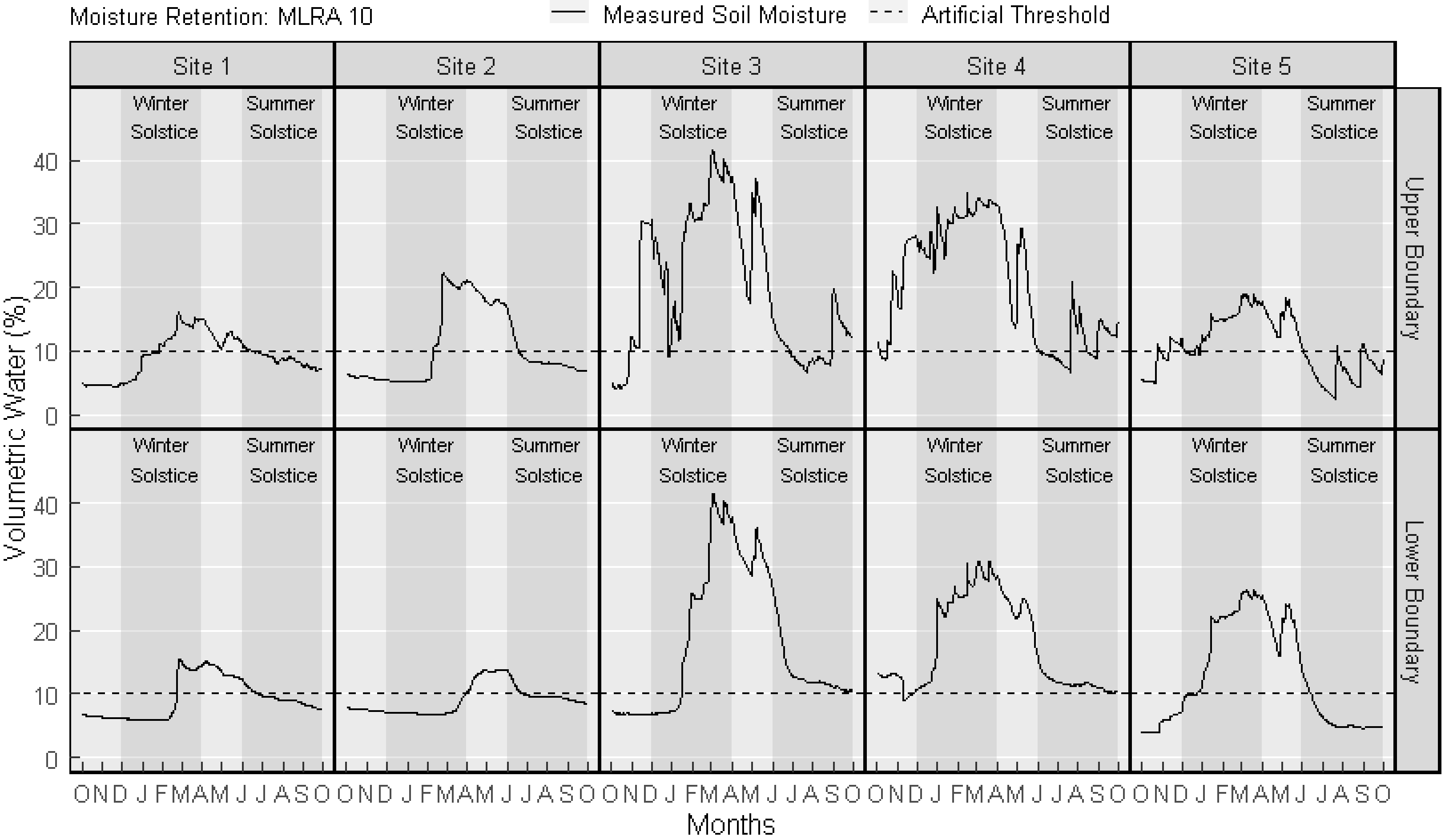


*Figure 1.13* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 10 during the 2018-2019 year beginning October 22nd. The dashed line represents 10% volumetric water.

## Figure 1.14: MLRA 12 Adjusted Threshold Annual Soil Moisture Distribution

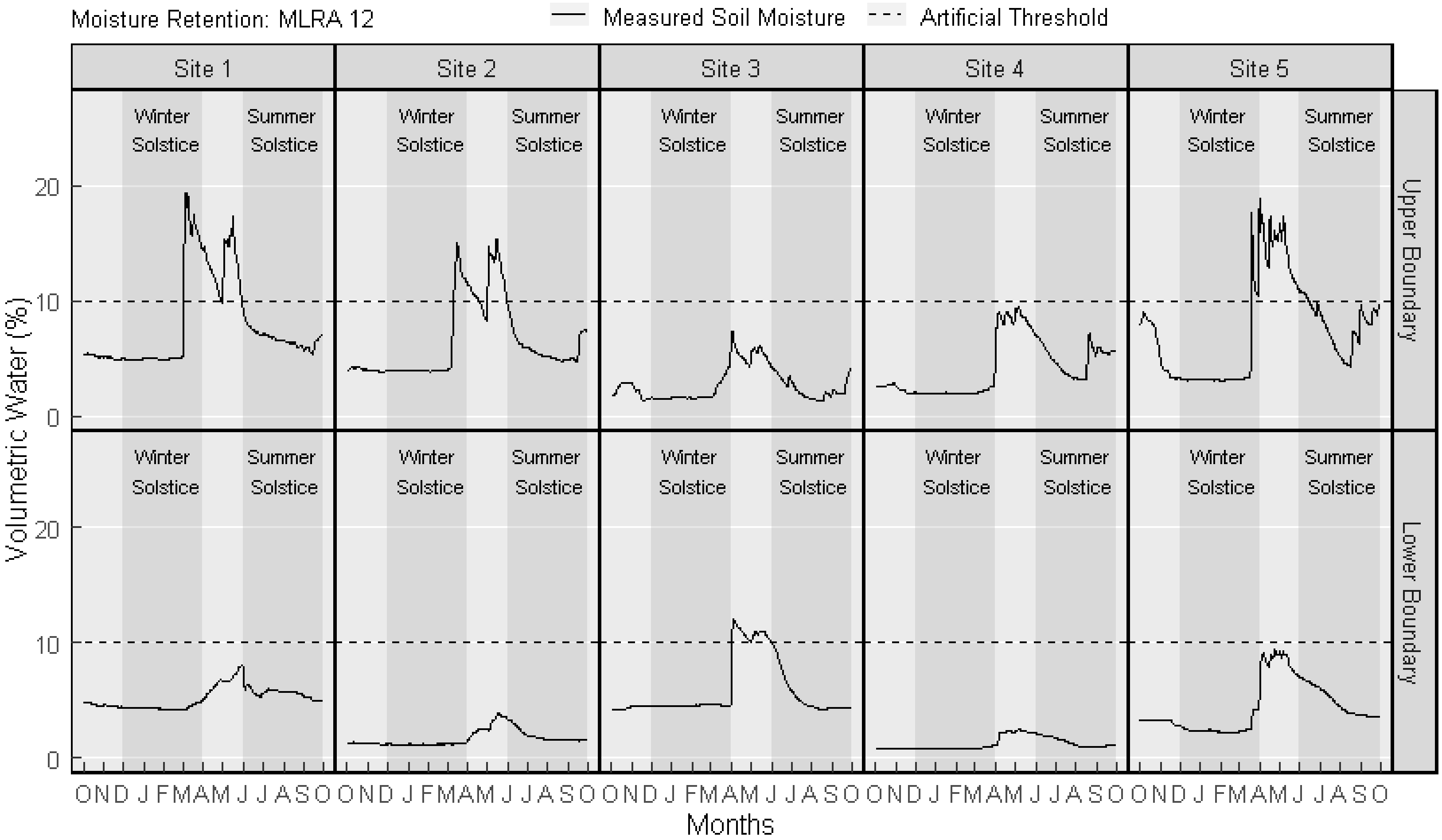


*Figure 1.14* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 10 during the 2018-2019 year beginning October 22$^{nd}$. The dashed line represents 10% volumetric water.

## Figure 1.15: MLRA 43A Adjusted Threshold Annual Soil Moisture Distribution

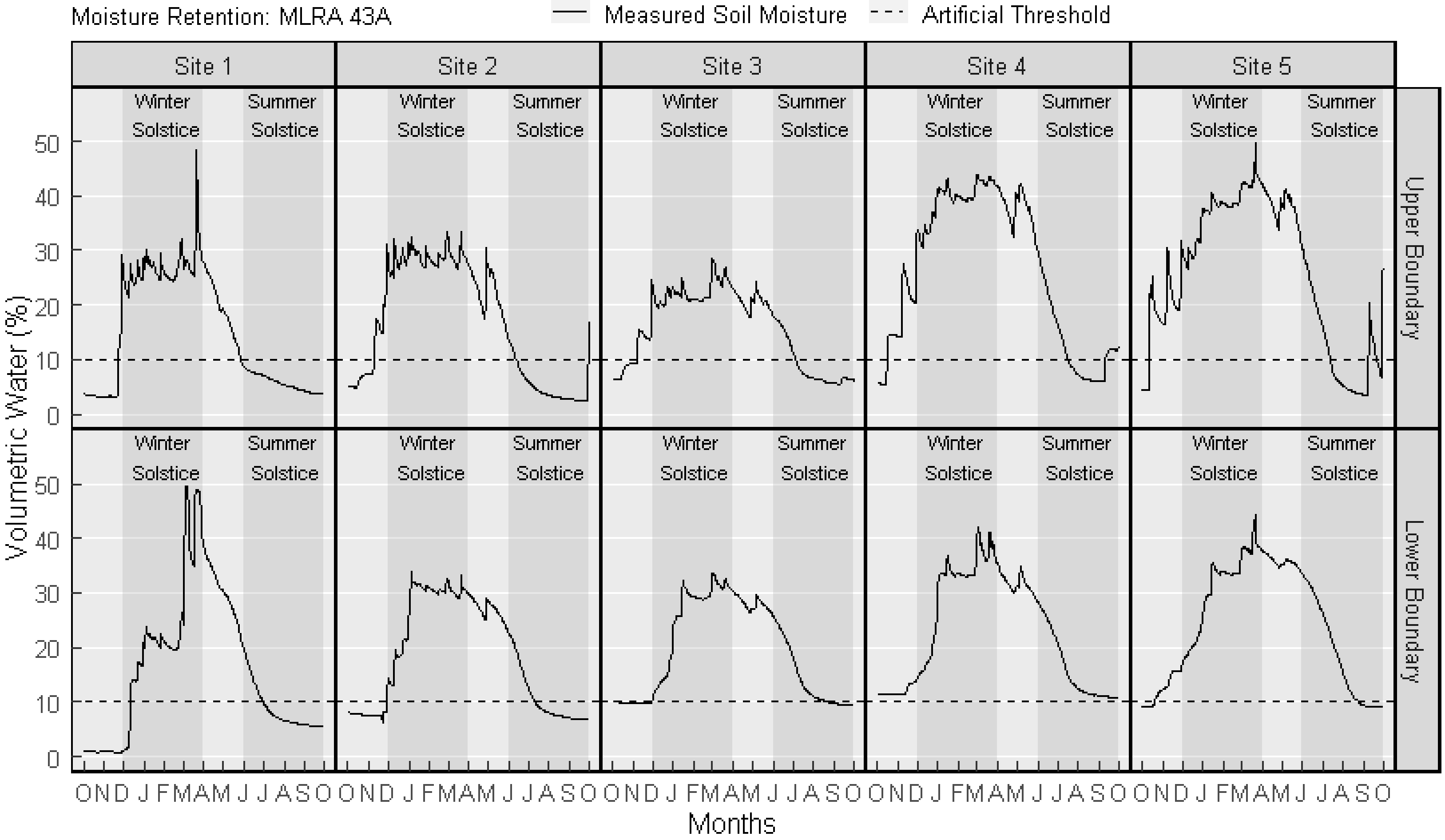


*Figure 1.15* The distribution of volumetric soil moisture for both upper and lower moisture control section boundaries of sites representing MLRA 43A during the 2018-2019 year beginning October 22nd. The dashed line represents 10% volumetric water.

## Table 1.1: MLRA Soil Moisture Regime Vegetative Delineations

| **SMR** | **Salem** | | **Redmond** | **Moscow** | | **Idaho Falls** | |
|---|---|---|---|---|---|---|---|
| | Overstory | Understory | Primary Species | Overstory | Understory | Overstory | Understory |
| **Udic** | PSME | ABAM | NA | ABLA | VAGL | ABLA | NA |
| | | | | | CARU | POTR5 | NA |
| | | | | | VASC | PSME | PHYSO |
| | | | | | LUHI | | ACGL |
| | | | | LALY | ABLA | | VAME |
| | | TSHE | | PIAL | ABLA | | SYAL |
| | | | | ABGR | SETR | | OSBE |
| | | | | | ASCA | | SPBE2 |
| | | | | | CLUN | | CARU |
| **Xeric** | | TSHE absent | FEID & ARTRV | | LIBO | | CELE3 |
| | | | | | XETE | | BEAQ |
| | | | | | VAGL | | JUCO6 |
| | | | | | PHMA | | ARCO9 |
| | | | | | SPBE | | SYOR2 |
| | | | | PSME | PHMA | | FEID |
| | | | | | VACA | | LEKI2 |
| **Aridic** | NA | | PSSP6<br>&<br>ARTRW8 | NA | | NA | |

# Table 1.2: Site Characteristics

| MLRA | Site | ID | Latitude | Longitude | Mean Annual Precipitation (mm) | Annual Mean Temperature (°C) |
|---|---|---|---|---|---|---|
| 12 | 1 | 2018ID703002 | -113.86426 | 44.16246 | 394.3 | 2.8 |
|  | 2 | 2018ID703001 | -113.84841 | 44.16001 | 436.9 | 2.4 |
|  | 3 | 2018ID703003 | -113.82738 | 44.15978 | 506.9 | 2.1 |
|  | 4 | 2018ID703004 | -113.82454 | 44.16011 | 506.9 | 2.1 |
|  | 5 | 2018ID703005 | -113.82732 | 44.21315 | 560.7 | 1.3 |
| 2 & 3 | 1 | 2018OR043991 | -122.77918 | 44.52629 | 1213.3 | 11.2 |
|  | 2 | 2018OR043992 | -122.71605 | 44.50782 | 1326.5 | 11.1 |
|  | 3 | 2018OR043993 | -122.68797 | 44.50764 | 1550.6 | 9.9 |
|  | 5 | 2018OR043995 | -122.54618 | 44.44802 | 2027.8 | 10.5 |
| 10 | 1 | 2019OR013501 | -120.29932 | 44.13552 | 328.4 | 8.6 |
|  | 2 | 2019OR013502 | -120.30763 | 44.14986 | 341.8 | 8.3 |
|  | 3 | 2018OR013004 | -120.35561 | 44.15772 | 369.3 | 7.7 |
|  | 4 | 2018OR013005 | -120.35288 | 44.18977 | 428.2 | 7.4 |
|  | 5 | 2018OR013006 | -120.35078 | 44.21413 | 541.2 | 6.6 |
| 43A | 1 | 2018ID057005 | -116.94889 | 46.68556 | 781.7 | 7.6 |
|  | 2 | 2018ID057004 | -116.93778 | 46.79806 | 856.3 | 7.3 |
|  | 3 | 2018ID057001 | -116.93722 | 46.80389 | 886.9 | 7.5 |
|  | 4 | 2018ID057003 | -116.55861 | 46.82500 | 923.1 | 6.8 |
|  | 5 | 2018ID057002 | -116.81583 | 46.79583 | 857.0 | 7.5 |

# Table 1.3: Soil Moisture Annual Distribution

| **Number of Days** | | Maximum Consecutive | | | Cumulative | | | | **Soil Moisture Regime** |
|---|---|---|---|---|---|---|---|---|---|
| **Moisture Status** | | Dry in All Parts | Moist in All Parts | Moist in All or Some Parts | | | Dry in All Parts | Dry in All or Some Parts | |
| **Timeframe** | | 4 months after summer solstice | 4 months after winter solstice | >8°C* | >6°C* | >5°C* | >5°C* | | |
| MLRA 12 | 1 | 55 | 0 | 76 | 120 | 127 | 78 | 365 | Ustic |
| | 2 | 4 | 0 | 101 | 152 | 175 | 23 | 365 | Ustic |
| | 3 | 105 | 0 | 0 | 7 | 23 | 86 | 362 | Aridic |
| | 4 | 52 | 0 | 3 | 23 | 39 | 51 | 365 | Aridic |
| | 5 | 0 | 123 | 10 | 68 | 83 | 0 | 0 | Udic |
| MLRA 2 & 3 | 1 | 0 | 123 | 205 | 349 | 365 | 0 | 0 | Udic |
| | 2 | 0 | 123 | 202 | 324 | 342 | 0 | 0 | Udic |
| | 3 | 0 | 123 | 185 | 324 | 334 | 0 | 0 | Udic |
| | 5 | 0 | 123 | 188 | 277 | 310 | 0 | 0 | Udic |
| MLRA 10 | 1 | 0 | 123 | 188 | 234 | 244 | 0 | 27 | Udic |
| | 2 | 0 | 123 | 188 | 234 | 244 | 0 | 0 | Udic |
| | 3 | 0 | 123 | 182 | 202 | 229 | 0 | 21 | Udic |
| | 4 | 0 | 123 | 170 | 200 | 228 | 0 | 0 | Udic |
| | 5 | 0 | 123 | 147 | 176 | 195 | 19 | 69 | Udic |
| MLRA 43A | 1 | 0 | 114 | 170 | 190 | 220 | 52 | 136 | Ustic |
| | 2 | 0 | 123 | 168 | 225 | 240 | 0 | 16 | Udic |
| | 3 | 0 | 123 | 161 | 190 | 221 | 0 | 0 | Udic |
| | 4 | 0 | 123 | 145 | 203 | 227 | 0 | 0 | Udic |
| | 5 | 0 | 123 | 144 | 199 | 214 | 0 | 0 | Udic |
| **SMR Definitions** | | | | | | | | | |
| MAST** > 22°C or SD** <6°C | | <45 | | | | | | <90 | Udic |
| | | | | <90 | | | >1/2 | | Aridic |
| | | >=45 | >=45 | | >1/2 | | | | Xeric |
| | | | | >=90 | | | | | |
| | | <45 | >=45 | | | | | | Ustic |
| | | | | | | >=1/2 | | >=90 | |

*Soil temperature at a depth of 50 cm

**MAST- Mean Annual Soil Temperature, SD- Soil Temperature Seasonal Difference

# Table 1.4: Soil Temperature Annual Distribution

| **Site** | | **Soil Temperature*** | | | | | |
|---|---|---|---|---|---|---|---|
| | | MAST** | SD** | Summer Mean | Days >6°C | Days >5°C | Regime |
| 12 | 1 | 7.0 | 18.9 | 14.7 | 196 | 205 | Cryic |
| | 2 | 6.0 | 17.7 | 13.3 | 170 | 198 | Cryic |
| | 3 | 3.4 | 9.6 | 6.9 | 90 | 109 | Cryic |
| | 4 | 2.5 | 9.1 | 6.4 | 74 | 90 | Cryic |
| | 5 | 1.7 | 10.7 | 5.6 | 68 | 83 | Cryic |
| 2 & 3 | 1 | 11.3 | 11.6 | 14.8 | 349 | 365 | Mesic |
| | 2 | 10.4 | 13.1 | 14.4 | 324 | 342 | Mesic |
| | 3 | 9.7 | 10.8 | 12.5 | 324 | 334 | Mesic |
| | 5 | 9.8 | 16.6 | 15.2 | 277 | 310 | Mesic |
| 10 | 1 | 11.8 | 23.1 | 21.4 | 234 | 244 | Mesic |
| | 2 | 11.2 | 22.0 | 20.2 | 234 | 244 | Mesic |
| | 3 | 9.7 | 19.3 | 17.7 | 202 | 229 | Mesic |
| | 4 | 8.6 | 16.0 | 14.9 | 200 | 228 | Mesic |
| | 5 | 7.6 | 13.4 | 12.9 | 193 | 214 | Frigid |
| 43A | 1 | 9.3 | 13.8 | 13.8 | 241 | 272 | Mesic |
| | 2 | 8.4 | 14.0 | 13.7 | 225 | 240 | Mesic |
| | 3 | 7.4 | 11.7 | 12.6 | 190 | 221 | Frigid |
| | 4 | 7.3 | 11.7 | 11.2 | 203 | 227 | Frigid |
| | 5 | 6.9 | 10.2 | 10.6 | 199 | 214 | Frigid |

*Soil temperature at a depth of 50 cm
**MAST- Mean Annual Soil Temperature, SD- Soil Temperature Seasonal Difference

# Table 1.5 Vegetative Community Composition

| Site | | Community Classification | Percent Understory Growth Habit Composition | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Tree | | Fern | Forb | Grass | Open | Shrub | Sub shrub | Vine |
| | | | Con | Decid. | | | | | | | |
| MLRA 12 | 1 | ARARL/FEID | - | - | - | 7 | 53 | 26 | 15 | - | - |
| | 2 | ARARL/FEID | - | - | - | 12 | 39 | 36 | 12 | 2 | - |
| | 3 | PSME/SYOR2 | - | - | - | - | 8 | 92 | - | - | - |
| | 4 | PSME/JUCO6 | 2 | - | - | - | 2 | 90 | 6 | - | - |
| | 5 | PSME/JUCO6 | - | - | - | - | - | 90 | 10 | - | - |
| MLRA 2 & 3 | 1 | PSME/COCO6-SYMO/COMU | - | 7 | 9 | 7 | 9 | 10 | 11 | 18 | 30 |
| | 2 | ABGR/COCO6/VAHE | 8 | 23 | 13 | 9 | 1 | 8 | 14 | 23 | - |
| | 3 | TSHE/POMU | 7 | 1 | 25 | 5 | - | 6 | 33 | 22 | - |
| | 5 | TSHE/MANE2-POMU | - | 2 | 6 | 12 | - | 4 | 45 | 30 | - |
| MLRA 10 | 1 | R010XY120OR – LOAMY FAN 9-12 PZ | - | - | - | 7 | 50 | 41 | 2 | - | - |
| | 2 | R010XB034OR – JD LOAMY 9-12 PZ | - | - | - | 2 | 52 | 44 | - | 2 | - |
| | 3 | R010XB027OR – JD CLAYEY 12-16 PZ | - | - | - | 8 | 27 | 54 | 11 | - | - |
| | 4 | R010XB085OR – JD MOUNTAIN NORTH 12-16 PZ | - | - | - | 11 | 80 | 9 | - | - | - |
| | 5 | CPG222 – PIPO/CAGA3 | - | - | - | 16 | 34 | 48 | 1 | - | - |
| MLRA 43A | 1 | PIPO/SYAL | - | - | - | 28 | 34 | 8 | 6 | 24 | - |
| | 2 | PSME/PHMA | 2 | - | - | 6 | 37 | 2 | 49 | 4 | - |
| | 3 | ABGR/PHMA | 4 | - | - | 23 | 3 | 8 | 35 | 26 | - |
| | 4 | ABGR/CLUN | - | - | - | 41 | 5 | 30 | 8 | 17 | - |
| | 5 | THPL/CLUN | - | - | - | 38 | 3 | 12 | 14 | 34 | - |

| Site | | Percent Overstory Species Composition | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ACGL | A CMA3 | JUOC | Open | PIFL2 | PIPO | PSME | SAPO | THPL | TSHE |
| MLRA 12 | 1 | - | - | - | 100 | - | - | - | - | - | - |
| | 2 | - | - | - | 100 | - | - | - | - | - | - |
| | 3 | - | - | - | 18 | - | - | 82 | - | - | - |
| | 4 | - | - | - | 34 | 2 | - | 64 | - | - | - |
| | 5 | - | - | - | 30 | - | - | 70 | - | - | - |
| MLRA 2 & 3 | 1 | - | - | - | 6 | - | - | 94 | - | - | - |
| | 2 | - | 32 | - | - | - | - | 68 | - | - | - |
| | 3 | - | 40 | - | - | - | - | 54 | - | - | - |
| | 5 | - | - | - | - | - | - | - | 6 | - | 94 |
| MLRA 10 | 1 | - | - | 25 | 75 | - | - | - | - | - | - |
| | 2 | - | - | - | 100 | - | - | - | - | - | - |
| | 3 | - | - | 9 | 91 | - | - | - | - | - | - |
| | 4 | - | - | - | 100 | - | - | - | - | - | - |
| | 5 | - | - | - | 92 | - | 8 | - | - | - | - |
| MLRA 43A | 1 | - | - | - | 74 | - | 26 | - | - | - | - |
| | 2 | - | - | - | 38 | - | 9 | 53 | - | - | - |
| | 3 | - | - | - | 18 | - | - | 61 | - | - | - |
| | 4 | 11 | - | - | 16 | - | - | 26 | - | - | - |
| | 5 | - | - | - | 16 | - | - | 22 | - | 34 | - |

# Table 1.6: Adjusted Threshold Annual Soil Moisture Distribution

| **Number of Days** | | Maximum Consecutive | | Cumulative | | | | | **Soil Moisture Regime** |
|---|---|---|---|---|---|---|---|---|---|
| **Moisture Status** | | Dry in All Parts | Moist in All Parts | Moist in All or Some Parts | | | Dry in All Parts | Dry in All or Some Parts | |
| **Timeframe** | | 4 months after summer solstice | 4 months after winter solstice | >8°C* | >6°C* | >5°C* | >5°C* | | |
| MLRA 12 | 1 | 124 | 0 | 21 | 50 | 57 | 148 | 365 | Aridic |
| | 2 | 124 | 0 | 23 | 31 | 45 | 153 | 365 | Aridic |
| | 3 | 122 | 0 | 0 | 0 | 9 | 100 | 365 | Aridic |
| | 4 | 124 | 0 | 0 | 0 | 0 | 90 | 365 | Aridic |
| | 5 | 97 | 0 | 0 | 1 | 1 | 82 | 365 | Aridic |
| MLRA 2 & 3 | 1 | 0 | 123 | 205 | 349 | 365 | 0 | 0 | Udic |
| | 2 | 0 | 123 | 202 | 324 | 342 | 0 | 0 | Udic |
| | 3 | 0 | 123 | 185 | 324 | 334 | 0 | 0 | Udic |
| | 5 | 0 | 123 | 188 | 277 | 310 | 0 | 0 | Udic |
| MLRA 10 | 1 | 39 | 99 | 90 | 108 | 113 | 131 | 237 | Aridic |
| | 2 | 3 | 99 | 90 | 108 | 114 | 130 | 271 | Aridic |
| | 3 | 7 | 0 | 182 | 188 | 202 | 27 | 156 | Ustic |
| | 4 | 123 | 0 | 170 | 200 | 228 | 0 | 77 | Udic |
| | 5 | 94 | 39 | 38 | 74 | 91 | 123 | 192 | Ustic |
| MLRA 43A | 1 | 94 | 113 | 77 | 97 | 127 | 145 | 197 | Aridic |
| | 2 | 82 | 123 | 85 | 106 | 121 | 119 | 169 | Ustic |
| | 3 | 40 | 123 | 123 | 141 | 157 | 64 | 147 | Ustic |
| | 4 | 0 | 123 | 145 | 203 | 227 | 0 | 70 | Udic |
| | 5 | 15 | 123 | 107 | 167 | 182 | 32 | 99 | Ustic |
| **SMR Definitions** | | | | | | | | | |
| MAST** > 22°C or SD* <6°C | | <45 | | | | | | <90 | Udic |
| | | | | <90 | | | >1/2 | | Aridic |
| | | >=45 | >=45 | | >1/2 | | | | Xeric |
| | | | | >=90 | | | | | |
| | | <45 | >=45 | | | | | | Ustic |
| | | | | | | | | | |
| | | | | | | >=1/2 | | >=90 | |

*Soil temperature at a depth of 50 cm
**MAST- Mean Annual Soil Temperature, SD- Soil Temperature Seasonal Difference

# Appendix A: Soil Moisture and Temperature Regime Definition Tables

## Soil Moisture Regime Definitions Table

| MAST* | Dry<br>>1.5 MPa | | | Moist<br>≤1.5 MPa | | | SMR |
|---|---|---|---|---|---|---|---|
| | Parts | Days | Timing | Parts | Days | Timing | |
| Saturated, reducing environment virtually free of dissolved oxygen while above biotic zero (5°C) | | | | | | | **Aquic** |
| <22°C<br>AND<br>SD**<br>>6°C | All | ≥45 consecutive | < 4 months after summer solstice | All | ≥45 consecutive | < 4 months after winter solstice | **Xeric** |
| | | | | AND | | | |
| | | | | Some or all | >1/2 cumulative | Soil temperature >6°C | |
| | | | | OR | | | |
| | | | | Some or all | ≥90 consecutive | Soil temperature >8°C | |
| NA | All | >½ cumulative | Soil temperature >5°C | Some or all | <90 consecutive | Soil temperature >8°C | **Aridic** |
| ≥22°C<br>OR<br>SD ≤6°C | Some or all | <90 cumulative | | | | | **Udic** |
| <22°C<br>AND<br>SD >6°C | Some or all | <90 cumulative | | | | | |
| | AND | | | | | | |
| | All | <45 consecutive | <4 months after summer solstice | | | | |
| | Some or all | ≥90 cumulative | | Some or all | ≥1/2 cumulative | Soil temperature >5°C | **Ustic** |
| | OR | | | | | | |
| | All | <45 consecutive | < 4 months after summer solstice | All | ≥45 consecutive | < 4 months after winter solstice | |
| ≥22°C<br>&<br>SD ≤6°C | Some or all | ≥90 cumulative | | Some or all | >180 cumulative<br>OR<br>≥90 consecutive | | |

*Mean Annual Soil Temperature at 50 cm
** Seasonal Difference Soil Temperature at 50 cm

## Soil Temperature Regime Definitions Table

<table>
<tr><td colspan="10">Mean Annual Temperature (°C)</td></tr>
<tr><td colspan="7"><8</td><td rowspan="6">8-15</td><td rowspan="6">15-22</td><td rowspan="6">>22</td></tr>
<tr><td colspan="6">Seasonal Difference <6°C<br>&<br>No Permafrost</td><td rowspan="5">Seasonal Difference >6°C</td></tr>
<tr><td>Organic Soil</td><td colspan="5">Mineral Soil</td></tr>
<tr><td rowspan="3"><6 MAST</td><td>Saturated</td><td colspan="2">Yes</td><td colspan="2">No</td></tr>
<tr><td>Organic Horizon Present</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td></tr>
<tr><td>Max. Annual Temp.</td><td><13</td><td><6</td><td><15</td><td><8</td></tr>
<tr><td colspan="6" rowspan="3">Cryic</td><td>Frigid</td><td>Mesic</td><td>Thermic</td><td>Hyperthermic</td></tr>
<tr><td colspan="4">Seasonal Difference <6°C?</td></tr>
<tr><td>Isofrigid</td><td>Isomesic</td><td>Isothermic</td><td>Isohyperthermic</td></tr>
</table>

# Appendix B: Soil Profile Data & Descriptions

## Soil Profile Data

*Hillslope & Parent Material*

| **Site** | | Elevation (m) | Slope (%) | Aspect (Degrees) | Slope Shape | | Position | Complexity | Landform | Parent Materials | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Across | Up-and-Down | | | | Surficial | 2 | 3 |
| 12 | 1 | 2113 | 7 | 204 | L | L | NONE | NONE | Alluvial Fan | Alluvium | - | - |
| | 2 | 2232 | 7 | 232 | L | L | NONE | NONE | Alluvial Fan | Alluvium | - | - |
| | 3 | 2513 | 33 | 290 | L | V | MT | S | Mountain Slope | Colluvium | - | - |
| | 4 | 2582 | 52 | 338 | V | L | MT | S | Mountain Slope | Colluvium | - | - |
| | 5 | 2617 | 52 | 40 | L | V | LT | S | Lateral Moraine | Colluvium | Till | - |
| 2 & 3 | 1 | 213 | 5 | 300 | L | V | UT | S | Mountain Slope | Colluvium | Residuum | - |
| | 2 | 201 | 35 | 320 | V | V | MT | S | Mountain Slope | Colluvium | - | - |
| | 3 | 453 | 6 | - | L | V | UT | S | Mountain Slope | Colluvium | - | - |
| | 5 | 343 | 7 | 0 | V | V | - | C | Mountain Slope | Colluvium | - | - |
| 10 | 1 | 1059 | 4 | 195 | L | L | LT | S | Alluvial Fan | Alluvium | Colluvium | - |
| | 2 | 1076 | 3 | 150 | V | L | MT | S | Alluvial Fan | Ash | Alluvium | - |
| | 3 | 1213 | 8 | 28 | L | L | MT | S | Mountain Slope | Ash | Residuum | - |
| | 4 | 1313 | 2 | 40 | L | L | MT | C | Mountain Slope | Ash | Residuum | - |
| | 5 | 1455 | 16 | 56 | V | L | UT | S | Mountain Slope | Ash | Colluvium | Residuum |
| 43A | 1 | 968 | 28 | 145 | L | C | MT | S | Mountain Slope | Ash | Loess | Residuum |
| | 2 | 1022 | 15 | 225 | V | L | MT | C | Mountain Slope | Ash | Loess | Residuum |
| | 3 | 1127 | 13 | 230 | V | V | SUMMIT | C | Mountain Slope | Ash | Loess | Residuum |
| | 4 | 1009 | 29 | 290 | L | L | LT | C | Mountain Slope | Ash | Loess | Alluvium |
| | 5 | 1010 | 25 | 235 | L | C | MT | C | Mountain Slope | Ash | Loess | Residuum |

### Taxonomy

| Site | | Classification | SMR | STR | Correlated Series |
|---|---|---|---|---|---|
| 12 | 1 | coarse-loamy, mixed, superactive, frigid Calcic Haploxeroll | Xeric | Frigid | To Be Mapped |
| | 2 | loamy-skeletal, mixed, superactive, frigid Calcic Haploxeroll | Xeric | Frigid | To Be Mapped |
| | 3 | loamy-skeletal, mixed, superactive Calcic Haplocryoll | Xeric | Cryic | To Be Mapped |
| | 4 | loamy-skeletal, mixed, superactive Typic Calcicryept | Xeric | Cryic | To Be Mapped |
| | 5 | loamy-skeletal, mixed, superactive Calcic Haplocryoll | Xeric | Cryic | To Be Mapped |
| 2 & 3 | 1 | fine-loamy, mixed, superactive, mesic Typic Humixerept | Xeric | Mesic | Hullt |
| | 2 | fine, mixed, active, mesic Xeric Haplohumult | Xeric | Mesic | Gelderman |
| | 3 | fine-loamy, mixed, active, mesic Typic Palehumult | Udic | Mesic | Honeygrove |
| | 5 | fine-loamy, isotic, mesic Andic Dystrudept | Udic | Mesic | Kinney- Taxadjunct |
| 10 | 1 | fine-loamy, mixed, superactive, mesic Calcic Argixeroll | Xeric | Mesic | Polly |
| | 2 | fine-loamy, mixed, superactive, mesic Calcic Argixeroll | Xeric | Mesic | Meadowridge |
| | 3 | fine, smectitic, mesic Vertic Palexeroll | Xeric | Mesic | Tub |
| | 4 | fine, smectitic, frigid Vertic Palexeroll | Xeric | Frigid | Wickiser |
| | 5 | clayey-skeletal, smectitic, frigid Vitrandic Argixeroll | Xeric | Frigid | Maule |
| 43A | 1 | fine-loamy, mixed, superative, mesic Oxyaquic Argixeroll | Xeric | Mesic | Southwick taxadjunct |
| | 2 | fine-loamy, mixed, superative, frigid Alfic Argixeroll | Xeric | Frigid | Joel |
| | 3 | fine-loamy, mixed, superative, frigid Vitrandic Haploxeralf | Xeric | Frigid | Carrico |
| | 4 | fine-silty, mixed, active, frigid Andic Glossudalf | Udic | Frigid | Grangemont |
| | 5 | ashy over loamy, amorphic over mixed, active, frigid Alfic Udivitrand | Udic | Frigid | Lado |

*Moisture Control Section*

| **Site** | | Laboratory Texture | | Moisture Control Section | Volumetric Water at -1.5 MPa (%) | |
|---|---|---|---|---|---|---|
| | | Particle Size Control Section | Family Particle Size Class | | Upper Boundary | Lower Boundary |
| 12 | 1 | 25-100 | coarse-loamy | 20-60 | 7 | 10 |
| | 2 | 25-100 | loamy-skeletal | 20-60 | 5 | 5 |
| | 3 | 25-100 | loamy-skeletal | 20-60 | 7 | 7 |
| | 4 | 25-100 | loamy-skeletal | 20-60 | 5 | 4 |
| | 5 | 25-100 | loamy-skeletal | 20-60 | 2 | 1 |
| 2 & 3 | 1 | 12-62 | fine-loamy | 10-30 | 10 | 13 |
| | 2 | 25-100 | fine-loamy over sandy | 20-60 | 8 | 8 |
| | 3 | 42-92 | fine-loamy over fine clayey | 10-30 | 8 | 9 |
| | 5 | 25-100 | fine-clayey | 10-30 | 12 | 14 |
| 10 | 1 | 25-100 | coarse-loamy | 20-60 | 5 | 5 |
| | 2 | 25-100 | sandy | 60-90 | 5 | 5 |
| | 3 | 25-100 | fine-loamy | 10-30 | 5 | 5 |
| | 4 | 23-100 | fine-clayey | 10-30 | 3 | 2 |
| | 5 | 55-86 | clayey-skeletal | 10-30 | 6 | 4 |
| 43A | 1 | 25-100 | coarse-loamy | 20-60 | 6 | 3 |
| | 2 | 25-100 | coarse-loamy | 20-60 | 3 | 3 |
| | 3 | 25-100 | coarse-loamy | 20-60 | 5 | 5 |
| | 4 | 25-100 | coarse-loamy | 20-60 | 2 | 5 |
| | 5 | 25-100 | coarse-loamy | 20-60 | 3 | 3 |

## Soil Profile Descriptions

*MLRA 2 & 3*

| Site | Horizon | Depth | Boundary | Color | Texture | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Field | | | | Laboratory | | | |
| | | | | | Class | S (%) | C (%) | CF (% Volume) | Class | S (%) | Si (%) | C (%) |
| 2 & 3.1 | Oi | 3 | AS | - | SPM | - | - | - | - | - | - | - |
| | A | 12 | CS | 7.5YR 3/3 | CL | 30 | 30 | 3 | SL | 58.8 | 29.6 | 11.6 |
| | Bt1 | 37 | CS | 7.5YR 3/4 | CL | 30 | 35 | 5 | L | 46.8 | 29.6 | 23.6 |
| | Bt2 | 54 | CW | 7.5YR 3/4 | CL | 33 | 35 | 10 | - | - | - | - |
| | Bt3 | 77 | CW | 7.5YR 3/4 | GR CL | 30 | 35 | 20 | CL | 40.8 | 27.6 | 31.6 |
| | Cr | 112 | - | 7.5YR 4/4 | GR CL | - | 35 | 30 | CL | 42.8 | 25.6 | 31.6 |
| 2 & 3.2 | Oi | 3 | AS | 7.5YR | SPM | - | - | - | - | - | - | - |
| | A1 | 24 | CW | 7.5YR 2.5/2 | GR SiCL | 28 | 30 | 20 | L | 47.2 | 33.2 | 19.6 |
| | A2 | 41 | CW | 7.5YR 2.5/3 | CB CL | 28 | 30 | 40 | SCL | 53.2 | 25.2 | 21.6 |
| | Bt | 67 | CW | 7.5YR 3/3 | GR CL | 36 | 30 | 25 | LS | 83.2 | 13.2 | 3.6 |
| | BC1 | 87 | CS | 7.5YR 4/3 | GR CL | 30 | 30 | 20 | - | - | - | - |
| | BC2 | 124 | AW | 7.5YR 4/4 | GR CL | 30 | 30 | 15 | - | - | - | - |
| | Cr | 149 | - | - | - | - | - | - | - | - | - | - |
| 2 & 3.3 | Oi | 3 | CS | - | SPM | - | - | 0 | - | - | - | - |
| | A | 21 | GS | 7.5YR 2.5/3 | CL | 28 | 30 | 0 | SCL | 57.2 | 19.2 | 23.6 |
| | BAt | 42 | CS | 7.5YR 3/3 | CL | 32 | 25 | 0 | SCL | 47.2 | 19.2 | 33.6 |
| | Bt1 | 65 | CS | 5YR 3/4 | CL | 32 | 25 | 0 | C | 25.2 | 19.2 | 55.6 |
| | Bt2 | 86 | CS | 5YR 3/4 | CL | 33 | 30 | 0 | - | - | - | - |
| | Bt3 | 99 | - | 5YR 4/4 | CL | 41 | 35 | 0 | C | 29.2 | 19.2 | 51.6 |
| 2 & 3.5 | Oi | 3 | AS | - | SPM | - | - | 0 | - | - | - | - |
| | A | 21 | CW | 7.5YR 3/3 | SiL | 22 | 20 | 10 | CL | 35.2 | 29.2 | 35.6 |
| | BA | 37 | CW | 7.5YR 3/4 | SiL | 22 | 25 | 5 | C | 23.2 | 23.2 | 53.6 |
| | Bw1 | 59 | GW | 5YR 3/4 | SiL | 25 | 25 | 2 | - | - | - | - |
| | Bw2 | 83 | CW | 5YR 3/4 | SiL | 25 | 25 | 0 | C | 15.2 | 25.2 | 59.6 |
| | Bw3 | 100 | - | 5YR 4/4 | SiCL | 28 | 25 | 0 | C | 17.2 | 25.2 | 57.6 |

| Site | Structure | | Consistence | | | | Roots | | | | | Pores | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Primary | Secondary | Rupture Resistance | | Stickiness | Plasticity | VF | F | M | C | VC | VF | F | M | C | VC |
| | | | Moist | Dry | | | | | | | | | | | | |
| 2 & 3.1 | - | - | FR | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M GR | - | FI | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 2 F SBK | - | FI | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 2 M SBK | - | FI | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 F SBK | - | FI | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 F SBK | - | VFR | SO | SO | PO | - | - | - | - | - | - | - | - | - | - |
| 2 & 3.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 2 F GR | - | - | - | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 F SBK | - | - | - | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 2 F SBK | - | - | - | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 F SBK | - | - | - | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M SBK | - | - | - | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | SO | PO | - | - | - | - | - | - | - | - | - | - |
| 2 & 3.3 | - | - | FR | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 2 M SBK | - | FR | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 2 M SBK | - | FR | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M SBK | - | FR | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M | - | FR | SH | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M | - | FR | SH | VS | VP | - | - | - | - | - | - | - | - | - | - |
| 2 & 3.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 1 F GR | - | VFR | - | SS | SP | - | - | - | - | - | - | - | - | - | - |
| | 1 M SBK | - | FR | - | SS | SP | - | - | - | - | - | - | - | - | - | - |
| | 1 M SBK | - | FR | - | SS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M SBK | - | FR | - | MS | MP | - | - | - | - | - | - | - | - | - | - |
| | 1 M SBK | - | FI | - | MS | MP | - | - | - | - | - | - | - | - | - | - |

| Site | Illuviation | | | | Carbonates | | | Redoximorphic Features | |
|---|---|---|---|---|---|---|---|---|---|
| | Siltans | Argillans | | | Masses | Effervescence | Field pH | Depletions | Concentrations |
| | | Pores | Ped Faces | Bridging | | | | | |
| 2 & 3.1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 0 | 0 | 0 | 0 | - | - | 6.7 | - | - |
| | 0 | 0 | 10 | 0 | - | - | 6.6 | - | - |
| | 0 | 0 | 10 | 0 | - | - | 6.4 | - | - |
| | 0 | 0 | 15 | 0 | - | - | 6.4 | - | - |
| | 0 | 0 | 0 | 0 | - | - | - | - | - |
| 2 & 3.2 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 0 | 0 | 0 | 0 | - | - | 6.8 | - | - |
| | 0 | 0 | 5 | 0 | - | - | 6.5 | - | - |
| | 0 | 0 | 0 | 0 | - | - | 6.5 | - | - |
| | 0 | 0 | 0 | 0 | - | - | 6.5 | - | - |
| | 0 | 0 | 0 | 0 | - | - | - | - | - |
| 2 & 3.3 | 0 | 0 | 0 | 0 | - | NE | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | 6.5 | - | - |
| | 0 | 0 | 10 | 0 | - | NE | 6.5 | - | - |
| | 0 | 0 | 20 | 0 | - | NE | 6.5 | - | - |
| | 0 | 0 | 30 | 0 | - | NE | 6.5 | - | - |
| | 0 | 0 | 30 | 0 | - | NE | 6.4 | - | - |
| 2 & 3.5 | 0 | 0 | 0 | 0 | - | NE | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | - | - | - |

*MLRA 10*

| Site | Horizon | Depth | Boundary | Color | **Texture** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Field | | | | Laboratory | | | |
| | | | | | Class | S (%) | C (%) | CF (% Volume) | Class | S (%) | Si (%) | C (%) |
| 10.1 | A | 10 | AS | 7.5YR 3/3 | SCL | 60 | 25 | 10 | SL | 57.2 | 25.2 | 17.6 |
| | Btk | 21 | CS | 7.5YR 3/3 | GR SCL | 50 | 32 | 32 | SL | 53.2 | 37.2 | 9.6 |
| | Bt | 54 | GS | 7.5YR 4/3 | SL | 65 | 17 | 10 | SL | 67.2 | 27.2 | 5.6 |
| | Bw | 69 | CS | 7.5YR 4/3 | SL | 65 | 15 | 12 | SL | 69.2 | 25.2 | 5.6 |
| | Bkq1 | 94 | CS | 7.5YR 4/4 | SL | 70 | 13 | 12 | SL | 75.2 | 19.2 | 5.6 |
| | Bkq2 | 115 | - | 7.5YR 5/4 | GR SL | 75 | 12 | 15 | - | - | - | - |
| 10..2 | Ap1 | 7 | AS | 10YR 3/2 | ASHY SL | 55 | 15 | 8 | SL | 63.2 | 29.2 | 7.6 |
| | Ap2 | 18 | CW | 10YR 3/2 | GR ASHY SL | 58 | 17 | 25 | SL | 62 | 32.4 | 5.6 |
| | 2Bt1 | 56 | GS | 10YR 3/3 | SCL | 65 | 21 | 10 | SL | 70 | 28.4 | 1.6 |
| | 2Bt2 | 86 | CS | 10YR 4/3 | SCL | 65 | 24 | 9 | LS | 72 | 26.4 | 1.6 |
| | 2Btk | - | - | 2.5Y 4/3 | VGR SCL | 60 | 27 | 40 | LS | 74 | 24.4 | 1.6 |
| 10.3 | A1 | 14 | CS | 10YR 3/2 | ASHY SL | 60 | 17 | 5 | LS | 78 | 14.4 | 7.6 |
| | A2 | 25 | CS | 10YR 3/2 | ASHY SCL | 60 | 22 | 10 | SL | 56 | 42.4 | 1.6 |
| | 2Bt1 | 42 | CS | 7.5YR 3/2 | SCL | 65 | 28 | 10 | SC | 48 | 16.4 | 35.6 |
| | 2Bt2 | 83 | CS | 7.5YR 4/3 | C | 35 | 48 | 0 | SL | 58 | 22.4 | 19.6 |
| | 2Bk | 137 | GS | 7.5YR 6/3 | SCL | 55 | 42 | 0 | - | - | - | - |
| | 2Crk | 158 | - | 5YR 7/2 | - | - | - | 0 | - | - | - | - |
| 10.4 | A1 | 7 | CS | 10YR 2/2 | ASHY L | 50 | 20 | 5 | SL | 60 | 38.4 | 1.6 |
| | A2 | 23 | AS | 10YR 2/2 | GR ASHY L | 45 | 25 | 20 | SL | 60 | 36.4 | 3.6 |
| | 2Bt | 51 | CW | 10YR 5/4 | CB C | 25 | 50 | 30 | CL | 36 | 24.4 | 39.6 |
| | 2Btss | 87 | GW | 10YR 3/4 | C | 25 | 58 | 5 | CL | 28 | 32.4 | 39.6 |
| | 2Btkss | 101 | - | 10YR 3/4 | C | 25 | 55 | 10 | CL | 30 | 30.4 | 39.6 |
| 10.5 | A1 | 10 | CS | 10YR 3/2 | GR ASHY SL | 60 | 16 | 20 | SL | 64 | 30.4 | 5.6 |
| | A2 | 35 | CS | 10YR 3/2 | GR ASHY SL | 55 | 18 | 25 | SL | 56 | 38.4 | 5.6 |
| | AB | 55 | CW | 10YR 3/2 | XST SCL | 55 | 26 | 60 | L | 50 | 30.4 | 19.6 |
| | 2Bt | 86 | AS | 7.5YR 4/3 | VGR C | 30 | 52 | 50 | C | 38 | 16.4 | 45.6 |
| | 2R | 86 | - | - | - | - | - | - | - | - | - | - |

| Site | Structure | | Consistence | | | | Roots | | | | | Pores | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Primary | Secondary | Rupture Resistance | | Stickiness | Plasticity | VF | F | M | C | VC | VF | F | M | C | VC |
| | | | Moist | Dry | | | | | | | | | | | | |
| 10.1 | 2 F GR | - | FR | S | MS | MP | 3 | 1 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 |
| | 2 M SBK | - | FR | SH | MS | MP | 1 | 2 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 |
| | 2 M SBK | - | FR | S | SS | SP | 1 | 2 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| | 1 M SBK | - | VFR | S | SS | SP | 2 | 2 | 1 | 0 | 0 | 2 | 3 | 0 | 0 | 0 |
| | 2 M SBK | - | VFR | S | SO | SP | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| | 1 CO SBK | - | VFR | S | SO | SP | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| 10.2 | 2 F GR | - | FR | L | SS | SP | 2 | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| | 1 CO PL | 2 M SBK | VFR | S | SS | SP | 2 | 2 | 2 | 0 | 0 | 2 | 3 | 0 | 0 | 0 |
| | 2 CO PR | 2 M SBK | VFR | S | SS | MP | 2 | 2 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 |
| | 2 CO SBK | - | VFR | S | SS | MP | 1 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| | 2 M SBK | - | VFR | SH | MS | MP | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 10.3 | 2 VF GR | - | - | - | - | - | 2 | 3 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 M SBK | - | - | - | - | - | 1 | 2 | 1 | 0 | 0 | - | - | - | - | - |
| | 2 M PR | - | - | - | - | - | 1 | 1 | 2 | 0 | 0 | - | - | - | - | - |
| | 3 M PR | - | - | - | - | - | 1 | 1 | 0 | 3 | 0 | - | - | - | - | - |
| | 2 CO SBK | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | - | - | - | - | - | - | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| 10.4 | 3 F GR | - | - | - | - | - | 3 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 M SBK | - | - | - | - | - | 1 | 1 | 1 | 0 | 0 | - | - | - | - | - |
| | 3 M SBK | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 3 CO PR | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 CO SBK | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| 10.5 | 2 F GR | - | - | - | - | - | 3 | 1 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 F SBK | - | - | - | - | - | 2 | 2 | 2 | 2 | 0 | - | - | - | - | - |
| | 2 M SBK | - | - | - | - | - | 1 | 1 | 1 | 2 | 0 | - | - | - | - | - |
| | 2 M PR | - | - | - | - | - | 1 | 1 | 0 | 0 | 0 | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| Site | Illuviation | | | | Carbonates | | | Redoximorphic Features | |
|---|---|---|---|---|---|---|---|---|---|
| | Siltans | Argillans | | | Masses | Effervescence | Field pH | Depletions | Concentrations |
| | | Pores | Ped Faces | Bridging | | | | | |
| 10.1 | 0 | 0 | 0 | 0 | 0 | SL | - | 0 | 0 |
| | 0 | 4 | 0 | 4 | 0 | SL | - | 0 | 0 |
| | 0 | 3 | 0 | 0 | 0 | NE | - | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | NE | - | 0 | 0 |
| | 0 | 0 | 0 | 0 | 75 | SL | - | 0 | 0 |
| | 0 | 0 | 0 | 0 | 10 | VE | - | 0 | 0 |
| 10.2 | 0 | 0 | 0 | 0 | 0 | NE | - | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | NE | - | 0 | 0 |
| | 0 | 0 | 0 | 2 | 0 | NE | - | 0 | 0 |
| | 0 | 0 | 5 | 5 | 0 | NE | - | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | NE | - | 0 | 0 |
| 10.3 | - | - | - | - | - | NE | 6.9 | - | - |
| | - | - | - | - | - | NE | 7 | - | - |
| | - | - | - | - | - | NE | 7.4 | - | - |
| | - | - | - | - | - | NE | 8.6 | - | - |
| | - | - | - | - | - | VE | 8.4 | - | - |
| | - | - | - | - | - | - | - | - | - |
| 10.4 | - | - | - | - | - | NE | 6.9 | - | - |
| | - | - | - | - | - | NE | 6.7 | - | - |
| | - | - | - | - | - | NE | 7.3 | - | - |
| | - | - | - | - | - | NE | 8.1 | - | - |
| | - | - | - | - | - | NE | 7.8 | - | - |
| 10.5 | - | - | - | - | - | NE | 6.9 | - | - |
| | - | - | - | - | - | NE | 6.5 | - | - |
| | - | - | - | - | - | NE | 6.6 | - | - |
| | - | - | - | - | - | NE | 5.8 | - | - |
| | - | - | - | - | - | - | - | - | - |

## MLRA 12

| Site | Horizon | Depth | Boundary | Color | Texture | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Field | | | | Laboratory | | | |
| | | | | | Class | S (%) | C (%) | CF (% Volume) | Class | S (%) | Si (%) | C (%) |
| 12.1 | A1 | 10 | CS | 10YR 3/3 | GR L | 40 | 13 | 20 | SL | 59.2 | 29.2 | 11.6 |
| | A2 | 23 | AS | 10YR 3/3 | GR L | 45 | 12 | 25 | L | 49.2 | 39.2 | 11.6 |
| | Bkk | 44 | CW | 10YR 3/5 | VGR L | 50 | 16 | 35 | CL | 43.2 | 29.2 | 27.6 |
| | Bkkq | 70 | GW | 10YR 3/6 | CB SL | 60 | 16 | 30 | L | 45.2 | 33.2 | 21.6 |
| | Bk | 100 | | 10YR 4/4 | CB SL | 70 | 10 | 25 | SL | 59.2 | 35.2 | 5.6 |
| 12.2 | A1 | 6 | AS | 7.5YR 3/2 | GR SiL | 25 | 12 | 15 | L | 45.2 | 43.2 | 11.6 |
| | A2 | 25 | CW | 10YR 3/3 | VGR L | 40 | 12 | 35 | L | 51.2 | 37.2 | 11.6 |
| | Bkk2 | 37 | CW | 10YR 4/3 | VGR SL | 55 | 15 | 37 | L | 51.2 | 33.2 | 15.6 |
| | Bkq1 | 56 | GW | 10YR 5/3 | XGR SL | 60 | 16 | 60 | SL | 53.2 | 31.2 | 15.6 |
| | Bkq2 | 70 | GW | 10YR 5/3 | XGR SL | 65 | 12 | 70 | SL | 59.2 | 33.2 | 7.6 |
| | Bkq3 | 90 | | 10YR 4/3 | VGR SL | 75 | 9 | 50 | LS | 73.2 | 25.2 | 1.6 |
| 12.3 | Oi | 3 | CW | 7.5YR 5/2 | SPM | - | - | 0 | - | - | - | - |
| | Oe | 7 | CW | 7.5YR 2.5/1 | MPM | - | - | 0 | - | - | - | - |
| | A | 15 | CW | 7.5YR 3/4 | GR SiL | 25 | 16 | 27 | L | 33.2 | 47.2 | 19.6 |
| | AB | 39 | CW | 7.5YR 3/2 | VGR L | 43 | 14 | 55 | L | 39.2 | 43.2 | 17.6 |
| | Bk1 | 58 | GW | 10YR 5/3 | CB SL | 60 | 13 | 70 | SL | 53.2 | 37.2 | 9.6 |
| | Bk2 | 72 | GW | 7.5YR 6/3 | CB SL | 65 | 12 | 55 | L | 51.2 | 31.2 | 17.6 |
| | BC | 100 | - | 10YR 7/2 | CB SL | 68 | 12 | 50 | SL | 59.2 | 33.2 | 7.6 |
| 12.4 | Oi | 5 | AS | - | SPM | - | - | 0 | - | - | - | - |
| | Oe | 10 | AS | - | MPM | - | - | 10 | - | - | - | - |
| | A | 21 | CW | 10YR 3/3 | GR L | 40 | 20 | 30 | CL | 39.2 | 33.2 | 27.6 |
| | BA | 38 | AW | 10YR 6/3 | VGR SiL | 60 | 17 | 50 | SL | 57.2 | 29.2 | 13.6 |
| | Ab | 47 | AW | 5YR 3/3 | VGR SL | 55 | 13 | 40 | SL | 55.2 | 37.2 | 7.6 |
| | Bk1 | 70 | GW | 10YR 6/2 | XGR SL | 65 | 9 | 70 | SL | 65.2 | 25.2 | 9.6 |
| | Bk2 | 95 | - | 10YR 6/2 | XGR LS | 75 | 5 | 75 | LS | 82.8 | 14 | 3.2 |
| 12.5 | Oi | 4 | CS | - | SPM | - | - | 0 | - | - | - | - |
| | A | 13 | CW | 10YR 2/2 | L | 45 | 12 | 20 | L | 48.8 | 32 | 19.2 |
| | Bk1 | 49 | GW | 7.5YR 2.5/2 | CB L | 50 | 15 | 25 | L | 50.8 | 34 | 15.2 |
| | Bk2 | 82 | CW | 10YR 3/2 | CB SL | 60 | 13 | 35 | L | 50.8 | 32 | 17.2 |
| | 2Bk3 | 103 | - | 10YR 4/2 | VGR CL | 40 | 35 | 30 | L | 38.8 | 36 | 25.2 |

| Site | Structure | | Consistence | | | | Roots | | | | | Pores | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Primary | Secondary | Rupture Resistance | | Stickiness | Plasticity | VF | F | M | C | VC | VF | F | M | C | VC |
| | | | Moist | Dry | | | | | | | | | | | | |
| 12.1 | 1 VF GR | - | - | - | - | - | 8 | 2 | 1 | 0 | 0 | - | - | - | - | - |
| | 2 F GR | - | - | - | - | - | 3 | 1 | 1 | 0 | 0 | - | - | - | - | - |
| | 2 F SBK | - | - | - | - | - | 1 | 0 | 0.5 | 0 | 0 | - | - | - | - | - |
| | 1 M SBK | - | - | - | - | - | 0.1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 1 CO SBK | - | - | - | - | - | 0.5 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| 12.2 | 1 VF GR | - | - | - | - | - | 5 | 2 | 0 | 0 | 0 | - | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 2 | 1 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 F SBK | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 F SBK | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 0 SGR | - | - | - | - | - | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| 12.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 0 | 1 | 3 | 0 | 25 | 2 | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 0 | 0 | 3 | 0 | 1 | 3 | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 0 | 1 | 1 | 0 | 0 | 3 | - | - | - | - |
| | 1 CO SBK | - | - | - | - | - | 0 | 0.5 | 2 | 1 | 0 | 3 | - | - | - | - |
| | 1 CO SBK | - | - | - | - | - | 0 | 0 | 0 | 0 | 1 | 3 | - | - | - | - |
| 12.4 | - | - | - | - | - | - | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | - | - | - | - | - | - | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 1 M SBK | - | - | - | - | - | 0 | 1 | 0 | 1 | 2 | - | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 0 | 1 | 2 | 0 | 0 | - | - | - | - | - |
| | 1 F SBK | - | - | - | - | - | 0 | 0 | 1 | 1 | 0 | - | - | - | - | - |
| | 2 F SK | - | - | - | - | - | 0 | 1 | 0 | 1 | 0 | - | - | - | - | - |
| | 0 SG | - | - | - | - | - | 0 | 1 | 0 | 0 | 0 | - | - | - | - | - |
| 12.5 | - | - | - | - | - | - | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | 1 M SBK | - | - | - | - | - | 1 | 1 | 1 | 0 | 0 | 2 | - | - | - | - |
| | 2 M SBK | - | - | - | - | - | 3 | 1 | 2 | 0 | 2 | 2 | - | - | - | - |
| | 1 M SBK | - | - | - | - | - | 1 | 0 | 1 | 0 | 1 | 3 | - | - | - | - |
| | 2 CO ABK | - | - | - | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 2 | - | - | - |

| Site | Illuviation | | | | Carbonates | | | Redoximorphic Features | |
|---|---|---|---|---|---|---|---|---|---|
| | Siltans | Argillans | | | Masses | Effervescence | Field pH | Depletions | Concentrations |
| | | Pores | Ped Faces | Bridging | | | | | |
| 12.1 | - | - | - | - | - | SL | 7.8 | - | - |
| | - | - | - | - | - | ST | 7.8 | - | - |
| | - | - | - | - | - | VE | 8.1 | - | - |
| | - | - | - | - | - | VE | 8.2 | - | - |
| | - | - | - | - | - | VE | 8.3 | - | - |
| 12.2 | - | - | - | - | - | NE | 7.6 | - | - |
| | - | - | - | - | - | ST | 7.6 | - | - |
| | - | - | - | - | - | VE | 7.8 | - | - |
| | - | - | - | - | - | VE | 8 | - | - |
| | - | - | - | - | - | VE | 8.1 | - | - |
| | - | - | - | - | - | VE | 8 | - | - |
| 12.3 | - | - | - | - | - | NE | 6.4 | - | - |
| | - | - | - | - | - | NE | 6.2 | - | - |
| | - | - | - | - | - | NE | 7 | - | - |
| | - | - | - | - | - | SL | 7.4 | - | - |
| | - | - | - | - | - | ST | 8.6 | - | - |
| | - | - | - | - | - | VE | 8.2 | - | - |
| | - | - | - | - | - | SL | 7.8 | - | - |
| 12.4 | - | - | - | - | - | NE | - | - | - |
| | - | - | - | - | - | NE | - | - | - |
| | - | - | - | - | - | NE | 6.8 | - | - |
| | - | - | - | - | - | NE | 6.8 | - | - |
| | - | - | - | - | - | NE | 7.6 | - | - |
| | - | - | - | - | - | ST | 7.8 | - | - |
| | - | - | - | - | - | VE | 8 | - | - |
| 12.5 | - | - | - | - | - | NE | - | - | - |
| | - | - | - | - | - | SL | 7 | - | - |
| | - | - | - | - | - | ST | 7.2 | - | - |
| | - | - | - | - | - | VE | 7.8 | - | - |
| | - | - | - | - | - | VE | 8.2 | - | - |

*MLRA 43A*

| Site | Horizon | Depth | Boundary | Color | Texture | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Field | | | | Laboratory | | | |
| | | | | | Class | S (%) | C (%) | CF (% Volume) | Class | S (%) | Si (%) | C (%) |
| 43A.1 | Oi | 3 | AS | - | SPM | - | - | - | - | - | - | - |
| | A1 | 15 | CS | 10YR 4/2 | SiL | - | 16 | 0 | SL | 58.8 | 36 | 5.2 |
| | A2 | 26 | CS | 10YR 5/2 | SiL | - | 18 | 2 | SL | 54.8 | 32 | 13.2 |
| | Bt1 | 54 | CW | 10YR 5/3 | L | - | 20 | 5 | L | 50.8 | 36 | 13.2 |
| | Bt2 | 85 | CW | 10YR 5/3 | L | - | 25 | 2 | L | 50.8 | 34 | 15.2 |
| | Bt3 | 100 | - | 10YR 5/3 | L | - | 25 | 2 | L | 46.8 | 36 | 17.2 |
| 43A.2 | Oi | 1 | AS | - | SPM | - | - | - | - | - | - | - |
| | Oe | 3 | AS | - | MPM | - | - | - | - | - | - | - |
| | A1 | 7 | AW | 7.5YR 5/2 | ASHY SIL | - | 18 | 0 | SL | 68.8 | 30 | 1.2 |
| | A2 | 21 | CW | 7.5YR 5/2 | ASHY SIL | - | 18 | 0 | SL | 58.8 | 32 | 9.2 |
| | AB | 34 | CW | 7.5YR 4/3 | L | - | 20 | 1 | SL | 58.8 | 34 | 7.2 |
| | Bt1 | 46 | CW | 7.5YR 6/3 | L | - | 20 | 2 | SL | 58.8 | 32 | 9.2 |
| | Bt2 | 56 | GW | 7.5YR 6/3 | L | - | 20 | 1 | SL | 56.8 | 34 | 9.2 |
| | Bt3 | 75 | CW | 7.5YR 7/3 | L | - | 23 | 10 | SL | 54.8 | 34 | 11.2 |
| | Bt4 | 92 | - | 7.5YR 6/4 | L | - | 25 | 2 | L | 48.8 | 38 | 13.2 |
| 43A.3 | Oi | 3 | - | - | SPM | - | - | - | - | - | - | - |
| | Oe | 5 | AW | - | MPM | - | - | - | - | - | - | - |
| | A1 | 11 | CS | 10YR 2/2 | ASHY SIL | - | 18 | 1 | SL | 52.8 | 40 | 7.2 |
| | A2 | 21 | AW | 10YR 3/2 | ASHY SIL | - | 18 | 1 | SL | 58.8 | 32 | 9.2 |
| | Bw | 37 | CW | 10YR 4/4 | L | - | 20 | 1 | SL | 58.8 | 34 | 7.2 |
| | Bt1 | 67 | CW | 7.5YR 5/3 | L | - | 22 | 3 | SL | 60.8 | 29.6 | 9.6 |
| | Bt2 | 81 | CW | 10YR 4/4 | L | - | 23 | 12 | LS | 78.8 | 13.6 | 7.6 |
| | Bt3 | 96 | CW | 10YR 4/3 | L | - | 24 | 5 | SL | 60.8 | 25.6 | 13.6 |
| | BC | 100 | - | 10YR 4/4 | GR L | - | 22 | 15 | - | - | - | - |
| 43A.4 | Oi | 2 | AS | - | SPM | - | - | - | - | - | - | - |
| | Oe | 4 | AS | - | MPM | - | - | - | - | - | - | - |
| | A | 8 | CW | 7.5YR 2.5/2 | ASHY SIL | - | 8 | 0 | SL | 68.8 | 27.6 | 3.6 |
| | Bw1 | 18 | CW | 7.5YR 4/3 | ASHY SIL | - | 8 | 0 | SL | 70.8 | 25.6 | 3.6 |
| | Bw2 | 29 | CW | 7.5YR 4/3 | ASHY SIL | - | 8 | 0 | SL | 70.8 | 27.6 | 1.6 |
| | Bw3 | 35 | AW | 7.5YR 4/4 | ASHY SIL | - | 8 | 0 | L | 42.8 | 47.6 | 9.6 |
| | 2Bt1 | 60 | GI | 7.5YR 4/4 | SIL | - | 21 | 1 | L | 48.8 | 39.6 | 11.6 |
| | 2Bt2 | 89 | CW | 7.5YR 5/3 | SIL | - | 23 | 2 | SL | 44.8 | 47.6 | 7.6 |
| | 2Bt/E | 93 | CW | 10YR 4/3 | SIL | - | 26 | 2 | SiL | 38.8 | 55.6 | 5.6 |

| Site | Horizon | Depth | Boundary | Color | Texture | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Field | | | | Laboratory | | | |
| | | | | | Class | S (%) | C (%) | CF (% Volume) | Class | S (%) | Si (%) | C (%) |
| | 2E/Bt | 100 | - | 10YR 5/3 | SIL | - | 21 | 2 | SiL | 36.8 | 55.6 | 7.6 |
| 43A.5 | Oi | 2 | AS | - | SPM | - | - | - | - | - | - | - |
| | Oe | 6 | AS | - | MPM | - | - | - | - | - | - | - |
| | A | 15 | CS | 10YR 3/3 | ASHY SIL | - | 10 | 0 | SiL | 36.8 | 55.6 | 7.6 |
| | Bw1 | 30 | GW | 7.5YR 6/4 | ASHY SIL | - | 10 | 0 | SiL | 38.8 | 55.6 | 5.6 |
| | Bw2 | 52 | AW | 10YR 4/4 | ASHY SIL | - | 10 | 0 | SL | 44.8 | 49.6 | 5.6 |
| | 2Bt1 | 73 | GW | 10YR 4/4 | SiL | - | 16 | 0 | L | 38.8 | 49.6 | 11.6 |
| | 3Bt2 | 95 | - | 10YR 4/4 | L | - | 16 | 1 | L | 42.8 | 45.6 | 11.6 |

| Site | Structure | | Consistence | | | | Roots | | | | | Pores | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Primary | Secondary | Rupture Resistance | | Stickiness | Plasticity | VF | F | M | C | VC | VF | F | M | C | VC |
| | | | Moist | Dry | | | | | | | | | | | | |
| 43A.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | FR | SH | SO | MP | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | - | - | FR | SH | SS | MP | 2 | 2 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 |
| | - | - | FI | H | SS | MP | 2 | 2 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 |
| | - | - | FI | MH | SS | VP | 1 | 1 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 |
| | - | - | FI | H | MS | VP | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 43A.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | VFR | S | SS | MP | 3 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| | - | - | VFR | S | SS | MP | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | - | - | FR | SH | SS | MP | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | - | - | FR | - | SS | MP | 2 | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| | - | - | FR | - | SS | MP | 2 | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| | - | - | FR | - | MS | MP | 2 | 2 | 0 | 2 | 0 | 3 | 2 | 0 | 0 | 0 |
| | - | - | FI | - | MS | VP | 2 | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 43A.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | SS | SP | - | - | - | - | - | - | - | - | - | - |
| | 3 F GR | - | FR | S | SS | SP | 3 | 0 | 2 | 2 | 0 | 3 | 0 | 0 | 0 | 0 |
| | 2 F SBK | 1 VF GR | FR | S | SS | SP | 2 | 0 | 2 | 0 | 0 | 3 | 1 | 0 | 0 | 0 |
| | 2 M SBK | - | FR | SH | SS | SP | 2 | 2 | 2 | 0 | 0 | 3 | 1 | 0 | 0 | 0 |
| | 2 F SBK | 2 M SBK | FR | SH | SS | SP | 2 | 2 | 2 | 0 | 0 | 3 | 1 | 1 | 0 | 0 |
| | 1 M SKB | 1 CO SBK | FR | SH | SS | SP | 2 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

| Site | Structure | | Consistence | | | | Roots | | | | | Pores | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Primary | Secondary | Rupture Resistance | | Stickiness | Plasticity | VF | F | M | C | VC | VF | F | M | C | VC |
| | | | Moist | Dry | | | | | | | | | | | | |
| | 1 M SBK | 1 CO SBK | FR | SH | SS | SP | 2 | 2 | 2 | 2 | 0 | 3 | 1 | 1 | 0 | 0 |
| | 1 CO SBK | - | FR | SH | SS | SP | 2 | 2 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 |
| 43A.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | VFR | S | SO | PO | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | - | - | VFR | S | SO | PO | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | - | - | VFR | S | SO | PO | 2 | 2 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| | - | - | VFR | S | SO | PO | 2 | 2 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| | - | - | FR | SH | SS | SP | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 |
| | - | - | FR | SH | SS | SP | 2 | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| | - | - | FR | - | MS | MP | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| | - | - | FR | - | SS | SP | 2 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 43A.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| | 1 F SBK | 1 F GR | VFR | S | SO | PO | 3 | 2 | 0 | 0 | 0 | - | - | - | - | - |
| | 2 F SBK | 2 M SBK | VFR | S | SO | PO | 2 | 2 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| | 2 F SBK | 2 M SBK | VFR | S | SO | PO | 2 | 2 | 2 | 2 | 0 | 3 | 0 | 0 | 0 | 0 |
| | 2 CO SBK | 2 M SBK | FR | MH | SS | SP | 2 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| | 1 F SBK | 2 M SBK | FR | MH | MS | SP | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |

| Site | Illuviation | | | | Carbonates | | | Redoximorphic Features | |
|---|---|---|---|---|---|---|---|---|---|
| | Siltans | Argillans | | | Masses | Effervescence | Field pH | Depletions | Concentrations |
| | | Pores | Ped Faces | Bridging | | | | | |
| 43A.1 | - | - | - | - | - | - | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | 6.6 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 6.4 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 6.4 | 0 | 0 |
| | 0 | 0 | 45 | 0 | - | NE | 6.2 | 0 | 0 |
| | 0 | 0 | 50 | 0 | - | NE | 6.3 | 0 | 35 |
| 43A.2 | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - |
| | 0 | 0 | 0 | 0 | - | NE | 6.2 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 6.6 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 6.1 | 0 | 0 |

| **Site** | **Illuviation** | | | | **Carbonates** | | | **Redoximorphic Features** | |
|---|---|---|---|---|---|---|---|---|---|
| | Siltans | Argillans | | | Masses | Effervescence | Field pH | Depletions | Concentrations |
| | | Pores | Ped Faces | Bridging | | | | | |
| | 0 | 0 | 10 | 0 | - | NE | 6.1 | 0 | 0 |
| | 0 | 10 | 10 | 0 | - | NE | 5.9 | 0 | 0 |
| | 0 | 10 | 10 | 0 | - | NE | 5.8 | 0 | 0 |
| | 0 | 0 | 10 | 0 | - | NE | 5.5 | 0 | 0 |
| 43A.3 | 0 | - | - | - | - | NE | - | 0 | 0 |
| | 0 | - | - | - | - | NE | 5.5 | 0 | 0 |
| | 0 | - | 0 | 0 | - | NE | 5.5 | 0 | 0 |
| | 0 | - | 0 | 0 | - | NE | 5.5 | 0 | 0 |
| | 0 | - | 0 | 0 | - | NE | 5.6 | 0 | 0 |
| | 0 | 0 | 3 | 3 | - | NE | 5.5 | 0 | 0 |
| | 0 | 0 | 2 | 2 | - | NE | 5.5 | 0 | 0 |
| | 0 | 0 | 3 | 3 | - | NE | 5.5 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 5.4 | 0 | 0 |
| 43A.4 | 0 | - | - | - | - | - | - | 0 | 0 |
| | 0 | - | - | - | - | - | - | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | - | 6.5 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 6.5 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 6 | 0 | 0 |
| | 0 | 0 | 0 | 0 | - | NE | 5.8 | 0 | 0 |
| | 20 | 10 | 10 | 0 | - | NE | 5.8 | 0 | 0 |
| | 2 | 5 | 5 | 0 | - | NE | 5.5 | 0 | 0 |
| | 0 | 10 | 10 | 0 | - | NE | 5.5 | 0 | 0 |
| | 0 | 5 | 5 | 0 | - | NE | 5.4 | 1 | 1 |
| 43A.5 | 0 | - | - | - | - | NE | - | 0 | 0 |
| | 0 | - | - | - | - | NE | 5.8 | 0 | 0 |
| | 0 | - | 0 | 0 | - | NE | 6 | 0 | 0 |
| | 0 | - | 0 | 0 | - | NE | 6.1 | 0 | 0 |
| | 0 | - | 0 | 0 | - | NE | 5.8 | 0 | 0 |
| | 0 | 15 | 20 | 0 | - | NE | 5.6 | 0 | 0 |
| | 0 | 10 | 10 | 0 | - | NE | 5.4 | 0 | 0 |

# Appendix C: Compiled Percent Understory Species

| Group | Species | MLRA 12 | | | | | MLRA 2 & 3 | | | | MLRA 10 | | | | | MLRA 43A | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Community | Classification | ARARL/FEID | ARARL/FEID | PSME/SYOR2 | PSME/JUCO6 | PSME/JUCO6 | PSME/COCO6-SYMO/COMU | ABGR/COCO6/VAHE | TSHE/POMU | TSHE/MANE2-POMU | R-10XY120OR – LOAMY FAN 9012 PZ | R-10XB-34OR – JD LOAMY 9012 PZ | R-10XB-27OR – JD CLAYEY 12016 PZ | R-10XB-85OR – JD MOUNTAIN NORTH 12016 | CPG222 – PIPO/CAGA3 | PIPO/SYAL | PSME/PHMA | ABGR/PHMA | ABGR/CLUN | THPL/CLUN |
| Coniferous Tree | ABGR | - | - | - | - | - | - | 0.9 | 5.3 | - | - | - | - | - | - | - | - | - | - | - |
| | PIFL2 | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | PSMEG | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.3 | 3.2 | - | - |
| | PSMEM | - | - | - | - | - | - | - | 1.1 | - | - | - | - | - | - | - | - | - | - | - |
| | TSHE | - | - | - | - | - | - | 6.6 | 1.1 | - | - | - | - | - | - | - | - | - | - | - |
| Deciduous Tree | A CMA3 | - | - | - | - | - | - | 7.5 | - | - | - | - | - | - | - | - | - | - | - | - |
| | ALRU2 | - | - | - | - | - | - | 16 | 1.1 | - | - | - | - | - | - | - | - | - | - | - |
| | CONU4 | - | - | - | - | - | 4.4 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | FRLA | - | - | - | - | - | 2.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | SAPO | - | - | - | - | - | - | - | - | 2.4 | - | - | - | - | - | - | - | - | - | - |
| Fern | DRAR3 | - | - | - | - | - | 2.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | FR01 | - | - | - | - | - | - | - | - | 1.2 | - | - | - | - | - | - | - | - | - | - |
| | POMU | - | - | - | - | - | 6.6 | 12.2 | 25.3 | 4.9 | - | - | - | - | - | - | - | - | - | - |
| | PTAQ | - | - | - | - | - | - | 0.9 | - | - | - | - | - | - | - | - | - | - | - | - |
| Forb | ADBI | - | - | - | - | - | - | 0.9 | - | 1.2 | - | - | - | - | - | - | - | - | 4.6 | - |
| | AF01 | - | - | - | - | - | 1.1 | 6.6 | 3.2 | 2.4 | 3.6 | 1.8 | - | 0.8 | 1.4 | 1.4 | - | - | - | 1.2 |
| | AGGL | - | - | - | - | - | - | - | - | - | - | - | - | 0.8 | - | - | - | - | - | - |
| | ALDE | - | - | - | - | - | - | - | - | - | 6.4 | - | 3.5 | - | - | - | - | - | - | - |
| | ANMA | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.3 | 1.1 | 3 | 2.3 |
| | ANPI | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.1 | - | 2.3 |
| | ARCO9 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.8 | - | - | - | - | - |
| | ASARU | - | - | - | - | - | - | - | - | 1.2 | - | - | - | - | - | - | - | - | - | - |
| | ASCO | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.2 | - | - |
| | ASTRA | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - | - |

| Group | Species | MLRA 12 | | | | | MLRA 2 & 3 | | | | MLRA 10 | | | | | MLRA 43A | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Forb | CIAL | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.5 | - |
| | COCA12 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.2 |
| | COGR4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.9 | - | - | - | - |
| | COLI2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.3 | - | - | - |
| | CRAC2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.8 | - | - | - | - | - |
| | CREPI | - | 3.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | DICEN | - | - | - | - | - | - | 0.9 | - | - | - | - | - | - | - | - | - | - | - | - |
| | DRVE2 | - | - | - | - | - | - | - | - | - | - | - | - | 1.7 | 1.4 | - | - | - | - | - |
| | ERCI6 | - | - | - | - | - | - | - | - | - | - | 1.8 | - | - | - | - | - | - | - | - |
| | ERHE2 | - | - | - | - | - | - | - | - | - | - | - | - | 0.8 | - | - | - | - | - | - |
| | FRFA | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.2 |
| | FRVE | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.3 | 2.2 | 1.5 | 3.5 |
| | GADI2 | - | - | - | - | - | - | - | - | - | - | - | - | 1.7 | - | - | - | - | - | - |
| | GALIU | - | - | - | - | - | 2.2 | - | 1.1 | 7.3 | - | - | - | - | - | - | - | - | - | - |
| | HIAL2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.5 | 1.2 |
| | HISCA | - | - | - | - | - | - | - | - | - | - | - | - | - | 4.2 | - | - | - | - | - |
| | IRMI | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.9 | - | - | - | - |
| | LIBOL | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.3 |
| | LIRU | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - |
| | LODI | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.9 | - | - | - | - |
| | LOTR2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.3 | - | - | - |
| | LOUT | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.3 |
| | LUAR3 | - | - | - | - | - | - | - | - | - | - | - | 0.9 | 4.2 | 1.4 | - | - | - | - | - |
| | LUSE4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.9 | - | - | - | - |
| | MAGR3 | - | - | - | - | - | - | 0.9 | - | - | - | - | - | - | - | 1.4 | - | - | - | - |
| | MARAA | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3.2 | 1.5 | - |
| | MAST4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3.2 | 15.2 | 8.1 |
| | MERTE | - | 1.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Forb | MOMA3 | - | - | - | - | - | 2.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | OSBE | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 10.7 | - |
| | PHHO | 4.9 | 5.1 | - | - | - | - | - | - | - | - | - | 3.5 | - | - | - | - | - | - | - |
| | PRTR4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.5 | - |
| | SENEC | - | - | - | - | - | - | - | - | - | - | - | - | 1.7 | - | - | - | - | - | - |
| | SOMI2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - |
| | THOC | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4.3 | - | - |
| | TRBOL | - | - | - | - | - | 1.1 | - | - | - | - | - | - | - | - | - | - | - | - | 10.4 |
| | TRILL | - | - | - | - | - | - | - | 1.1 | - | - | - | - | - | - | - | - | - | - | - |

| Group | Species | MLRA 12 | | | | | MLRA 2 & 3 | | | | MLRA 10 | | | | | MLRA 43A | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| | VICIA | 1.6 | 1.7 | - | - | - | - | - | - | - | - | - | - | - | - | 5.8 | - | - | - | - |
| Graminoid | ACTH7 | - | - | - | - | - | - | - | - | - | - | - | 0.9 | - | - | - | - | - | - | - |
| | AGCR | - | - | - | - | - | - | - | - | - | - | 27.1 | - | - | - | - | - | - | - | - |
| | BRBR5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - |
| | BRMA4 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - | - |
| | BRTE | - | - | - | - | - | - | - | - | - | 27.2 | 23.5 | - | 7.5 | 1.4 | 2.9 | - | - | - | - |
| | BRVU | - | - | - | - | - | 5.5 | - | - | - | - | - | - | - | - | 2.9 | 3.9 | 2.2 | 4.6 | 2.3 |
| | CAGE2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 15.4 | - | - | - | - | - |
| | CARU | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 18.7 | 34 | 23.8 | - | 1.2 |
| | DAGLG | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | 11.8 | - | - | - |
| | ELEL5 | - | - | - | - | - | - | - | - | - | 0.9 | - | - | 2.5 | 1.4 | - | - | - | - | - |
| Graminoid | FEID | - | - | 3.2 | - | - | - | - | - | - | - | - | 16.5 | 18.4 | 9.8 | - | 2.6 | - | - | - |
| | FEOC | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.6 | - | - | - |
| | GR01 | - | - | - | - | - | 3.3 | 0.9 | - | - | - | - | - | - | - | - | - | - | - | - |
| | KOMA | - | - | - | - | - | - | - | - | - | 0.9 | - | 0.9 | 1.7 | - | - | - | - | - | - |
| | POSE | 8.2 | 18.5 | 4.8 | 2 | - | - | - | - | - | 10.9 | - | 5.2 | 18.4 | 2.8 | - | - | - | - | - |
| | PSSP6 | 44.4 | 20.2 | - | - | - | - | - | - | - | 7.3 | - | 3.5 | 30.9 | - | 15.8 | 2.6 | - | - | - |
| Open | | 26 | 36 | 92 | 90 | 90 | 10 | 8 | 6 | 4 | 41 | 44 | 54 | 9 | 51 | 8 | 2 | 8 | 30 | 12 |
| Shrub | ACCI | - | - | - | - | - | - | 2.8 | 32.7 | 29.2 | - | - | - | - | - | - | - | - | - | - |
| | AMALA | - | - | - | - | - | 1.1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | ARAR8 | 14.8 | 10.1 | - | - | - | - | - | - | - | - | - | 4.3 | - | - | - | - | - | - | - |
| | ARTRV | - | 1.7 | - | - | - | - | - | - | - | - | - | 1.7 | - | - | - | - | - | - | - |
| | ARTRW8 | - | - | - | - | - | - | - | - | - | 1.8 | - | 0.9 | - | - | - | - | - | - | - |
| | BASA | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - |
| | CRDO2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4.3 | - | - | - | - |
| | CESA | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3.5 |
| | CHVI8 | - | - | - | - | - | - | - | - | - | - | - | 1.7 | - | - | - | - | - | - | - |
| | COCO6 | - | - | - | - | - | 9.9 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | FRPU7 | - | - | - | - | - | 1.1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | HODI | - | - | - | - | - | - | 9.4 | - | - | - | - | - | - | - | - | 6.5 | 2.2 | 7.6 | 3.5 |
| | JUCO6 | - | - | - | 2 | 8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | PAMY | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.2 |
| | PERA4 | - | - | - | - | - | - | - | - | - | - | - | 2.6 | - | - | - | - | - | - | - |
| | PHMA5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 22.2 | 21.6 | - | 5.8 |
| | PUTR2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.4 | - | - | - | - | - |
| | RIBES | - | - | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | SASC | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.2 | - | - |
| | SH01 | - | - | - | - | - | - | 1.9 | - | 15.8 | - | - | - | - | - | - | - | - | - | - |

| Group | Species | MLRA 12 | | | | | MLRA 2 & 3 | | | | MLRA 10 | | | | | MLRA 43A | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| | SPBE2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2.9 | 2.6 | - | - | 1.2 |
| | SYOR2 | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Subshrub | ARTR4 | - | 1.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | CHUM | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4.6 |
| | GASH | - | - | - | - | - | - | 9.4 | - | - | - | - | - | - | - | - | - | - | - | - |
| | MANE2 | - | - | - | - | - | - | 0.9 | 20.1 | 15.8 | - | - | - | - | - | - | - | - | - | - |
| | ROGY | - | - | - | - | - | 1.1 | - | - | - | - | - | - | - | - | - | - | 9.7 | 3 | 1.2 |
| | RUPA | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4.6 |
| | RUUR | - | - | - | - | - | 11 | 0.9 | - | 12.2 | - | - | - | - | - | - | - | - | - | - |
| | SYAL | - | - | - | - | - | 5.5 | 6.6 | - | - | - | 1.8 | - | - | - | 17.2 | 2.6 | 9.7 | 13.7 | 23.2 |
| | VAME | - | - | - | - | - | - | 5.6 | 2.1 | 2.4 | - | - | - | - | - | - | - | - | - | - |
| Vine | LOHI2 | - | - | - | - | - | 27.4 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | TODI | - | - | - | - | - | 2.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |