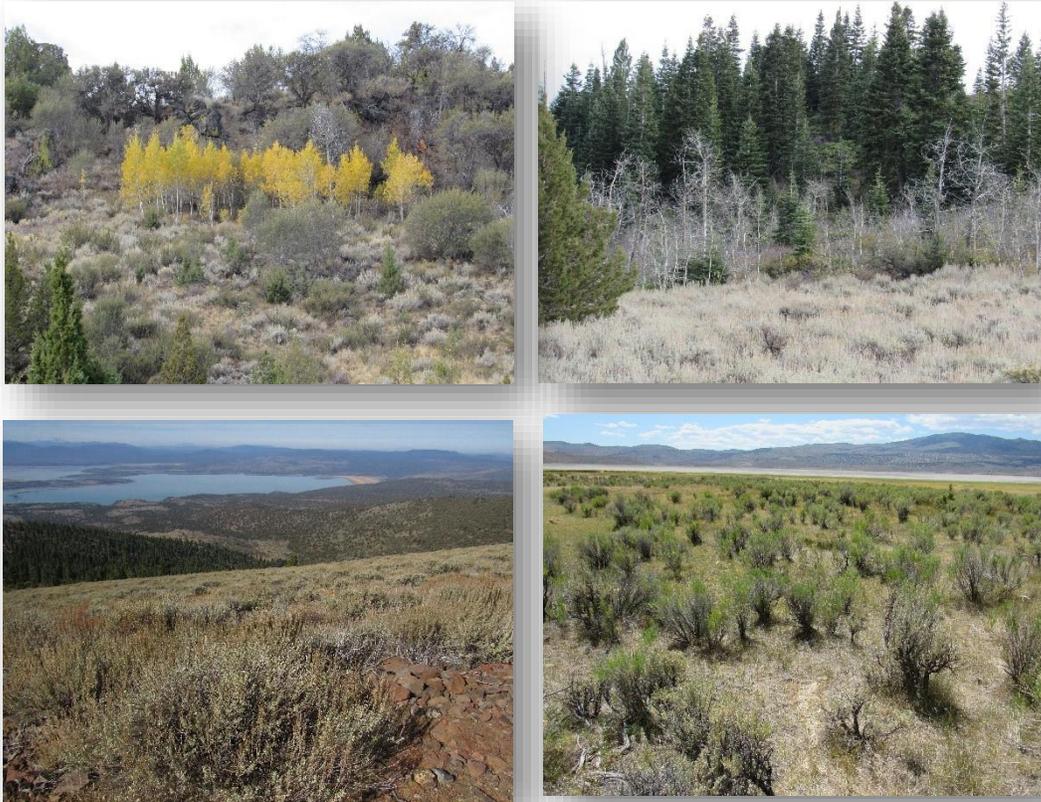


**FINE-SCALE VEGETATION MAP OF A PORTION OF MODOC
AND LASSEN COUNTIES, CALIFORNIA, FOR THE BUREAU
OF LAND MANAGEMENT (EAGLE LAKE FIELD OFFICE)
Contract L17PX00036**



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ABSTRACT

Under contract to the U.S. Bureau of Land Management (BLM), Aerial Information Systems (AIS) created a fine-scale vegetation map of portions of the Modoc Plateau in northeastern California. AIS subcontracted the California Native Plant Society (CNPS) to conduct classification development work needed for this project, as well as accuracy assessment (AA) field data collection. The California Department of Fish and Wildlife's (CDFW) Vegetation Classification and Mapping Program (VegCAMP) provided in-kind service to allocate and score the AA.

The mapping study area, consisting of approximately 66,402 acres, of Lassen County. Work was performed on the project between 2019 and 2021. The primary purpose was an effort toward BLM's goal of developing fine-scale digital vegetation maps for all the public lands it manages in California.

The vegetation classification follows protocols compliant with the Federal Geographic Data Committee (FGDC) and National Vegetation Classification Standards (NVCS). The classification is based on new surveys and classification work conducted in collaboration with CDFW VegCAMP. The map was produced applying heads-up digitizing techniques using a base of one-meter National Agricultural Imagery Program (NAIP) imagery (true-color and color infrared), in conjunction with ancillary data and imagery sources. Map polygons are assessed for Vegetation Type, Percent Cover, Exotics, Development Disturbance, and other attributes. The minimum mapping unit (MMU) is 1 acre; exceptions are made for wetlands and riparian types, which were mapped to a 1/4 acre MMU.

Field reconnaissance and accuracy assessment enhanced map quality. There were a total of 78 mapping classes. The overall Fuzzy Accuracy Assessment ratings for the final vegetation map at the Alliance level were 86.3 percent at the 60-100% Correct or Acceptable level, and 81.9 percent at the 80-100% Correct or Acceptable level. At the Association level, the Fuzzy Accuracy Assessment ratings were 84.0 percent at the 60-100% Correct or Acceptable level, and 72.4 percent at the 80-100% Correct or Acceptable level.

Keywords: Bureau of Land Management, National Vegetation Classification Standard, NVCS, Modoc Plateau, vegetation, photointerpretation

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CHAPTER 1: Introduction

1.1 The Mapping Program

Under Contract L17PX00036, the U.S. Bureau of Land Management (BLM) tasked Aerial Information Systems, Inc. (AIS) to conduct vegetation classification development and fine-scale vegetation mapping of approximately 705,000 acres over four areas within Modoc, Lassen, Mendocino, Kern, San Diego, and Imperial counties of California. The classification and mapping efforts were completed as four projects, designated as Eagle Lake, Applegate, Point Arena/Stornetta, and Desert Renewable Energy Conservation Plan (DRECP).

This report describes the work effort for the Eagle Lake study area. Separate reports were written for each of the other study areas of the contract. Point Arena/Stornetta was completed in 2020 and is reported in Buck-Diaz J., K. Sikes, J. Evens (2020). DRECP, which includes the subareas of Jawbone North, Salton Sea North, and Flat-Tailed Horned Lizard, was completed in 2020, and is reported in Reyes et al. (2021). Applegate was completed in 2021 and is reported in Menke et al. (2021).

The Eagle Lake study area totals 66,402 acres in Lassen County of the Modoc Plateau region, within the Eagle Lake Field Office District. Work performed in this effort is based on the classification and mapping standards as outlined in the Survey of California Vegetation, Classification, and Mapping Standards developed by the California Department of Fish and Wildlife's (CDFW) Vegetation, Classification, and Mapping Program (VegCAMP) (VegCAMP, 2020). California Native Plant Society (CNPS), as a subcontractor to AIS, conducted any classification development work and accuracy assessment needed for this project.

BLM's goal is to develop fine-scale vegetation maps for all the public lands it manages in California. Previous and concurrent vegetation mapping of approximately 1,945,674 acres in the region was conducted by the California State University Geographic Information Center (GIC) at Chico from 2016 to 2021 for CDFW (Kreb 2021).

The vegetation classification, which follows Federal Geographic Data Committee (FGDC) and National Vegetation Classification Standards (NVCS), builds on the existing classification work previously conducted for the area by CDFW. The classification effort for the project was conducted in conjunction with concurrent mapping for BLM's Applegate Field Office District (under same contract with AIS, see Menke et al., 2021). The classification analysis was based on new and previous surveys. Non-vegetative classes such as water bodies and land use are included.

Field reconnaissance was conducted by staff from AIS, accompanied on a few trips by VegCAMP and/or CNPS staff. AIS photointerpreters then created a map representing Vegetation Types (vegetation Alliance and, where applicable, Associations) and Percent Cover of different vegetative life forms. Map polygons were assessed for Exotics, Development Disturbance, and other attributes (see Appendix A). The minimum mapping unit (MMU) for vegetation is 1 acre; exceptions are made for wetlands and riparian types, which are mapped to a 1/4 acre MMU. Land use polygons are mapped to a 1 acre MMU.

The geodatabase was produced using on-screen heads-up digitizing, with the data georeferenced to 2018 one-meter National Agricultural Imagery Program (NAIP) imagery. Ancillary data and imagery sources were used to supplement attribution. The geodatabase passed quality control procedures before being finalized. Accuracy Assessments (AA) were conducted by VegCAMP and CNPS staff. Sample allocation locations for AA were created by VegCAMP for CNPS field crews to use during the field data collection. Once the field plot information was entered into a database, the point data was analyzed and scored by VegCAMP.

1.2 General Study Area

The Eagle Lake study area (**Figure 1**) lies in the hills between Eagle Lake on the west and Horse Lake on the east, and between the Madeline Plains in the north, and Willow Creek Valley to the south. The entire eastern edge of the study area follows the GIC vegetation mapping boundary. The northern edge of the study area follows BLM managed land boundary westward to Bailey Creek, and includes one piece of non-BLM land straddling Chase Canyon, and the northeast quarter of the northeast quarter of Section 15 of Township 34N, Range 12E. The eastern boundary follows the edge of BLM managed land south to the top of Township 33N, Range 12E. It follows the cadastral line westward to the northwest corner of Section 6, where it turns southward along the east edge of the same Township-Range cadastral area until Highway 139 is encountered. The study area follows the highway southward to the top edge of Section 5 of Township 32N, Range 12E, where it heads eastward. At the eastern edge of the western quarter of Section 4 the boundary turns south until it meets the edge of BLM managed land and stair-steps to the southeast, then roughly follows the southern edge of the Sections 9 and 10, where it veers in a south-southeasterly direction through Sections 14, to the southeast corner of Section 23, where it turns east. The study area boundary turns south then east along the western edge of BLM managed land until it meets the northwest corner of Section 31. The boundary heads directly southeast to the center of the west edge of Section 32, where it follows the edge of BLM managed land heading east then north, then east again, following the north edge of Section 33 until it meets the west edge of the GIC vegetation mapping area.

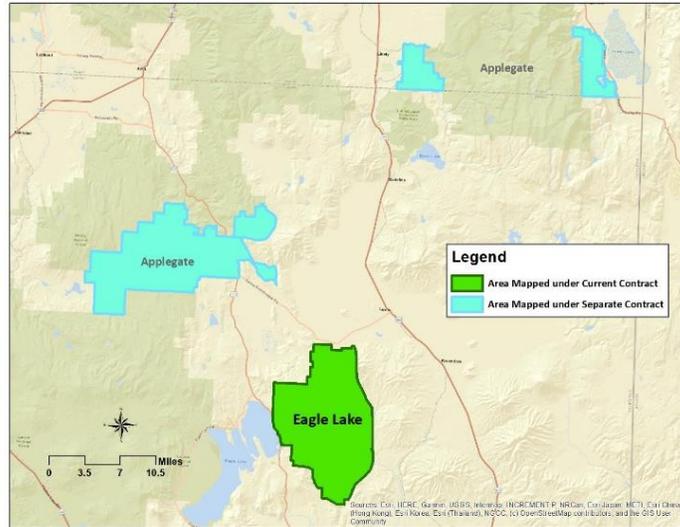
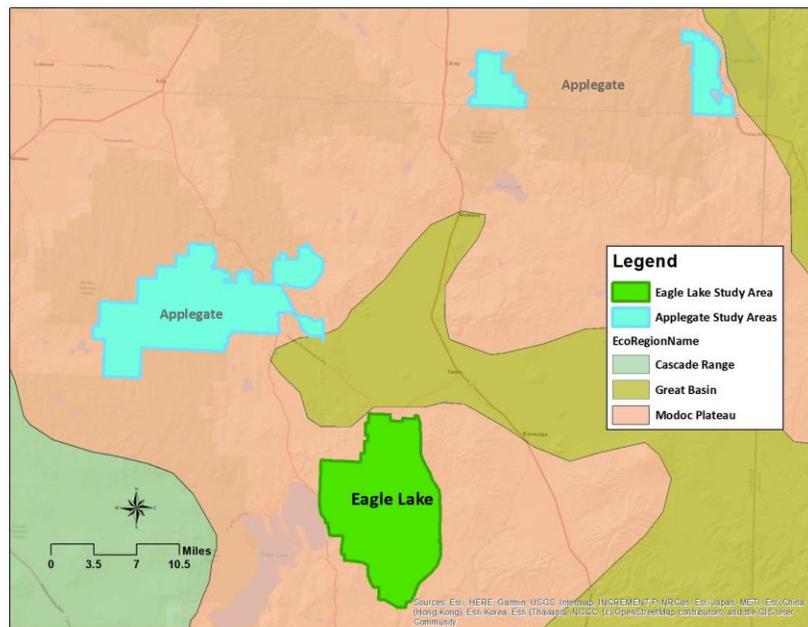


Figure 1: Location of the Study Area

1.3 Ecological Region of the Study Area

The study area is located in the Modoc Plateau ecoregion, adjacent to the Cascade Range, Great Basin, and Sierra Nevada ecoregions, which are shown in **Figure 2**.

Figure 2: The Modoc Plateau Ecoregion



The Eagle Lake study area is transitional between the Modoc Plateau, the Southern Cascades, and the Great Basin ecoregions. The study area is mostly an interior drainage basin with streams draining into Eagle, Honey, and Horse Lakes.

The area encompasses the highest elevations in the mapping area (Fredonyer Peak 7943 feet) where significant stands of *Abies concolor* dominate or co-dominate with yellow pine species, most of which trend toward *Pinus jeffreyi*. Adjacent to these conifer

woodlands, extensive stands of montane chaparral comprising mixes of *Arctostaphylos patula*, *Ceanothus velutinus* and *Prunus emarginata* were sampled adjacent to high elevation stands of *Artemisia tridentata* ssp. *vaseyana*, *Holodiscus discolor* and *Cercocarpus ledifolius*. Along small drainages and localized seeps, patches of vegetation dominated by *Populus tremuloides* were encountered, often with components of *Prunus emarginata* in the understory or immediately adjacent.

At lower elevations, mixes of sagebrush communities were found throughout, including stands of *Artemisia tridentata* and *A. arbuscula*, as well as shrublands co-dominated by *Purshia tridentata* and *A. tridentata*. In more open and disturbed grassy settings, *Ericameria nauseosa* was noted, usually sharing dominance with *A. tridentata*. On thinner-soiled and steeper sites, stands dominated by *Cercocarpus ledifolius* were sampled in a wide range of cover.

Juniperus occidentalis was encountered and observed to be the dominant conifer in all but the highest areas of the Eagle Lake mapping area. Multiple associations were sampled depending on the understory shrub layer composition in addition to other conifer species (notably yellow pine species) co-dominating in the overstory. Cover density of junipers were observed from less than 2% to upwards of 30% in some areas, where pine occasionally co-dominated the tree layer.

Meadow vegetation types were sampled on flats south of Horse Lake. In most circumstances, it was determined on the ground that many of the herbaceous Alliances would have to be mapped at a more generalized Group or Macrogroup level in the hierarchy. The most common meadow type encountered included stands dominated or co-dominated by *Juncus balticus* along with other species including *Poa secunda*, *Danthonia* spp., *Carex douglasii* and/or *Muhlenbergia richardsonis* frequently co-dominating the herbaceous cover.

Several burns were observed, one of which occurred after the baseline imagery was taken.

CHAPTER 2: Methodology

2.1 Overview

The mapping effort began with the compilation of a preliminary mapping classification provided by CDFW based on existing Modoc area floristic classifications. As the current project floristic classification development progressed, the mapping classification was augmented as needed. The project staff of experienced photointerpreters then conducted field reconnaissance visits to prepare for the photointerpretation effort. Using geographic information system (GIS) technology, they applied their knowledge and observations of California vegetation to create a map of vegetation types. Codes representing a suite of other attributes were assigned to the vegetation polygons. Several quality control and accuracy assessment (AA) procedures were implemented prior to finalizing the geodatabase. A more detailed discussion of these methodology components follows.

2.2 Project Materials

2.2.1 Computer Software/Hardware

The mapping effort was conducted using Dell workstations with dual monitors. The extra monitor was helpful in viewing ancillary image sources and ground photos while the map was being created on the primary monitor. The maps were produced using Esri's ArcGIS software. The final map was delivered in ArcGIS 10.6 file geodatabase format.

2.2.2 Imagery

The digital orthophoto base for the mapping project was 1-meter 2018 NAIP imagery (true-color and color-infrared). Another set of true-color digital imagery available through ArcGIS online (variable dates depending on scale viewed) was used as supplemental imagery to aid in the vegetation mapping effort. The vegetation mappers were able to bring this georeferenced imagery set directly into their ArcMap sessions.

The photointerpreters also referred to imagery available from the Internet, such as Google Earth, Google Maps, and Bing Maps. Google Earth allowed for viewing imagery from various months of previous years, which was helpful in assessing long-term trends and varying phenological appearances of the vegetation. The Google Maps and Bing Maps street view option was sometimes used where available. Although these supplemental sources were used, all delineations, in addition to all floristic and structural attributes, were based on the NAIP base imagery as previously stated.

However, in some instances, photointerpreters mapped to more recent conditions than shown on the base imagery. This was done only where field observations indicated large areas of change, such as cleared land, new urbanization, etc., that had been created after the base imagery was flown. These areas were flagged in the field and subsequently evaluated back in the office. Polygon for these situations were mapped if the boundaries could be seen on post-base dated imagery (usually Google Earth) or determined by using visible features on the landscape such as fence lines or roads.

2.2.3 Ancillary Data

The distribution of vegetation on the landscape is influenced by a variety of environmental factors, such as geology, soils, topography, and fire history. Digital data sources addressing these factors helped the photointerpreters in the delineation of vegetation map units. Existing maps of vegetation were also a valuable reference. All of these data sources were georeferenced and viewed by the mappers within their ArcMap sessions.

The following sources, some of which were provided by partnering agencies, were used regularly throughout the mapping effort:

1. CalFIRE – downloaded from <http://frap.cdf.ca.gov/data/frapgisdata-subset.php>
2. CA State Geology Maps – downloaded from <http://datagateway.nrcs.usda.gov>
3. Digital Elevation Models – via ArcGIS Online
4. Federal Lands – downloaded from <http://www.nationalatlas.gov/atlasftp.html>
5. Indian Lands – downloaded from for <http://www.nationalatlas.gov/atlasftp.html>
6. Roads GTLF – Provided by BLM
 - Lassen County
 - Modoc County
7. Surface Management Area – provided by BLM
8. Vegetation – Modoc Plateau 2020 (GIC) – Provided by CDFW
9. Wetlands CONUS BLM Areas – downloaded from <http://www.fws.gov/wetlands/Data/State-Downloads.html>
10. Wilderness – downloaded from <http://www.blm.gov/wo/st/en.html>

2.3 Floristic Classification

The floristic vegetation classification developed for the Modoc Plateau region is a means to organize and catalog the vegetation alliance, association, or plant community stands that occur within a given area. Because of the close proximity of Eagle Lake and Applegate study areas, both a part of the Modoc Plateau region, the classification development was conducted in concert, with data collection as separate efforts, but classification analysis as a combined endeavor over the entire region.

The floristic classification is derived from, and is represented by, the classification plot information collected through a limited amount of point data surveyed in and/or extrapolated from an area. The floristic vegetation classification and corresponding descriptions and keys are developed from a multi-step process through the collaboration of CDFW, CNPS, NatureServe, and other partners, and is based on the hierarchical National Vegetation Classification System (NVCS).

2.3.1 Data Collection for Classification

CNPS collected classification samples in the two project study areas under the same BLM contract, i.e., Eagle Lake and Applegate, using stratified random sampling and directed, opportunistic sampling approaches. Existing GIS layers, such as CalVEG, elevation, and geology, were used to generate sample allocations to ensure multiple samples of each vegetation type were collected in the project areas. In particular, samples were spread across each study area and distributed among the vegetation types to represent rare and common types. Access to sites was factored into the sampling, including those lands where permissions were granted and areas that were proximate within approximately 500 meters from roads and trails to maximize efficiency in the field. CNPS timed the data collection to coincide with peak phenology to obtain adequate cover values and reliable plant taxa identification, such that sampling took place in June 2017 for Applegate East (AGE) subarea, and between June and July 2019 for Applegate West (AGW) and Eagle Lake (EL) subareas. The new data collection was funded for 3 weeks in AGE, 2.5 weeks in AGW, and 4 weeks in EL areas.

Field staff used the CNPS-CDFW Protocol for Combined Vegetation Rapid Assessment and Relevé Field Form ([See https://www.cnps.org/plant-science/field-protocols-guidelines](https://www.cnps.org/plant-science/field-protocols-guidelines) for copies of the form and protocol). Also, CNPS supplemented the classification samples by using a more succinct CNPS Reconnaissance form (see Appendix D for the field forms). Protocols comply with state and national standards as defined by the Survey of California Vegetation (SCV) (VegCAMP 2020) and the US National Vegetation Classification (USNVC) (Faber-Langendoen et al. 2009, Jennings et al. 2009). Each survey location was digitally photographed and marked using a GPS device to produce a GIS map of the surveyed data points. Recorded data included plant species composition, species abundance, structure, site impacts, and environmental setting. Percent cover of plant species was visually estimated both individually and by vegetation strata (tree, shrub, herbaceous).

In addition to the data collected in 2017 and 2019, CNPS compiled other available vegetation sampling data from the region upon contacting partners for information. CNPS selected data found within the ecological subsections that overlap with the Eagle Lake and Applegate Districts. This included data from the BLM and Natural Resources Conservation Service's long-term monitoring (Assessment Inventory and Monitoring). The vegetation data was reviewed for quality and accuracy, and the compiled data was archived into a standardized MS Access database. CNPS used the USDA NRCS PLANTS Database (USDA, NRCS, 2015) to normalize the plant nomenclature and species codes. Data will be publicly available through CDFW's Biogeographic Information and Observation System (BIOS) and other data-sharing utilities upon project completion. The number of vegetation samples compiled and analyzed for vegetation classification is summarized below in **Table 1** (see Boul et al. 2021 for a display of the geographical spread of these surveys).

Table 1. Compilation of Vegetation Classification Samples for Applegate and Eagle Lake Subareas. Numbers in bold are within the project area boundaries.

Location of sampling	Entity	Type of survey	No. of samples
Modoc Plateau and Northwestern Basin & Range Ecoregion Sections	BLM and NRCS 2013-2018	Transects, AIM method (3-50 m and subplots)	459 (35)
Lava Beds National Monument	NPS 2010-2011	Relevés (100 to 1000 m ²)	138
Modoc Plateau Ecoregion and Medicine Lake Lava Flows Subsection	USFS 1985-2017	Ecoplots (e.g., 400 m ² for woody stands)	462 (1)
Pine Creek and Fitzhugh Creek Wildlife Areas	CDFW 2006	Rapid assessments and Relevés	79
Modoc Plateau and Northwestern Basin & Range Ecoregion Sections	CDFW & GIC 2016-2018	Rapid assessments and Relevés	697 (3)
Applegate East	CNPS	Rapid assessments and Relevés	65
Applegate West	CNPS	Rapid assessments and Relevés	62
Eagle Lake	CNPS	Rapid assessments and Relevés	102

2.3.2 Data Analysis for Classification & Vegetation Key, Descriptions

VegCAMP was also conducting vegetation mapping in the general vicinity of the project areas in tandem with the contracted effort. VegCAMP compiled data for those related projects, and, along with CNPS, co-analyzed the various datasets to classify vegetation from Modoc Plateau and Northwestern Basin & Range ecoregions, including the Eagle Lake and Applegate study areas. Data was imported into PC-ORD and converted into plot-by-species matrices. Taxa that occurred in a small number of plots (i.e., less than 5 plots) were removed to generate additional plot-by-species matrices that had lower alpha and beta diversity and lower coefficients of variation for species (typically <200%).

Hierarchical cluster analyses were employed to group similar surveys based on plant species composition and abundance. These groups, along with indicator species analyses, were interpreted to develop a hierarchical classification that defines the vegetation types for a project area. This included cluster analysis with Sørensen

distance and Flexible beta linkage method (McCune and Mefford 2006). Grouping levels with the lowest average p-values and highest number of significant indicators were used to drive the vegetation classification process. Each survey was assigned to an Alliance and an Association (if possible) based on the analyses results, along with information from existing classifications and related data. Upon assigning classification names, CNPS staff reviewed the classification to evaluate additions and changes to the classification to ensure compliance with the Manual of California Vegetation (Sawyer et al. 2009) and the US National Vegetation Classification (FGDC 2008, Jennings et al. 2009).

During the floristic classification development, CNPS updated the vegetation field key that was originally generated for portion of the region (Hickson et al. 2007), in which the key is organized by various characteristics such as layer (e.g., tree, shrub, herb), NVC name (e.g., Group, Alliance, and Association), and habitat (e.g., riparian/wetland, upland). This key provides users with the ability to assess vegetation types while in the field or while photointerpreting and delineating polygons. Field testing of the vegetation key was performed during the field reconnaissance for the mapping stage in 2019 and 2020. See Appendix E for an updated version of the field key. Also, crosswalks showing the relationship of the vegetation types in the classification to the USNVC and others (e.g. CWHR, CalVEG) are provided in the GIS vegetation map products.

Detailed vegetation descriptions were written for each Alliance including criteria such as: sample size, distribution in the study area, summarized environmental data, cover by lifeform, and summarized plant species composition, including percent constancy and abundance values for species in the type. Concept summaries also were written for associations (see Boul et al. 2021).

2.4 Mapping Classification

Mapping of the vegetation using the floristic classification may be limited by the constraints of the aerial imagery (color limitations and resolution), the minimum mapping unit (MMU) resolution for the project, or the complexity of the stands on the ground and their relationships with one another. Therefore, a mapping classification is developed to outline and catalog mappable vegetation units. The mapping classification contains mappable vegetation types, as well as what are called Mapping Units. Mapping Units are units that are not included in the floristic vegetation classification, such as sand, rock, mud, or approved units composed of multiple individual types that are not mappable due to MMU constraints but consistently occur together on the ground as ecologically related complexes (the latter being a rare exception). The mapping classification also includes additional attributes outside of the vegetation type, such as percent cover of conifer trees, hardwood trees, shrubs, and herbaceous vegetation; disturbance attributes, and others (See Appendix A).

For the current project, the map classification was based on the existing Modoc Plateau area vegetation mapping effort conducted by GIC and VegCAMP. New floristic classification analyses were completed for the AGE, AGW, and EL subareas. Mapping for AGE preceded AGW and EL due to timing of available funds. As a result, AGE was completed before the classification analysis of AGW and EL commenced. Once AGW

and EL classification development was complete, it became apparent that changes to the AGE classification was needed. As AIS mapping proceeded, potential changes to the mapping classification were brought to the attention of VegCAMP staff for possible floristic classification revision. At the completion of the project, the classification for AGE, AGW, and EL were all reconciled to one comprehensive mapping classification for the entire region.

2.5 Field Reconnaissance

Field reconnaissance/verification visits serve two major functions. First, they enable photointerpreters to relate the vegetation on the ground at each observation site to the signatures on the aerial imagery. Second, is to answer questions regarding vegetation assemblages that arise during the photointerpretation process and to check the mapping and attribution prior to delivering the data for accuracy assessment. In addition, with guidance from ecologists in the field, the photointerpreters become familiar with the flora, vegetation assemblages, and local ecology of the study area. At the same time, ecologists gain understanding from the photointerpreters' perspective about assessing vegetation through the framework of map creation.

In August 2019 and July 2020, AIS conducted two field reconnaissance trips dispersed throughout the mapping area with one crew per trip. The trips are summarized in **Table 2**.

Table 2: Summary of Field Reconnaissance Trips

Trip No.	Dates	Staff from:	Location
1	August 14-18, 2019	AIS/CDFW	Eagle Lake
2	July 12-18, 2020	AIS/CNPS/CDFW	Eagle Lake

Prior to each trip, AIS staff reviewed imagery on-screen to identify and select potential reconnaissance sites in close proximity to roads. Sites were selected to represent different vegetation types and percent cover, as well as variations in geography, landform, and abiotic factors such as percent slope, aspect, shape of the slope, and elevation. Multiple sites were chosen to provide alternatives in case one or more sites were to prove inaccessible. Field routes were planned to maximize the number of vegetation types and ecological regions visited while taking into consideration time constraints and accessibility.

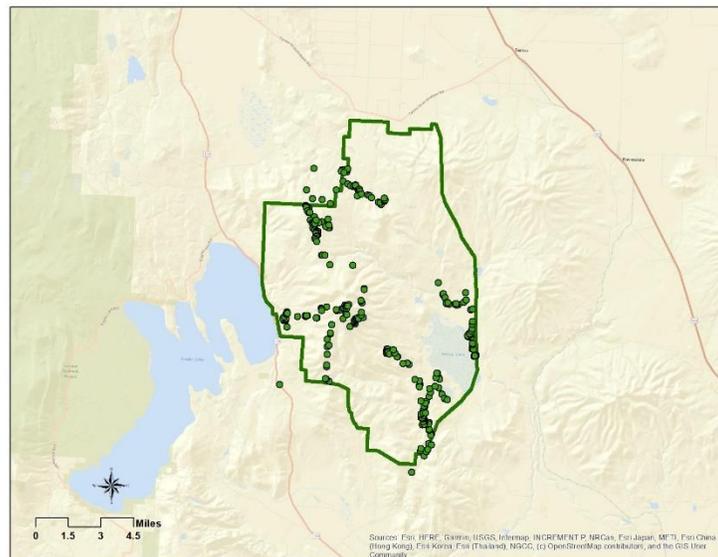
The field crew used the Collector application for ArcGIS on Apple computer tablets to facilitate navigation and data collection. The vegetation database imagery, roads, and any other pertinent ancillary data were loaded onto the tablet prior to the field trip.

During reconnaissance/verification, crews traversed the areas in 4WD vehicles and stopped at the preselected sites. Areas encountered in transit between initially selected sites, and areas of noteworthy or unusual significance, were sometimes added in the field as observation points. Also, observation points were frequently taken to mark the transition between vegetation types, with the intent of helping photointerpreters determine the edges of stands. A single observation point may have contained information about two or more stands. It was also possible for a given stand to be assessed in multiple places. Some stands of vegetation were remotely observed at a distance with the aid of binoculars. The location of these remote stands was determined using a compass and laser rangefinder. Field crew members recorded each location visited on a GPS unit and logged pertinent information in the Collector app on the tablet.

At many observation points, the crew took digital color ground photos. The photo number, photo direction, corresponding field point, and other pertinent information were recorded and available for reference during the mapping effort. The field data and ground photos were essential for correlating conditions seen on the aerial imagery to conditions on the ground.

Field crews from AIS collected over 300 reconnaissance observations as shown in **Figure 3**.

Figure 3: Location of Eagle Lake Reconnaissance Observation Points



2.6 Photointerpretation Mapping Procedures

There are two distinct aspects of the photointerpretation mapping process. In what can be called the "photointerpretation process," the photointerpreter applies his or her understanding of photo signature and knowledge of the geographic characteristics of ground features to formulate a reasoned decision about how to represent a feature and what to call it. The "mapping process" involves the creation of the digital geodatabase through the use of computer hardware and software. In other words, the mapping

process captures for subsequent users a permanent record of the results of the photointerpretation process. Both aspects happen simultaneously as a map is created.

2.6.1 Photointerpretation Process

Photointerpretation is the process of identifying map units based on their photo signature. All land cover features have a photo signature. These signatures are defined by the color, texture, tone, size, and pattern exhibited on the aerial imagery. By observing the context and extent of the photo signatures associated with specific land cover types, the photointerpreter is able to identify and delineate the boundaries between plant communities or signature units.

It should be noted that vegetation stature, as well as, the scale and resolution of the aerial imagery determine the visibility of individual plants, and the degree to which they can be photointerpreted. Trees and shrubs are usually visible as individuals on high-resolution digital imagery. However, grasses (other than bunch grass clumps) are rarely seen as individual plants.

Environmental factors, such as elevation, slope, and aspect, also play an important part in the photointerpretation decision-making process. Knowledge of these factors, and how plant communities respond to them, guides a photointerpreter in choosing from among Alliances with similar photo signatures. Beyond this, such knowledge enables vegetation mappers to create biogeographical models of expected vegetation communities where the vegetation types are indistinct on the imagery. This ecological approach produces a more accurate product than would be created by relying solely on extracting information from the imagery, which is subject to variations in clarity and ground conditions.

The detailed descriptions of each vegetation type found in Appendix B include numerous examples of the types of information the photointerpreters incorporate into their understanding of the models. To give some examples, one shrub Alliance may favor rocky slopes, while another is found at the perimeters of dry lakes. Some Alliances flourish on disturbed sites, while others cannot tolerate the cool temperatures at higher elevations. And, some Alliances are ubiquitous and found in a variety of settings.

The descriptions also discuss the relative percent cover of various plant species in the Alliance. Frequently, complicated relationships exist between the relative covers of plants, such as in Alliances named for indicator species having lower percent cover than other species present. Thus, both environmental setting and rules regarding relative cover factor into the intelligent delineation of vegetation polygons.

2.6.2 Mapping Process

Just as the use of mental models by experienced photointerpreters contributed to the production of a high-quality vegetation map, the use of tried-and-true mapping procedures allowed for the map to be produced in a highly efficient manner. For example, the study area was divided into modules that corresponded to USGS 1:24,000 topographic quadrangles or portions thereof. This expedited project work flow by enabling several staff members to work on the mapping effort simultaneously.

Each vegetation mapper brought one of the modules into his or her ArcMap session. Using an on-screen heads-up digitizing method, the photointerpreters had at their disposal a suite of standard and custom ArcMap tools to facilitate the creation of polygons. The photointerpreters generally viewed the imagery at scales ranging from 1:1000 to 1:3000. They used variations in signature to draft boundaries separating areas of different vegetation types and/or distinct categories of percent cover of several stature levels. To assist in boundary placement and coding decisions, photointerpreters also referenced supplemental imagery, vegetation field data, and other data, such as elevation contours and fire history. These sources were displayed in the ArcMap sessions as needed.

Photointerpreters assigned each polygon the appropriate attribute code string: Vegetation Type (Map Unit), five different Percent Cover types, Exotics, Roadedness Disturbance, Development Disturbance, Anthropogenically Altered Disturbance, Isolated Tree Modifier, *Juniper occidentalis* Expansion Modifier, Restoration Modifier, Tree Size, Tree Height, and Method ID. The map classification is presented in Appendix A.

A custom coding menu enabled values to be assigned efficiently, minimizing the possibilities for entry errors. The codes themselves were entered as numeric values, which are easier to input and manipulate than alphanumeric codes or drop-down menus. Numeric code values also allow for the hierarchical grouping of like vegetation communities, reminding the mapper at a glance which Alliances and Associations are found in a particular hierarchical grouping. Once the geodatabase neared completion, the numeric code values were replaced with the actual vegetation type names.

As the individual modules were completed, they were edge-matched and checked for invalid codes and topology errors. As mapping progressed, completed modules within a subarea unit were joined together. These database units were subject to further processing, edge-match checks, and review by a senior staff member before being delivered to VegCAMP for AA allocation, prior to AA data collection by CNPS. Quality control procedures implemented during the mapping effort and before final delivery of the data improved the consistency and accuracy of the overall database. Quality control and accuracy assessment will be discussed in greater detail in later sections of this report.

2.6.3 Mapping Criteria

As discussed above, reference sources, photointerpretation training, knowledge of vegetation communities, as well as the use of appropriate GIS tools, are all essential in creating a quality vegetation map. However, without the establishment and refinement of mapping criteria, a given vegetation map could be riddled with discrepancies, as different staff members approach the task with different assumptions and styles. Guidelines and rules regarding exceptions, special situations, and minimum feature size are discussed and disseminated to all staff members before and during the mapping effort. This creates a clear and consistent product. Establishing criteria also makes the mapping process more efficient, as individual photointerpreters do not have to pause

too long to consider how best to capture the more common ambiguous situations that are confronted.

The specific criteria for each attribute type are discussed below under the appropriate heading.

2.6.3.1 Vegetation Type (Map Unit)

The final map contains 78 types that were mapped, composed of 20 Alliances and Alliance-level types such as Provisional Alliances, Semi-natural Stands, and Mapping Units; 49 Sub-alliance-level types, such as Associations, Sub-alliance, and Sub-alliance Mapping Units; and 5 miscellaneous classes relating to features such as agriculture, water, and urban disturbance; and 4 upper-level hierarchical types, such as Class, Subclass, Macrogroup and Group. When the photointerpreter could not confidently classify a polygon at the Alliance level, the polygon was assigned a broader upper-level code. This was most common with herbaceous communities, whose differences at the Alliance level are often not readily discernible on imagery. Each map unit is described in Appendix B; the map classification is presented in Appendix A; and a summary table of polygon counts and acreage by map unit is presented in Appendix C.

2.6.3.1.1 Vegetation Mapping Considerations

Minimum polygon size is an important consideration when creating and viewing a vegetation geodatabase. The choice of an MMU is influenced by the clarity of the imagery, the purpose of the data, and time and budget constraints. MMU can vary for different categories of features being mapped.

The map classification presented in Appendix A indicates the MMU for each map unit class. In this project, the MMU for upland vegetation is 1 acre. This encompasses the majority of the stands mapped. Exceptions were created for vegetation stands of special significance. In this mapping effort, riparian vegetation and wetland types were mapped to a 1/4 acre MMU. Polygons representing land use were mapped with a 1 acre MMU.

CDFW's long-range goal is to map vegetation for the entire state of California. This is accomplished as funding or need allows, one area or project at a time. The BLM vegetation geodatabase created in this project is to be incorporated into the Statewide vegetation mapping effort. The general Statewide mapping criteria (VegCAMP, 2020) specifies an MMU of one acre for non-desert environs.

A summary of the minimum mapping units for this mapping effort is presented in **Table 3**.

Table 3: Minimum Mapping Units

Mapped Feature	Minimum Mapping Unit Desert
Riparian vegetation; wetlands	1/4 acre
Water: perennial streams and lakes/ponds, dammed ephemeral ponds,	1/4 acre
Land use: agriculture, built-up, water impoundment features	1 acre
Upland vegetation	1 acre

The establishment of an MMU entails the need for making rules for aggregating stands below MMU. In general, similar life forms are aggregated together: tree-dominated types are aggregated with other tree-dominated types, shrub types with other shrub types, and herbaceous types with other herbaceous vegetation types. However, if possible, wetland vegetation types are not aggregated with upland types, even if they are in the same life form. Another guideline is that a unit below MMU is aggregated with the vegetation type that completely surrounds it. Finally, if a unit that is below MMU is the same life form as two adjacent larger stands, and the adjacent stand types are very dissimilar in environment, the unit may be aggregated with the more similar adjacent type.

In addition to establishing MMU size, guidelines were formulated for the minimum mapping width (MMW) of a map polygon. The rule of thumb was to make the minimum width roughly half the width of a square MMU box. This guideline did not preclude the creation of polygons where a small section fell below the minimum width, as long as the greater portion of the polygon met the stated criteria in an attempt to capture the continuity of linear types, such as riparian or wetland units.

Another type of mapping consideration pertains to sparsely vegetated to nonvegetated types. It was assumed that all vegetation polygons contained some unvegetated or barren areas. On the other hand, sparsely vegetated to nonvegetated types were not mapped in the database unless they met the minimum mapping resolution and could exist as standalone polygons. An example of this is the Columbia Plateau cliff, scree and rock Mapping Unit.

2.6.3.1.2 Miscellaneous Classes

Miscellaneous classes includes types that are not covered by the floristic classification. In order to have a comprehensive vegetation map, these types need to be included. Classification categories include types, such as agriculture, urban disturbance, and water features.

Agriculture includes woody agriculture and non-woody row and field agriculture. An important consideration in mapping agriculture is deciding whether a plot of land that was farmed in the past should still be considered as active agriculture. A currently inactive plot of agricultural land may have been abandoned permanently, or it may just be in a fallow phase before farming resumes. To handle the uncertainty in such cases, a decision was made to review image sets covering the five years prior to the base imagery date. If the imagery showed that the land had been actively farmed in any of those years, then it was mapped as agriculture.

Areas of non-agricultural human activity were categorized as either the generic Built-up & Urban Disturbance (all built-up land use activities), or Anthropogenic Areas of Little or No Vegetation (non-built-up clearings).

Water was mapped with an MMU of one acre. Distinctions were made between perennial stream channels, small earthen-dammed lakes and ponds, and other undifferentiated water features..

It should be noted that percent cover was not evaluated for most of the Miscellaneous Classes. A description of each of the Miscellaneous Classes can be found in Appendix B.

2.6.3.2 Percent Cover

Percent cover, also referred to as “density,” is a quantitative estimate of the aerial extent of the living plants for each vegetation layer within a stand. Cover is the primary metric used to quantify the importance or abundance of a life form and/or species.

Photointerpreters formed separate polygons when there were changes from one cover class to another within a vegetation type or mapping unit as long as the resulting polygons were at least triple the size of the applicable MMU. A given vegetation polygon might have been subdivided due to cover differences regardless of which strata the cover difference occurred in. For example, two adjacent polygons in the geodatabase may have had the same hardwood tree vegetation type assigned but different cover values for shrubs (for example, 12% versus >23%).

The photointerpreters considered the coverage pattern of each life form before assigning a cover code to the polygon. To ensure consistency, it was helpful to compare percent cover values of polygons with clumped and unevenly distributed vegetation to those of similar-sized polygons with an even distribution of plant cover.

Photointerpreters assess the total cover of vegetation by considering the cover of the different life forms visible on the imagery, including nonvegetated areas. The total percent cover of trees, shrubs, herbaceous and nonvegetated areas had to add up to 100 percent. The cover percentages for each life form was then assigned to each corresponding attribute field for each polygon

Vegetative cover for a given polygon is assigned for woody vegetation (conifer, hardwood, shrubs) as a whole integer. Herbaceous vegetation is attributed to the following category ranges:

- 1 = None or Not Observable, <2%
- 2 = 2-9%
- 3 = 10-40%
- 4 = >40%
- 999 = Not applicable/Not assigned

2.6.3.2.1 Percent Cover Mapping Considerations

It is important to note that the photointerpreters could only accurately quantify the vegetation that is visible on the aerial imagery. Therefore, “bird’s eye” total cover was mapped, meaning that the cover of understory layers which were obscured by overstory layers was not included. For this reason, total cover for shrubs and herbaceous plants may be underestimated if their extent was hidden under the crowns of trees, and may differ from assessments done on the ground by field crews.

Where the cover of a particular life form is very sparse, it can be difficult to decide between a cover class “0” (None or Not observable) and “1” or “2”. The photointerpreters looked for the consistent presence of very sparse types throughout a polygon before assigning it a cover class of “1” or higher.

Where overstory cover exceeds 40 percent, such as closed canopy forests and dense riparian stands, it was considered too dense to give a reliable estimate of lower tier canopy or understory percent cover. In these situations the code assigned for percent cover for the understory life forms would be “Not applicable/Not assigned.” This same criterion is used in Statewide mapping efforts.

The date that the aerial photography mission is flown influences the percent cover assigned to vegetation types. Subsequent field verification and accuracy assessments must take into consideration the following factors that can cause apparent discrepancies between the percent cover evident on the imagery and percent cover seen in the field:

- Seasonality - The percent cover of most plants is variable due to their annual growth cycle. Depending on whether the aerial imagery was taken during the wet season or the dry season, a mapped unit could show a different percent cover on the aerial imagery than is observed during an on-site visit at a different time of the year. Differences in leafiness (cold deciduous, drought deciduous) can affect plant cover determination. Leaf-on conditions obscure the understory. Imagery of leaf-off conditions would allow photointerpretation of the understory, but make it difficult to identify the overstory species since there is no foliage present.
- Annual variability - The environmental conditions at the time of the imagery (wet vs. drought years, flooding, etc.) may contrast with the conditions seen during on-site field visits thus resulting in differences of the percent cover assigned to a polygon in the field versus those assigned during photointerpretation.
- Dead vegetation –When vegetation is dead, it is not counted in the cover class analysis; however, vegetation in a stressed phenology state is included in the cover class density. Determining the difference between dead and stressed vegetation solely through photointerpretation is difficult, so field information reflecting the conditions on the ground is used when possible. Where dead

vegetation is so dense as to obscure the understory vegetation, then the understory vegetation cover class is coded as “Not applicable/Not assigned.”

2.6.3.3 Exotics

Photointerpreters assigned each existing polygon a code reflecting the level of impact by exotic invasive species such as *Bromus tectorum* grass . Polygons were not created or split because of differences in the presence of exotics. **Table 4**, adapted from Appendix F of *2013 California Desert Vegetation Map and Accuracy Assessment in Support of the Desert Renewable Energy Conservation Plan* (VegCAMP, 2013), presents the map classes for Exotics.

Table 4: Map Classes for Exotics

Code	Range	Discussion
0	None visible	Sparse herbaceous vegetation with a minimal to low relative cover of exotic species; based on field data, no evidence of exotics in sampling, no evidence of exotics on imagery and based on modeling, assumed not present or not regular in the stand.
1	Patches of exotics visible, but cover not significant (relative cover to total <33%)	Sparse to moderate cover of herbaceous vegetation with a low to moderately high relative cover of exotic species. Patches of exotics are visible, but cover is not significant.
2	Exotics (particularly herbaceous) significant and cover may exceed dominant vegetation strata (relative cover <66%)	Exotics are significant and cover may exceed the dominant vegetation strata. Areas of higher disturbance are likely to be in this category.
3	Stand characterized by exotics (vegetation type is “exotic”) (relative cover >66%)	This is reserved primarily for Alliance-level calls which are defined by exotics; stands are characterized by exotic vegetation (as defined by the map unit). Examples of this are stands of <i>Bromus tectorum</i> .
9	Not applicable/Not assigned	Exotics are not applicable when the MapUnit is 9230, 9300, 9310, 9320, 9800, 9801, 9803, 9805.

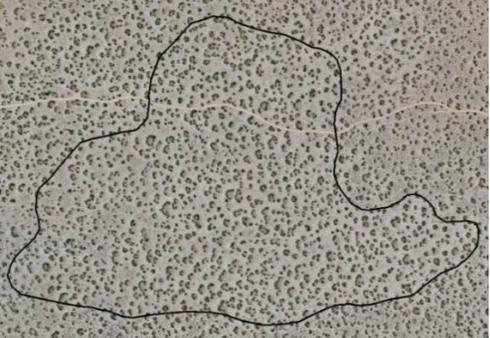
2.6.3.4 Roadedness Disturbance

Roadedness Disturbance is defined as the level of impact in a polygon by paved and unpaved roads, off highway vehicle (OHV) trails, railroads, berms, and covered

aqueducts. Impact is defined by the proportion of any polygon that is contiguously without these features, as shown in **Table 5**. The table is adapted from VegCAMP (2012). Roads following polygon boundaries were not included in the assessment. Each existing vegetation polygon was assigned a Roadedness Disturbance class. Polygons were not created or split because of differences in roadedness.

The Roadedness Disturbance code reflects the combination of the amount of roads in the polygon and the roads' effect on the contiguous space that has no roads – that is, where the roads fall within the polygon. This definition of roadedness has the advantage of helping to identify roadless areas, but the disadvantage of being scale independent. For example, any polygon with a road more or less bisecting it will be assigned a code of Moderate, regardless of size. This means that a very large polygon with a “Moderate” Roadedness Disturbance code might still contain an extensive roadless area.

Table 5: Map Classes for Roadedness Disturbance

Code	Range	Example
0	None visible	
1	Low: at least 2/3 (67% to 100%) of the vegetation polygon area is roadless	
2	Moderate: between 1/3 and 2/3 (33% to 66%) of the vegetation polygon is intersected by roads of any kind	

Code	Range	Example
3	High: less than 1/3 (<33%) of the vegetation polygon lacks roads of any kind	
9	Not applicable/Not assigned	<p>Roadedness is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.</p>

2.6.3.5 Development Disturbance

Development Disturbance accounts for the level of impact by structures and settlements that are smaller than the MMU criteria for land use. Structures may include buildings, tanks, trailers, metal electrical towers, communication towers, and utility and mining structures. This attribute includes paved parking lots and collapsed structures. Note that it also includes debris such as junked vehicles, major trash dumping, etc., the removal of which could result in a vegetation stand that could be in very good to pristine ecological condition. Disturbance that does not involve these types of features is accounted for in Anthropogenically Altered Disturbance. Polygons were not created or split because of differences in development disturbance, but existing vegetation polygons were assigned a Development Disturbance class. **Table 6**, adapted from Appendix F of *2013 California Desert Vegetation Map and Accuracy Assessment in Support of the Desert Renewable Energy Conservation Plan* (VegCAMP, 2013), presents the map classes for Development Disturbance.

Table 6: Map Classes for Development Disturbance

Code	Range	Discussion
0	None visible	There are no noticeable junk piles, isolated homes, structures, etc. within the polygon.
1	Low; less than 2% of polygon affected	Junk piles, structures, cement pads, etc. are inconsistently distributed at very low density.
2	Moderate; between 2% to 5% of the polygon affected	Multiple examples of dispersed junk, buildings, or other structures, etc. are visible throughout the polygon. There may be a dense concentration of development within a single or few parts of the vegetation polygon.
3	High; more than 5% of polygon affected	Multiple examples are evenly distributed in a vegetated polygon; typically meets the 2.5 acre threshold to map a "Built-up and Urban Disturbance" (9300) polygon. However, mines or open pits coded as 9300 may be assigned a Development Disturbance code of 0, 1, 2, or 3 depending on the amount of structures or debris present in the polygon.
9	Not applicable/Not assigned	Development Disturbance is not applicable when the MapUnit is 9200, 9210, 9220, 9801.

2.6.3.6 Anthropogenically Altered Disturbance

This indicates the level of impact on vegetation through tillage, scraping, mining, etc. Disturbance from structures, pavement, or debris is not included here but is addressed in Development Disturbance. Anthropogenically Altered Disturbance captures past disturbances in the landscape that are still visible through their impact on vegetation, but do not have enough of an impact to change the vegetation type or percent cover range. For example, striations from former cultivation may be present on parcels of land that have not been under agriculture for decades. Anthropogenically Altered

Disturbance is typically bounded by a straight-line feature such as a fenceline or road, implying man-induced activity. Not included are small clearings caused by OHV traffic at road intersections, fire effects, and powerline tower pedestal clearings.

Polygons were not created or split because of differences in anthropogenically altered disturbance, but existing vegetation polygons were assigned one of the classes presented in **Table 7**, which was adapted from Appendix F of VegCAMP (2013).

Table 7: Map Classes for Anthropogenically Altered Disturbance

Code	Range	Discussion
0	None visible	No ghost lines of tilling, differential effects of enclosure/exclosure fencing, effects of grazing/browsing, etc. are visible.
1	Less than 33% of polygon is affected and/or impact is seen but does not affect vegetation cover or type	Less than 1/3 of a vegetation polygon has visible evidence of clearing, prior agricultural activity or other effects.
2	Between 33% to 66% of polygon is affected	A vegetation polygon has more than 1/3 but less than 2/3 visible effects of clearing, prior agricultural or other effects.
3	More than 66% of polygon affected	A vegetation polygon has more than 2/3 visible effects of clearing, prior agricultural or other effects.
9	Not applicable/Not assigned	Anthropogenic alteration is not applicable when the MapUnit is 9801.

2.6.3.7 Method ID

This attribute was used to indicate how the MapUnit coding decision was reached for a polygon by identifying what type of field data (if any) was used to support the vegetation type assignment. For polygons that did not have any corresponding point data, the value of “photo interpretation” was assigned. The Method ID attribute facilitated the accuracy assessment sample allocation process, as polygons that had reliable field information for type assignment could be identified and omitted from the final allocation.

The following is a list of the values used:

- 1 - Rapid Assessment (current project)
- 2 – Relevé
- 3 - Field Verification
- 4 - Photo Interpretation
- 5 - Adjacent Stand: Information or Ground Photo
- 6 - Reconnaissance (current project)
- 7 - Other Information
- 8 - Older Plot Data

- 9 - Older Recon Data
- 10 - Accuracy Assessment
- 60 - Additional Recon Information

2.6.3.8 *Isolated Tree*

The Isolated Tree attribute is a binary field (yes/no) indicating polygons that have a presence of trees too low to assign a percent cover. It may assist in denoting habitats where raptors can perch on isolated trees to look for prey, such as sage grouse. It is frequently used for nearly treeless sagebrush flats.

- 1 = Yes
- 2 = No

2.6.3.9 *JuOc Expansion*

The JUOC Expansion attribute describes invasion of *Juniperus occidentalis* into stands. It can denote expansion of young junipers into any habitat, including juniper or other conifer woodlands, meadows, shrublands and upland grasslands). "Young" is defined as less than 6" diameter at breast height (dbh).

- 0 = Non visible
- 1 = 0-1% young
- 2 = 1-4% young
- 3 = 4-10% young
- 4 = >10% young
- 999 = Not applicable/Not assigned

2.6.3.10 *Restoration*

The Restoration attribute describes several types of restorative activity. Primarily indicates restoration of grassland habitats for grouse by cutting down large swaths of juniper, often left dead in place. There are 6 categories, but the only category used frequently is juniper removal.

- 1 = Not obvious
- 2 = JUOC removal
- 3 = Grass/forbs seeding
- 4 = Shrub/tree planting
- 5 = Thinning (Pine, JUOC)
- 6 = Other (see comments in Notes field)
- 999 = Not applicable/Not assigned

2.6.3.11 *Size (Modal CWHR Size Class for Trees) (inches)*

CWHR Size were mapped for forest and woodland types only, as part of the photointerpretation process.

- 1 = Seedlings (<1")
- 2 = Saplings (1-6")
- 3 = Pole (6-11")
- 4 = Small (11-24")

5 = (Medium-Large (>24"))
6 = MultiLayer
999 = Not applicable/Not assigned

2.6.3.7 Height (Modal Tree Height) (meters)

Height attribution was mapped for forest and woodland types only, as part of the photointerpretation process. The classes are given as ranges of values.

1 = <1/2m
2 = 1/2-1m
3 = 1-2m
4 = 2-5m
5 = 5-10m
6 = 10-15m
7 = 15-20m
8 = 20-35m
9 = 35-50m
10 = >50m
999 = Not applicable/Not assigned

2.6.4 Quality Control

Quality control was an iterative process, conducted at many phases of the mapping effort. For the entire duration of the project, photointerpreters consulted with one another as each module was mapped. This sharing of perspectives and examples ensured consistency in the mapping decisions made throughout the study area.

Completed modules were subjected to a series of automated checks. Any instances of invalid codes, uncoded polygons, adjoining polygons with the same code, or topology problems were flagged for correction by the photointerpreter. Another type of automated check verified that illogical combinations of codes were not used. For instance, a polygon coded as a conifer tree type must have a conifer cover code in Conifer Cover attribute field. Additionally, each photointerpreter reviewed his or her completed module for consistent application of codes and MMU considerations. When adjoining completed modules were edge-matched, any mapping discrepancies found at the edges between modules were corrected and, if necessary, changes were applied throughout the modules.

When all the modules were joined together, a senior photointerpreter reviewed the data for registration of linework to the base imagery and for code accuracy and consistency. Automated final checks were again conducted for invalid codes and code field correlations. Topological errors were checked, as were any edge-match problems. Another round of quality control was conducted after AA results had been applied to each of the subarea units.

2.7 Accuracy Assessment

To validate the vegetation maps, an accuracy assessment (AA) was performed in the Eagle Lake subarea. Polygons from the vegetation geodatabases were allocated for AA using a stratified random sampling, in which allocated polygons were distributed across the mapped units so that both rare and common types were represented. For the contracted subareas, CDFW staff provided in-kind time to allocate the accuracy assessment polygons. The sample allocation of polygons to select for visitation took the following parameters into consideration: land ownership, proximity to roads and trails (e.g., within 500 meters), other accessibility issues (e.g., slope steepness), and a targeted number of allocated polygons based on the number of vegetation types.

Using the field key and descriptions developed during classification analysis, field staff visited allocated polygons to determine the vegetation type, without knowledge of the polygon attribution. For a polygon to be validly assessed for accuracy, at least 20% of its area has to be viewed, however, usually >50% of the area is viewed. For each AA survey, the location of the survey was marked using a GPS device (i.e. iPad, Trimble, Garmin), and ground photos were taken at the AA GPS location. The field staff provided a primary vegetation type call and a list of dominant plant species, along with percent cover estimates by species and by vegetation strata. If a polygon contained more than one mappable vegetation type, notes were provided for how the polygon should be divided, and a separate survey was taken for each type meeting the minimum map unit size. See Appendix D for the AA field form.

AA field data was entered into a standardized database developed by CDFW and CNPS. CDFW ecologists, independent from CNPS field and AIS mapping staff, scored the accuracy of the vegetation geodatabase based on a fuzzy logic method as used for the Survey of California Vegetation (VegCAMP 2020). CDFW staff reviewed each AA and removed from consideration any samples that had problems associated with access, vegetation identification, visibility, or significant changes in land use or vegetation since the date of the imagery on which the map was based. If the field crews could not identify the vegetation type based on the field key or incorrectly identified the type, staff assigned the correct type based on the species covers recorded in the AA, any additional notes taken by the field crews, and sometimes the field photos.

AA scores were calculated by vegetation type and results were summarized in the form of a contingency table, so that specific and systematic errors could be addressed by the photointerpreters. Two forms of accuracy (User's and Producer's) can be estimated from the data (Story and Congalton 1986). User's accuracy provides an estimate of commission error, or how well spatial mapping data actually represents what is found on the ground; i.e., when the user goes to a location mapped as a certain class, the resulting probability that it is in fact that class is provided (with a percent accuracy). Producer's accuracy, on the other hand, measures omission error, or the probability that vegetation of a given class in the field is mapped as that class. Producer's accuracy may inform the mappers how well a mapping class can be detected by the photointerpreters (Story and Congalton 1986, Lea and Curtis 2010). Both user's and producer's accuracy were calculated. Once a subarea had been scored, the accuracy

assessment results were reviewed by senior photointerpreters. In some cases, the photointerpreter flagged a specific AA finding for follow-up discussion and review with the AA ecologist staff, resulting in either accepting, modifying the AA call, or eliminating the AA point out of the analysis. Once AA review was completed, any types not achieving 80% accuracy were further evaluated in consultation between the ecologists and mapping staff. The photointerpreters then revised the polygons based on the AA results.

A fuzzy logic method was used to score each AA survey, rather than simply denoting whether a sample was correct or incorrect (Congalton and Green 2009, Gopal and Woodcock 1994, Hagen 2003). Each field-verified polygon was scored according to a set of decision rules (**Table 8**), with a total of 5 possible points for each. Scores were summed for each vegetation type, then divided by the total possible score and multiplied by 100 for a percent accuracy. Additionally, a total overall accuracy was calculated by counting up the AA surveys that were deemed correct (score of 5, or 100%) or acceptable (score of 3 or 4, or 60% or 80% accurate), and then dividing that count by the total number of AA surveys scored across all vegetation types.

Table 8. Accuracy Assessment (AA) Scoring Rules and Points.

Code	Reason for Score	Score
A	PI completely correct.	5
B	The PI chose the correct Group OR the next level up in the hierarchy.	4
C	Threshold/transition between PI (Producers') call and Final (Field assessed) call. This was used when cover values of the dominant or indicator species were close to the values that would key to the PI's type (e.g., an AA call of <i>Yucca brevifolia</i> Alliance for a stand with 1% evenly distributed <i>Yucca brevifolia</i> over <i>Larrea tridentata</i> – <i>Ambrosia dumosa</i> would get this score if the PI call was <i>Larrea tridentata</i> – <i>Ambrosia dumosa</i> Alliance with <1% <i>Yucca brevifolia</i>).	4
D	Correct at Macrogroup level OR next level up in hierarchy.	3
E	Based on close ecological similarity. Ecological similarity addresses assessed and mapped calls that contained vegetation with overlapping diagnostic species but were not technically closely related in the NVCS hierarchy. This was common in stands that contain a mix of species of late and early seral vegetation types and also common in zones of overlap between ecoregions.	3
F	Correct at Division level (OR next level up in hierarchy).	2

Code	Reason for Score	Score
G	Some floristic/hydrologic similarity. This addresses cases in which the mapped and the assessed vegetation type had different diagnostic species, but bear some similarity in ecological traits based on predicted and actual setting such as hydrologic regime, overall climate, or successional state.	2
H	Correct only at Lifeform, without any floristic similarity.	1
I	No similarity above Formation and incorrect life form.	0
J	Survey removed because there was a significant change in the polygon (e.g., the stand was burned, developed, or cleared since the date of the base imagery).	no score
K	Survey removed because inadequate portion (<20%) of the polygon was viewed by the field assessment.	no score
L	Survey removed because field/PI data are incomplete, inadequate or confusing (e.g., cover values were not provided for key species in the stand).	no score
M	Supplementary record not scored (for multiple point assessments within a polygon where the AA call was the same).	no score

CHAPTER 3: Results

This section presents results for the floristic classification effort, vegetation mapping for the subareas, and accuracy assessment.

3.1 Floristic Classification

CNPS staff collected 65 new surveys in the Applegate East subarea, 62 in the Applegate West subarea, and 102 in the Eagle Lake subarea in the spring–summer of 2017 and 2019. CNPS also collaborated with CDFW staff who collected and/or compiled an additional 1,835 samples combined with these new surveys to develop a comprehensive classification for the region. The classification analysis resulted in recognizing 61 Alliances and 51 Associations within the greater Modoc – Lassen county areas, within the Modoc Plateau and Northwestern Basin and Range ecological regions. Of this area, the subset of surveys specific to the Applegate East & West and Eagle Lake study areas included 32 Alliances and 51 Associations. See **Table 9** for a summary of the classification units at the Association level for these local study areas. Since some of the Association-level classification units were too difficult for photointerpreters to map at that finer scale, sometimes higher-level Alliance, Groups or Macrogroups were mapped instead of Associations (e.g Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group instead of *Carex simulata*, *Juncus nevadensis*, or similar Associations).

Upon developing this classification, CNPS assisted CDFW in updating an existing field key to vegetation types of the Modoc – Lassen county region (See Appendix E). Vegetation Alliance and Association descriptions for each type sampled in the region were written, based on the compiled vegetation sampling data from the region. See Boul et al. (2021) for these descriptions. Most of the units that were mapped have local descriptions, and the MCV online includes fuller statewide descriptions (see <https://vegetation.cnps.org>).

This classification provided updates to the statewide Alliance definitions, including the following. Four new Alliances were described, namely *Eriogonum* spp. / *Poa secunda* Dwarf-shrubland Alliance, *Bidens cernua* – *Euthamia occidentalis* – *Ludwigia palustris* Wet Herbaceous Alliance, *Navarretia leucocephala* ssp. *minima* - *Plagiobothrys cusickii* Herbaceous vernal pool Alliance, and *Pinus ponderosa* / Shrub Understory Woodland Alliance. Twenty-nine new Associations were defined such as *Artemisia arbuscula* – *Eriogonum (microthecum, sphaerocephalum)* Association, *Eriogonum sphaerocephalum* / *Poa secunda* Association, *Taraxia tanacetifolia* – *Iva axillaris* provisional Association, and *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association. Other classification changes including merging of ecologically similar types such as parts of three previous Alliances were merged into a montane *Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Herbaceous Alliance; at least three riparian scrub Alliances were merged into *Salix boothii* – *Salix geyeriana* – *Salix lutea* Shrubland Alliance; and two montane upland Alliances were merged into the *Prunus emarginata* - *Holodiscus discolor* Shrubland Alliance. The classification also resulted in redefining of Alliance concepts, including a montane

chaparral type was expanded to *Arctostaphylos patula* – *Arctostaphylos nevadensis* Shrubland Alliance, and another montane shrubland Alliance was expanded to *Amelanchier utahensis* – *Cercocarpus montanus* – *Cercocarpus intricatus* Shrubland Alliance.

Table 9. Vegetation Classification in the Applegate East (AGE) & West (AGW), and Eagle Lake (EL) Subareas, Organized by Lifeform (MapUnit code noted when available. Higher level classifications above alliance are displayed in bold. Number of classification surveys per area are provided along with the number of Accuracy Assessment surveys in parentheses.)

Map Unit Code	Map Unit	AGE	AGW	EL
11110	Abies concolor Alliance	(1)		(2)
11111	Abies concolor – Pinus ponderosa / Amelanchier alnifolia Association	2 (1)	(1)	4 (8)
14100	Central Rocky Mountain Ponderosa Pine Open Woodland Group			(1)
16110	Juniperus occidentalis Alliance	2	(1)	(1)
16117	Juniperus occidentalis – (Pinus jeffreyi – Pinus ponderosa) / Cercocarpus ledifolius Association	9 (15)	4 (10)	10 (5)
16115	Juniperus occidentalis / (Poa secunda – Festuca idahoensis – Pseudoroegneria spicata) Association	6	(8)	
16118	Juniperus occidentalis / Artemisia arbuscula / Poa secunda Association	12 (6)	(7)	1 (1)
16119	Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	6 (1)	(5)	12 (5)
10000	Forest and Woodland Class			(1)
14120	Pinus ponderosa / Shrub Understory Alliance	(1)	(1)	
14112	Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata) Association	4	2 (6)	4 (3)
15124	Pinus jeffreyi / Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	(6)	3 (8)	1 (2)
14111	Pinus ponderosa – Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	1	(4)	
15123	Pinus ponderosa / Arctostaphylos patula – Purshia tridentata Association	1	(1)	(1)
12110	Populus tremuloides Alliance	1		1
12111	Populus tremuloides / Symphoricarpos rotundifolius Association		1 (2)	4 (4)
31140	Amelanchier utahensis – Cercocarpus montanus – Cercocarpus intricatus Alliance			
31142	Cercocarpus montanus / Pseudoroegneria spicata Association	1		
31130	Arctostaphylos patula – Arctostaphylos nevadensis Alliance			
31131	Arctostaphylos patula Association		(1)	1

Map Unit Code	Map Unit	AGE	AGW	EL
31132	Arctostaphylos patula – Ceanothus velutinus Association		(1)	5 (6)
22210	Artemisia arbuscula Alliance			(2)
22214	Artemisia arbuscula – Eriogonum (microthecum, sphaerocephalum) Association		(2)	(1)
22213	Artemisia arbuscula / Bromus spp. – Elymus caput-medusae Association	1 (9)	(2)	(2)
22215	Artemisia arbuscula ssp. arbuscula / Festuca idahoensis Association		(3)	
22211	Artemisia arbuscula / Poa secunda Association	5 (2)	1 (10)	12 (12)
41110	Artemisia cana Alliance	1	(2)	1
41111	Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda Association	3	(5)	3 (5)
22220	Artemisia nova Alliance			1
22221	Artemisia nova / Poa secunda Association			(1)
22310	Artemisia tridentata Alliance	(1)	(1)	
22313	Artemisia tridentata Association	4 (2)	(10)	9 (10)
22317	Artemisia tridentata – (Ericameria nauseosa) / Bromus tectorum Association	4 (6)	1 (2)	1 (3)
22311	Artemisia tridentata / Distichlis spicata Association			1
22320	Artemisia tridentata ssp. vaseyana Alliance		(1)	(1)
22321	Artemisia tridentata ssp. vaseyana – Symphoricarpos oreophilus / Bromus carinatus Association	2 (2)		4 (10)
22323	Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	2 (3)	2 (12)	8 (4)
22322	Symphoricarpos oreophilus Association		1	
31110	Ceanothus velutinus Alliance			(1)
31111	Ceanothus velutinus Association	2	(1)	2 (4)
31112	Ceanothus velutinus – Prunus emarginata – Artemisia tridentata Association			(4)
16210	Cercocarpus ledifolius Alliance		(3)	(1)
16212	Cercocarpus ledifolius Association	2	3 (6)	4 (2)
16211	Cercocarpus ledifolius – Artemisia tridentata ssp. vaseyana Association	3 (4)	(6)	2 (7)
24110	Chrysothamnus viscidiflorus Alliance			
24111	Chrysothamnus viscidiflorus Association	2		
43130	Cornus sericea – Rosa woodsii – Ribes spp. Alliance Association			
43132	Rosa woodsii Association	1		
22110	Ericameria nauseosa Alliance			
22111	Ericameria nauseosa Association	3	(2)	4 (1)

Map Unit Code	Map Unit	AGE	AGW	EL
22112	Ericameria nauseosa / Bromus tectorum Association	2 (1)	(2)	(1)
22230	Eriogonum spp. / Poa secunda Alliance			
22231	Eriogonum sphaerocephalum / Poa secunda Association	2	(1)	2 (1)
31120	Prunus emarginata – Holodiscus discolor Alliance			
31122	Holodiscus discolor Association			(2)
31121	Prunus emarginata Sierran Association	1	2	(4)
31123	Ribes velutinum Association			(1)
41130	Prunus virginiana Alliance	1	(2)	(1)
41132	Prunus subcordata Association			(4)
41131	Prunus virginiana / Symphoricarpos rotundifolius Association	1		(2)
22330	Purshia tridentata – Artemisia tridentata Alliance	(1)		
22335	Purshia tridentata – Artemisia tridentata Association	2 (1)	1 (12)	2 (2)
22333	Purshia tridentata – Artemisia tridentata / Achnatherum hymenoides Association	2		
22336	Tetradymia canescens Association	(2)		
43120	Salix boothii – Salix geyeriana – Salix lutea Alliance			(1)
43121	Salix lucida / Poa pratensis Association	1		1
41120	Salix exigua Alliance	1		1 (1)
43110	Salix lasiolepis Alliance		(1)	
47110	Sarcobatus vermiculatus Alliance			(1)
47111	Sarcobatus vermiculatus – Artemisia tridentata Association	1		
31100	Western North American Montane Scrub Group		(1)	
22120	Bromus tectorum – Elymus caput-medusae Alliance		(2)	(1)
22121	Bromus tectorum Association	2	(3)	(1)
22122	Elymus caput-medusae Association	4 (7)	(7)	(1)
22123	Ventenata dubia Association	1		
44100	Californian Vernal Pool Group	3		
41310	Carex (aquatilis, lenticularis) Alliance			
41311	Carex aquatilis – Carex lenticularis Association			1
44240	Carex (pansa, praegracilis) Alliance			
44241	Carex praegracilis Association			1
41320	Carex simulate Alliance			
41321	Carex simulata Association			1
41360	Danthonia californica – Deschampsia cespitosa – Camassia quamash Alliance			

3.2 Mapping

For acreage counts by vegetation type for the Eagle Lake subarea, refer to Appendix C.

3.3 Accuracy Assessment

The accuracy of mapped polygons for the subareas was assessed at different times by CNPS staff, based on when AIS produced the draft vegetation maps. Due to the timing and location of the Applegate West and Eagle Lake subarea mapping, it was determined that these two subareas would be combined into one area for AA sample allocation, and the AA data collection, AA scoring would be conducted separately. Having chronologically preceded AGE and EL, AA for AGE was conducted as a separate effort. The locations, timing, and number of AA field surveys are summarized below in **Table 10**. The AAs were stand-based, in which both the vegetation type and the extent of the polygon were evaluated when possible. When a mapped polygon could be divided due to the presence of more than one vegetation type within the given MMU standards, an assessment was done for each type (i.e., a polygon sometimes had more than one AA survey). Also, the survey point locations are displayed in the **Figure 4** below.

Table 10. Locations and Dates for AA Field Surveys

Location	Dates for AA Field Surveying	No. of AA Surveys Collected	No. of Surveys Scored	No. of Polygons Scored
Applegate East	10/12/2018 – 10/17/2018	79	78	77
Applegate West	9/9/2020 – 10/22/2020	189	182	176
Eagle Lake	10/3/2020 – 10/22/2020	167	161	154

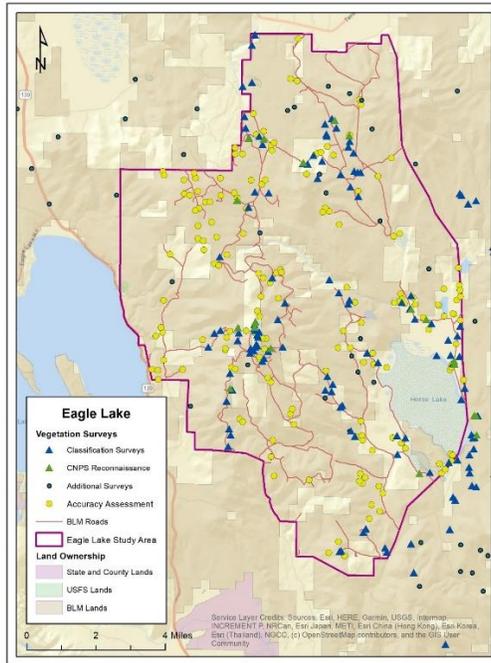


Figure 4: Map of the AA Survey Locations for Eagle Lake Subarea

The AA field data were analyzed by CDFW-VegCAMP staff to verify accuracy of the vegetation maps. The resulting calculated percent accuracy for each area was greater than 80% overall for fuzzy scores 3 and above. Tables with AA scores for the Eagle Lake study area is provided in **Tables 11** and **12** below.

Also, contingency tables displaying assessed types by users (Field assessed types) and producers (PI mapped types) for this accuracy assessment are included in Appendix G. Each column in the table represents a type assessed in the field for each polygon (users), while each row represents the type mapped by the photointerpreters (producers). Numbers on the diagonal are correct calls by the photointerpreters. These contingency tables display the numbers of assessed polygons by type, and do not include fuzzy scores.

Table 11. Alliance Level Accuracy Assessment Scores for the Eagle Lake Subarea

Map Unit	Map_Class	User's Count	User's Accuracy	Producer's Count	Producer's Accuracy
10000	Forest and Woodland Class	1	100	1	100
11111	Abies concolor Alliance	10	100	10	100
12110	Populus tremuloides Alliance	4	100	4	100
14100	Central Rocky Mountain Ponderosa Pine Open Woodland Group	1	100	2	90
14120	Pinus ponderosa / Shrub Understory Alliance	7	97.1	8	85
16110	Juniperus occidentalis Alliance	11	89.1	9	100
16210	Cercocarpus ledifolius Alliance	10	100	12	95
22110	Ericameria nauseosa Alliance	2	100	10	62
22120	Bromus tectorum - Elymus caput-medusae Alliance	3	53.3	5	32
22210	Artemisia arbuscula Alliance	17	80	10	100
22220	Artemisia nova Alliance	1	40		0
22230	Eriogonum spp. / Poa secunda Alliance	1	100	2	90
22310	Artemisia tridentata Alliance	13	98.5	15	88
22320	Artemisia tridentata ssp. vaseyana Alliance	15	92	13	93.8
22330	Purshia tridentata - Artemisia tridentata Alliance	2	100	4	95
31110	Ceanothus velutinus Alliance	9	88.9	5	100
31120	Prunus emarginata – Holodiscus discolor Alliance	7	88.6	8	92.5
31130	Arctostaphylos patula - Arctostaphylos nevadensis Alliance	6	100	9	93.3

32110	Festuca idahoensis– Pseudoroegneria spicata–Poa secunda Alliance	2	100	6	63.3
41110	Artemisia cana Alliance	5	32	1	100
41120	Salix exigua Alliance	1	100	1	100
41130	Prunus virginiana Alliance	3	86.7	1	100
41300	Vancouverian - Rocky Mountain Montane Wet Meadow & Marsh Grp	13	90	17	80
41380	Poa secunda - Muhlenbergia richardsonis - Carex douglasii Alliance		0	1	60
43120	Salix boothii - Salix geyeriana - Salix lutea Alliance	1	100	1	100
44110	Eleocharis (acicularis, macrostachya) Alliance		0	4	45
44210	Navarretia leucocephala ssp. minima–Plagiobothrys cusickii Alliance	3	53.3	1	40
47110	Sarcobatus vermiculatus Alliance	1	80		0
48110	Distichlis spicata Alliance	6	53.3	1	100
48120	Elymus cinereus – Elymus triticoides Alliance	5	48		0
Overall Count		160			
60-100% (Scores 3 and Above)		138	86.3%		
80-100% (Scores 4 and Above)		131	81.9%		
Fuzzy Overall Percent Accuracy (60-100% Correct or Acceptable)		86.3%			
Fuzzy Overall Percent Accuracy (80-100% Correct or Acceptable)		81.9%			

Table 12. Association Level Accuracy Assessment Scores for the Eagle Lake Subarea

Map Unit	Map Type	User's count	User's Accuracy	Producer's count	Producer's Accuracy
10000	Forest and Woodland Class	1	100	1	100
11110	Abies concolor Alliance	3	100	3	100
11111	Abies concolor - Pinus ponderosa / Amelanchier alnifolia Association	7	100	7	100
12111	Populus tremuloides / Symphoricarpos rotundifolius Association	4	100	4	100

Map Unit	Map Type	User's count	User's Accuracy	Producer's count	Producer's Accuracy
14100	Central Rocky Mountain Ponderosa Pine Open Woodland Group	1	100	2	90
14112	Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus - Purshia tridentata) Association	3	100	4	95
14120	Pinus ponderosa / Shrub Understory Alliance	1	80		0
15123	Pinus ponderosa / Arctostaphylos patula - Purshia tridentata Association	1	100	1	100
15124	Pinus jeffreyi / Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	2	90	3	60
16117	Juniperus occidentalis - (Pinus jeffreyi - Pinus ponderosa) / Cercocarpus ledifolius Association	4	70	2	100
16118	Juniperus occidentalis / Artemisia arbuscula / Poa secunda Association	2	100	3	93.3
16119	Juniperus occidentalis / Artemisia tridentata - Purshia tridentata Association	5	96	4	100
16211	Cercocarpus ledifolius - Artemisia tridentata ssp. vaseyana Association	8	92.5	6	96.7
16212	Cercocarpus ledifolius Association	2	100	5	88
22111	Ericameria nauseosa Association	1	100	7	51.4
22112	Ericameria nauseosa / Bromus tectorum Association	1	80	3	66.7
22120	Bromus tectorum - Elymus caput-medusae Alliance	1	20	-	0
22121	Bromus tectorum Association	1	100	5	32
22122	Elymus caput-medusae Provisional Association	1	40	-	0
22210	Artemisia arbuscula Alliance	1	80	-	0
22211	Artemisia arbuscula / Poa secunda Association	11	65.5	4	95
22213	Artemisia arbuscula / Bromus spp. - Elymus caput-medusae Association	2	60	2	80
22214	Artemisia arbuscula - Eriogonum (microthecum, sphaerocephalum) Association	3	86.7	4	90

Map Unit	Map Type	User's count	User's Accuracy	Producer's count	Producer's Accuracy
22221	Artemisia nova / Poa secunda Association	1	20	-	0
22231	Eriogonum sphaerocephalum / Poa secunda Association	1	100	2	80
22311	Artemisia tridentata / Distichlis spicata Provisional Association	-	0	1	80
22313	Artemisia tridentata Association	8	95	8	92.5
22317	Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Association	5	96	6	76.7
22320	Artemisia tridentata ssp. vaseyana Alliance	1	80	-	0
22321	Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Bromus carinatus Association	10	82	8	87.5
22322	Symphoricarpos oreophilus Association	-	0	1	80
22323	Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	4	90	4	90
22335	Purshia tridentata - Artemisia tridentata Association	2	100	4	80
31110	Ceanothus velutinus Alliance	1	60	-	0
31111	Ceanothus velutinus Association	4	95	3	100
31121	Prunus emarginata Association	4	85	6	80
31122	Holodiscus discolor Association	2	100	2	100
31131	Arctostaphylos patula Association	-	0	2	80
31123	Ribes velutinum Provisional Association	1	80	-	0
31132	Arctostaphylos patula - Ceanothus velutinus Association	6	93.3	6	90
32110	Festuca idahoensis - Pseudoroegneria spicata - Poa secunda Alliance	1	80	-	0
32111	Pseudoroegneria spicata - Poa secunda Association	-	0	4	55
32112	Festuca idahoensis - Pseudoroegneria spicata Association	1	100	2	70
41111	Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda Association	5	32	1	100
41120	Salix exigua Alliance	1	100	1	100
41130	Prunus virginiana Alliance	1	80	-	0

Map Unit	Map Type	User's count	User's Accuracy	Producer's count	Producer's Accuracy
41131	Prunus virginiana / Symphoricarpos rotundifolius Association	2	60	1	80
41300	Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group	6	56.7	5	52
41370	Juncus balticus - Juncus mexicanus Alliance	1	60	-	0
41371	Juncus arcticus var. balticus - (var. mexicanus) Association	6	86.7	11	69.1
41380	Poa secunda - Muhlenbergia richardsonis - Carex douglasii Alliance	-	0	1	60
41382	Taraxia tanacetifolia - Iva axillaris Provisional Association	1	20	1	40
43120	Salix boothii - Salix geyeriana - Salix lutea Alliance	1	80	-	0
43121	Salix lucida / Poa pratensis Association	-	0	1	80
44210	Navarretia leucocephala ssp. minima - Plagiobothrys cusickii Alliance	2	60	-	0
44111	Eleocharis macrostachya Provisional Association	-	0	4	40
47110	Sarcobatus vermiculatus Alliance	1	80	-	0
48110	Distichlis spicata Alliance	6	53.3	1	100
48121	Elymus cinereus Association	3	46.7	-	0
48122	Elymus triticoides - Poa secunda Association	2	50	-	0
10000	Forest and Woodland Class	1	100	1	100
Overall Count		156			
60-100% (Scores 3 and Above)		131	84.0%		
80-100% (Scores 4 and Above)		113	72.4%		
Fuzzy Overall Percent Accuracy (60-100% Correct or Acceptable)		84.0%			
Fuzzy Overall Percent Accuracy (80-100% Correct or Acceptable)		72.4%			

In addition to the limited revisions made to the data as a result of AA, there were a few suggestions for improving the map that were not applied to the final data set due to limitations of the quality and resolution of the project imagery (higher resolution imagery and LiDAR data if it becomes available in the future), diminishing detail through

generalization of the map by lumping Associations/Alliances (especially for those with scores near the threshold of acceptable percentages), and no available funding for additional AA on the data to ascertain the accuracy of a new map. The following are the suggestions made by CDFW:

- ***Ericameria nauseosa* types:** These tend to be disturbed stands, which make determining the vegetation type difficult in the field and during photointerpretation due to high variability, high potential for stand homogeneity, and threshold shrub covers. For these reasons, stands characterized by *Ericameria nauseosa* tend to be confused with disturbed stands of other Alliances and may be included in polygons mapped under this type (and visa verse). In order to increase the accuracy of this type within the map, a re-evaluation of stands mapped as *Ericameria nauseosa* would need to be performed: For stand where shrub cover is significant, *Ericameria nauseosa* needs to be very strongly dominant to go to this Alliance. One should err on the side of any other shrub that one sees in the stand (*Artemisia tridentata*, *Artemisia arbuscula*) to determine Alliance and then go for the disturbed version of that. Review *Ericameria nauseosa* stands with very low shrub cover and possibly put to disturbance herb type.
- ***Artemisia arbuscula* types:** The Alliance level was mapped quite accurately. However, it appears difficult to distinguish the disturbed from the undisturbed associations. Further review of stands using higher resolution imagery for high herb cover and lower shrub cover would be required to consider for the disturbance type more accurately.
- ***Artemisia tridentata* types:** It is difficult to distinguish between the disturbed Associations and the un-disturbed. The disturbed type is not as common as is being mapped. Further review stands using higher resolution imagery for low herb cover as a possible indication of native type.
- ***Eriogonum* spp. / *Poa secunda* Association:** This association is often misapplied to stands that would better fit the *Artemisia arbuscula*-*Eriogonum* Association, which is very ecologically similar. Although it is difficult to discern individual plants in low shrub cover stands, further review of stands using higher resolution imagery for higher cover shrub stands to possibly reassign to the *Artemisia arbuscula*-*Eriogonum* Association, especially in harsher settings on shallow soils consisting of ash flows or pumice, with insignificant organic content.
- ***Bromus tectorum* - *Elymus caput-medusae* Alliance:** The *Elymus caput-medusae* Association is more common on the landscape than is being mapped. Co-dominance of *E. caput-medusae* with *Bromus tectorum* would key the stand to the *El. caput-medusae* Association, which means that it is the stronger indicator. However, scoring at Alliance level was very good. Photo interpretation cannot determine species composition of these stands. Therefore, additional field work during peak phenology would facilitate higher accuracy.

- ***Festuca idahoensis* - *Pseudoroegneria spicata* - *Poa secunda* Alliance and its Associations:** Possibly mapped more often than it occurs (however there were a low number of AA samples), and were typically non-native grass, wet meadow, or shrub types when visited in the field. In order to increase the accuracy of this type, further review with higher resolution imagery would need to occur for stands mapped as this type that have higher shrub cover to possibly put to a shrub type. In addition, a review of disturbances and herb cover to determine if polygons need to go to a disturbance type. Use of more detailed topographic data (e.g. LiDAR) for differentiating upland vs. wetland types would be useful for further improved accuracy.
- **Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group:** Consider lumping Alliances and Associations into the Group level. User should use the accuracy assessment to ascertain the level of map category to use. In addition, more detailed topographic data (e.g. LiDAR), can be used for differentiating upland vs. wetland types.
- Consider reassigning the *Eleocharis macrostachya* Provisional Association to the California Vernal Pool Group or the Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group.
- *Navarretia leucocephala* ssp. *minima* - *Plagiobothrys cusickii* Alliance, and *Elymus cinereus* – *Elymus triticoides* Alliance are possibly under-mapped. Photo interpretation cannot determine species composition of these stands. Therefore, additional field work during peak phenology would facilitate higher accuracy.
- *Distichlis spicata* Alliance is possibly under-mapped. Photo interpretation cannot determine species composition of these stands. Therefore, additional field work during peak phenology would facilitate higher accuracy.

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GLOSSARY

Alliance	a vegetation classification unit of low rank (7th level) containing one or more associations, and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation (Jennings <i>et al.</i> 2006). Alliances reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.
Bosque	in arid climates, an oasis-like ribbon of canopied vegetation that only exists near rivers, streams, or other water courses.
Cismontane	refers to the portion of Southern California on the coastal side of the Transverse and Peninsular mountain ranges. The term "Southern California" often refers to this region specifically. See also " transmontane ".
Colluvial	referring to loose earth material that has accumulated at the base of a hill through the action of gravity.
Cove (on a hillside)	a hollow or recess in a mountain; a narrow pass or sheltered area between woods or hills.
Cryptobiotic crust	a layer on the surface of desert soils composed of biotic organisms such as blue-green algae, lichens, mosses, green algae, microfungi, and bacteria.
Decadent	(botany) a plant that is dead or dying.
Defile	a narrow passage, especially between mountains.
Desiccation	the state of being thoroughly dried up.
Endorheic	of or pertaining to interior drainage basins (basins that don't drain to the ocean).
Edaphic	related to or caused by particular soil conditions, as of texture or drainage, rather than by physiographic or climatic factors.
Facultative	having the capacity to live under more than one specific set of environmental conditions - as opposed to "obligate".
Fluvial	of or pertaining to a river; produced by or found in a river.
Geodatabase	a database designed to store, query, and manipulate geographic information and spatial data.

Group	a vegetation classification unit of intermediate rank (6th level) defined by combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (cf. Pignatti <i>et al.</i> 1994, Specht and Specht 2001).
Hummocky	relating to any topographic surface characterized by rounded or conical mounds.
Hydrophobic (soil)	a condition in which water collects on the soil surface rather than infiltrating into the ground. Wildfires generally cause soils to be hydrophobic temporarily.
Intermontane	a feature between mountains, such as a plateau or a basin.
Lens	a body of rock or ore that is thick in the middle and thinner toward the edges, similar in shape to a biconvex lens.
Lithomorphic	pertaining to a soil with a shallow profile, with organic soil horizons directly overlying bedrock.
Macrogroup	a vegetation classification unit of intermediate rank (5th level) defined by combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (cf. Pignatti <i>et al.</i> 1994).
Mesic	of, pertaining to, or adapted to an environment having a balanced supply of moisture.
Panne	a shallow depression or flat that is often unvegetated and can have encrustations of salt left by evaporation.
Phenology	the science dealing with the influence of climate on the recurrence of such annual phenomena of plant life as budding and other growth phases.
Playa	the sandy, salty, or mud-caked flat floor of a desert basin having interior drainage, usually occupied by a shallow lake during or after prolonged, heavy rains.
Pool and swale topography	landscape characterized by shallow depressions where water can collect seasonally (pools), and long, narrow, shallow, troughs or depressions that may slope downward (swales).
Premontane	pertaining to an elevation zone corresponding to foothills or lower mountain slopes.
Psammophytic	a plant that grows in sand or sandy soil.

Rhizomatous	a plant producing rhizomes, which are root-like subterranean stems, commonly horizontal in position, that usually produce roots below and send up shoots progressively from the upper surface.
Scald	a hard impermeable surface on saline or sodic soils as a result of wind or sheet erosion (dry scald) or by surface sealing through deposition of salts and clays following evaporation of surface water (wet scald).
Sclerophyllous	typically scrub, but also forest, in which the leaves of the trees and shrubs are evergreen, hard, thick, leathery, and usually small. A dominant plant form in hot dry areas, especially Mediterranean-type climates.
Seral	referring to a community that is an intermediate stage in ecological succession, preceding the climax community.
Signature	the visual characteristics of objects on an aerial photograph that allow one to differentiate them. The characteristics include tone, shape, size, pattern, texture, and shadow.
Stoloniferous	producing or bearing stolons, which are prostrate stems, at or just below the ground surface, that produce new plants from buds at their tips or nodes.
Transmontane	refers to the largely desert areas of Southern California, on the noncoastal side of the Transverse and Peninsular mountain ranges. See also " cismontane ".

Note: Refer to Appendix E and F for further vegetation terminology.

List of Acronyms

AA	Accuracy Assessment
AIS	Aerial Information Systems, Inc.
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife (name changed 1/1/13)
DEM	Digital Elevation Model
DRG	Digital Raster Graphics
FGDC	Federal Geographic Data Committee
GIS	Geographic Information System
GPS	Global Positioning System
MMU	Minimum Mapping Unit
MMW	Minimum Mapping Width
MOLA	Modoc-Lassen
NAIP	National Agricultural Imagery Program
NVCS	National Vegetation Classification Standards
OHV	Off-Highway Vehicle
OHVP	Off-Highway Vehicle Park
PI	Photointerpretation, photointerpreter
ROW	Right-of-way
USGS	US Geological Survey
VegCAMP	Vegetation Classification and Mapping Program

APPENDIX A: Map Classification

APPENDIX A-1: MOLA Mapping Classification Hierarchy – 2/24/2021

This document is arranged hierarchically, not numerically, based on the 2019 MOLA Hierarchy received from CDFW 1/15/2020 and updated to the Hierarchy created 4-10-2020 in addition to a more recent versions received in 7/2020 and 1/2021. This classification document contains the history of the Hierarchy, beginning with the 2017 version of the MOLA Hierarchy that was used to map Applegate by AIS.

& = New code in 2019, based on Hierarchy created by CDFW (1/15/2020, 4/10/2020, 7/8/2020, 1/15/2021)

Yellow highlight indicates wetland/riparian types at ¼ acre MMU

10000 - Forest & Woodland Class

 Temperate & Boreal Forest & Woodland Subclass

 Cool Temperate Forest & Woodland Formation

 Rocky Mountain Forest & Woodland Division

 [11000] [Retired from Hierarchy]

 [11100] [Retired from Hierarchy]

 [11110] [moved in Hierarchy to 15100 - Californian Montane Conifer Forest & Woodland Group]

 [11111] [moved in Hierarchy to 15100 - Californian Montane Conifer Forest & Woodland Group]

14000 - Central Rocky Mountain Dry Lower Montane – Foothill Forest Macrogroup

 14100 - Central Rocky Mountain Ponderosa Pine Open Woodland Group

 &14120 - *Pinus ponderosa* / Shrub Understory Alliance

 [contains former codes (from 2017 Hierarchy):

 14110 - *Pinus ponderosa* / Shrub Understory Central Rocky Mountain Alliance

 15120 - *Pinus jeffreyi* – *Pinus washoensis* Mixed Conifer Woodland Alliance]

 [14110] [Retired code, moved in hierarchy to a new type: 14120 - *Pinus ponderosa* / Shrub Understory Alliance]

 14111 - *Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association

- &14112 – *Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata)* Association
 - [name changed from *Pinus (jeffreyi, ponderosa) – Juniperus occidentalis* Association]
 - [contains former codes (from 2017 Hierarchy):
 - 15121 - *Pinus jeffreyi – Pinus ponderosa / Amelanchier alnifolia – Mahonia repens* Association
 - 15122 - *Pinus jeffreyi / Lupinus caudatus* Association]
 - 15123 - *Pinus ponderosa / Arctostaphylos patula – Purshia tridentata* Association
 - [name change from *Pinus jeffreyi / Arctostaphylos patula* Association]
 - [moved in hierarchy from former 15120 *Pinus jeffreyi – Pinus washoensis* Mixed Conifer Woodland Alliance]
 - 15124 - *Pinus jeffreyi / Artemisia tridentata ssp. vaseyana / Festuca idahoensis* Association
 - [moved in hierarchy from former 15120 *Pinus jeffreyi – Pinus washoensis* Mixed Conifer Woodland Alliance]
- &14113 - *Pinus ponderosa var. washoensis / Arctostaphylos nevadensis* Association
- &14114 - *Pinus ponderosa var. washoensis / Symphoricarpos spp. / Pseudostellaria jamesiana* Association
- 12000 - Rocky Mountain Subalpine – High Montane Conifer Forest Macrogroup
- 12100 - Rocky Mountain Subalpine Moist Spruce – Fir Forest & Woodland Group
- 12110 - *Populus tremuloides* Alliance
 - [name change from *Populus tremuloides* Forest Alliance]
 - 12111 - *Populus tremuloides / Symphoricarpos rotundifolius* Association
- Vancouverian Forest & Woodland Division
- 15000 - Southern Vancouverian Montane – Foothill Forest Macrogroup
- 15100 - Californian Montane Conifer Forest & Woodland Group
- 11110 - *Abies concolor* Alliance
 - [name change from *Abies concolor* Dry Forest & Woodland Alliance]

- [moved in Hierarchy from 11100 - Southern Rocky Mountain White Fir – Douglas-fir Dry Forest Group]
 - 11111 - *Abies concolor* – *Pinus ponderosa* / *Amelanchier alnifolia* Association
 - [moved in Hierarchy from 11100 - Southern Rocky Mountain White Fir – Douglas-fir Dry Forest Group]
 - [name changed from *Abies concolor* – *Pinus ponderosa* / *Cercocarpus ledifolius* Association]
- 15110 - *Pinus ponderosa* – *Calocedrus decurrens* – *Pseudotsuga menziesii* Alliance
 - [name change from *Pinus ponderosa* – *Calocedrus decurrens* – *Pseudotsuga menziesii* Forest Alliance]
- 15111 - *Pinus ponderosa* – *Calocedrus decurrens* / *Ceanothus prostratus* Association
- [15120] [Retired code, moved in hierarchy to a new type: 14120 - *Pinus ponderosa* / Shrub Understory Alliance]
- [15121] [Retired code, moved in hierarchy to a new type: 14112 - *Pinus (jeffreyi, ponderosa)* – *Juniperus occidentalis* Association]
- [15122] [Retired code, moved in hierarchy to a new type: 14112 - *Pinus (jeffreyi, ponderosa)* – *Juniperus occidentalis* Association]
- [15123] [Retained code & moved in hierarchy to a new type: 14120 - *Pinus ponderosa* / Shrub Understory Alliance]
- [15124] [Retained code, moved in hierarchy to a new type: 14120 - *Pinus ponderosa* / Shrub Understory Alliance]
- &15200 - Cascadian Oregon White Oak - Conifer Forest & Woodland Group
 - &15210 - *Quercus garryana* Alliance
 - &15211 - *Quercus garryana* / *Ceanothus cuneatus* / *Festuca idahoensis* Association
- &19000 – Vancouverian Subalpine-High Montane Forest Macrogroup
 - [Added 2/24/2021 from CDFW RB email]
- &19100 – Sierra-Cascade Cold-Dry Subalpine Woodland Group
 - [Added 2/24/2021 from CDFW RB email]
- &19110 – *Pinus contorta* ssp. *murrayana* Alliance

[Added 2/24/2021 from CDFW RB email]

Western North American Pinyon – Juniper Woodland & Scrub Division

16000 - Intermountain Singleleaf Pinyon – Juniper Woodland Macrogroup

16100 - Columbia Plateau Western Juniper Open Woodland Group

16110 - *Juniperus occidentalis* Alliance

[name change from *Juniperus occidentalis* Woodland & Savanna Alliance]

[16111] [Retired code, moved in hierarchy to a new type: 16117 -
Juniperus occidentalis – (*Pinus jeffreyi* – *Pinus ponderosa*) /
Cercocarpus ledifolius Association]

[16112] [Retired code, moved in hierarchy to a new type: 16118 -
Juniperus occidentalis / *Artemisia arbuscula* / *Poa secunda*
Association]

[16113] [Retired code, moved in hierarchy to a new type: 16119 -
Juniperus occidentalis / *Artemisia tridentata* – *Purshia tridentata*
Association]

[16114] [Retired code, moved in hierarchy to a new type: 16117 -
Juniperus occidentalis – (*Pinus jeffreyi* – *Pinus ponderosa*) /
Cercocarpus ledifolius Association]

16115 - *Juniperus occidentalis* / (*Poa secunda* – *Festuca idahoensis* –
Pseudoroegneria spicata) Association

[name change from *Juniperus occidentalis* / *Pseudoroegneria*
spicata Wooded Grassland Association]

[16116] [Retired code, split between 2 new types: 16118 - *Juniperus*
occidentalis / *Artemisia arbuscula* / *Poa secunda* Association &
16119 - *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia*
tridentata Association]

&16117 - *Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) /
Cercocarpus ledifolius Association

[contains former codes (from 2017 Hierarchy):

16111 - *Juniperus occidentalis* – *Pinus jeffreyi* / (*Purshia tridentata*,
Prunus virginiana) Association

16114 - *Juniperus occidentalis* / *Cercocarpus ledifolius* Association]

- &16118 - *Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association
 - [contains former codes (from 2017 Hierarchy):
 - 16112 - *Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association
 - 16116 - *Juniperus occidentalis* / *Purshia tridentata* / *Festuca idahoensis* – *Pseudoroegneria spicata* Association]
- &16119 - *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association
 - [contains former codes (from 2017 Hierarchy):
 - 16113 - *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association
 - 16116 - *Juniperus occidentalis* / *Purshia tridentata* / *Festuca idahoensis* – *Pseudoroegneria spicata* Association]
- 16200 - Intermountain Basins Curl-leaf Mountain-Mahogany Woodland & Scrub Group
 - 16210 - *Cercocarpus ledifolius* Alliance
 - [name change from *Cercocarpus ledifolius* Scrub Alliance]
 - 16211 - *Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association
 - 16212 - *Cercocarpus ledifolius* Association
 - [name change from *Cercocarpus ledifolius* – *Prunus virginiana* – *Symphoricarpos rotundifolius* Scrub Association]
- Temperate Flooded & Swamp Forest Formation
 - Rocky Mountain – Great Basin Montane Flooded & Swamp Forest Division
 - 13000 - Rocky Mountain – Great Basin Montane Riparian & Swamp Forest Macrogroup
 - 13100 - Northern Rocky Mountain Lowland – Foothill Riparian Forest Group
 - 13110 - *Populus trichocarpa* Alliance
 - [name change from *Populus tremuloides* Forest Alliance]
- Warm Temperate Forest & Woodland Formation
 - Californian Forest & Woodland Division
 - 17000 - Californian Ruderal Forest Macrogroup
 - 17100 - Californian Ruderal Forest Group
 - 17110 - *Eucalyptus* spp. – *Ailanthus altissima* – *Robinia pseudoacacia* Alliance

- [name change from *Eucalyptus spp.* Ruderal Forest Alliance]
- 18000 – Californian Forest & Woodland Macrogroup
- 18100 – Californian Broadleaf Forest & Woodland Group
- 18110 – *Quercus kelloggii* Alliance
- [18111] [retired from Hierarchy 7/9/2020- map as Alliance]

20000 - Desert & Semi-Desert Formation Class

Cool Semi-Desert Scrub & Grassland Formation Subclass

Cool Semi-Desert Scrub & Grassland Formation

Western North American Cool Semi-Desert Scrub & Grassland Division

21000 - Great Basin – Intermountain Dry Shrubland & Grassland Macrogroup

21100 - Intermountain Semi-Desert Steppe & Shrubland Group

21110 - *Krascheninnikovia lanata* Alliance

[name change from *Krascheninnikovia lanata* Steppe & Dwarf-shrubland Alliance]

24110 - *Chrysothamnus viscidiflorus* Alliance

[name change from *Chrysothamnus viscidiflorus* Steppe and Shrubland Alliance]

[moved in Hierarchy from 24100 - Intermontane Seral Shrubland Group]

24111 - *Chrysothamnus viscidiflorus* Association

[name change from *Chrysothamnus viscidiflorus* / *Poa secunda* – *Bromus tectorum* Ruderal Shrubland Association]

[moved in Hierarchy from 24100 - Intermontane Seral Shrubland Group]

22110 - *Ericameria nauseosa* Alliance

[name change from *Ericameria nauseosa* Shrubland Alliance]

[moved in Hierarchy from 22000 - Intermountain Tall and Dwarf Sagebrush Scrub Steppe Macrogroup]

22111 - *Ericameria nauseosa* Association

[name change from *Ericameria nauseosa* Shrubland Association]

[moved in Hierarchy from 22000 - Intermountain Tall and Dwarf Sagebrush Scrub Steppe Macrogroup]

22112 - *Ericameria nauseosa* / *Bromus tectorum* Association

- [name change from *Ericameria nauseosa* / *Bromus tectorum*
Ruderal Shrubland Association]
[moved in Hierarchy from 22000 - Intermountain Tall and Dwarf
Sagebrush Scrub Steppe Macrogroup]
- 24120 – Place holder for Alliance
[moved in Hierarchy from 22000 - Intermountain Tall and Dwarf
Sagebrush Scrub Steppe Macrogroup]
- 24121 - *Iliamna bakeri* Stands
[moved in Hierarchy from 22000 - Intermountain Tall and Dwarf
Sagebrush Scrub Steppe Macrogroup]
[name changed from *Iliamna bakeri* Provisional Association]
- &21400 - Great Basin-Intermountain Ruderal Dry Shrubland & Grassland Group
[added name to Hierarchy 7/9/2020; added code 8/6/2020]
- 22120 - *Bromus tectorum* – *Elymus caput-medusae* Alliance
[name change from *Bromus tectorum* – *Elymus caput-medusae* Ruderal
Annual Grassland Alliance]
[moved in Hierarchy from 22100 - Intermountain Ruderal Steppe and
Shrubland Group]
- 22121 - *Bromus tectorum* Association
[name change from *Bromus tectorum* Ruderal Grassland
Association]
[moved in Hierarchy from 22100 - Intermountain Ruderal Steppe
and Shrubland Group]
- 22122 - *Elymus caput-medusae* Provisional Association
[name change from *Elymus caput-medusae* Intermontane
Provisional Association]
[moved in Hierarchy from 22100 - Intermountain Ruderal Steppe
and Shrubland Group]
- 22123 - *Ventenata dubia* Provisional Association
[moved in Hierarchy from 22100 - Intermountain Ruderal Steppe
and Shrubland Group]
- 21200 – Mojave Mid-Elevation Mixed Desert Scrub Group
21210 – *Ephedra nevadensis* – *Lycium andersonii* – *Grayia spinosa* Alliance

- &21300 - Intermountain Semi-Desert Grassland Group
 - [&21310] [retired &21310 - *Hesperostipa comata* Grassland Alliance from Hierarchy 7-8-2020; may be added back in later]
 - &21320 – *Aristida purpurea* – *Elymus elymoides* – *Poa secunda* Alliance
 - &21321 – *Elymus elymoides* Provisional Association
 - [added from emails RY/RB week of 1/18/21]
- 22000 - Intermountain Tall and Dwarf Sagebrush Scrub Steppe Macrogroup
 - [22100] [retired code- Intermountain Ruderal Steppe and Shrubland Group]
 - [22120] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [22121] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [22122] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [22123] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [24100] [retired from Hierarchy (Intermontane Seral Shrubland Group) per RB 7/8/2020]
 - [24110] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [24111] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [24120] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [24121] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [22110] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [22111] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
 - [22112] [moved in Hierarchy to 21100 - Intermountain Semi-Desert Steppe & Shrubland Group]
- 22200 - Great Basin – Intermountain Dwarf Shrub Steppe Group
 - 22210 - *Artemisia arbuscula* Alliance

- [name change from *Artemisia arbuscula* Steppe & Shrubland Alliance]
 22211 - *Artemisia arbuscula* / *Poa secunda* Association
 22212 - *Artemisia arbuscula* ssp. *longicaulis* – *Grayia spinosa* Shrubland Association
 22213 - *Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association
 [name change from *Artemisia arbuscula* / *Bromus tectorum* Ruderal Shrubland Association]
 &22214 - *Artemisia arbuscula* – *Eriogonum (microthecum, sphaerocephalum)* Association
 &22215 - *Artemisia arbuscula* ssp. *arbuscula* / *Festuca idahoensis* Association
 22220 - *Artemisia nova* Alliance
 22221 - *Artemisia nova* / *Poa secunda* Association
 22230 – *Eriogonum* spp. / *Poa secunda* Alliance
 [name change from *Eriogonum* spp. / *Poa secunda* Dwarf-shrub Herbaceous Alliance]
 22231 - *Eriogonum sphaerocephalum* / *Poa secunda* Association
 [name change from *Eriogonum sphaerocephalum* / *Poa secunda* Dwarf-shrub Grassland Association]
 22300 - Intermountain Big Sagebrush Steppe & Shrubland Group
 22310 - *Artemisia tridentata* Alliance
 [name change from *Artemisia tridentata* Shrubland Alliance]
 22311 - *Artemisia tridentata* / *Distichlis spicata* Provisional Association
 22312 - *Artemisia tridentata* – *Ephedra viridis* / *Pseudoroegneria spicata* Association
 [name change from *Artemisia tridentata* – *Ephedra* spp. Shrubland Association]
 22313 - *Artemisia tridentata* Association
 [name change from *Artemisia tridentata* Shrubland Association]
 [22314] [Retired number, keep name, and map as new type: 22317 – *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association]

- [22315] [Retired number, map as new type: 22317 – *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association]
- 22316 – *Artemisia tridentata* - *Grayia spinosa* Shrubland Association
- &22317 – *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association
- [contains the former codes (from 2017 Hierarchy):
- 22314 - *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Ruderal Shrubland Association
- 22315 - *Artemisia tridentata* - *Atriplex confertifolia* Shrubland Association]
- 22320 - *Artemisia tridentata* ssp. *vaseyana* Alliance
- [name change from *Artemisia tridentata* ssp. *vaseyana* – Mixed Steppe & Shrubland Alliance]
- 22321 - *Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association
- [name change from *Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Shrubland Association]
- 22322 - *Symphoricarpos oreophilus* Association
- [name change from *Symphoricarpos oreophilus* Shrubland Association]
- 22323 - *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association
- [name change from *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Shrub Grassland Association]
- &22324 - *Artemisia tridentata* – *Salvia dorrii* – *Chamaebatiaria millefolium* Association
- 22330 - *Purshia tridentata* - *Artemisia tridentata* Alliance
- [name change from *Purshia tridentata* – *Artemisia tridentata* Mesic Steppe & Shrubland Alliance]
- [22331] [Retired code, map as same name with new code: 22335 – *Purshia tridentata* – *Artemisia tridentata* Association]

- [22332] [Retired code, split between 2 types: 22335 – *Purshia tridentata* – *Artemisia tridentata* Association & 22336 – *Tetradymia canescens* Provisional Association]
- 22333 - *Purshia tridentata* – *Artemisia tridentata* / *Achnatherum hymenoides* Association
- [22334] [Retired code, map as same name with new code: 22336 – *Tetradymia canescens* Provisional Association]
- &22335 – *Purshia tridentata* – *Artemisia tridentata* Association
[contains former codes (from 2017 Hierarchy):
22331 - *Purshia tridentata* – *Artemisia tridentata* Association
22332 - *Purshia tridentata* – *Artemisia tridentata* – *Tetradymia canescens* Association]
- &22336 – *Tetradymia canescens* Provisional Association
[contains former codes (from 2017 Hierarchy):
22332 - *Purshia tridentata* – *Artemisia tridentata* – *Tetradymia canescens* Association
22334 - *Tetradymia canescens* Provisional Association]
- 22340 – Place holder for Alliance (none given in previous Hierarchies)
- 22341 – *Prunus andersonii* Provisional Association
- 23000 - Great Basin Saltbush Scrub Macrogroup
 - 23100 - Intermountain Shadscale – Saltbush Scrub Group
 - 23110 - *Atriplex canescens* Alliance
[name change from *Atriplex canescens* Scrub Alliance]
 - 23120 - *Atriplex confertifolia* Alliance
[name change from *Atriplex confertifolia* Scrub Alliance]
 - [23121] [Retired code, remove this Association (*Atriplex confertifolia* – *Picrothamnus desertorum* / *Krascheninnikovia lanata* Association) from 2019 Hierarchy; no direction from CDFW how to map this if it is encountered.]
- 30000 - Shrub & Herb Vegetation Formation Class
 - Temperate & Boreal Grassland & Shrubland Formation Subclass
 - Temperate Grassland & Shrubland Formation

- Western North American Interior Chaparral Division
 - 31000 - Cool Interior Chaparral Macrogroup
 - 31100 - Western North American Montane Scrub Group
 - [name change from Western North American Montane Sclerophyll Scrub Group]
 - 31110 - *Ceanothus velutinus* Alliance
 - [name change from *Ceanothus velutinus* Shrubland Alliance]
 - 31111 - *Ceanothus velutinus* Association
 - [name change from *Ceanothus velutinus* Shrubland Association]
 - &31112 – *Ceanothus velutinus* – *Prunus emarginata* – *Artemisia tridentata* Association
 - [added 1/29/2021 by CDFW during AA scoring]
 - 31120 - *Prunus emarginata* – *Holodiscus discolor* Alliance
 - [name change from *Prunus emarginata* – *Holodiscus discolor* Shrubland Alliance]
 - 31121 - *Prunus emarginata* Association
 - [name change from *Prunus emarginata* Sierran Chaparral Shrubland Association]
 - &31122 - *Holodiscus discolor* Association
 - &31123 - *Ribes velutinum* Provisional Association
 - &31140 - *Amelanchier utahensis* – *Cercocarpus montanus* – *Cercocarpus intricatus* Alliance
 - &31141 - *Amelanchier utahensis* Association
 - &31142 - *Cercocarpus montanus* / *Pseudoroegneria spicata* Association
 - 41130 - *Prunus virginiana* Alliance
 - [moved in hierarchy from different Group: 41100 - Rocky Mountain – Great Basin Lowland – Foothill Riparian Shrubland Group]
 - 41131 - *Prunus virginiana* – *Symphoricarpos rotundifolius* Association
 - [moved in hierarchy from different Group: 41100 - Rocky Mountain – Great Basin Lowland – Foothill Riparian Shrubland Group]
 - [name change from *Prunus virginiana* / *Leymus cinereus* Shrubland Association]
 - &41132 - *Prunus subcordata* Provisional Association
 - [added to Hierarchy 7/9/2020]

- 31130 - *Arctostaphylos patula* - *Arctostaphylos nevadensis* Alliance
[name change from *Arctostaphylos patula* - *Arctostaphylos nevadensis* Shrubland Alliance]
- 31131 - *Arctostaphylos patula* Association
[name change from *Arctostaphylos patula* Shrubland Association]
- &31132 - *Arctostaphylos patula* – *Ceanothus velutinus* Association
- &31150 - *Chrysolepis sempervirens* Alliance
- &31151 - *Chrysolepis sempervirens* Association
- Western North American Grassland & Shrubland Division
- 32000 - Central Rocky Mountain Montane – Foothill Grassland & Shrubland Macrogroup
- 32100 - Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group
- 32110 - *Festuca idahoensis* – *Pseudoroegneria spicata* – *Poa secunda* Alliance
[name change from *Festuca idahoensis* – *Elymus spicatus* – *Poa secunda* Dry Grassland Alliance]
- 32111 - *Pseudoroegneria spicata* – *Poa secunda* Association
[name change from *Elymus spicatus* – *Poa secunda* Grassland Association]
- 32112 - *Festuca idahoensis* – *Pseudoroegneria spicata* Association
[name change from *Festuca idahoensis* Provisional Association]
- 32120 - *Elymus smithii* Stands
[Includes *Elymus smithii* Central Rocky Mountain Grassland Association, formerly code 32121]
[changed named to *Elymus smithii* Unique Stands per RB, 7/9/2020; was formerly named *Festuca idahoensis* – *Elymus spicatus* – *Elymus smithii* Mesic Grassland Alliance][32121] [Retired code and moved in Hierarchy to be part of 32120 *Elymus smithii* Unique Stands (32121= *Elymus smithii* Central Rocky Mountain Grassland Association)]
- &35000 - Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow Macrogroup
[added name 7/9/2020; added code 8/6/2020]
- &35100 - Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group
[added name 7/9/2020; added code 8/6/2020]
- 41380 - *Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance

[Moved in Hierarchy from 41300 - Vancouverian – Rocky Mountain
Montane Wet Meadow & Marsh Group]

41381 - *Carex douglasii* Association

[moved in Hierarchy from 41300 - Vancouverian – Rocky Mountain
Montane Wet Meadow & Marsh Group]

Mediterranean Scrub & Grassland Formation

Californian Scrub & Grassland Division

33000 - Californian Ruderal Grassland, Meadow & Scrub Macrogroup

33100 - Californian Ruderal Grassland, Meadow & Scrub Group

33110 - *Lolium perenne* Alliance

[name change from *Festuca perennis* Ruderal Grassland Alliance]

33111 - *Lolium perenne* – *Lotus corniculatus* Association

[name change from *Festuca perennis* – *Lotus corniculatus*
Association]

34000 - Californian Annual & Perennial Grassland Macrogroup

34100 - Californian Annual Grassland & Forb Meadow Group

34110 – *Lotus unifoliolatus* Provisional Alliance

&34200 - Californian Perennial Grassland Group

&34210 - *Corethrogyne filaginifolia* – *Eriogonum (elongatum, nudum)* Alliance

40000 - Shrub & Herb Wetland Formation Subclass

Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland Formation

Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland Division

41000 - Western North American Montane – Subalpine – Boreal Marsh, Wet Meadow &
Shrubland Macrogroup

41100 - Rocky Mountain – Great Basin Lowland – Foothill Riparian Shrubland Group

41110 - *Artemisia cana* Alliance

[name change from *Artemisia cana* Wet Shrubland Alliance]

41111 - *Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda*
Association

[name change from *Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) /
Poa secunda Wet Shrubland Association]

41120 - *Salix exigua* Alliance

- [name updated from *Salix exigua* – *Salix irrorata* – *Salix melanopsis* Shrubland Alliance]
 [41121] [Retired from Hierarchy; map to the Alliance 41120 *Salix exigua* Alliance]
- [41130] [Retain name, moved in hierarchy to different Group: 31100 Western North American Montane Scrub Group]
 [41131] [Retain name, moved in hierarchy to different Group: 31100 Western North American Montane Scrub Group]
- 41200 - Western Montane – Subalpine Riparian & Seep Shrubland Group**
61200 - Western North American Sparsely Vegetated Rivershore mapping unit
 [moved in Hierarchy from 61000 - Western North American Cliff, Scree & Rock Vegetation Macrogroup]
- 41210 - *Betula occidentalis* Alliance**
 [name change from *Betula occidentalis* Wet Shrubland Alliance]
- 43130 - *Cornus sericea* – *Rosa woodsii* – *Ribes* spp. Alliance**
 [name change from *Cornus sericea* – *Dasiphora fruticosa* ssp. *floribunda* – *Ribes* spp. Wet Shrubland Alliance]
43131 - *Cornus sericea* Association
 [name change from *Cornus sericea* Rocky Mountain Shrubland Association]
- 43132 - *Rosa woodsii* Association**
 [name change from *Rosa woodsii* Wet Shrubland Association]
- 43110 - *Salix lasiolepis* Alliance**
 [name change from *Salix lasiolepis* Wet Shrubland Alliance]
 [moved in the hierarchy document- was previously nested under the duplicated code of 43100 Western Montane – Subalpine Riparian & Seep Shrubland Group, which has now been retired]
- 43111 - *Salix lasiolepis* – *Rosa woodsii* / Mixed Herbs Association**
 [name change from *Salix lasiolepis* – *Rosa woodsii* / Mixed Herbs Wet Shrubland Association]
 [moved in the hierarchy document- was previously nested under the duplicated code of 43100 Western Montane – Subalpine Riparian & Seep Shrubland Group, which has now been retired]

43120 - *Salix boothii* – *Salix geyeriana* – *Salix lutea* Alliance

[name change from *Salix boothii* – *Salix geyeriana* – *Salix lutea* Montane Wet Shrubland Alliance]

[moved within the hierarchy document, but still in same MG & Gp. It was previously nested under the duplicated code of 43100 Western Montane – Subalpine Riparian & Seep Shrubland Group, which has now been retired due to duplication.]

43121 - *Salix lucida* / *Poa pratensis* Association

[moved within the hierarchy document, but still in same MG & Gp. It was previously nested under the duplicated code of 43100 Western Montane – Subalpine Riparian & Seep Shrubland Group, which has now been retired due to duplication.]

41300 - Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group

41310 - *Carex (aquatilis, lenticularis)* Alliance

41311 - *Carex aquatilis* – *Carex lenticularis* Association

41320 - *Carex simulata* Alliance

41321 - *Carex simulata* Association

[41330] [Retired from Hierarchy, 7/9/2020]

[41331] [moved in Hierarchy to 41360 *Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance]

41340 - *Carex nebrascensis* Alliance

41341 - *Carex nebrascensis* Association

41350 - *Juncus nevadensis* Alliance

[name change from *Juncus nevadensis* Herbaceous Alliance]

41351 - *Juncus nevadensis* Association

41360 - *Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance

[name change from *Danthonia spp.* – *Camassia spp.* Wet Meadow Alliance]

41361 - *Danthonia unispicata* – *Poa secunda* Association

[name change from *Danthonia unispicata* – *Poa secunda* Wet Meadow Association]

&41441 - *Hordeum brachyantherum* Association

- [moved in Hierarchy from 41440 *Hordeum brachyantherum* Alliance]
- 41331 - *Deschampsia cespitosa* Association
[moved in Hierarchy from 41330 *Deschampsia cespitosa* Alliance]
- 41370 - *Juncus balticus* – *Juncus mexicanus* Alliance
[name change from *Juncus balticus* – *Juncus mexicanus* Wet Meadow Alliance]
- 41371 - *Juncus arcticus* var. *balticus* – (var. *mexicanus*) Association
[name change from *Juncus balticus* Wet Meadow Association]
- [41380] [name change from *Muhlenbergia richardsonis* – *Carex douglasii* Moist Meadow Alliance]
[moved in Hierarchy to Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow]
- [41381] [name change from *Carex douglasii* Herbaceous Vegetation Association]
[moved in Hierarchy to Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow]
- [41382] [Retained name and code; moved in hierarchy to new alliance:
44210 - *Navarretia leucocephala* ssp. *minima* – *Plagiobothrys cusickii* Alliance]
- &41390 - *Eleocharis quinqueflora* Alliance
- &41410 - *Carex scopulorum* Alliance
- &41411 - *Carex scopulorum* Association
- &41420 - *Scirpus microcarpus* Alliance
- &41421 - *Scirpus microcarpus* Association
- &41430 - *Solidago canadensis* Alliance
- [&41330] [retired from Hierarchy 7/9/2020]
- [41441] [moved in Hierarchy to 41360 *Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance]
- 42000 - Vancouverian Lowland Marsh, Wet Meadow & Shrubland Macrogroup
- 42100 - Temperate Pacific Freshwater Wet Mudflat Group
- 42110 - *Bidens cernua* – *Euthamia occidentalis* – *Ludwigia palustris* Alliance
- 42111 - *Artemisia douglasiana* Provisional Association

- &42200 – Vancouverian Freshwater Wet Meadow & Marsh Group
[added from emails RY/RB week of 1/18/21]
- &42210 – *Carex (pansa, praegracilis)* Alliance
[added from emails RY/RB week of 1/18/21]
- &42211 – *Carex praegracilis* Association
[added from emails RY/RB week of 1/18/21]
- [43000] [Retired code, was a duplicate of code 41000]
- [43100] [Retired code, was a duplicate of code 41200]
- [43110] [moved in hierarchy document to: 41200 - Western Montane – Subalpine Riparian & Seep Shrubland Group, due to duplicate MG and Gp codes (41000 & 43000, 41200 &43100)]
- [43111] [moved in hierarchy document to: 41200 - Western Montane – Subalpine Riparian & Seep Shrubland Group, due to duplicate MG and Gp codes (41000 & 43000, 41200 &43100)]
- [43120] [moved in hierarchy document to: 41200 - Western Montane – Subalpine Riparian & Seep Shrubland Group, due to duplicate MG and Gp codes (41000 & 43000, 41200 &41200)]
- [43121] [moved in hierarchy document to: 41200 - Western Montane – Subalpine Riparian & Seep Shrubland Group, due to duplicate MG and Gp codes (41000 & 43000, 41200 &41200)]
- 44000 - Western North American Vernal Pool Macrogroup
- 44100 - Californian Vernal Pool Group
- 44110 - *Eleocharis (acicularis, macrostachya)* Alliance
[name change from *Eleocharis macrostachya* Vernal Pool Alliance]
- 44111 - *Eleocharis macrostachya* Provisional Association
[name change from *Eleocharis macrostachya* Vernal Pool Provisional Association]
- [44112] [Retired code, code as different alliance (44210) in a different Group]
- &44200 - Oregon-Washington-British Columbia Vernal Pool Group
- &44210 - *Navarretia leucocephala ssp. minima – Plagiobothrys cusickii* Alliance
[contains former code (from 2017 Hierarchy):

- 44112 - *Muhlenbergia richardsonis* – *Downingia bacigalupii* Provisional Association]
- 41382 - *Taraxia tanacetifolia* – *Iva axillaris* Provisional Association
[moved in hierarchy from different Group : 41300 - Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group]
- 45000 - Arid West Interior Freshwater Marsh Macrogroup
- 45100 - Arid West Interior Freshwater Marsh Group
- 45110 - *Typha domingensis* – *Typha latifolia* – *Typha angustifolia* Alliance
[name change from *Typha domingensis* – *Typha latifolia* – *Typha angustifolia* Western Marsh Alliance]
- 45111 - *Typha domingensis* Association
[name change from *Typha domingensis* Western Marsh Association]
- 45120 - *Schoenoplectus americanus* Alliance [name change per CDFW (R/Y/RB) 1/15/2021]
[name change from *Schoenoplectus americanus* - *Schoenoplectus acutus* - *Schoenoplectus californicus* Marsh Alliance]
- 45121 - *Schoenoplectus americanus* Association
[name change from *Schoenoplectus americanus* Western Marsh]
- 46000 - Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup
- 46100 - Western North American Ruderal Marsh, Wet Meadow & Shrubland Group
- 46110 - *Phalaris aquatica* – *Phalaris arundinacea* Alliance
[name change from *Phalaris arundinacea* Western Marsh Alliance]
- 46111 - *Phalaris arundinacea* Association
[name change from *Phalaris arundinacea* Western Marsh Association]
- 46120 - *Poa pratensis* – *Agrostis gigantea* – *Agrostis stolonifera* Alliance
[name change from *Poa pratensis* – *Agrostis gigantea* – *Agrostis stolonifera* Ruderal Marsh Alliance]
- 46121 - *Agrostis (gigantea, stolonifera)* Association
[name change from *Agrostis (gigantea, stolonifera)* Ruderal Marsh Association]
- &46122 - *Poa pratensis* Association

[name change from *Phleum pratense* – *Poa pratense* – *Bromus spp.* Association]

&46130 - *Agropyron cristatum* Semi-natural Alliance

[added from emails RY/RB week of 1/18/21]

Salt Marsh Formation

North American Western Interior Brackish Marsh, Playa & Shrubland Division

48000 - Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland Macrogroup

47100 - North American Desert Alkaline-Saline Wet Scrub Group

47110 - *Sarcobatus vermiculatus* Alliance

[name change from *Sarcobatus vermiculatus* Intermountain Wet Shrubland Alliance]

47111 - *Sarcobatus vermiculatus* – *Artemisia tridentata* Association

[name change from *Sarcobatus vermiculatus* – *Artemisia tridentata* Wet Shrubland Association]

&47112 - *Sarcobatus vermiculatus* – *Atriplex confertifolia* – (*Picrothamnus desertorum*, *Suaeda moquinii*) Association

48100 - North American Desert Alkaline-Saline Marsh & Playa Group

48110 - *Distichlis spicata* Alliance

[name change from *Distichlis spicata* Alkaline Wet Meadow Alliance]

48120 - *Elymus cinereus* – *Elymus triticoides* Alliance

[name change from *Elymus cinereus* – *Elymus triticoides* Alkaline Wet Meadow Alliance]

48121 - *Elymus cinereus* Association

[name change from *Elymus cinereus* Bottomland Wet Meadow Association]

48122 - *Elymus triticoides* – *Poa secunda* Association

[name change from *Elymus triticoides* – *Poa secunda* Wet Meadow Association]

&48130 - *Eleocharis (palustris, rostellata)* Alliance

&48131 - *Eleocharis rostellata* Association

50000 - Aquatic Vegetation Formation Class

Freshwater Aquatic Vegetation Formation Subclass

Temperate & Boreal Freshwater Aquatic Vegetation Formation

North American Freshwater Aquatic Vegetation Division

51000 - Western North American Freshwater Aquatic Vegetation Macrogroup

51100 - Western North American Temperate Freshwater Aquatic Vegetation Group

60000 - Open Rock Vegetation Class

Temperate & Boreal Open Rock Vegetation Subclass

Temperate & Boreal Cliff, Scree & Other Rock Vegetation Formation

Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation Division

61000 - Western North American Cliff, Scree & Rock Vegetation Macrogroup

61100 - Columbia Plateau cliff, scree and rock mapping unit

[61200] [moved in Hierarchy to 41200 Western Montane – Subalpine Riparian & Seep

Shrubland Group]

Agricultural & Developed Vegetation Class (*This section is covered in the Miscellaneous codes, 9xxxx.*)

Herbaceous & Woody Developed Vegetation Subclass

Other Developed Vegetation Formation

Other Developed Vegetation Division

Tree Developed Vegetation Macrogroup

NOTE: Miscellaneous Classes created by AIS and were not comprehensively included in the Hierarchical Vegetation Classification.

90000 - Miscellaneous Classes

92000 - Agriculture (within the current 5-year cycle)

92100 - Woody Agriculture (orchards, vineyards)

92200 - Non-woody Row and Field Agriculture

92300 - Irrigated Pastures

93000 - Built-up & Urban Disturbance

93100 - Urban Window

93200 - Anthropogenic Areas of Little or No Vegetation

95000 - Planted Trees and Shrubs

97000 - Burn Areas

97010 - Sparsely Vegetated Recently Burned Areas

98000 - Water

98010 - Perennial Stream Channel (Open Water)

98030 - Small Earthen-dammed Ponds & Natural Lakes

98040 - Major Canals and Aqueducts

98050 - Water Impoundment Feature

APPENDIX A-2: MOLA Mapped Classes Alphabetical List by Lifeform – 2/24/2021

Trees

- Abies concolor* Alliance (11110)
 - Abies concolor* – *Pinus ponderosa* / *Amelanchier alnifolia* Association (11111)
- Central Rocky Mountain Ponderosa Pine Open Woodland Group (14100)
- Juniperus occidentalis* Alliance (16110)
 - Juniperus occidentalis* / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Association (16115)
 - Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (16117)
 - Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association (16118)
 - Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (16119)
- Pinus contorta* ssp. *murrayana* Alliance (19110)
- Pinus ponderosa* / Shrub Understory Alliance (14120)
 - Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111)
 - Pinus (jeffreyi, ponderosa)* / (*Ceanothus prostratus* – *Purshia tridentata*) Association (14112)
 - Pinus ponderosa* / *Arctostaphylos patula* – *Purshia tridentata* Association (15123)
 - Pinus jeffreyi* / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (15124)
- Populus tremuloides* Alliance (12100)
 - Populus tremuloides* / *Symphoricarpos rotundifolius* Association (12111)
- Populus trichocarpa* Alliance (13110)

Shrubs

- Arctostaphylos patula* - *Arctostaphylos nevadensis* Alliance (31130)
 - Arctostaphylos patula* Association (31131)
 - Arctostaphylos patula* – *Ceanothus velutinus* Association (31132)
- Artemisia arbuscula* Alliance (22210)
 - Artemisia arbuscula* / *Poa secunda* Association (22211)
 - Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association (22213)
 - Artemisia arbuscula* – *Eriogonum (microthecum, sphaerocephalum)* Association (22214)
- Artemisia cana* Alliance (41110)
 - Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda* Association (41111)
- Artemisia tridentata* Alliance (22310)
 - Artemisia tridentata* / *Distichlis spicata* Provisional Association (22311)
 - Artemisia tridentata* Association (22313)
 - Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317)
- Artemisia tridentata* ssp. *vaseyana* Alliance (22320)

Artemisia tridentata ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association (22321)
Symphoricarpos oreophilus Association (22322)
Artemisia tridentata ssp. *vaseyana* / *Festuca idahoensis* Association (22323)
Betula occidentalis Alliance (41210)
Ceanothus velutinus Alliance (31110)
Ceanothus velutinus Association (31111)
Ceanothus velutinus – *Prunus emarginata* – *Artemisia tridentata* Association (31112)
Cercocarpus ledifolius Alliance (16210)
Cercocarpus ledifolius – *Artemisia tridentata* ssp. *vaseyana* Association (16211)
Cercocarpus ledifolius Association (16212)
Chrysothamnus viscidiflorus Alliance (24110)
Chrysothamnus viscidiflorus Association (24111)
Cornus sericea – *Rosa woodsii* – *Ribes* spp. Alliance (43130)
Rosa woodsii Association (43132)
Ericameria nauseosa Alliance (22110) none
Ericameria nauseosa Association (22111)
Ericameria nauseosa / *Bromus tectorum* Association (22112)
Eriogonum spp. / *Poa secunda* Alliance (22230)
Eriogonum sphaerocephalum / *Poa secunda* Association (22231)
Prunus emarginata – *Holodiscus discolor* Alliance (31120)
Prunus emarginata Association (31121)
Holodiscus discolor Association (31122)
Ribes velutinum Provisional Association (31123)
Prunus virginiana Alliance (41130)
Prunus virginiana / *Symphoricarpos rotundifolius* Shrubland Association (41131)
Purshia tridentata - *Artemisia tridentata* Alliance (22330)
Purshia tridentata – *Artemisia tridentata* Association (22335)
Purshia tridentata – *Artemisia tridentata* / *Achnatherum hymenoides* Association (22333)
Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (41100)
Salix boothii – *Salix geyeriana* – *Salix lutea* Alliance (43120)
Salix lucida / *Poa pratensis* Association (43121)
Salix exigua Alliance (41120)
Salix lasiolepis Alliance (43110)
Salix lasiolepis – *Rosa woodsii* / *Mixed Herbs* Association (43111)
Sarcobatus vermiculatus Alliance (47110)
Sarcobatus vermiculatus – *Artemisia tridentata* Association (47111)
Western North American Montane Scrub Group (31100)

Herbaceous

Arid West Interior Freshwater Marsh Group (45100)
Bromus tectorum – *Elymus caput-medusae* Alliance (22120)
Bromus tectorum Association (22121)
Elymus caput-medusae Provisional Association (22122)

Californian Vernal Pool Group (44100)
Carex (aquatilis, lenticularis) Alliance (41310)
 Carex aquatilis – *Carex lenticularis* Association (41311)
Carex simulata Alliance (41320)
Danthonia californica – *Deschampsia cespitosa* – *Camassia quamash* Alliance (41360)
 Deschampsia cespitosa Association (41331)
Distichlis spicata Alliance (48110)
Eleocharis (acicularis, macrostachya) Alliance (44110)
 Eleocharis macrostachya Provisional Association (44111)
Elymus cinereus – *Elymus triticoides* Alliance (48120)
 Elymus cinereus Association (48121)
 Elymus triticoides – *Poa secunda* Association (48122)
Elymus smithii Stands (32120)
Festuca idahoensis – *Pseudoroegneria spicata* – *Poa secunda* Alliance (32110) App28
 Pseudoroegneria spicata – *Poa secunda* Association (32111)
 Festuca idahoensis – *Pseudoroegneria spicata* Association (32112)
Juncus balticus – *Juncus mexicanus* Alliance (41370)
 Juncus arcticus var. *balticus* – (var. *mexicanus*) Association (41371)
Juncus nevadensis Alliance (41350)
 Juncus nevadensis Association (41351)
Lotus unifoliolatus Provisional Alliance (34110)
Navarretia leucocephala ssp. *minima* – *Plagiobothrys cusickii* Alliance (44210)
 Taraxia tanacetifolia – *Iva axillaris* Provisional Association (41382)
 North American Desert Alkaline – Saline Marsh & Playa Group (48100)
 Oregon – Washington – British Columbia Vernal Pool Group (44200)
Poa secunda – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance (41380)
Schoenoplectus americanus Alliance (45120)
 Schoenoplectus americanus Association (45121)
Typha domingensis – *Typha latifolia* – *Typha angustifolia* Alliance (45110)
 Typha domingensis Association (45111)
 Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group (41300)
 Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup (46000)

Sparse

Columbia Plateau cliff, scree and rock Mapping Unit (6110)

Miscellaneous Classes

Agriculture (92000)
 Woody Agriculture (orchards, vineyards) (92100)
 Non-woody Row and Field Agriculture (92200)
 Irrigated Pastures (92300)
 Built-up & Urban Disturbance (93000)
 Anthropogenic Areas of Little or No Vegetation (93200)
 Water (98000)
 Perennial Stream Channel (Open Water) (98010)

Small Earthen-Dammed Ponds & Natural Lakes (98030)

Other Attributes

Percent Cover - Woody (Conifer, Hardwood, Total Tree, Shrub)

Absolute Cover 1% increment

nnn = Absolute Cover

000 = None or None Observable

999 = Not Applicable, Not Assessed

Percent Cover – Herbaceous

1 = 0-2%, None or Not Observable

2 = >2-10%

3 = >10-40%

4 = >40%

999 = Not Applicable, Not Assessed

Roadedness Disturbance

0 = No observed Roadedness features.

1 = Low Roadedness: Less than one-third of the polygon is crossed by Roadedness features. Polygons adjacent to paved roads are also placed into this category.

2 = Moderate Roadedness: Between one-third and two-thirds of the polygon is crossed by Roadedness features.

3 = High Roadedness: Over two-thirds of the polygon is crossed by Roadedness features.

999 = Not Applicable/Not Assigned

Development Disturbance

0 = None/Not observable

1 = Low – 0-2% of polygon affected

2 = Moderate – >2-5% of polygon affected

3 = High – >5% of polygon affected

999 = Not Applicable/Not Assigned

Anthropogenically Altered Disturbance (Clearing)

0 = None/Not observable

1 = Low Anthropogenic Clearing: Less than one-third of the polygon has been cleared of at least the understory vegetation.

2 = Moderate Anthropogenic Clearing: Between one-third and two-thirds of the polygon has been cleared of at least the understory vegetation.

3 = High Anthropogenic Clearing: Over two-thirds of the polygon has been cleared of at least the understory vegetation.

999= Not Applicable/Not Assigned

Exotics (Invasives)

0 = None/Not observable: Less than 5%

- 1 = Low Invasive Plant Cover: Less than 33% of the polygon but over 5% is covered with invasive plants.
- 2 = Moderate Invasive Plant Cover: Between 33% and 66% of the polygon is covered with invasive plants.
- 3 = High Invasive Plant Cover: Over 66% of the polygon's area is covered with invasive plants.
- 999 = Not Applicable/Not Assigned

Isolated Tree

The Isolated Tree attribute indicates the presence of lone tree(s) primarily in agricultural areas.

- 1 = Yes
- 2 = No

JuOc Expansion

The JUOC Expansion attribute describes invasion of *Juniperus occidentalis* into stands. Young is defined as less than 6" diameter at breast height (dbh).

- 0 = Non visible
- 1 = 0-1% young
- 2 = 1-4% young
- 3 = 4-10% young
- 4 = >10% young
- 999 = Not applicable

Restoration

The Restoration attribute describes several types of restorative activity.

- 1 = Not obvious
- 2 = JUOC removal
- 3 = Grass/forbs seeding
- 4 = Shrub/tree planting
- 5 = Thinning (Pine, JUOC)
- 6 = Other (see comments in Notes field)
- 999 = Not applicable

Height Class

- 01 = <.5m
- 02 = >.5-1m
- 03 = >1-2m
- 04 = >2-5m
- 05 = >5-10m
- 06 = >10-15m
- 07 = >15-20m
- 08 = >20-35m
- 09 = >35-50m
- 10 = >50m
- 999 = Not Applicable/Not Assessed

California Wildlife Habitat Relations (CWHR) Tree Size Class

- 1 = Seedlings (<1" dbh)
- 2 = Saplings (>1"-6" dbh)
- 3 = Pole (>6"-11" dbh)
- 4 = Small (>11"-24" dbh)
- 5 = Medium-large (>24" dbh)
- 6 = Multi-layered medium-large trees over smaller trees in densities >60%
- 999 = Not Applicable/Not Assessed

Method ID

- 01 = Rapid Assessment (current project)
- 02 = Releve
- 03 = Field Verification
- 04 = Photo Interpretation
- 05 = Adjacent stand information or photo
- 06 = Reconnaissance (current project)
- 07 = Other information
- 08 = Older plot data
- 09 = Older recon data
- 10 = Accuracy Assessment
- 60 = Additional Recon Information

Note

A Comment Field in the database used to add any pertinent additional information, such as significant additional species present not accounted for in the alliance or association name.

APPENDIX A-3: MOLA Mapped Classes Numeric List by Lifeform – 2/24/2021

Trees

- 11110 = *Abies concolor* Alliance
 - 11111 = *Abies concolor* – *Pinus ponderosa* / *Amelanchier alnifolia* Association
- 14100 = Central Rocky Mountain Ponderosa Pine Open Woodland Group
- 14120 = *Pinus ponderosa* / Shrub Understory Alliance
 - 14111 = *Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association
 - 14112 = *Pinus (jeffreyi, ponderosa)* / (*Ceanothus prostratus* – *Purshia tridentata*) Association
 - 15123 = *Pinus ponderosa* / *Arctostaphylos patula* – *Purshia tridentata* Association
 - 15124 = *Pinus jeffreyi* / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association
- 12110 = *Populus tremuloides* Alliance
 - 12111 = *Populus tremuloides* / *Symphoricarpos rotundifolius* Alliance
- 13110 = *Populus trichocarpa* Alliance
- 16110 = *Juniperus occidentalis* Alliance
 - 16115 = *Juniperus occidentalis* / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Association
 - 16117 = *Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association
 - 16118 = *Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association
 - 16119 = *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association
- 19110 = *Pinus contorta* ssp. *murrayana* Alliance

Shrubs

- 16210 = *Cercocarpus ledifolius* Alliance
 - 16211 = *Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association
 - 16212 = *Cercocarpus ledifolius* Association
- 22110 = *Ericameria nauseosa* Alliance
 - 22111 = *Ericameria nauseosa* Association
 - 22112 = *Ericameria nauseosa* / *Bromus tectorum* Association
- 22210 = *Artemisia arbuscula* Alliance
 - 22211 = *Artemisia arbuscula* / *Poa secunda* Association
 - 22213 = *Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association
 - 22214 = *Artemisia arbuscula* – *Eriogonum (microthecum, sphaerocephalum)* Association
- 22230 = *Eriogonum* spp. / *Poa secunda* Alliance
 - 22231 = *Eriogonum sphaerocephalum* / *Poa secunda* Association

- 22310 = *Artemisia tridentata* Alliance
 - 22311 = *Artemisia tridentata* / *Distichlis spicata* Provisional Association
 - 22313 = *Artemisia tridentata* Association
 - 22317 = *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association
- 22320 = *Artemisia tridentata* ssp. *vaseyana* Alliance
 - 22321 = *Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association
 - 22322 = *Symphoricarpos oreophilus* Association
 - 22323 = *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association
- 22330 = *Purshia tridentata* - *Artemisia tridentata* Alliance
 - 22333 = *Purshia tridentata* – *Artemisia tridentata* / *Achnatherum hymenoides* Association
 - 22335 = *Purshia tridentata* – *Artemisia tridentata* Association
- 24110 = *Chrysothamnus viscidiflorus* Alliance
 - 24111 = *Chrysothamnus viscidiflorus* Association
- 31100 = Western North American Montane Scrub Group
- 31110 = *Ceanothus velutinus* Alliance
 - 31111 = *Ceanothus velutinus* Association
 - 31112 = *Ceanothus velutinus* – *Prunus emarginata* – *Artemisia tridentata* Association
- 31120 = *Prunus emarginata* – *Holodiscus discolor* Alliance
 - 31121 = *Prunus emarginata* Association
 - 31122 = *Holodiscus discolor* Association
 - 31123 = *Ribes velutinum* Provisional Association
- 31130 = *Arctostaphylos patula* - *Arctostaphylos nevadensis* Alliance
 - 31131 = *Arctostaphylos patula* Association
 - 31132 = *Arctostaphylos patula* – *Ceanothus velutinus* Association
- 41100 = Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group
- 41110 = *Artemisia cana* Alliance
 - 41111 = *Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda* Association
- 41120 = *Salix exigua* Alliance
- 41130 = *Prunus virginiana* Alliance
 - 41131 = *Prunus virginiana* / *Symphoricarpos rotundifolius* Shrubland Association
- 41210 = *Betula occidentalis* Alliance
- 43110 = *Salix lasiolepis* Alliance
 - 43111 = *Salix lasiolepis* – *Rosa woodsii* / Mixed Herbs Association
- 43120 = *Salix boothii* – *Salix geyeriana* – *Salix lutea* Alliance
 - 43121 = *Salix lucida* / *Poa pratensis* Association
- 43130 = *Cornus sericea* – *Rosa woodsii* – *Ribes* spp. Alliance
 - 43132 = *Rosa woodsii* Association
- 47110 = *Sarcobatus vermiculatus* Alliance
 - 47111 = *Sarcobatus vermiculatus* – *Artemisia tridentata* Association

Herbaceous

- 22120 = *Bromus tectorum* – *Elymus caput-medusae* Alliance
 - 22121 = *Bromus tectorum* Association
 - 22122 = *Elymus caput-medusae* Provisional Association
- 32110 = *Festuca idahoensis* – *Pseudoroegneria spicata* – *Poa secunda* Alliance
 - 32111 = *Pseudoroegneria spicata* – *Poa secunda* Association
 - 32112 = *Festuca idahoensis* – *Pseudoroegneria spicata* Association
- 32120 = *Elymus smithii* Stands
- 34110 = *Lotus unifoliolatus* Provisional Alliance
- 41300 = Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group
- 41310 = *Carex (aquatilis, lenticularis)* Alliance
 - 41311 = *Carex aquatilis* – *Carex lenticularis* Association
- 41320 = *Carex simulata* Alliance
- 41350 = *Juncus nevadensis* Alliance
 - 41351 = *Juncus nevadensis* Association
- 41360 = *Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance
 - 41331 = *Deschampsia cespitosa* Association
- 41370 = *Juncus balticus* – *Juncus mexicanus* Alliance
 - 41371 = *Juncus arcticus* var. *balticus* – (var. *mexicanus*) Association
- 41380 = *Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance
- 44100 = Californian Vernal Pool Group
- 44110 = *Eleocharis (acicularis, macrostachya)* Alliance
 - 44111 = *Eleocharis macrostachya* Provisional Association
- 44200 = Oregon – Washington – British Columbia Vernal Pool Group
- 44210 = *Navarretia leucocephala* ssp. *minima* – *Plagiobothrys cusickii* Alliance
 - 41382 = *Taraxia tanacetifolia* – *Iva axillaris* Provisional Association
- 45100 = Arid West Interior Freshwater Marsh Group
- 45110 = *Typha domingensis* – *Typha latifolia* – *Typha angustifolia* Alliance
 - 45111 = *Typha domingensis* Association
- 45120 = *Schoenoplectus americanus* Alliance
 - 45121 = *Schoenoplectus americanus* Association
- 46000 = Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup
- 48100 = North American Desert Alkaline – Saline Marsh & Playa Group
- 48110 = *Distichlis spicata* Alliance
- 48120 = *Elymus cinereus* – *Elymus triticoides* Alliance
 - 48121 = *Elymus cinereus* Association
 - 48122 = *Elymus triticoides* – *Poa secunda* Association

Sparse

- 61100 = Columbia Plateau cliff, scree and rock Mapping Unit

Miscellaneous Classes

- 92000 = Agriculture

92100 = Woody Agriculture (orchards, vineyards)
92200 = Non-woody Row and Field Agriculture
92300 = Irrigated Pastures
93000 = Built-up & Urban Disturbance
93200 = Anthropogenic Areas of Little or No Vegetation
98000 = Water
98010 = Perennial Stream Channel (Open Water)
98030 = Small Earthen-Dammed Ponds & Natural Lakes

Other Attributes

Percent Cover - Woody (Conifer, Hardwood, Total Tree, Shrub)

Absolute Cover 1% increment

nnn = Absolute Cover

000 = None or None Observable

999 = Not Applicable, Not Assessed

Percent Cover – Herbaceous

1 = 0-2%, None or Not Observable

2 = >2-10%

3 = >10-40%

4 = >40%

999 = Not Applicable, Not Assessed

Roadedness Disturbance

0 = No observed Roadedness features.

1 = Low Roadedness: Less than one-third of the polygon is crossed by Roadedness features. Polygons adjacent to paved roads are also placed into this category.

2 = Moderate Roadedness: Between one-third and two-thirds of the polygon is crossed by Roadedness features.

3 = High Roadedness: Over two-thirds of the polygon is crossed by Roadedness features.

999 = Not Applicable/Not Assigned

Development Disturbance

0 = None/Not observable

1 = Low – 0-2% of polygon affected

2 = Moderate – >2-5% of polygon affected

3 = High – >5% of polygon affected

999 = Not Applicable/Not Assigned

Anthropogenically Altered Disturbance (Clearing)

0 = None/Not observable

1 = Low Anthropogenic Clearing: Less than one-third of the polygon has been cleared of at least the understory vegetation.

2 = Moderate Anthropogenic Clearing: Between one-third and two-thirds of the polygon has been cleared of at least the understory vegetation.

3 = High Anthropogenic Clearing: Over two-thirds of the polygon has been cleared of at least the understory vegetation.

999= Not Applicable/Not Assigned

Exotics (Invasives)

0 = None/Not observable: Less than 5%

1 = Low Invasive Plant Cover: Less than 33% of the polygon but over 5% is covered with invasive plants.

2 = Moderate Invasive Plant Cover: Between 33% and 66% of the polygon is covered with invasive plants.

3 = High Invasive Plant Cover: Over 66% of the polygon's area is covered with invasive plants.

999 = Not Applicable/Not Assigned

Isolated Tree

The Isolated Tree attribute indicates the presence of lone tree(s) primarily in agricultural areas.

1 = Yes

2 = No

JuOc Expansion

The JUOC Expansion attribute describes invasion of *Juniperus occidentalis* into stands. Young is defined as less than 6" diameter at breast height (dbh).

0 = Non visible

1 = 0-1% young

2 = 1-4% young

3 = 4-10% young

4 = >10% young

999 = Not applicable

Restoration

The Restoration attribute describes several types of restorative activity.

1 = Not obvious

2 = JUOC removal

3 = Grass/forbs seeding

4 = Shrub/tree planting

5 = Thinning (Pine, JUOC)

6 = Other (see comments in Notes field)

999 = Not applicable

Height Class

01 = <.5m

02 = >.5-1m

03 = >1-2m

04 = >2-5m
05 = >5-10m
06 = >10-15m
07 = >15-20m
08 = >20-35m
09 = >35-50m
10 = >50m
999 = Not Applicable/Not Assessed

California Wildlife Habitat Relations (CWHR) Tree Size Class

1 = Seedlings (<1" dbh)
2 = Saplings (>1"-6" dbh)
3 = Pole (>6"-11" dbh)
4 = Small (>11"-24" dbh)
5 = Medium-large (>24" dbh)
6 = Multi-layered medium-large trees over smaller trees in densities >60%
999 = Not Applicable/Not Assessed

Method ID

01 = Rapid Assessment (current project)
02 = Releve
03 = Field Verification
04 = Photo Interpretation
05 = Adjacent stand information or photo
06 = Reconnaissance (current project)
07 = Other information
08 = Older plot data
09 = Older recon data
10 = Accuracy Assessment
60 = Additional Recon Information

Note

A Comment Field in the database used to add any pertinent additional information, such as significant additional species present not accounted for in the alliance or association name.

APPENDIX B: Map Unit Descriptions

Explanation of Map Unit Descriptions

This appendix contains descriptions for each of the Vegetation Types (Map Units) represented in the final geodatabase for the current project.

The descriptions for the majority of vegetation types have the following components:

A **screenshot** of aerial imagery and a **ground photo** are featured on the first page. The screenshots give the reader a sense of the photo signatures. The stand of vegetation being described is outlined in red. The ground photos, taken mostly by CNPS during classification field visits, otherwise by AIS staff, show the appearance of the plants on the landscape.

The second page includes a **Description**, which discusses the expected locations, percent cover considerations, and other factors pertaining to each vegetation type, mostly taken from the vegetation key (Appendix E); **Photointerpretation Signature**, which describes the color, tone, texture, pattern, etc. commonly seen on the aerial imagery; and a listing of **Types with Similar Photointerpretation Signatures**. The signature traits that differentiate each vegetation type in the list from the vegetation type being described are addressed.

Following the Types with Similar Photointerpretation Signatures is a **distribution map** and a brief discussion of the **Distribution** of the vegetation type in the study area. For vegetation types with only a few, small polygons in the entire study area, the size of the polygons on the distribution map was enhanced (or represented as a star) so that their locations could be seen. The distribution map shows the vegetation type occurrence in the current mapping effort.

Following the distribution map discussion is an **elevation range** chart showing the elevation values (count) for a given vegetation type within the study area. The chart was derived by extracting the elevation data (30 meter pixels) from the Digital Elevation Models (DEMs) in the National Elevation Dataset, available from the USGS, using the areal extent of the vegetation type. Along the vertical axis is the number of pixels occurring in the established elevation ranges. Along the horizontal axis are the elevation ranges in meters. This chart is not an elevation profile of the vegetation type, nor does it represent the geographic distribution of its elevation range. It includes the full extent of the vegetation type as mapped in the current mapping effort.

Descriptions for vegetation types in the Miscellaneous Classes are similar to the standard descriptions, but the ground photo, list of Types with Similar Photointerpretation Signatures, and elevation range chart have been omitted.

Some vegetation types have a very limited presence in the study area at sizes above MMU. For these types, it was not possible to formulate the standard in-depth

descriptions. Instead, they are represented only with a distribution map (with enhanced polygons) and a brief discussion.

APPENDIX B-1: Trees

Abies concolor Alliance (11110)

Abies concolor – *Pinus ponderosa* / *Amelanchier alnifolia* Association (11111)

Central Rocky Mountain Ponderosa Pine Open Woodland Group (14100)

Juniperus occidentalis Alliance (16110)

Juniperus occidentalis – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (16117)

Juniperus occidentalis / *Artemisia arbuscula* / *Poa secunda* Association (16118)

Juniperus occidentalis / *Artemisia tridentata* – *Purshia tridentata* Association (16119)

Pinus contorta ssp. *murrayana* Alliance (19110)

Pinus ponderosa / Shrub Understory Alliance (14120)

Pinus ponderosa – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111)

Pinus (jeffreyi, ponderosa) / (*Ceanothus prostratus* – *Purshia tridentata*) Association (14112)

Pinus ponderosa / *Arctostaphylos patula* – *Purshia tridentata* Association (15123)

Pinus jeffreyi / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (15124)

Populus tremuloides Alliance (12100)

Populus tremuloides / *Symphoricarpos rotundifolius* Association (12111)

***Abies concolor* Alliance (11110)**

White fir forest Alliance



The aerial view shows an open previously logged stand of *Abies concolor*. The understory is shrubby with *Prunus*, *Ceanothus*, and regenerating pines.



This is an open stand with an overstory of *Abies concolor*, and an understory of regenerating *Pinus ponderosa*.

***Abies concolor* Alliance (11110)**

DESCRIPTION: *Abies concolor* is dominant to co-dominant in the tree layer. *Pinus ponderosa* or *Pinus jeffreyi* are co-dominant to absent. *Juniperus occidentalis* may be present, but at very low cover.

PHOTOINTERPRETATION SIGNATURE: *Abies concolor* has a narrower more conical shape than other conifers; especially pines. Colors trend more blue-green than pine. Cover is generally higher than either juniper or pine woodlands stands. Limited at lower elevations in riparian and north-trending slopes where it often interfaces with *Pinus ponderosa* or *P. jeffreyi*. *Pinus ponderosa* and *P. jeffreyi* both have a medium to large, rounded dense crown with branching extending broadly to the mid-crown.

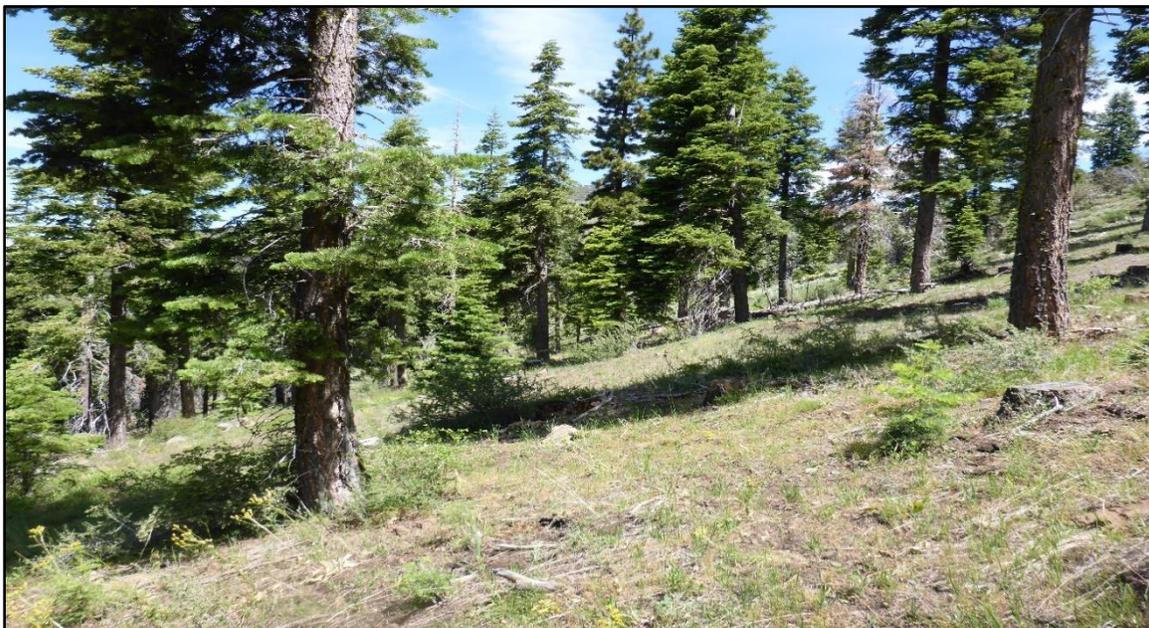
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Types dominated by *Pinus ponderosa* and *Pinus jeffreyi* are found adjacent at lower elevations and generally have a larger more rounded crown, however *P. jeffreyi* can overlap with *Abies* in elevation. Pines in general usually have a yellow-green color. Crowns tend to be more open.

***Abies concolor* – *Pinus ponderosa* / *Amelanchier alnifolia* Association (11111)**
White fir – Ponderosa pine / Serviceberry Association



The aerial view depicts a dense, previously logged stand of *Abies concolor*. The stand trends north to northwest averaging about 7200 feet.



This ground photo shows open margins of the stand depicting an open grassy understory with minimal shrub cover.

***Abies concolor* – *Pinus ponderosa* / *Amelanchier alnifolia* Association (11111)**

DESCRIPTION: *Abies concolor* is dominant to co-dominant in the tree layer. *Pinus ponderosa* or *Pinus jeffreyi* is co-dominant to absent. *Juniperus occidentalis* may be present but insignificant. Higher elevation, cold-tolerant shrubs are present and may include *Amelanchier utahensis*, *Cercocarpus ledifolius*, *Ribes* spp., *Symphoricarpos rotundifolius*, *Artemisia tridentata* ssp. *vaseyana*, and *Prunus* spp. The shrub and herb layers are characteristically sparse (less than 10% absolute cover) and are low in species diversity.

PHOTOINTERPRETATION SIGNATURE: *Abies concolor* has a narrower more conical shape than other conifers; especially pines. Colors trend more blue-green than pine. Cover is generally higher than either juniper or pine woodlands stands. Limited at lower elevations in riparian and north-trending slopes where it often interfaces with *Pinus ponderosa* or *P. jeffreyi*.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Types dominated by *Pinus ponderosa* and *Pinus jeffreyi* are found adjacent at lower elevations and generally have a larger more rounded crown, however *P. jeffreyi* can overlap with *Abies* in elevation. Pines in general usually have a yellow-green color. Crowns tend to be more open.

***Juniperus occidentalis* Alliance (16110)**

Western juniper woodland Alliance



This image depicts *Juniperus occidentalis* over a scree substrate with little vegetation.



This photo shows *Juniperus occidentalis* occurring among talus/scree slopes.

***Juniperus occidentalis* Alliance (16110)**

DESCRIPTION: *Juniperus occidentalis* is the sole coniferous tree species in the overstory or is strongly dominant with *Pinus jeffreyi*. *Juniperus occidentalis* may have as little as 3% cover when it is the sole tree species present, but the trees will include mature individuals, be evenly distributed throughout the stand, have obvious regenerating juniper in the understory, and the shrub layer will usually be less than 10% absolute cover. Where *Juniperus occidentalis* is co-dominant with *Pinus ponderosa* and/or *Pinus jeffreyi*, then the stand is considered the *Pinus ponderosa* / Shrub Understory Alliance.

This type is usually mapped to the Association level and typically is not mapped at the more generalized level across the study area.

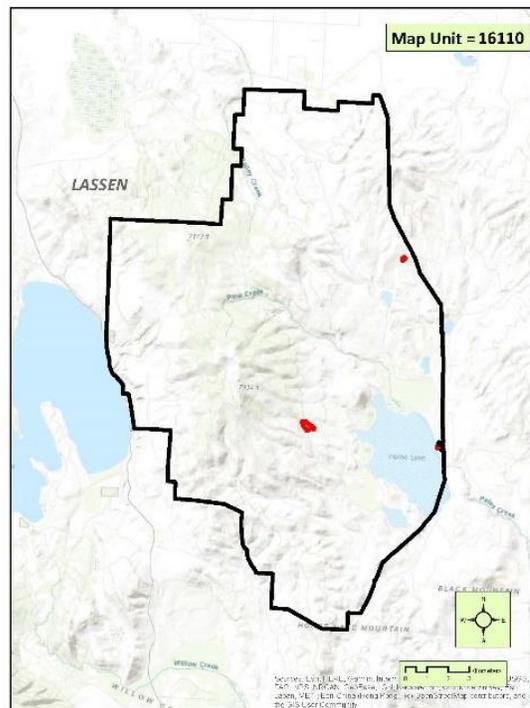
PHOTOINTERPRETATION SIGNATURE: *Juniperus occidentalis* woodlands have signatures that are highly variable depending on stand age and disturbance history. Junipers can appear similar to other conifers. Juniper crowns are more variable in shape than pine or fir, are irregular and open, but tend to have a similar color as *Pinus ponderosa*. In addition, juniper branching narrows from lower to higher up the main stem of the crown, forming a conical shape.

Pinus ponderosa and *P. jeffreyi* both have a medium to large, rounded dense crown with branching extending broadly to the mid crown.

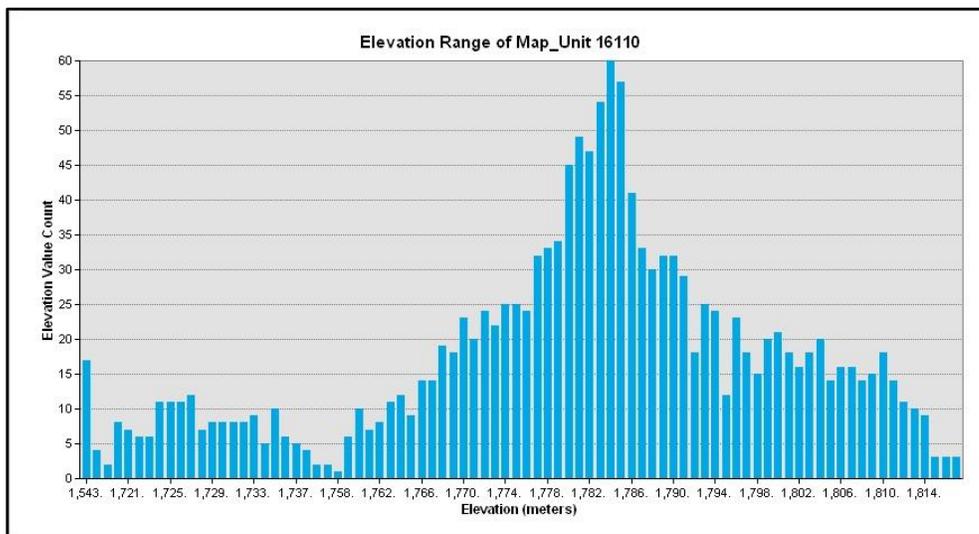
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pinus ponderosa* and *Pinus jeffreyi* crowns are generally more rounded; tree cover across the stand is usually more consistent.

Juniperus occidentalis Alliance (16110)

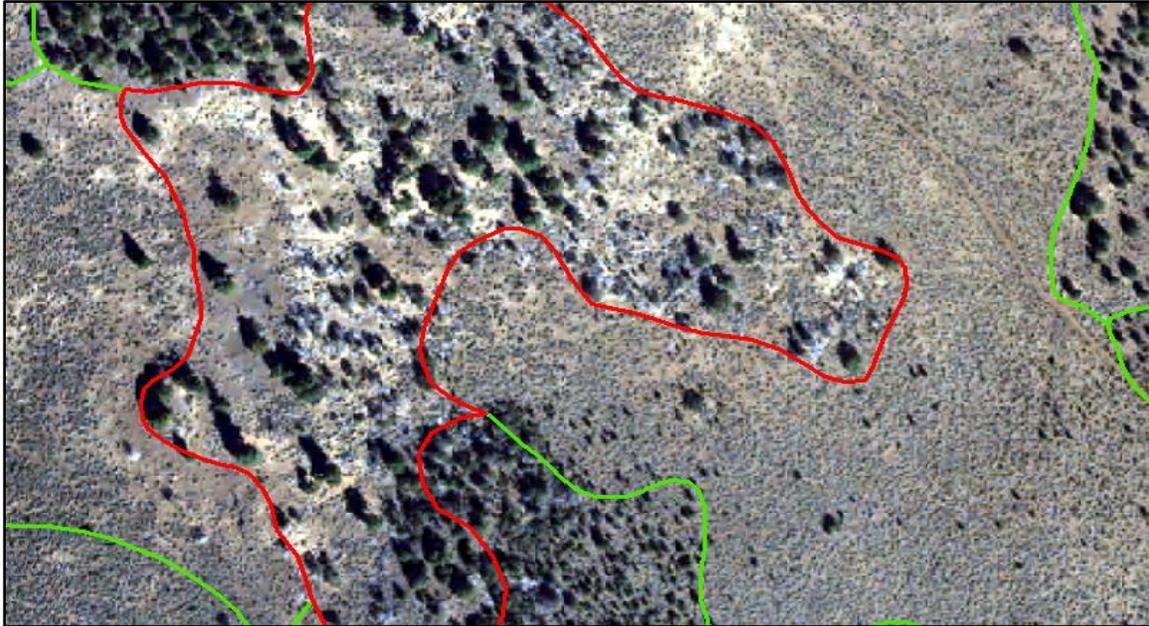


DISTRIBUTION: *Juniperus occidentalis* is infrequently mapped to the Alliance level. Three polygons, were mapped, one north of Branham Reservoir, one just northeast of Horse Lake, and another next to Shoals Creek.



***Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (16117)**

Western juniper – (Jeffrey pine – Western yellow pine) / Curl-leaf mountain mahogany Association



This stand consists of very old *Juniperus occidentalis* with some *Pinus jeffreyi* over an understory dominated by *Artemisia tridentata* ssp. *vaseyana*.



The photo shows both *Juniperus occidentalis* and *Pinus jeffreyi* in an open setting with an understory of *Artemisia*.

***Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (16117)**

DESCRIPTION: *Juniperus occidentalis* is dominant with sub-dominant *Pinus jeffreyi* and/or *Pinus ponderosa* or has a shrub understory that is indicative of higher elevations. Pines may have as little as 1% cover or occasionally may not be present. Shrub understory is variable. When pines are present, the understory can be dominated by *Artemisia tridentata* and *Purshia tridentata* with some *Cercocarpus ledifolius* and/or may include other higher elevation shrub species. When pines are not present, higher elevation shrub species such as *Cercocarpus ledifolius*, *Ribes* spp., *Artemisia tridentata* ssp. *vaseyana*, and *Symphoricarpos* spp. are present in the understory, which differentiate this type from *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association. If pines are strongly dominant (greater than 60% relative cover in the tree layer) then the stand is considered the *Pinus ponderosa* / Shrub Understory Alliance.

Two phases of this Association have been mapped in the study area. One is characterized more by the understory cover of *Cercocarpus ledifolius* and the other has a variable cover of emergent *Pinus* spp. The former phase is mapped in rockier settings; both phases generally occur in slightly higher elevations than pure juniper woodlands.

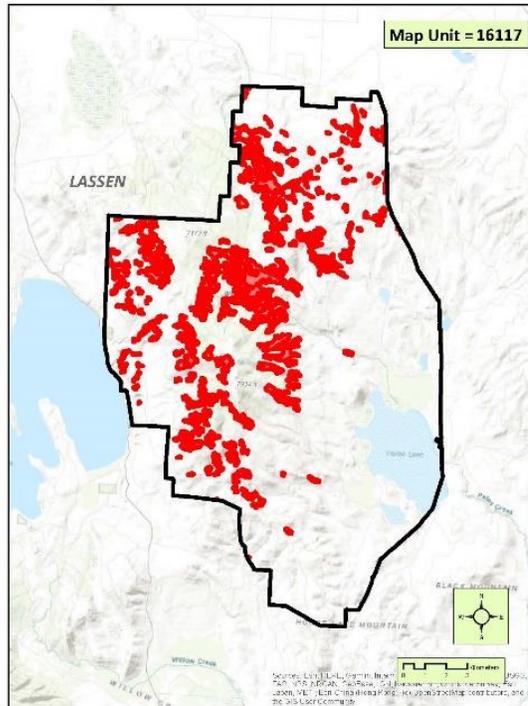
PHOTOINTERPRETATION SIGNATURE: *Juniperus occidentalis* woodlands have signatures that are highly variable depending on stand age and disturbance history. Junipers can appear similar to other conifers. Juniper crowns are more variable in shape than pine or fir, are irregular and open, but tend to have a similar color as *Pinus ponderosa*. In addition, juniper branching narrows from lower to higher up the main stem of the crown, forming a conical shape.

The *Pinus jeffreyi* component is easily recognizable when dominated by large individuals which are often significantly taller than adjacent junipers. Individual pines create shadows that depict extended branching off the main stem well into mid-section of the trees.

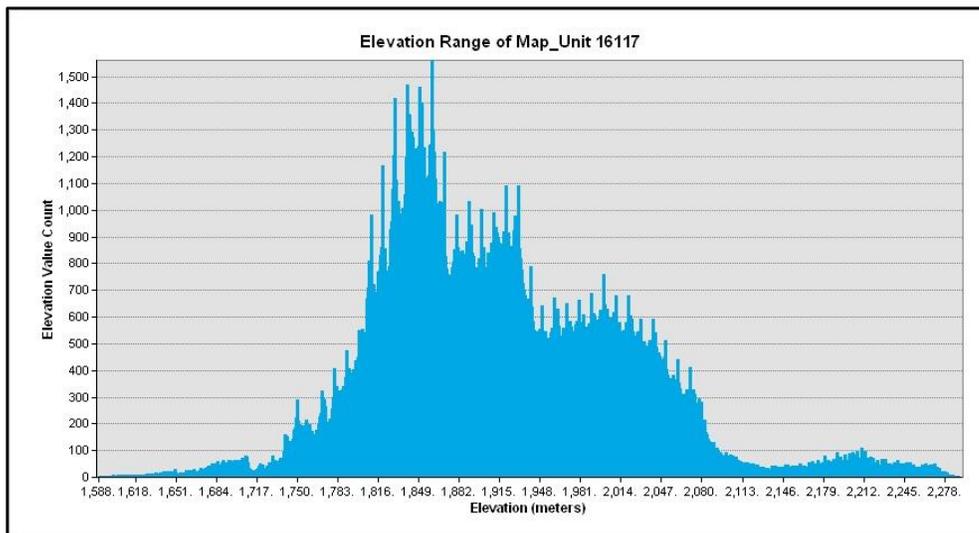
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pinus ponderosa* / Shrub Understory Alliance (14112) – Pines are consistent throughout the stand and are not noticeable as an emergent tree over the much shorter junipers.

***Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (16117)**



DISTRIBUTION: This Association occurs frequently throughout the northeastern two thirds of the study area, as a wide swath running north to south ranging from 5400 feet to 7400 feet on moderately steep slopes on both sides of Fredonyer Peak, and northward toward the Madeline Plains.



***Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association (16118)**
Western juniper / Low sagebrush / Pine bluegrass Association



This image depicts low growing *Juniperus occidentalis* over a sparse understory of *Artemisia arbuscula* and *Poa* spp.



Stand edge showing *Juniperus occidentalis*, with a small *Pinus jeffreyi* tree at the left. Native herbaceous is the primary understory with sparse *Artemisia arbuscula* over a cobbly substrate.

***Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association (16118)**

DESCRIPTION: *Juniperus occidentalis* is the sole or dominant tree. *Artemisia arbuscula* is strongly dominant to co-dominant in the shrub layer with *Purshia tridentata* and *Eriogonum* spp. Rarely, *A. arbuscula* is absent (usually disturbance-related), but associated herbs will still be present. Native grasses are common and diverse, including *Poa secunda*, *Festuca idahoensis*, *Pseudoroegneria spicata*, *Achnatherum thurberianum*, and *Danthonia unispicata*. Other herbs may include *Blepharipappus scaber*, *Epilobium brachycarpum*, and *Lomatium* spp. Stands are rocky with typically greater than 30% cover of surficial rocks (cobble-bedrock).

Stands are mapped where *A. arbuscula* varies in cover from sparse and inconsistent to moderately dense, occasionally over 20%, with an overstory of *Juniperus occidentalis* ranging from as little as 3-5% to at times over 20%.

PHOTOINTERPRETATION SIGNATURE: *Juniperus occidentalis* woodlands have signatures that are highly variable depending on stand age and disturbance history. Junipers can appear similar to other conifers. Juniper crowns are more variable in shape than pine or fir, are irregular and open, but tend to have a similar color as *Pinus ponderosa*. In addition, juniper branching narrows from lower to higher up the main stem of the crown, forming a conical shape.

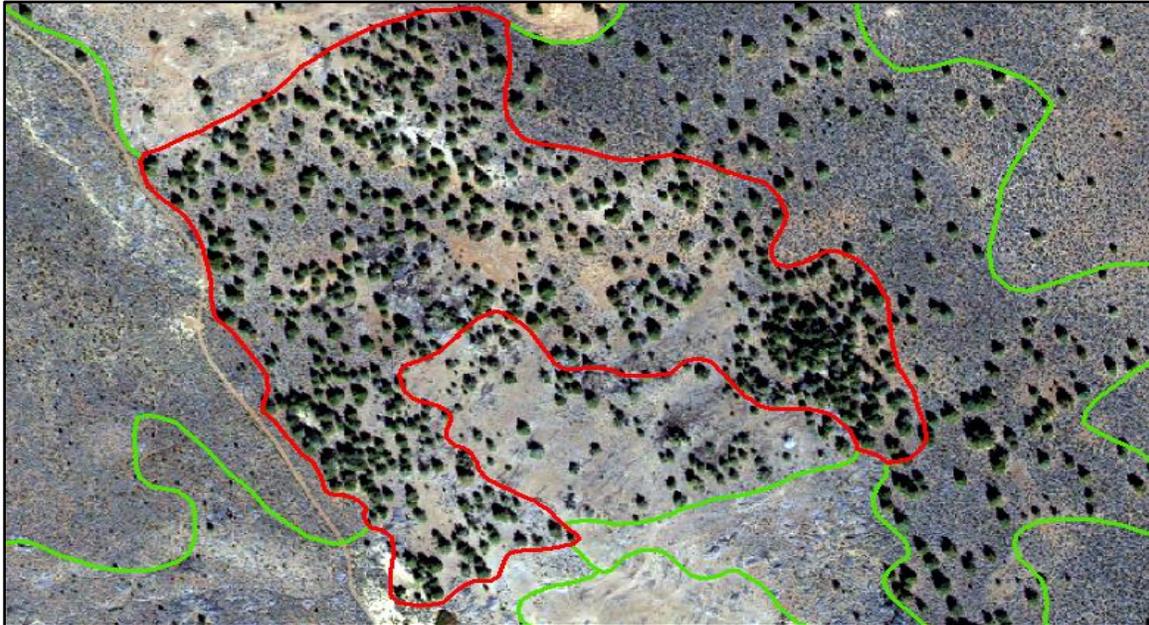
Juniperus occidentalis in this Association are generally smaller in size than in other Associations found in less harsh environments. As with other juniper Associations, tree cover varies considerably. Most noteworthy in this Association is the distinct substrate which yields a light brown to gray color with interspersed cobbling throughout. *A. arbuscula* can be detected if shrub cover averages over 7-10% cover as small medium to dark gray shrubs.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (16119): Stands of both types adjacent or near the margins of each other are not often distinct in either substrate or shrub characteristics. Gradients often occur over broad stretches of landscape. In these situations, mappers have included most of the gradient into the *Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association stand.
- *Juniperus occidentalis* / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Association (16115): Disturbance-modified stands containing *A. arbuscula* with low cover are similar to this Association. Substrate characteristics are generally more like the *A. arbuscula* type with a higher herbaceous component. Shrub cover in both Associations in these settings are generally low.

***Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association
(16119)**

Western juniper / Big sagebrush – Antelope bitterbrush Association



The imagery depicts a fairly dense stand of *Juniperus occidentalis* over a patchy inconsistent understory of *Artemisia tridentata* and *Purshia tridentata*.



This photo shows short stature *Juniperus occidentalis* over a fairly dense understory of *A. tridentata* and *P. tridentata* with a gravelly substrate.

***Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (16119)**

DESCRIPTION: *Juniperus occidentalis* is the sole or dominant tree. Pines are typically absent, and stands are at lower elevations compared to *Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association. *Artemisia tridentata* is present with at least 1% cover but typically dominates or co-dominates the shrub layer. *Purshia tridentata* usually present with *A. tridentata* and may dominate. However, *A. tridentata* is commonly the dominant shrub. *Cercocarpus ledifolius* and *Prunus* spp. are typically absent.

Juniperus occidentalis / *Artemisia tridentata* – *Purshia tridentata* stands are what is commonly thought of when one envisions a juniper-sagebrush woodland in the Great Basin and adjacent ecoregions. This is by far the most frequently mapped tree-dominated type in the study area. It is mapped in a variety of settings, generally on steeper topography than most juniper Associations overall. Stands vary considerably in tree cover but normally average lower than those having a pine component. Understory shrub cover is also highly variable but averages more than the Association dominated by *A. arbuscula* and less than stands dominated by *Cercocarpus ledifolius*.

PHOTOINTERPRETATION SIGNATURE: *Juniperus occidentalis* woodlands have signatures that are highly variable depending on stand age and disturbance history. In this study, *Juniperus occidentalis* has an irregular somewhat diffuse crown trending medium to light green. In addition, juniper branching narrows from lower to higher up the main stem of the crown, forming a conical shape. Understory shrubs are more often dominated by *A. tridentata* yielding a blue-gray signature. Uncommonly occurring stands dominated with the understory shrub *P. tridentata* have a dark green signature.

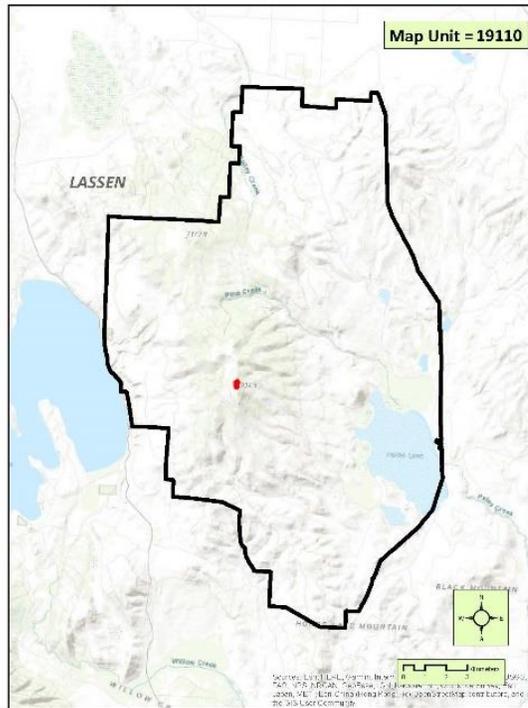
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juniperus occidentalis* / *Artemisia arbuscula* / *Poa secunda* Association (16118): Most stands dominated by the smaller-sized *A. arbuscula* have a lower tree and shrub cover and can be recognized by the substrate characteristics described for that type. However, ground disturbance modifications including juniper removal efforts make it difficult to separate out based on substrate characteristics.
- *Juniperus occidentalis* / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Association (16115): Disturbed grassy stands barely meeting the threshold of a minimum cover of shrubs as defined for this type (see description for this type above) are indistinguishable at the Association level.

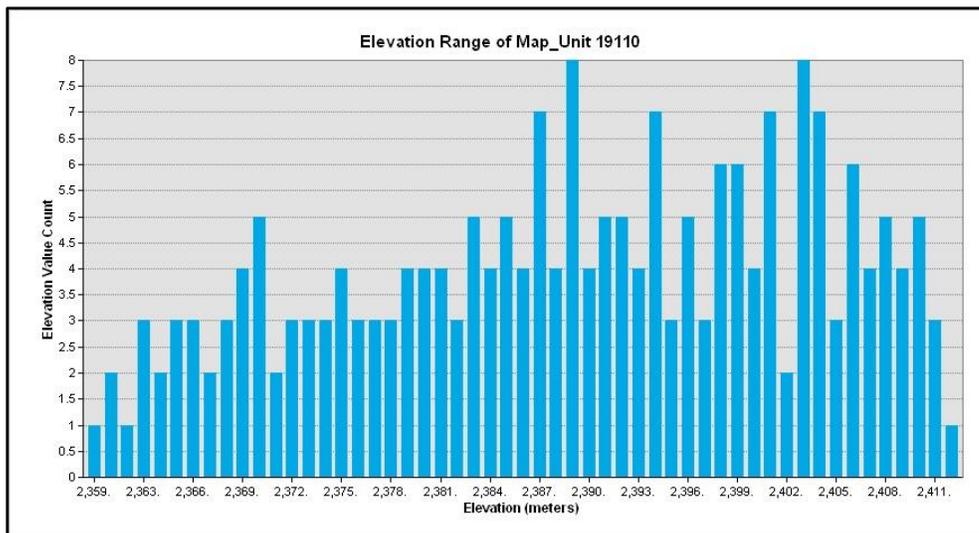
***Pinus contorta* ssp. *murrayana* Alliance (19110)**

Lodgepole Pine Alliance

DESCRIPTION: *Pinus contorta* ssp. *murrayana* is dominant to co-dominant in the tree canopy with *Abies* spp., *Pinus jeffreyi* and *Pinus monticola*. Stands occur at upper montane to subalpine elevations where cold-dry conditions exist.



DISTRIBUTION: This Alliance is mapped only on the upper north slope below the summit of Fredonyer Peak above 7900 feet. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project due to a very limited presence at sizes above MMU in the study area.



***Pinus ponderosa* / Shrub Understory Alliance (14120)**
Yellow pine / Shrub understory woodland Alliance



Imagery depicts *Pinus* spp. in a post juniper removal effort.



This photo shows a stand of *Pinus ponderosa* with historical logging.

Pinus ponderosa / Shrub Understory Alliance (14120)

DESCRIPTION: *Pinus ponderosa* and/or *Pinus jeffreyi* are dominant to co-dominant in the overstory. *Pinus ponderosa* var. *washoensis* may be the dominant variety. *Juniperus occidentalis* may be present to co-dominant. *Calocedrus decurrens* is absent. The shrub layer will vary depending on the Association.

This type is usually mapped to the Association level and typically is not mapped at the more generalized level across the study area.

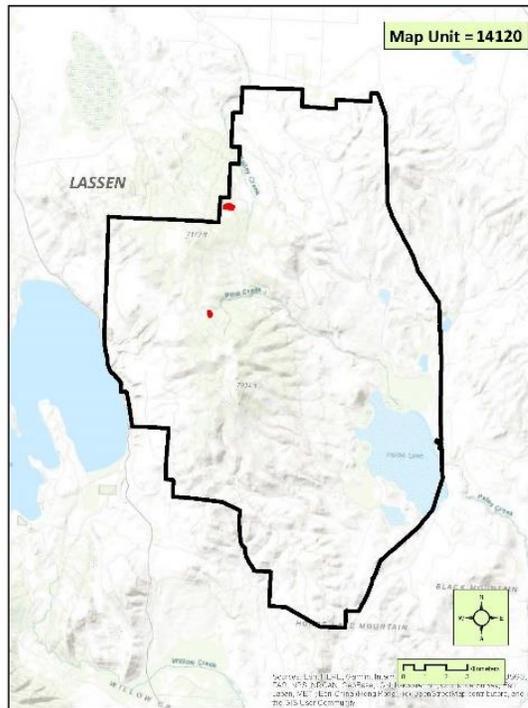
PHOTOINTERPRETATION SIGNATURE: Stands are dominated by *Pinus ponderosa* or *P. jeffreyi*, both of which have a medium to large, rounded dense crown with branching extending broadly to the mid crown.

Juniperus occidentalis can appear similar to other conifers. Juniper crowns are more variable in shape than pine or fir, are irregular and open, but tend to have a similar color as *Pinus ponderosa*. In addition, juniper branching narrows from lower to higher up the main stem of the crown, forming a conical shape.

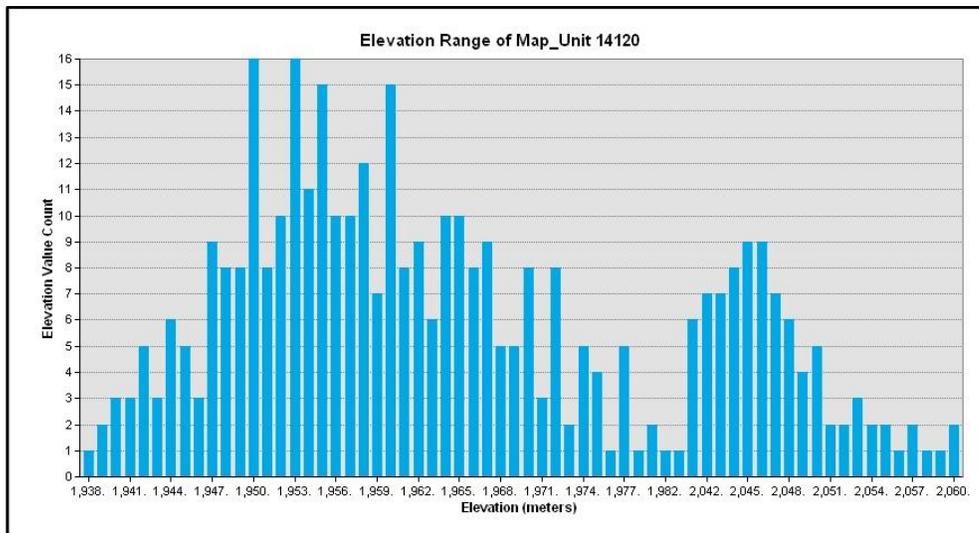
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- None

Pinus ponderosa / Shrub Understory Alliance (14120)



DISTRIBUTION: *Pinus ponderosa* is mapped at the Alliance level only as two polygons, on a mid slope north of Fredonyer Peak, and mid slope northwest of Cleghorn Flat.



***Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111)**

Western yellow pine – Western juniper / Big sagebrush – Antelope bitterbrush Association



This aerial view depicts an open stand of yellow pine (*P. jeffreyi* or *P. ponderosa*) with some *Juniperus occidentalis* over a dense understory of *Artemisia tridentata*.



This stand is composed of *Pinus ponderosa* and *Juniperus occidentalis* with an understory of *Artemisia tridentata*.

***Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111)**

DESCRIPTION: *Pinus ponderosa* and/or *Pinus jeffreyi* is dominant to co-dominant in the overstory. *Juniperus occidentalis* is typically present to co-dominant with *Pinus ponderosa*, and lower elevation shrub species such as *Purshia tridentata*, *Artemisia tridentata*, and *Cercocarpus ledifolius* dominate the shrub layer. *Arctostaphylos patula* is typically absent or insignificant.

Mapped stands are dominated by *Pinus ponderosa* or *P. jeffreyi* in this conifer woodland in an open setting usually with a small component of *Juniperus occidentalis*. *Artemisia tridentata* dominates the understory in canopy openings. This type is rarely mapped, because in most lower-elevation open woodlands, where this type is found, *Juniperus occidentalis* dominates the tree canopy.

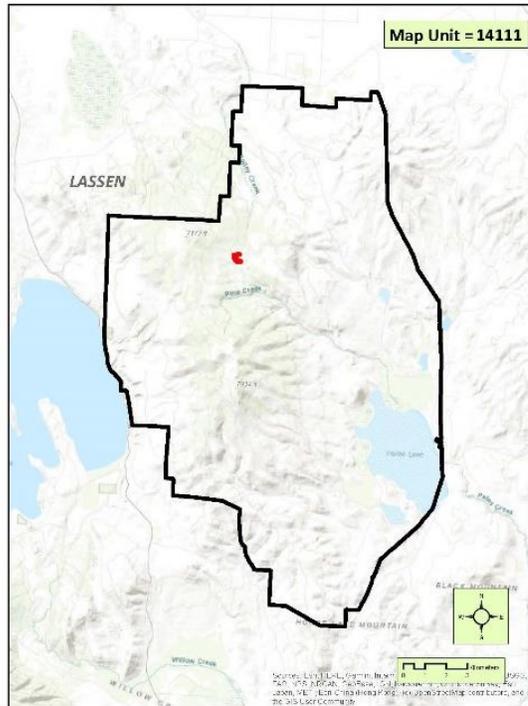
PHOTOINTERPRETATION SIGNATURE: Stands are dominated by *Pinus ponderosa* or *P. jeffreyi*, both of which have a medium to large, rounded dense crown with branching extending broadly to the mid crown. Understory shrubs dominated by *Artemisia tridentata* occur frequently in canopy openings throughout the stand, generally in dense cover. In most settings, the shrub understory yields a light blue-gray to gray color depending on the leaf vigor of the shrub layer.

Juniperus occidentalis can appear similar to other conifers. Juniper crowns are more variable in shape than pine or fir, are irregular and open, but tend to have a similar color as *Pinus ponderosa*. In addition, juniper branching narrows from lower to higher up the main stem of the crown, forming a conical shape.

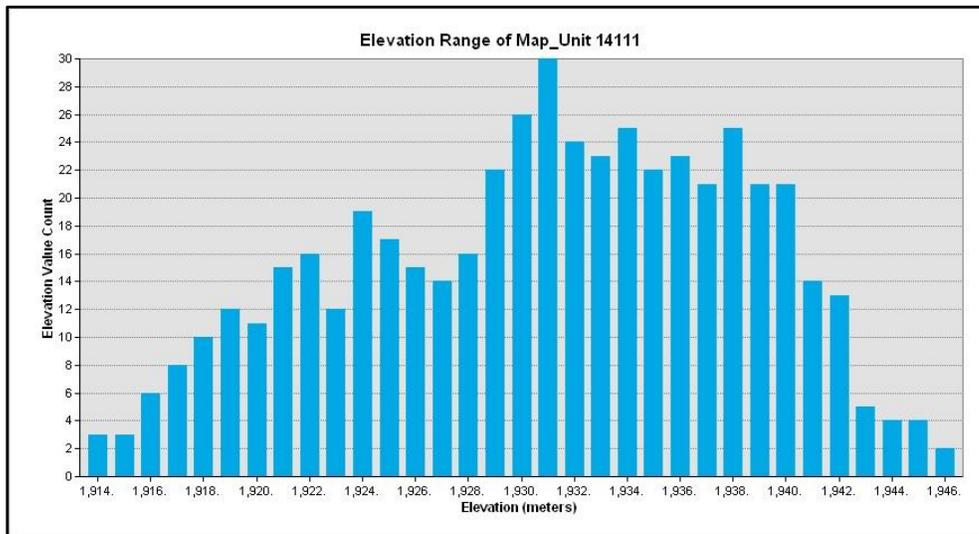
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata)* Association (14112): Stands in this type are also dominated by *P. ponderosa* or *P. jeffreyi* but occur in dense woodland and forest settings with minimal crown openings. Understory shrubs when visible are not dominated by *A. tridentata*.
- *Pinus jeffreyi / Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (15124): In this Association, *Pinus jeffreyi* is the dominant conifer in generally open settings, usually with a moderately dense shrub layer of high elevation sagebrush dominated by *Artemisia tridentata* ssp. *vaseyana*. In this Association, the *Artemisia* cover is even higher overall than that of the *Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association. The two types are nearly inseparable both in setting and signature. Higher elevation is a key modeling indicator.
- *Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (16117): Conifer cover is similar, but in this type, the juniper dominates the tree overstory. *A. tridentata* generally has lower cover. If there is a significant understory of *Cercocarpus ledifolius* in the shrub layer, it should be mapped to this type.

***Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111)**



DISTRIBUTION: Only one polygon of this Association is mapped, on a mid slope north of upper Pine Creek.



Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata)
Association (14112)

Yellow pine / Mahala mat – Antelope bitterbrush Association



This image depicts *Pinus jeffreyi* or *P. ponderosa* in a dense woodland setting.



This photo captures the understory forb and herbaceous layer beneath the yellow pine canopy.

***Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata)*
Association (14112)**

DESCRIPTION: *Pinus ponderosa* and/or *Pinus jeffreyi* is dominant to co-dominant in the overstory. *Juniperus occidentalis* is often sub-dominant with *Pinus ponderosa* and/or *Pinus jeffreyi*. The shrub layer is sparse to moderately dense with a variety of higher elevation, cold-tolerant shrubs present including *Amelanchier utahensis*, *Cercocarpus ledifolius*, *Ceanothus prostratus*, *Prunus virginiana*, and *Symphoricarpos* spp. *Artemisia tridentata* is typically absent or only a small component of the shrub layer.

This Association is mapped where yellow pine (*Pinus ponderosa* and/or *P. jeffreyi*) occurs in dense woodland and forest settings with a shrub understory that is at times obscured by the conifer cover. Stands are mapped where *Artemisia tridentata* is not detected in the stand. For the most part, the mesic shrub understory is at best only partially visible in openings in the forest. With the exception of the white fir forests (*Abies concolor*), this is usually the densest conifer type in the study area.

PHOTOINTERPRETATION SIGNATURE: *Pinus ponderosa* has a rounded crown that is generally medium to dark green in this dense woodland setting. In dense settings, mid-crown branching is not as robust, but stands appear less conical than in forests dominated by *Abies concolor*. The conifer cover in most settings prevents any meaningful evaluation of shrub composition or dominance.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111): This type is similar in that it is dominated by *Pinus* spp., however the cover is significantly lower with openings of *Artemisia tridentata* frequently occurring throughout the stand.
- *Abies concolor* – *Pinus ponderosa* / *Amelanchier alnifolia* Association (11111): Fir-dominated stands are mapped at higher elevations and the conifer cover is usually a little higher. Firs tend to be more conical with mid-level branching extending out not quite as far as typically found in yellow pines.

***Pinus ponderosa* / *Arctostaphylos patula* – *Purshia tridentata* Association (15123)**
Western yellow pine / Greenleaf manzanita – Antelope bitterbrush Association



The imagery depicts an open, young stand of yellow pine at the 6400-foot level over a dense understory of montane chaparral dominated by *Arctostaphylos patula*.

There are no ground photos for this Association.

***Pinus ponderosa* / *Arctostaphylos patula* – *Purshia tridentata* Association (15123)**

DESCRIPTION: *Pinus ponderosa* is dominant in the overstory, while *Juniperus occidentalis* may be present to co-dominant. *Artemisia tridentata* is absent or insignificant in the understory, and *Purshia tridentata*, *Ceanothus prostratus*, and *Arctostaphylos patula* dominate the shrub layer. Stands occur at higher elevations in the western portions of the region (Warner Mountains.), where winter precipitation is relatively greater and persistent snow is more frequent.

This Association is mapped in open woodland settings, generally where *Pinus jeffreyi* or *P. ponderosa* occurs under 20% cover. Dense, patchy openings of *Arctostaphylos patula* are characteristic and dominate the shrub layer. Shrub cover is often over 60%. Stands are mapped at higher elevations, generally over 6300 feet.

PHOTOINTERPRETATION SIGNATURE: Individual *Pinus ponderosa* or *P. jeffreyi* trees in this setting are often quite large with broad mid-crown branching. The *Arctostaphylos*-dominated understory is patchy and dense where it occurs, yielding a bright medium green signature with well-defined clonal shaped edges. Higher elevation occurrences may indicate *Pinus jeffreyi*.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Stands dominated by yellow pine with other chaparral dominant species such as *Ceanothus velutinus* may occur in the study, however none were identified during any of the reconnaissance efforts.

***Pinus jeffreyi* / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis*
Association (15124)**

Jeffrey pine /Mountain big sagebrush / Idaho fescue Association



This image depicts an open stand of *Pinus jeffreyi* over dense *Artemisia tridentata* ssp. *vaseyana* at the 6400' level north of Pine Creek.



This photo shows an open stand of *Pinus jeffreyi* with an understory of *Artemisia tridentata* ssp. *vaseyana*.

***Pinus jeffreyi* / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis*
Association (15124)**

DESCRIPTION: *Pinus jeffreyi* is dominant in the overstory while *Juniperus occidentalis* may just be present. Though there may be high shrub diversity, *Artemisia tridentata* ssp. *vaseyana* is the dominant shrub. *Festuca idahoensis* is characteristically present and typically the dominant herb.

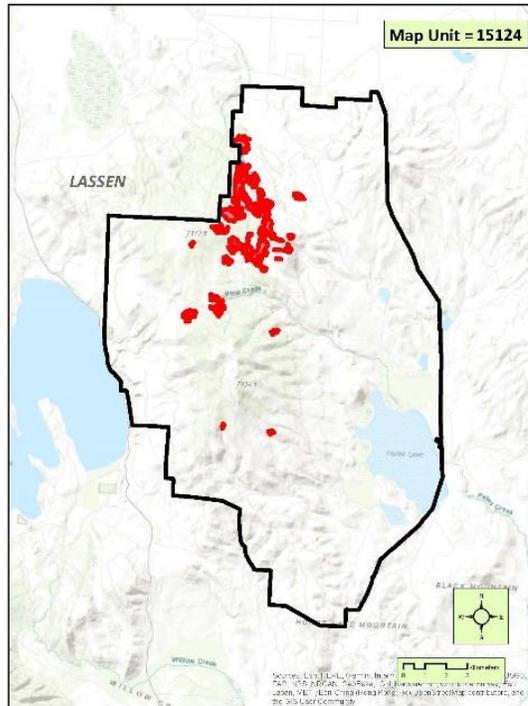
This type is mapped in open pine-dominated stands with a dense sagebrush understory, generally in high elevations. In the area near Fredonyer Peak, they often occur adjacent to *Abies concolor* forests.

PHOTOINTERPRETATION SIGNATURE: *Pinus jeffreyi* has a large crown with extensive branching at the mid crown level. The understory sagebrush is consistent throughout the stand and tends not to be patchy.

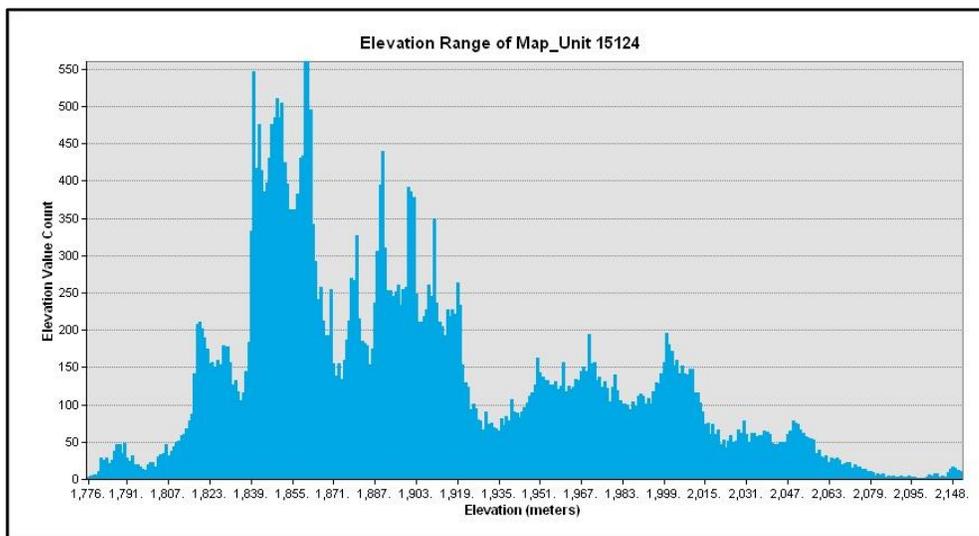
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pinus ponderosa* – *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association (14111): This association is extremely similar in signature in that both stands occur as open woodlands with a sagebrush understory. This type is mapped at lower elevations where *Artemisia tridentata* ssp. *tridentata* was identified in the understory. *Juniperus occidentalis* is a component to this Association but is generally not identifiable on imagery. It is infrequently mapped in the study area.

***Pinus jeffreyi* / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (15124)**



DISTRIBUTION: This Association is mapped primarily in the upper watersheds of Pine Creek and Bailey Creek, around Cleghorn Flat, and on two sites south of Fredonyer Peak.



***Populus tremuloides* Alliance (12110)**

Aspen groves Alliance



The image depicts a small stand of mixed *Populus tremuloides*, *Salix* spp., and *Betula occidentalis* along Barber Creek



The ground photo depicts mixed riparian setting with *Populus tremuloides* co-dominating the stand.

***Populus tremuloides* Alliance (12110)**

DESCRIPTION: *Populus tremuloides* is dominant to co-dominant in the tree layer (note: stands may be short, resprouting, shrubby “trees”). If co-dominating with *Populus trichocarpa*, then the stand is considered as the *Populus trichocarpa* Alliance.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

PHOTOINTERPRETATION SIGNATURE: *Populus tremuloides* has a highly variable signature depending on stature, overall health, and cover density of the stand. They share the common characteristics of a cold-season deciduous hardwood in that their overall color is more subdued, in this case a light to medium green. Nearly all stands have a die-back component either from past drought or fire disturbances. Stands on slopes where water seeps from the ground often are adjacent to *Artemisia* shrublands.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Populus trichocarpa* Alliance (13110): Because both types occur in similar riparian settings they are difficult to differentiate from each other in those settings. However, *P. tremuloides* is more indicative in upland mesic settings where moisture may seep out from sideslopes,

***Populus tremuloides* / *Symphoricarpos rotundifolius* Association (12111)**
Quaking aspen / Mountain snowberry Association



In this aerial view, *Populus tremuloides* dominates the small riparian channel at the 6000' level just below Cottonwood Springs.



A young stand of *Populus tremuloides* is depicted with some dying snags in the foreground.

***Populus tremuloides* / *Symphoricarpos rotundifolius* Association (12111)**

DESCRIPTION: *Populus tremuloides* is dominant to co-dominant in the tree layer (note: stands may be short, resprouting, shrubby “trees”). *Symphoricarpos rotundifolius* and/or other mesic shrubs are characteristic in the shrub layer. Stands are usually in concavities or on steep sheltered and rocky slopes

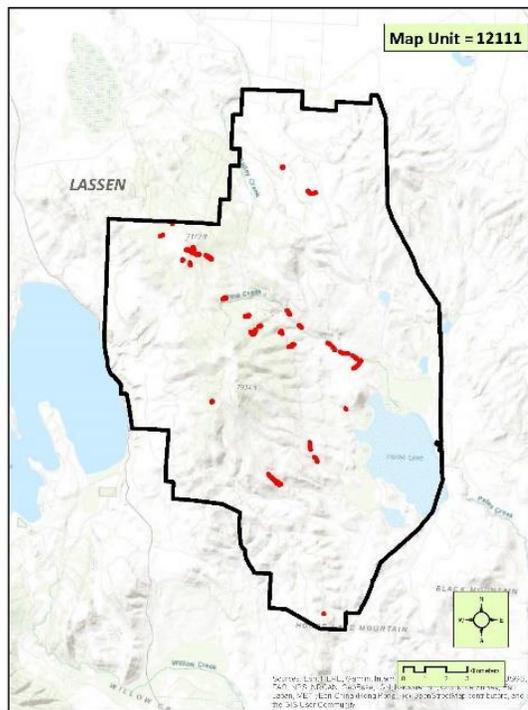
This Association is mapped in a variety of settings, including in riparian conditions, and on seeps adjacent to talus and other rocky slopes. Stands in riparian settings often are dominated by fairly tall trees while those along seeps are often shrubby.

PHOTOINTERPRETATION SIGNATURE: *Populus tremuloides* has a highly variable signature depending on stature, overall health, and cover density of the stand. They share the common characteristics of a cold-season deciduous hardwood in that their overall color is more subdued, in this case a light to medium green. Nearly all stands have a die-back component either from past drought or fire disturbances. Stands on slopes where water seeps from the ground often are adjacent to *Artemisia* shrublands.

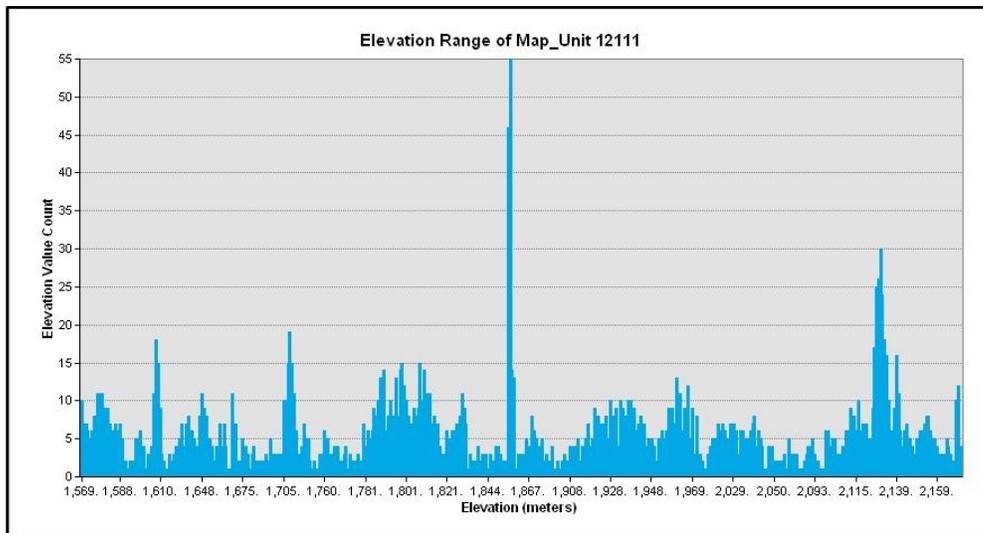
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Prunus emarginata* Association (31121): Vegetation dominated by this montane cold season deciduous chaparral can look like shrubby aspen, especially since the two species can co-occur in close proximity to one another. There is generally less dieback and the overall signature is a darker green.

***Populus tremuloides* / *Symphoricarpos rotundifolius* Association (12111)**



DISTRIBUTION: Small stands are mapped primarily below Fredonyer Peak ridge along upper Pine Creek and adjacent tributaries to the west.



APPENDIX B-2: Shrubs

- Arctostaphylos patula* - *Arctostaphylos nevadensis* Alliance (31130)
 - Arctostaphylos patula* Association (31131)
 - Arctostaphylos patula* – *Ceanothus velutinus* Association (31132)
- Artemisia arbuscula* Alliance (22210)
 - Artemisia arbuscula* / *Poa secunda* Association (22211)
 - Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association (22213)
 - Artemisia arbuscula* – *Eriogonum (microthecum, sphaerocephalum)* Association (22214)
- Artemisia cana* Alliance (41110)
 - Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda* Association (41111)
- Artemisia tridentata* Alliance (22310)
 - Artemisia tridentata* / *Distichlis spicata* Provisional Association (22311)
 - Artemisia tridentata* Association (22313)
 - Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317)
- Artemisia tridentata* ssp. *vaseyana* Alliance (22320)
 - Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association (22321)
 - Symphoricarpos oreophilus* Association (22322)
 - Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (22323)
- Ceanothus velutinus* Alliance (31110)
 - Ceanothus velutinus* Association (31111)
- Cercocarpus ledifolius* Alliance (16210)
 - Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association (16211)
 - Cercocarpus ledifolius* Association (16212)
- Chrysothamnus viscidiflorus* Alliance (24110)
 - Chrysothamnus viscidiflorus* Association (24111)
- Cornus sericea* – *Rosa woodsii* – *Ribes* spp. Alliance (43130)
 - Rosa woodsii* Association (43132)
- Ericameria nauseosa* Alliance (22110) none
 - Ericameria nauseosa* Association (22111)
 - Ericameria nauseosa* / *Bromus tectorum* Association (22112)
- Eriogonum* spp. / *Poa secunda* Alliance (22230) none
 - Eriogonum sphaerocephalum* / *Poa secunda* Association (22231)
- Prunus emarginata* – *Holodiscus discolor* Alliance (31120)
 - Prunus emarginata* Association (31121)
 - Holodiscus discolor* Association (31122)
 - Ribes velutinum* Provisional Association (31123)
- Prunus virginiana* Alliance (41130)
 - Prunus virginiana* / *Symphoricarpos rotundifolius* Shrubland Association (41131)
- Purshia tridentata* - *Artemisia tridentata* Alliance (22330)
 - Purshia tridentata* – *Artemisia tridentata* Association (22335)
- Salix boothii* – *Salix geyeriana* – *Salix lutea* Alliance (43120)
 - Salix lucida* / *Poa pratensis* Association (43121)

Salix exigua Alliance (41120) App(41121)

***Arctostaphylos patula* – *Arctostaphylos nevadensis* Alliance (31130)**

Greenleaf manzanita – Pinemat manzanita chaparral Alliance

DESCRIPTION: *Arctostaphylos patula* is strongly dominant to co-dominant in the shrub layer with *Ceanothus velutinus*, *Cercocarpus ledifolius*, and/or *Artemisia tridentata* ssp. *vaseyana*.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Arctostaphylos patula* Association (31131)**
Greenleaf manzanita Association



The aerial view shows a dense stand of *Arctostaphylos patula* with emergent *Pinus jeffreyi*.



The ground view shows the shiny green foliage of *A. patula* in a dense cover setting greater than 60%

***Arctostaphylos patula* Association (31131)**

DESCRIPTION: *Arctostaphylos patula* is strongly dominant in the shrub layer, though many other shrub species may be present at low cover including *Cercocarpus ledifolius*, *Purshia tridentata*, and/or *Ceanothus velutinus*. Herb layer is usually sparse and may include *Poa secunda*, *Achillea millefolium* or *Castilleja applegatei*.

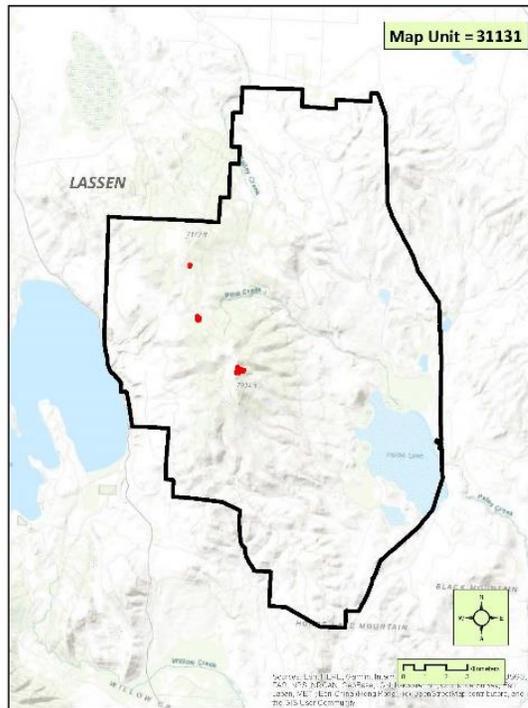
Mapped stands tend to have patchy shrub cover, but within the patches, cover is extremely high, often over 70%. Stands are often dotted with widely scattered emergent pine or fir, usually under 3% cover.

PHOTOINTERPRETATION SIGNATURE: *Arctostaphylos patula* has a bright medium green color. Although common in other *Arctostaphylos* species in drier settings, there is almost no affect from the reddish color to the stems due to the high leaf cover. Pure stands yield a smooth texture; stands with a component of other montane chaparral species such as *Ceanothus velutinus* will interrupt the smoothness of the texture slightly. Stands where *Prunus spp.* and/or young sapling trees share dominance will yield a more complex and variable texture.

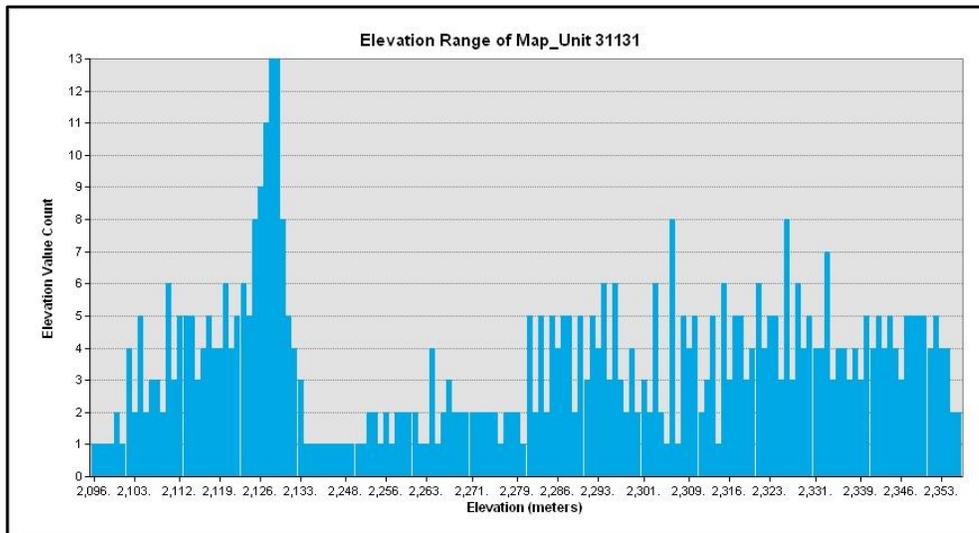
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Arctostaphylos patula* – *Ceanothus velutinus* Association (31132): Stands where these two species co-dominate are significantly more common, occurring at somewhat lower elevations. *Ceanothus velutinus* has a somewhat darker green color, however, overlap is significant, and color distinction alone is an unreliable indicator. In general, determining relative cover of *A. patula* and *C. velutinus* in a stand is difficult if not impossible in most circumstances.

Arctostaphylos patula Association (31131)



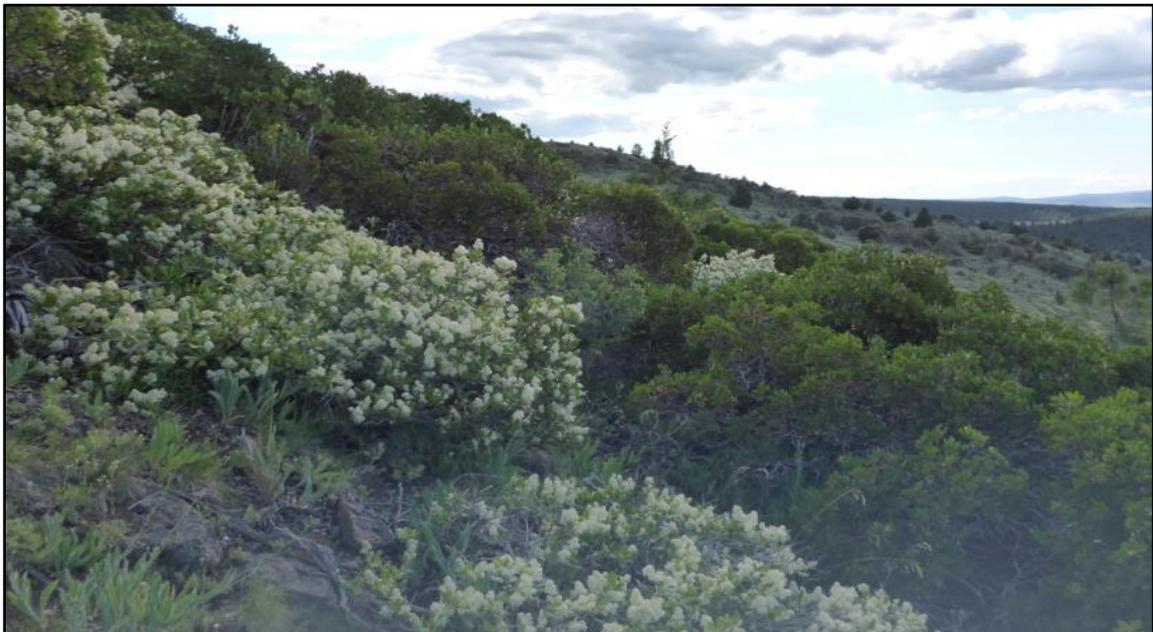
DISTRIBUTION: Stands dominated by *Arctostaphylos patula* are mapped infrequently. Three polygons are mapped, primarily along the Fredonyer Peak ridgeline at elevations slightly over 7000 feet.



***Arctostaphylos patula* – *Ceanothus velutinus* Association (31132)**
Greenleaf manzanita – Tobacco brush Association



The aerial view shows an open stand of *Arctostaphylos patula* and *Ceanothus velutinus*. Both species of montane chaparral have a similar signature. *Artemisia tridentata* ssp. *vaseyana* surrounds the stand.



The photo shows both *Ceanothus velutinus* (in flower) and *Arctostaphylos patula* in the background (medium green color).

***Arctostaphylos patula* – *Ceanothus velutinus* Association (31132)**

DESCRIPTION: *Arctostaphylos patula* and *Ceanothus velutinus* co-dominate in the shrub layer with *Cercocarpus ledifolius*, *Prunus emarginata*, and/or *Ceanothus prostratus*. The herb layer is sparse and variable in species composition but may include *Viola purpurea*, *Wyethia mollis*, or *Elymus elymoides*.

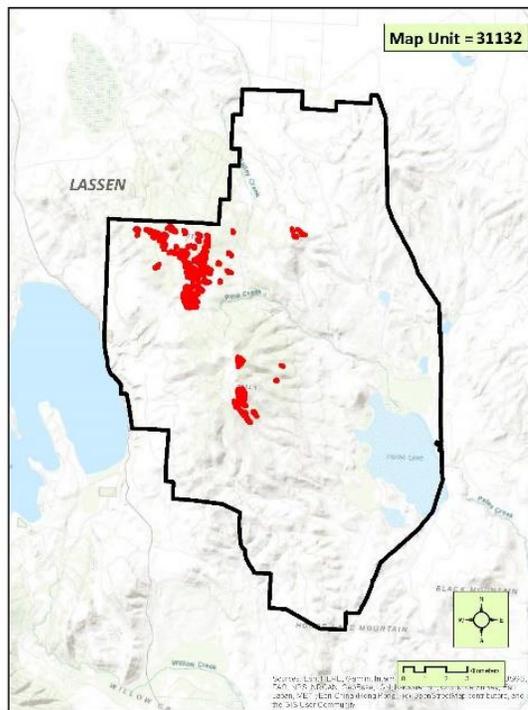
Stands are mapped to this Association when the presence of several montane chaparral species are characteristic throughout the stand. Species other than *C. velutinus* and *A. patula* are recognizable and make the co-dominance of the two montane species defining this Association more likely.

PHOTOINTERPRETATION SIGNATURE: *Arctostaphylos patula* and *Ceanothus velutinus* yield similar signatures, but the presence of other chaparral species in the shrub layer indicate a somewhat greater likelihood that the two indicator species (*C. velutinus* & *A. patula*) co-dominate. *Arctostaphylos patula* has a bright medium green color. The characteristically red stems of manzanita is not normally visible in this species due to the dense foliage in most individual plants. Pure stands yield a smooth texture; stands with a component of other montane chaparral species such as *Ceanothus velutinus* will interrupt the smoothness of the texture slightly. Stands where *Prunus spp.* and/or young sapling trees share dominance will yield a more complex and variable texture.

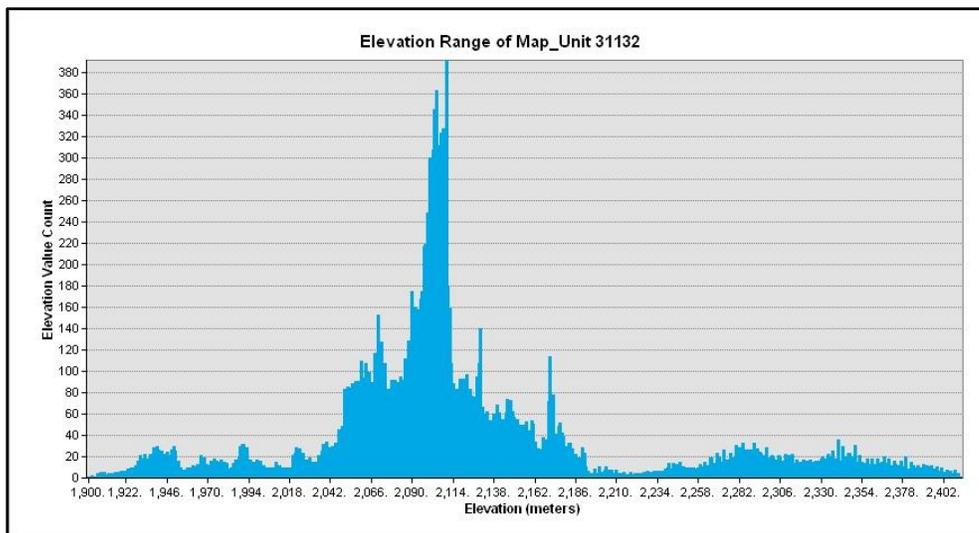
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Arctostaphylos patula* Association (31131): In most cases, the signature between the two associations is indistinguishable. There may be partial success using the presence of high elevation conifer species such as emergent *Abies concolor* to model out this type.

Arctostaphylos patula – Ceanothus velutinus Association (31132)



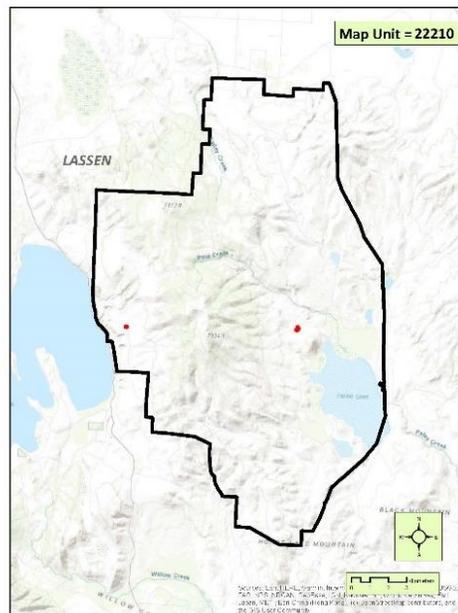
DISTRIBUTION: This Association is mapped on upper slopes below Fredonyer Peak and the continuing ridgeline to the north.



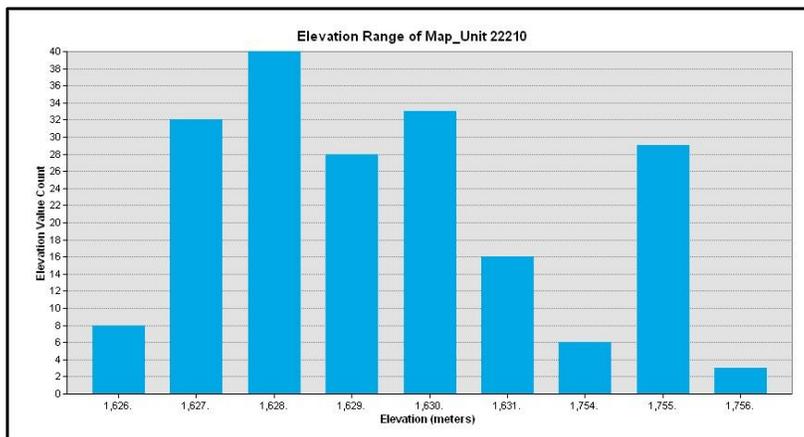
Artemisia arbuscula Alliance (22210)

Low sagebrush Alliance

DESCRIPTION: *Artemisia arbuscula* is strongly dominant to co-dominant in the shrub layer. *Purshia tridentata*, *Artemisia tridentata*, *Ericameria* spp., and *Chrysothamnus* spp. may be co-dominant to sub-dominant. *A. arbuscula* stands tend to grow on flats or gradual slopes and tolerate heavier clay soils (“pimpled plains” clay accretion mounds), or otherwise more impervious (shallow, or very rocky) soil than the various subspecies of *A. tridentata*. Stands are susceptible to type conversion. Many stands are in transition between *Artemisia arbuscula* and non-native annual grasses (*Bromus tectorum*, *Ventenata dubia*, and *Elymus caput-medusae*) or are sites of rapid and recent colonization by *Juniperus occidentalis*. *Artemisia arbuscula* ssp. *arbuscula* dominates. *Artemisia nova* is absent. This type is usually mapped to the Association level and typically is not mapped at the more generalized level across the study area.



DISTRIBUTION: Only two polygons were mapped at the Alliance level. They are located just east of Eagle Lake, and southwest of Fredonyer Reservoir.



***Artemisia arbuscula* / *Poa secunda* Association (22211)**
Low sagebrush / Pine bluegrass Association



The central portion of the aerial view shows an average cover of approximately 12% *Artemisia arbuscula* over a sparse herbaceous layer of *Poa secunda*.



The ground view shows a low cover of *A. arbuscula* increasing towards the juniper. The green herbaceous vegetation is dominated by *P. secunda*.

***Artemisia arbuscula* / *Poa secunda* Association (22211)**

DESCRIPTION: *Artemisia arbuscula* is dominant and evenly distributed in the shrub layer and is usually greater than 10% absolute cover although it may be as low as 3% absolute cover. Herb layer is sparse to moderately dense and is usually dominated by native grasses such as *Poa secunda* and *Pseudoroegneria spicata* although non-native annual grasses can exceed cover of natives. Other herbs may include *Blepharipappus scaber*, *Epilobium brachycarpum*, and *Antennaria dimorpha*. Typically found on flats or gentle slopes (0-5 degrees) with variable cover (0 to greater than 35%) of surficial rock (cobble, stone, boulder, and/or bedrock). Although not common, stands at slightly higher elevations can have a component of *Festuca idahoensis* or may locally dominate the herbaceous cover. Settings with *F. idahoensis* may also occur in cold air basins at slightly lower elevations.

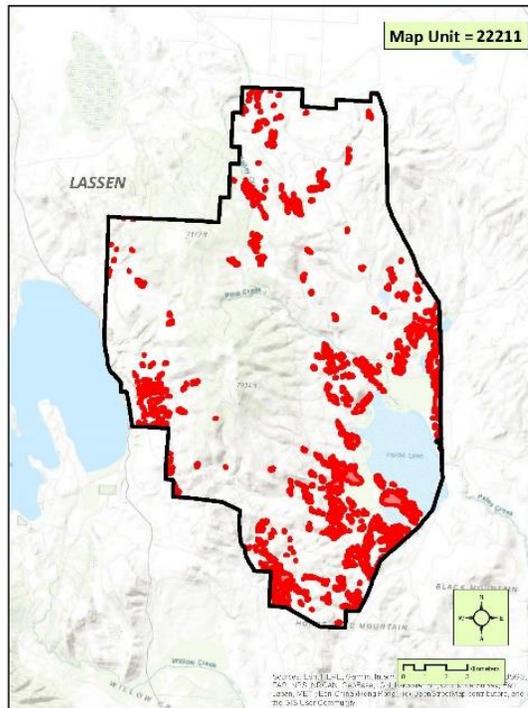
This Association is mapped where visible disturbance (especially intensive grazing and clearing) is minimal and the herbaceous layer appears not to be overwhelmed by non-native grasses. *A. arbuscula* in most stands appear most frequently to range from 7-16% cover, inconsistently distributed within the stand. Stands dominated by this species of sagebrush are only slightly less common than stands of *A. tridentata*.

PHOTOINTERPRETATION SIGNATURE: *Artemisia arbuscula* is generally a third to half the size of *A. tridentata* and occurs generally in lower cover. On medium resolution imagery (NAIP), stands where cover is greater than 5-7% it appear as darker gray fuzzy dots on a buffy tan to grayish brown substrate. In stands where herbaceous cover is higher, the substrate appears tawnier with a more straw-like colored hue.

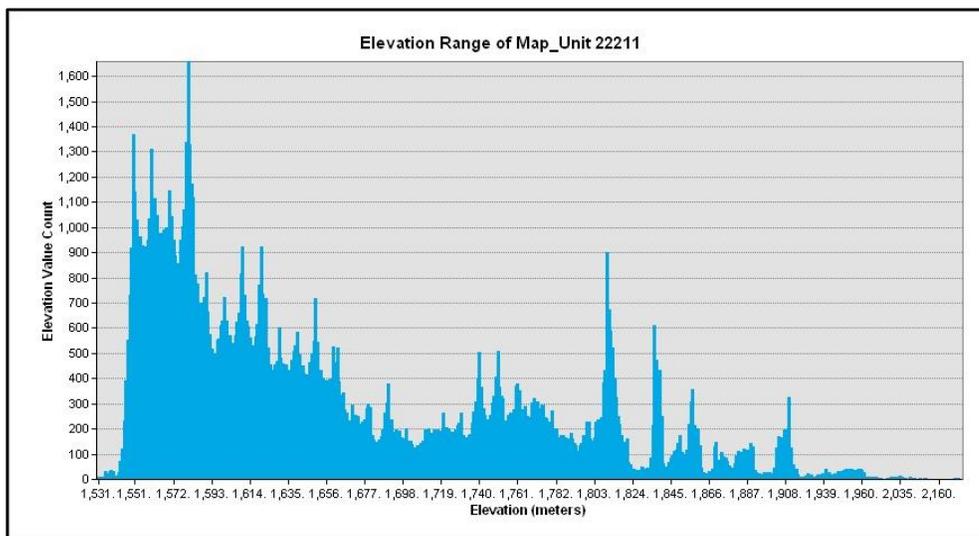
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association (22213): This type is mapped where disturbance is evident. Where disturbance has occurred more recently, the herbaceous layer appears similar in cover to less altered sites. In older disturbance settings, annual grasses give off the characteristic straw color indicative to a denser herbaceous cover. This association is difficult to separate out, therefore it is sparingly mapped where disturbance patterns appear severe.

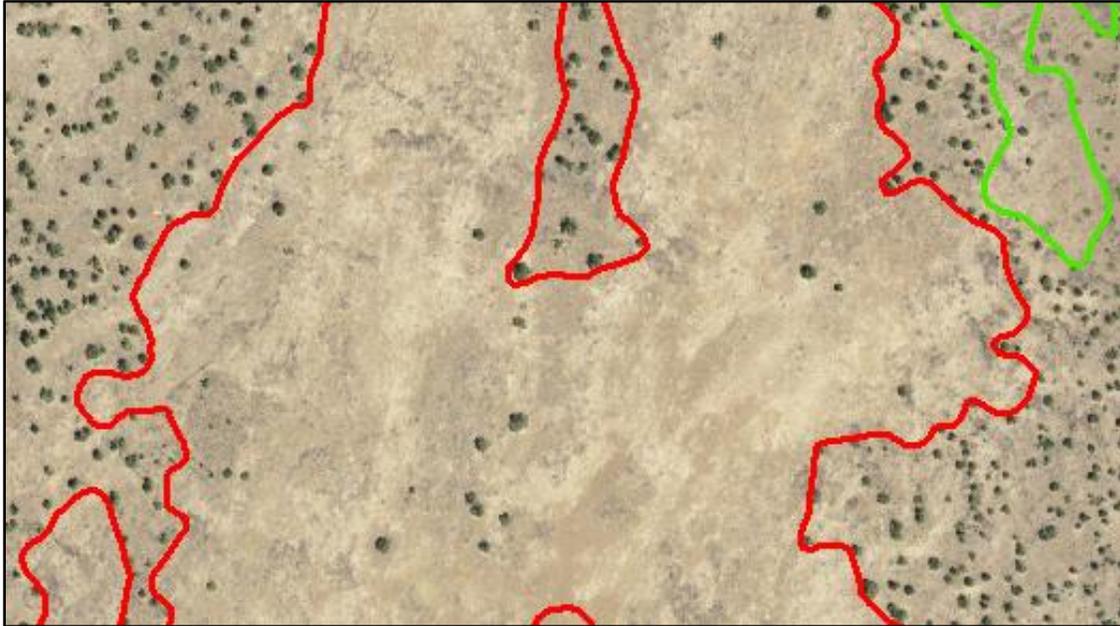
Artemisia arbuscula / Poa secunda Association (22211)



DISTRIBUTION: This Association is most common throughout the study area. It is mapped extensively around Horse Lake and the mid to lower slopes of Horse Lake Mountain. It is also mapped on slopes in the upper drainages of Cleghorn Flat, Whiskey Canyon, and Chase Canyon, as well as mid to lower slopes northeast of Eagle Lake.



***Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association (22213)**
Low sagebrush / Brome – Medusa head Association



The central portion of the aerial view depicts a stand dominated by *Artemisia arbuscula* with a variable cover across the stand. The stand is locally dominated by dense patches of *Bromus tectorum*.



The ground view depicts widely scattered *A. arbuscula* over dense *B. tectorum*.

***Artemisia arbuscula* / *Bromus* spp. – *Elymus caput-medusae* Association (22213)**

DESCRIPTION: *A. arbuscula* is dominant in the shrub layer although it may have a low as 5% absolute cover. Stands are in a degraded state from clearing, grazing, fire, or other disturbances (although the mode of disturbance may not be obvious). The herbaceous layer typically has higher cover than more pristine stands of the Alliance and is dominated by non-native annual grasses such as *Bromus tectorum* and *Elymus caput-medusae*. Native herbaceous cover is usually insignificant.

Stands are mapped infrequently in highly disturbed settings, usually from intensive grazing, where *A. arbuscula* falls below 5% cover.

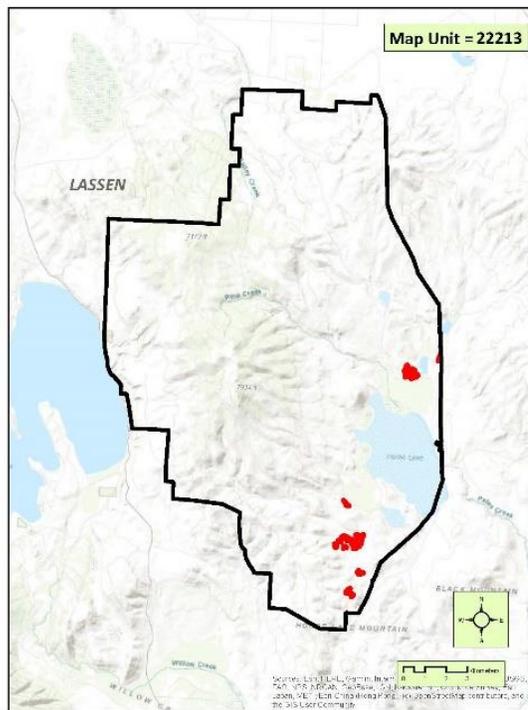
PHOTOINTERPRETATION SIGNATURE: *Artemisia arbuscula* is generally a third to half the size of *A. tridentata* and occurs generally in lower cover. On medium resolution imagery (NAIP), stands where cover is greater than 5-7% it appear as darker gray fuzzy dots on a buffy tan to grayish brown substrate. In stands where herbaceous cover is higher, the substrate appears tawnier with a more straw-like colored hue.

Artemisia arbuscula is more difficult to discern in this Association generally because of the denser and taller herbaceous cover. Photo interpretation signature characteristics indicate a generally less cobble strewn presence and the higher herbaceous cover tends to smooth out the texture across the stand. Cobble patches occur less frequently in this Association.

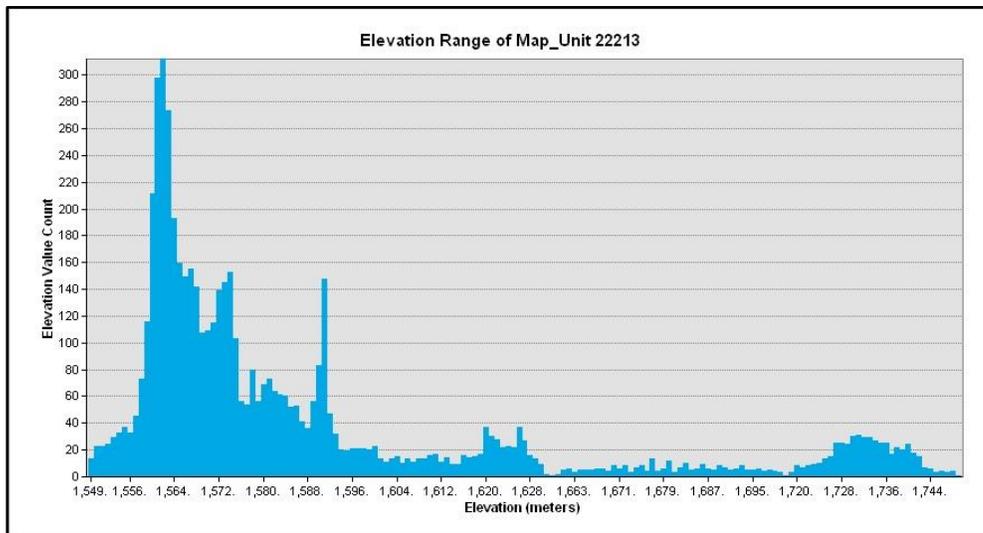
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia arbuscula* / *Poa secunda* Association (22211): Stands defined to this type generally have a lower herbaceous cover and visible disturbance is minimal. Shrub cover is generally higher in this association.
- *Bromus tectorum* Association (22121): In settings where *A. arbuscula* is below 5%, it is extremely difficult to separate out nonnative grasslands from very sparse stands of *A. arbuscula*.
- *Elymus caput-medusae* Provisional Association (22122): In settings where *A. arbuscula* is below 5%, it is extremely difficult to separate out nonnative grasslands from very sparse stands of *A. arbuscula*.

Artemisia arbuscula / Bromus spp. – Elymus caput-medusae Association (22213)



DISTRIBUTION: This Association is mapped in several clusters on lower slopes to the north and southwest of Horse Lake.



***Artemisia arbuscula* – *Eriogonum* (*microthecum*, *sphaerocephalum*) Association (22214)**

Low sagebrush / Slender buckwheat Association



The aerial view shows the fine stippling of small stature *Artemisia arbuscula* with sparse *Eriogonum* spp. Substrate soil is somewhat more orange than other Associations within this Alliance.



The ground view is composed primarily of *A. arbuscula* with *Eriogonum* spp. (light yellow flowers) scattered in the stand.

***Artemisia arbuscula* – *Eriogonum (microthecum, sphaerocephalum)* Association (22214)**

DESCRIPTION: *Artemisia arbuscula* is the dominant shrub and one or more *Eriogonum* spp. subshrubs is characteristically present. Soils are very shallow with insignificant organic content, and the substrate is often derived from ash flows or pumice and may often be less weathered than other local sub-shrub vegetation. Herb layer is very sparse but typically high in native forb diversity including *Phlox hoodii*, *Balsamorhiza hookeri*, *Phoenicaulis cheiranthoides*, *Lomatium* spp., and annual *Eriogonum* spp.

This Association is mapped in fairly sparse settings where shrub cover averages approximately 11-12%. The substrate yields a distinct rust tint, and emergent tree cover is extremely low to non-existent. Herbaceous cover is also quite low. Note that several examples of this type containing a high component of *Ericameria nauseosa* are mapped in the study area. These phases are currently being placed into this Association per the floristic classification analysis.

PHOTOINTERPRETATION SIGNATURE: *Artemisia arbuscula* is generally a third to half the size of *A. tridentata* and occurs generally in lower cover. On medium resolution imagery (NAIP), stands where cover is greater than 5-7% it appear as darker gray fuzzy dots on a buffy tan to grayish brown substrate. In stands where herbaceous cover is higher, the substrate appears tawnier with a more straw-like colored hue.

Artemisia arbuscula in this setting is sparse; this Association is mapped using the distinctive gravelly rust-colored volcanic substrate.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia arbuscula* / *Poa secunda* Association (22211): This Association differs primarily in substrate signature. The harsh clay substrate characteristic of this type yield a tawny to grayish brown color compared with the volcanic rust tinge unique to the *A. arbuscula* – *Eriogonum* spp. Association.
- *Eriogonum sphaerocephalum* / *Poa secunda* Association (22231): Occurring on similar substrate with the only difference being the dominance of *Eriogonum* instead of *A. arbuscula* make distinguishing these two types extremely difficult.

***Artemisia cana* Alliance (41110)**

Silver sagebrush wet shrubland Alliance

DESCRIPTION: *Artemisia cana* is dominant in the shrub canopy. *Chrysothamnus* species may co-dominate.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda* Association (41111)**
Silver sagebrush / Pine bluegrass Association



The aerial view depicts *Artemisia cana* with fairly consistent cover across the stand, with an understory of *Eleocharis* spp.



The ground view shows openings in the *Artemisia cana* shrub cover dominated by early growth *Eleocharis* spp. (bright green) in a vernal flooded setting.

***Artemisia cana* (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda* Association (41111)**

DESCRIPTION: *Artemisia cana* (ssp. *bolanderi*) is strongly dominant in the shrub layer. *Chrysothamnus* species may co-dominate in disturbed versions of this type. Herb layer may include vernal pool indicators such as *Psilocarphus brevissimus* and *Navarretia* spp. or more generally moist herbs such as *Hordeum brachyantherum*, *Muhlenbergia richardsonis*, and *Juncus* spp. Stands of this type occur on mesic sites including basin bottoms, stream terraces, swales, and flats.

This type is mapped often with the aid of reconnaissance and other ground defined data, in mesic settings that do not occur on meadow edges, but are more likely found in vernal wet settings. The best examples are where *A. cana* occurs in extensive, larger than average stands. These larger stands tend to yield plants that occur across the landscape and are evenly well-spaced from one another.

PHOTOINTERPRETATION SIGNATURE: *Artemisia cana* stands give off a gray signature that rarely has any hint of bluish tinges common to upland species of *Artemisia*. Meadow substrate is wet but not to the point where there is any green herbaceous signature. This results in a gray shrub signature occurring over a tan to tan-gray substrate. The indicator here is that this signature occurs in a wetland meadow setting in areas where water does not appear to flow laterally but instead evaporates vernaly. However, even by evaluating all these photointerpretation models and signature characteristics, the reliability of mapping this association can at times be challenging.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* Association (22313): Stands dominated by this species of *Artemisia* can occur in moist meadow environments. Herbaceous understory in these settings is generally bright green, and in viewing slope characteristics and drainage patterns one can ascertain that there is lateral water movement in this kind of topography.

***Artemisia tridentata* Alliance (22310)**

Big sagebrush Alliance



The aerial view shows scattered *Artemisia tridentata* and *Grayia spinosa* on an east facing steep rocky slope.



This photos shows *Artemisia tridentata* and *Grayia spinosa* mixing on a rocky slope, with a grassy matrix.

***Artemisia tridentata* Alliance (22310)**

DESCRIPTION: *Artemisia tridentata* is dominant to co-dominant in the shrub layer (if *A. tridentata* ssp. *vaseyana* is present see Associations in the *Artemisia tridentata* ssp. *vaseyana* Alliance). *Purshia tridentata* may be present as a co-dominant, but if it is greater than 50% relative cover, it is considered as the *Purshia tridentata* – *Artemisia tridentata* Alliance. *Ephedra viridis*, *Ericameria nauseosa*, and/or *Chrysothamnus viscidiflorus* may be present to co-dominant.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Artemisia tridentata* Association (22313)**
Big sagebrush Association



The aerial view shows a stand of *Artemisia tridentata* in varying cover. *Juniperus occidentalis* dominates the lower left portion of the image, also with *A. tridentata* in the understory.



The photo shows an open cobbly understory with variable amounts of *A. tridentata*, with a sparse young juniper overstory.

***Artemisia tridentata* Association (22313)**

DESCRIPTION: *Artemisia tridentata* is strongly dominant to co-dominant with *Chrysothamnus viscidiflorus* or *Purshia tridentata* (if *P. tridentata* is greater than 50% relative cover then the stand is considered as the *Purshia tridentata* – *Artemisia tridentata* Alliance). The herb layer is sparse to moderately dense with high relative cover of native herbs. Stands are on lower slopes to bottom topographic positions with heavy soils. Many have significant regeneration of *Juniperus occidentalis*. If *A. tridentata* is co-dominating with *Chrysothamnus viscidiflorus* or *Ericameria nauseosa* then the herb layer has high relative nativity and signs of disturbance are minimal.

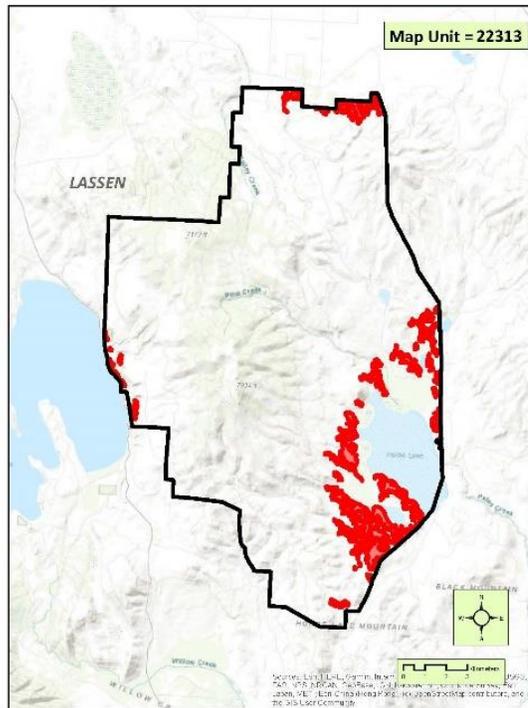
Stands are mapped primarily using models of elevation (generally below 5500 feet), and associated vegetation. This particular Association is mapped in a wide variety of settings from meadow edges to steep sideslopes in cover averaging slightly under 20%. Associated conifers are generally limited to *Juniperus occidentalis*, whereas higher elevation conifers such as *Pinus jeffreyi* will usually have an understory of *A. tridentata* ssp. *vaseyana*.

PHOTOINTERPRETATION SIGNATURE: *Artemisia tridentata* is found with a wide range of photointerpretation characteristics. Stands can average up to 5-6 feet in height, and their cover density can range from less than 5% to over 30%. Shrub canopy height is highly variable depending on soil depth, stand age, and water availability. Generally, stands appear silver-gray to blue-green depending on leaf vigor. Stand edges can be gradational or definitive and can at times have a high cover of regenerating juniper.

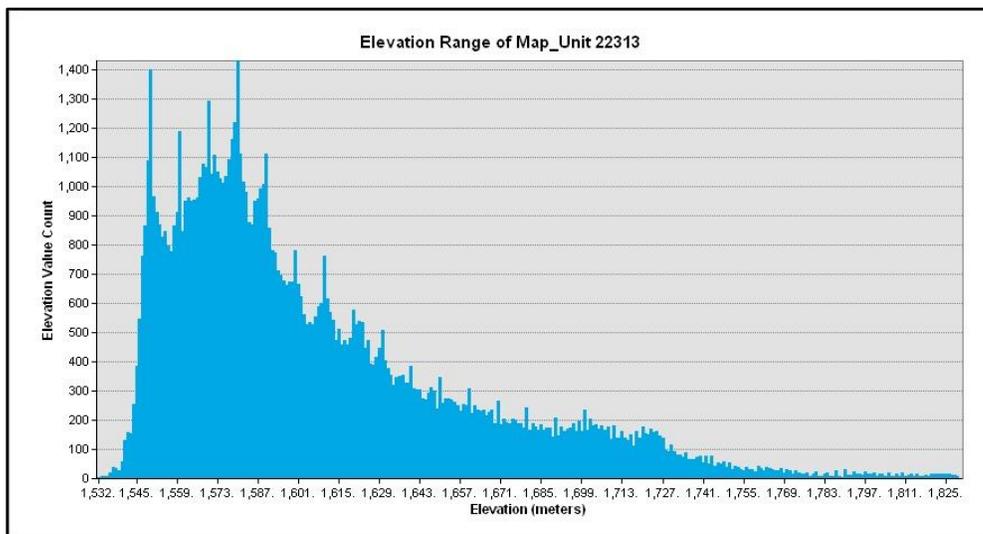
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (22323): Both associations are separated based on elevation and associated and/or adjacent vegetation. Overall, this type has an appearance of a smoother texture due possibly to mature stands having a slightly more consistent canopy height, however, this signature characteristic is anecdotal and should not be used solely in separating out high elevation stands dominated by *A. tridentata* ssp. *vaseyana*.
- *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317): Stands are mapped in this Association where disturbance (mainly intensive grazing or clearing) is noted. Individual *E. nauseosa* plants can trend medium green, silver-white, or dark gray, depending primarily on leaf vigor. Crowns of *E. nauseosa* tend to have a distinct edge and are slightly more rounded, which can be detected especially where the plants contrast noticeably with the substrate.

Artemisia tridentata Association (22313)



DISTRIBUTION: This Association is extensively mapped on the lower slopes surrounding Horse Lake, on the edge of the Madeline Plains in the north, and adjacent to the northeast portion of Eagle Lake.



***Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association
(22317)**

Big sagebrush – (Rabbitbrush) / Cheatgrass Association



The aerial view shows a patchy stand of *Artemisia tridentata* with *Ericameria nauseosa* co-dominating the stand. Note the lower shrub cover west of the road.



The ground view depicts *Artemisia tridentata* in the foreground with young *Ericameria* on the other side of the fence.

***Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317)**

DESCRIPTION: *Artemisia tridentata* is dominant to co-dominant with or without *Ericameria nauseosa* and/or *Chrysothamnus viscidiflorus*. Shrub cover averages around 10% cover but may be as low as 2% and herb cover is typically greater than 10% absolute cover, with very low relative cover of native herbs. Signs of disturbance such as fire, grazing, and roads/trails are present and typically severe. Herb layer is characterized by high non-native grass cover and very low nativity in general.

This Association is mapped conservatively where a minimum amount of an *E. nauseosa* component is visible in the shrub layer in settings which indicate obvious disturbance.

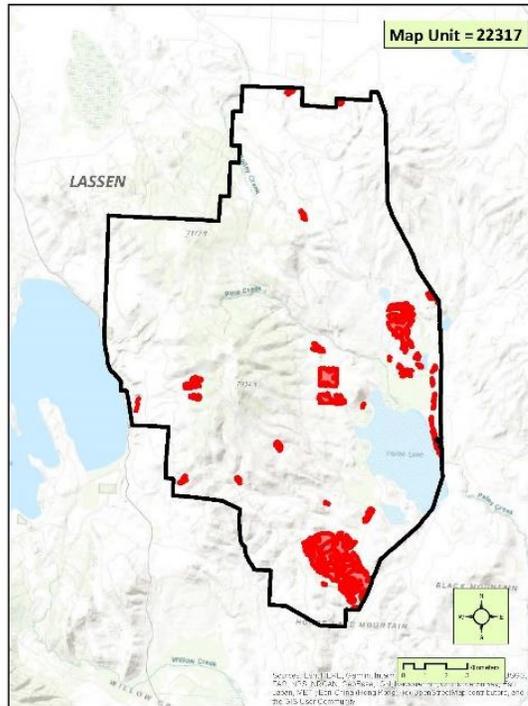
PHOTOINTERPRETATION SIGNATURE: *Artemisia tridentata* is found with a wide range of photointerpretation characteristics. Stands can average up to 5-6 feet in height, and their cover density can range from less than 5% to over 30%. Shrub canopy height is highly variable depending on soil depth, stand age, and water availability. Generally, stands appear silver-gray to blue-green depending on leaf vigor. Stand edges can be gradational or definitive and can at times have a high cover of regenerating juniper.

Ericameria nauseosa has a wide variability of signature characteristics, especially color, which is generally determined based on stress variables which affect leaf vigor. Shrubs can be silver, silver-gray, medium to dark gray, or medium green. Individual shrubs can at times yield a distinct shadow if it is contrasted against a light-colored substrate.

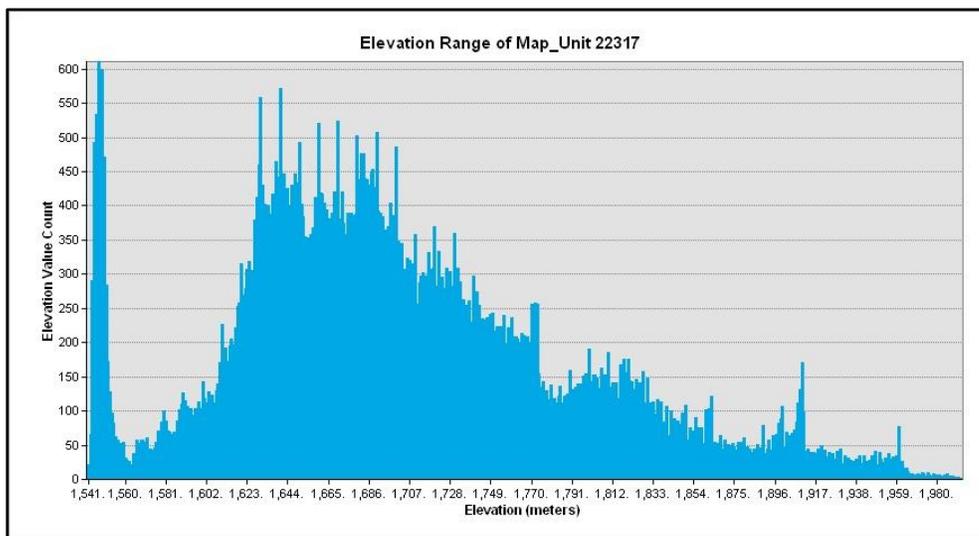
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Chrysothamnus viscidiflorus* Association (24111): This Association occurs in similar disturbance-related settings but is much less common. Plants for the most part have a distinct green to dark green color.

***Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317)**



DISTRIBUTION: This Association is mapped in post-fire settings. Stands here are mapped in the vicinity of Horse Lake and Horse Lake Mountain, and on the mid slopes below Fredonyer Peak. A few sites are also found on the edge of the Madeline Plains.

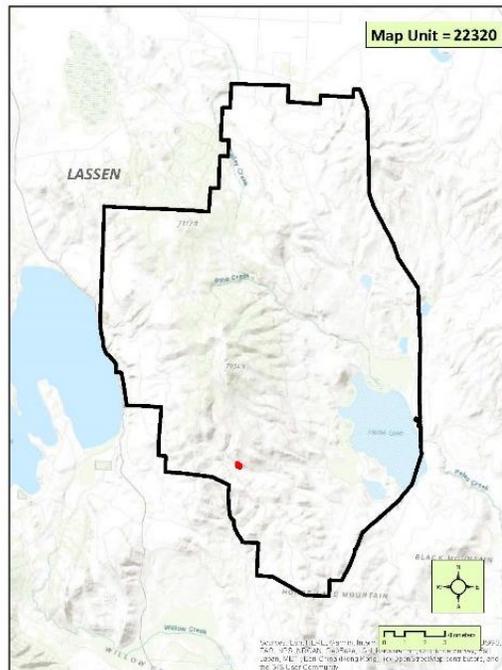


***Artemisia tridentata* ssp. *vaseyana* Alliance (22320)**

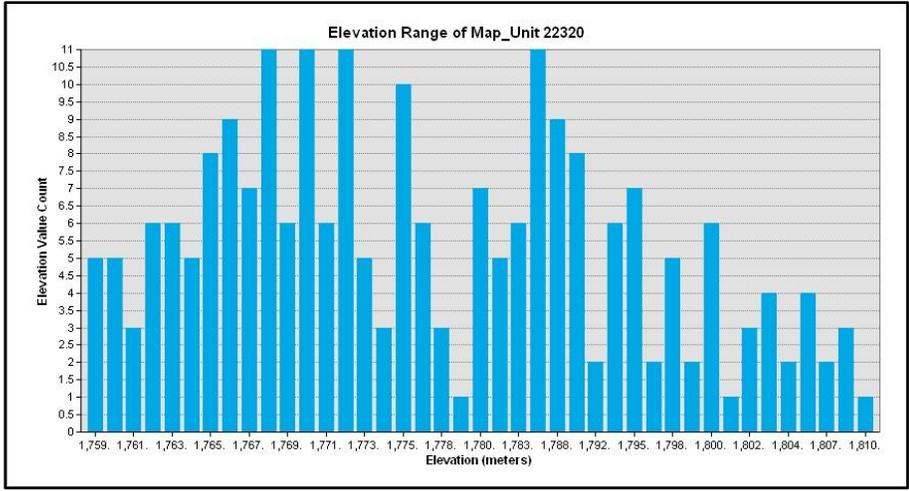
Mountain big sagebrush Alliance

DESCRIPTION: *Artemisia tridentata* ssp. *vaseyana* and/or *Symphoricarpos rotundifolius* dominate in the shrub layer. Found at higher elevations on slopes and ridges, often with *Cercocarpus ledifolius*, *Abies concolor*, and winter-deciduous shrubs *Holodiscus discolor*, *Prunus virginiana*, *P. emarginata*, and shrubby *Populus tremuloides*. *Purshia tridentata*, *Tetradymia canescens*, *Salvia dorrii*, *Chamaebatiaria millefolium*, and/or *Chrysothamnus viscidiflorus* may co-dominate.

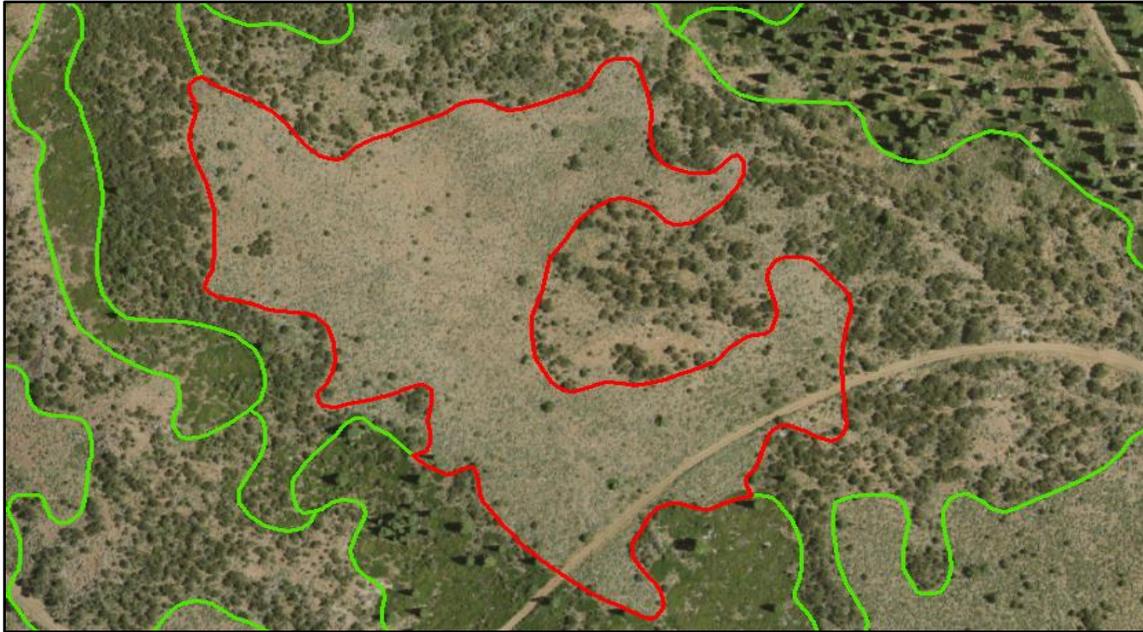
This type is usually mapped to the Association level and typically is not mapped at the more generalized level across the study area.



DISTRIBUTION: Only one polygon was mapped at the Alliance level, on the mid slope of Horse Lake Mountain.



***Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association (22321)**
Mountain big sagebrush – Mountain snowberry / California bromegrass Association



The aerial view shows a dense stand of *Artemisia tridentata* ssp. *vaseyana* with adjacent high elevation shrubs such as *Cercocarpus* and *Arctostaphylos*, and *Abies concolor* in the northeast corner of the image.



The photo depicts an indicator species (*Wyethia mollis* – yellow flowers) common to this Association with *Artemisia tridentata* ssp. *vaseyana* dominating. Note white fir in an adjacent stand in the background.

***Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association (22321)**

DESCRIPTION: *Artemisia tridentata* ssp. *vaseyana* dominates or co-dominates with mesic shrubs such as *Symphoricarpos rotundifolius* (a synonym for the Jepson manual's *S. oreophilus*), *Ribes velutinum*, and/or *Prunus virginiana*. *Bromus carinatus* and other mesic herbs are found in the understory.

The Association is mapped based in part on substrate and signature color.

PHOTOINTERPRETATION SIGNATURE: This Association is less frequently mapped than the adjacent lower elevation type where just *A. tridentata* ssp. *vaseyana* is characteristic in the vegetation. It is mapped where a significant portion of the stand shares a consistently greener component to the shrubs, which generally indicate the presence of *S. oreophilus*. Overall, this type is mapped at slightly higher elevations on a somewhat rockier substrate.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (22323): This association lacks the green component to the shrub color. It tends to concentrate further away from rockier talus settings where other mesic shrubs such as *S. oreophilus* may share dominance in the vegetation cover. Differentiating these two associations however, is extremely difficult.

***Symphoricarpos oreophilus* Association (22322)**
Mountain snowberry Association



The aerial view shows *Wyethia mollis* along a ridgeline in a post-fire setting. *W. mollis* is a common indicator to this Association.



Wyethia mollis dominates the herbaceous cover with *Pinus jeffreyi* in the background in this ground view.

***Symphoricarpos oreophilus* Association (22322)**

DESCRIPTION: *Symphoricarpos rotundifolius* (a synonym for the Jepson manual's *S. oreophilus*) co-dominates in the shrub layer with *Chrysothamnus viscidiflorus*, but without *Artemisia tridentata* ssp. *vaseyana*. Stands with high cover of *Wyethia mollis* and low shrub cover are included in this type. This type is indicative of disturbance (fire, grazing, clearing) and is related to successional stands formerly dominated or co-dominated by *Artemisia tridentata* ssp. *vaseyana*.

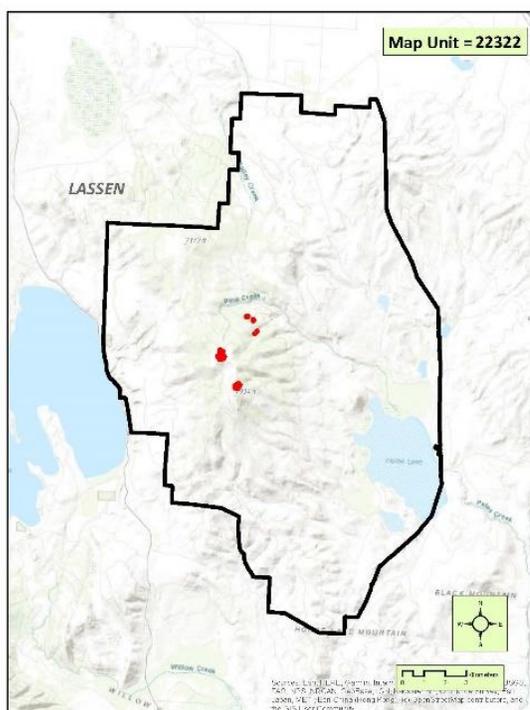
This Association is mapped primarily on upper slopes and ridges in post-disturbance settings where *W. mollis* strongly dominates or shares dominance with *C. viscidiflorus*. In the study area *W. mollis* is the dominant species in this Association.

PHOTOINTERPRETATION SIGNATURE: Where *W. mollis* dominates the stand, it has a medium green color and a stipple-like texture. Cover densities vary across the stand considerably. In the Fredonyer Peak examples where both *W. mollis* and *C. viscidiflorus* share dominance, signature color is more variable but still trend a medium to dark green.

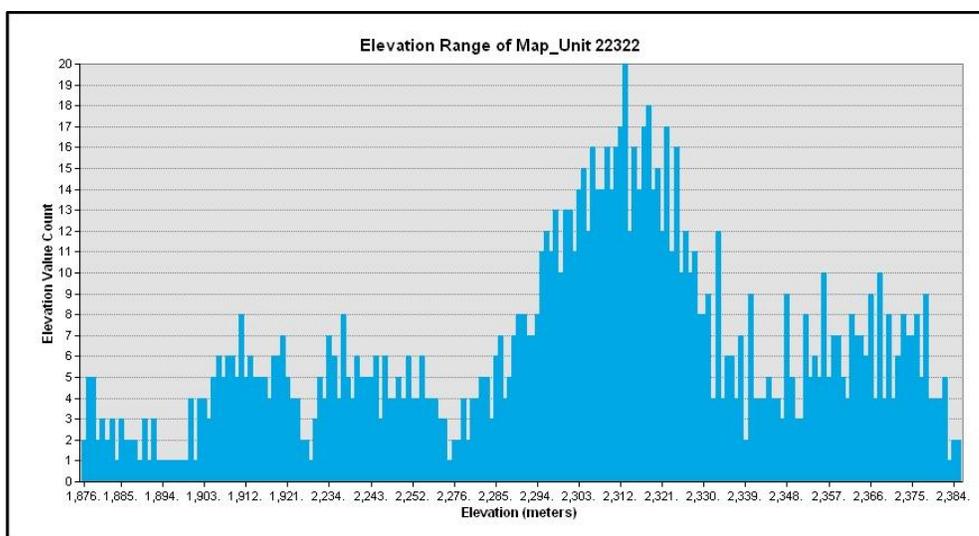
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* ssp. *vaseyana* – *Symphoricarpos oreophilus* / *Bromus carinatus* Association (22321): In this Association there is a significant component of *Artemisia*. This yields a blue-gray component to the signature color not found in the Association with *W. mollis*.

***Symphoricarpos oreophilus* Association (22322)**



DISTRIBUTION: This Association is mapped at a few sites along and to the northeast of the Fredonyer Peak ridge generally over 7000 feet.



***Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (22323)**
Mountain big sagebrush / Idaho fescue Association



The aerial view to the right shows a dense cover of *Artemisia tridentata* ssp. *vaseyana*. *Juniperus occidentalis* increases in cover in the left portion of the image. There is a small patch of *Arctostaphylos patula* at the bottom right.



The ground view shows a dense cover of *A. tridentata* ssp. *vaseyana* with a characteristically even height across the stand

***Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (22323)**

DESCRIPTION: *Artemisia tridentata* ssp. *vaseyana* is strongly dominant to co-dominant in the shrub layer with *Purshia tridentata*, *Tetradymia canescens*, and/or *Chrysothamnus viscidiflorus*. Emergent *Pinus jeffreyi* and *Juniperus occidentalis* are often present although at low cover. *Festuca idahoensis* is dominant to co-dominant in the herb layer with *Poa secunda*, *Achnatherum thurberianum*, *Pseudoroegneria spicata* and/or *Achillea millefolium*.

This is the most frequently mapped Association of *A. tridentata* ssp. *vaseyana* in the study area. Most stands are mapped in elevations over 5500 feet. Stands are generally mapped in cover from 15 to 30%, which is higher on average than the lower elevation sagebrush types.

PHOTOINTERPRETATION SIGNATURE: *Artemisia tridentata* ssp. *vaseyana* yields a signature that has a slightly healthier leaf vigor than lower elevation, drier *A. tridentata* subspecies. This often results in a stronger, more vibrant blue-green signature. Canopy cover is high for a shrub type and mature stands tend to have a fairly even height across the stand.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* Association (22313): This is a lower elevation Association, which is extremely difficult to separate out. Modeling based on elevation is the most important criteria in differentiating the two Associations. Associated vegetation in adjacent communities, including conifer identification, is an important secondary modeling approach. In general, conifers other than the exclusive dominance of western juniper would tend to point to the *A. tridentata* ssp. *vaseyana* Association. These often include *Abies concolor* and/or *Pinus jeffreyi*. The presence of any number of montane chaparral species would also indicate an elevation which supports *A. tridentata* ssp. *vaseyana*.

***Ceanothus velutinus* Alliance (31110)**

Tobacco brush or Snow bush chaparral Alliance

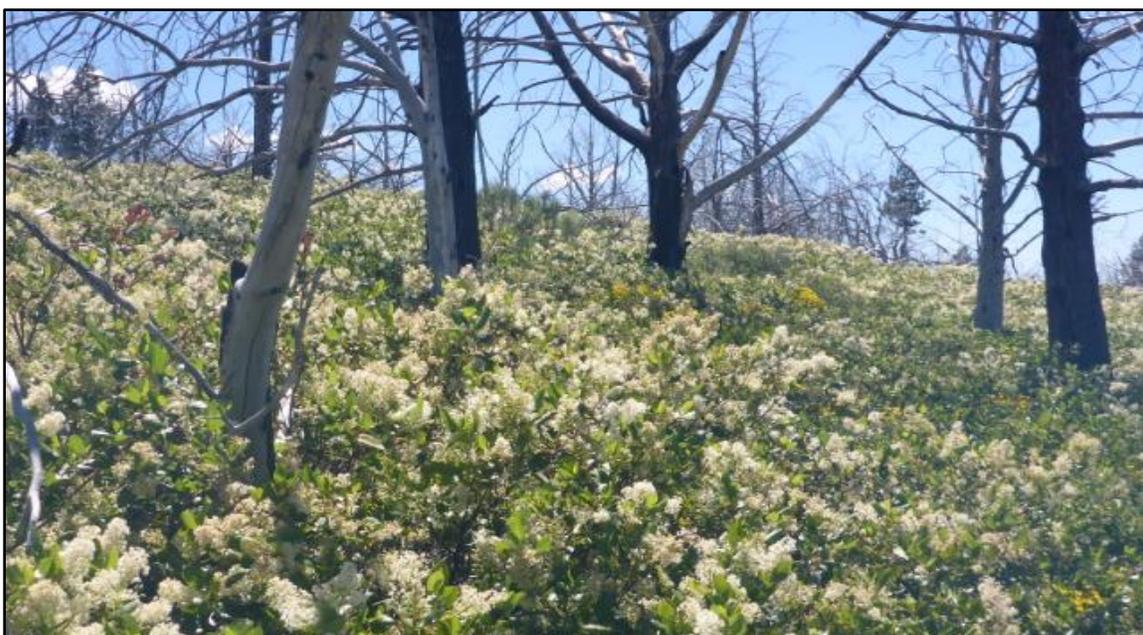
DESCRIPTION: *Ceanothus velutinus* is dominant to co-dominant in the shrub layer with *Prunus emarginata*, *Symphoricarpos rotundifolius*, and *Artemisia tridentata*. If *C. velutinus* is co-dominating with *Arctostaphylos patula* then the stand is considered as the *Arctostaphylos patula* – *Ceanothus velutinus* Association of the *Arctostaphylos patula* – *Arctostaphylos nevadensis* Alliance. Typically found on moderately steep (greater than 10 degrees), north-facing slopes. Emergent *Abies concolor* may be present. Herb layer may include *Bromus carinatus*, *Wyethia angustifolia*, and/or *Crepis acuminata*. Evidence of fire is common (locally after fires, *C. velutinus* germinates from seed bank within burned stands of conifers or *Cercocarpus*).

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Ceanothus velutinus* Association (31111)**
Tobacco brush Association



The aerial view depicts *Ceanothus velutinus* with variable cover in a post-fire setting.



Ceanothus velutinus in bloom dominates the shrub cover in this post-fire setting with emergent juniper and Jeffrey pine snags.

***Ceanothus velutinus* Association (31111)**

DESCRIPTION: *Ceanothus velutinus* is strongly dominant in the shrub layer. *Prunus emarginata* and *Artemisia tridentata* (ssp. *vaseyana*) might be present as sub-dominants.

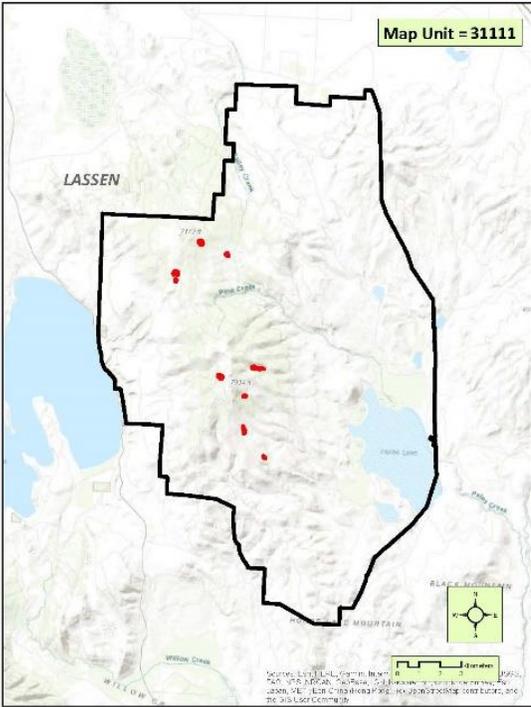
Mapped in higher elevations where *C. velutinus* dominates the shrub layer. Stands are generally dense in cover except in post-fire settings.

PHOTOINTERPRETATION SIGNATURE: Pure stands of *Ceanothus velutinus* are for the most part indistinguishable from *Arctostaphylos patula*, both species have a characteristically smooth even-color medium green across the stand.

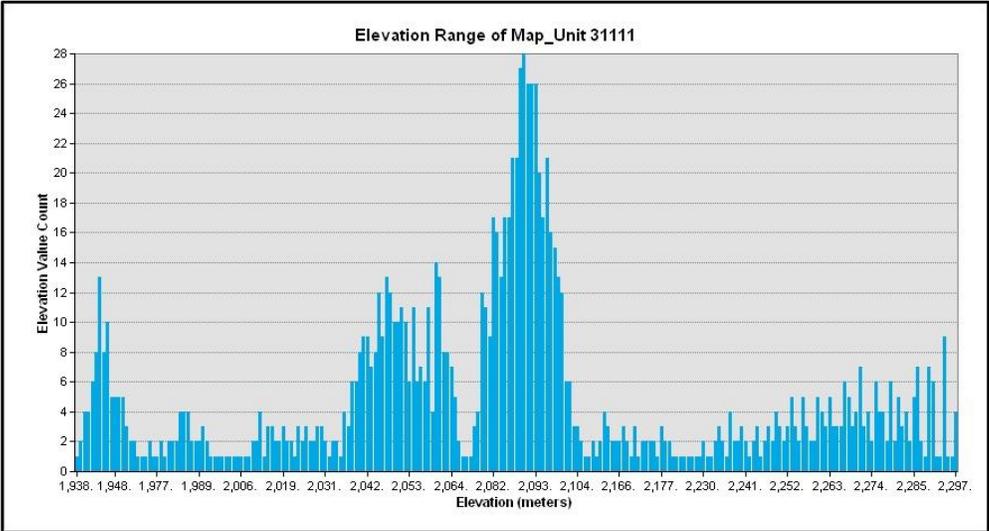
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Arctostaphylos patula* – *Ceanothus velutinus* Association (31132): Stands mapped to this Association are strongly dominated by or mixing with *Arctostaphylos patula*, and are difficult to distinguish from strongly dominated *C. velutinus*. *A. patula* generally is mapped in higher elevations.

Ceanothus velutinus Association (31111)



DISTRIBUTION: Stands are mapped, most notably in small patches along Cottonwood Canyon and above Jauriga Spring below Fredonyer Peak, and in the upper watershed of Pine Creek.



***Ceanothus velutinus* – *Prunus emarginata* – *Artemisia tridentata* Association
(31112)**

Tobacco brush – Bitter cherry – Big sagebrush Association



The aerial view shows a dense shrub cover of *Artemisia tridentata* ssp. *vaseyana* co-dominating the stand with *Ceanothus velutinus*.



In this ground photo, *C. velutinus* (sprawling, medium bright green colored shrub) co-dominates with the blue-gray sagebrush.

***Ceanothus velutinus* – *Prunus emarginata* – *Artemisia tridentata* Association
(31112)**

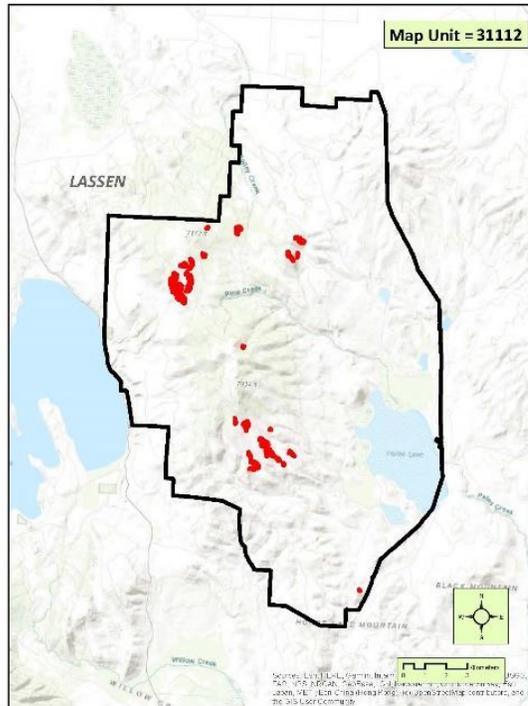
DESCRIPTION: *Ceanothus velutinus* co-dominates with *Prunus emarginata* and/or *Artemisia tridentata* ssp. *vaseyana*. Other shrubs like *Symphoricarpos rotundifolius* are often present.

PHOTOINTERPRETATION SIGNATURE: The bright green *C. velutinus* signature contrasts significantly with that of the blue-gray *Artemisia*; they often co-dominate the landscape over large areas.

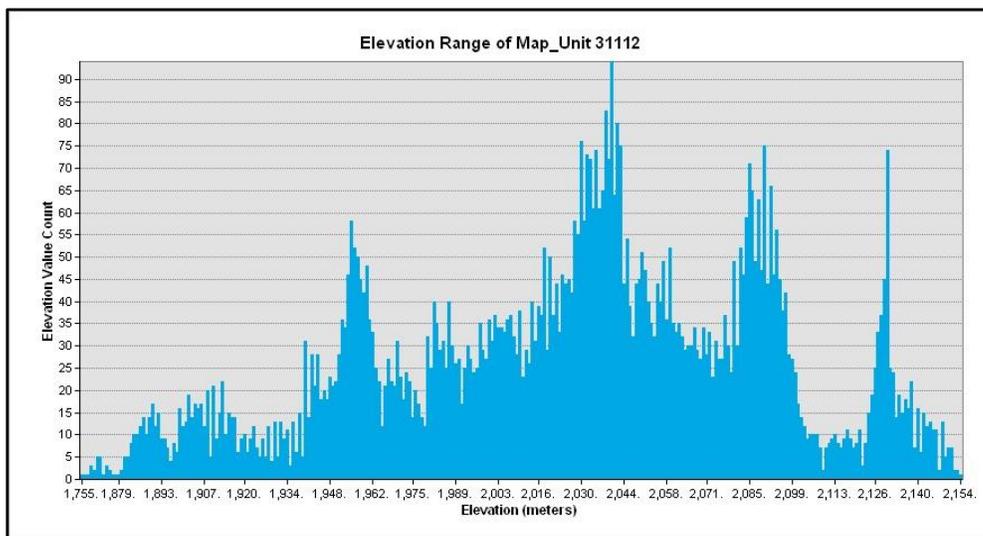
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Prunus emarginata* Association (31121): *Artemisia tridentata* ssp. *vaseyana* can be a component to this type also, but generally in much lower cover. *P. emarginata* photo signature is not as brightly colored as that of *C. velutinus*. This type is usually found in moister settings.

***Ceanothus velutinus* – *Prunus emarginata* – *Artemisia tridentata* Association (31112)**



DISTRIBUTION: Stands are mapped primarily on the mid and upper slopes of the ridgelines north and south of Fredonyer Peak, and on several sites in the upper Pine Creek watershed.



***Cercocarpus ledifolius* Alliance (16210)**
Curl-leaf mountain mahogany scrub Alliance



The aerial view shows a highly disturbed stand of *Cercocarpus ledifolius* that has undergone juniper removal.

No ground photo is available for this Alliance.

***Cercocarpus ledifolius* Alliance (16210)**

DESCRIPTION: Tall shrubs or small trees of *Cercocarpus ledifolius* are dominant to co-dominant in the mid/shrub layer. Other shrubs may include *Artemisia tridentata* (various subspecies), *Symphoricarpos rotundifolius*, *Prunus virginiana*, *Ribes velutinum* and/or *Purshia tridentata*. *Juniperus occidentalis* and *Pinus ponderosa* may be emergent in the tree layer but do not have enough cover to map as the *Juniperus occidentalis* Alliance or the *Pinus ponderosa* / Shrub Understory Alliance.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association (16211)**
Curl-leaf mountain mahogany – Mountain big sagebrush Association



The aerial view shows an open stand of *Cercocarpus ledifolius* emergent to the lower growing *Artemisia tridentata* ssp. *vaseyana*. Adjacent to the north, white fir dominates. To the south and west, *Cercocarpus* dominates in higher cover without sagebrush.



This ground view depicts tree-form *Cercocarpus ledifolius* emergent to an *Artemisia tridentata* ssp. *vaseyana* shrub layer. Junipers are widely scattered in the stand.

***Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association (16211)**

DESCRIPTION: *Cercocarpus ledifolius* is co-dominant with *Artemisia tridentata* ssp. *vaseyana* in the shrub layer, and no other shrub species are present with comparable cover.

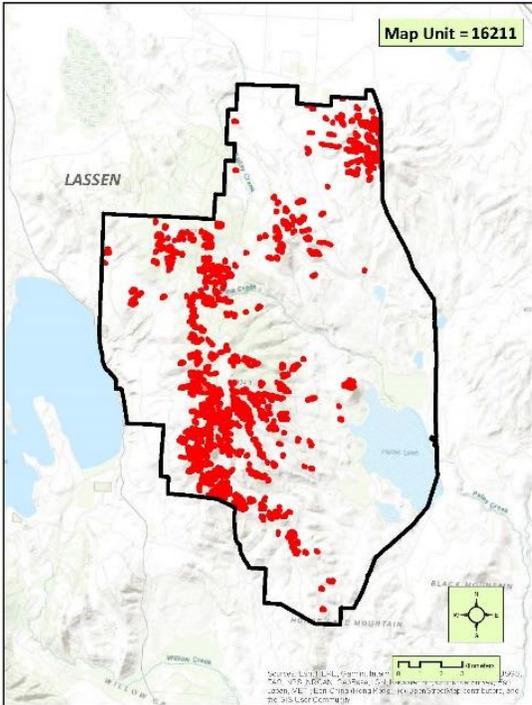
This Association is mapped on settings that are somewhat steeper and at times rockier than types mapped to the *Artemisia* Alliances. In this Association, stands of *Cercocarpus ledifolius* occur as a tall emergent shrub to *Artemisia tridentata* ssp. *vaseyana*.

PHOTOINTERPRETATION SIGNATURE: *Cercocarpus ledifolius* has a narrowly defined easy to recognize signature which varies minimally despite settings or location. Crowns are tall for a shrub and irregularly shaped. Color ranges from dark green to dark green with a grayish tint. Cover densities tend to vary considerably across the stand creating numerous breaks where density changes. Openings in the tall shrub canopy are dominated by *Artemisia tridentata* ssp. *vaseyana*. There is often a significant die-off component to the canopy which is the only significant factor altering its signature.

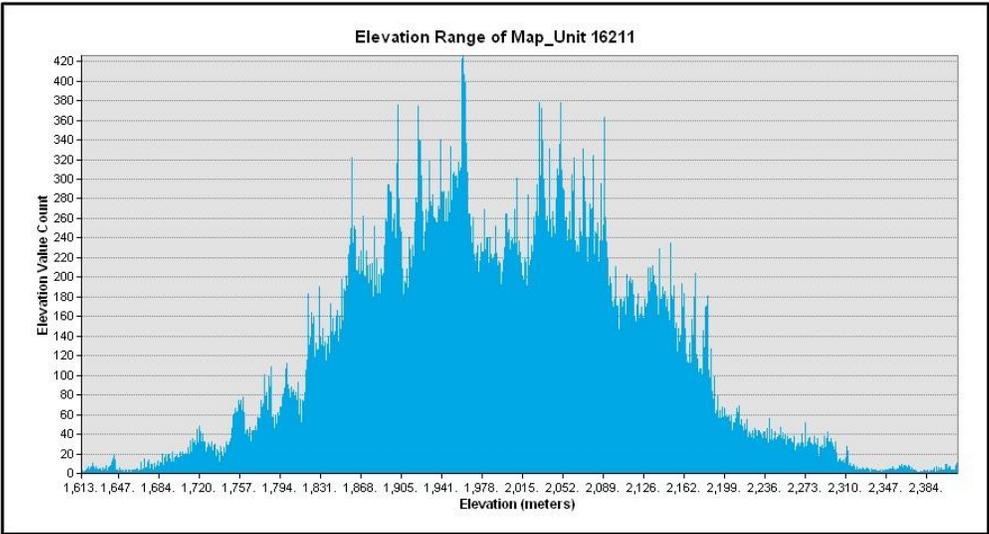
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Cercocarpus ledifolius* Association (16212): In this Association, shrub cover is extremely high and is strongly dominated by *Cercocarpus*. Stands tend to occur on steeper topography in somewhat rockier settings. Closer to the actual rocky outcroppings, mesic shrubs such as *Prunus* spp. and/or *Symphoricarpos rotundifolius* are often identifiable in the stand.

***Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association (16211)**



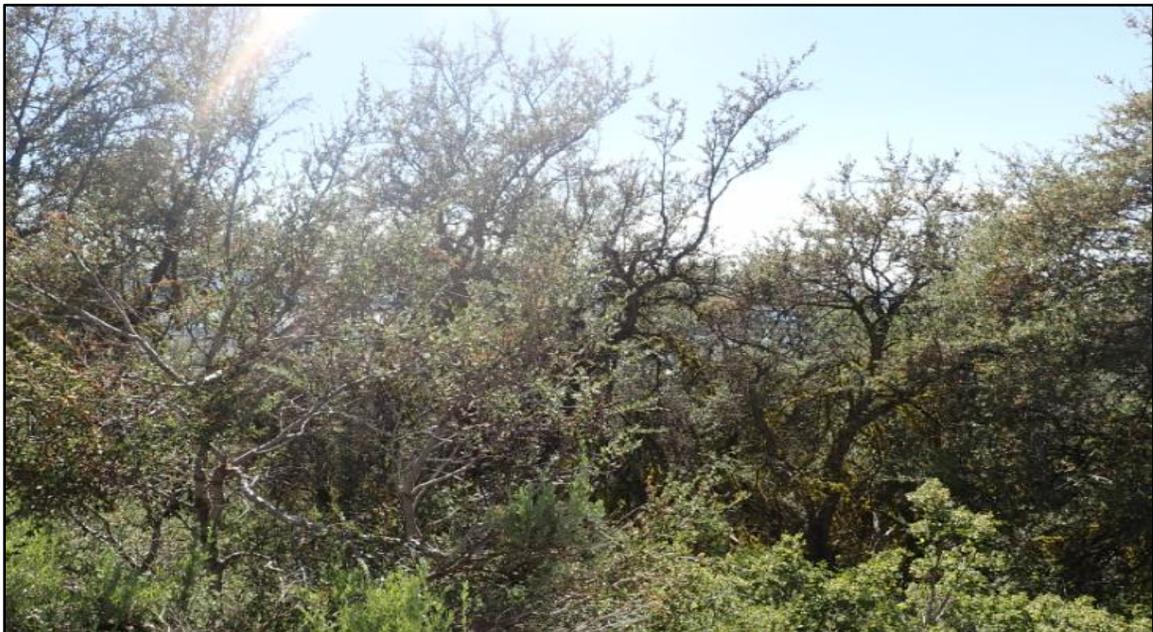
DISTRIBUTION: This Association is very common, where over 2300 acres are mapped. It is mapped along the mid to upper slopes of the Fredonyer Peak ridgeline and Horse Lake Mountain. It is also mapped in the hills around Pinecone Reservoir and the hills south of Glade Reservoir.



***Cercocarpus ledifolius* Association (16212)**
Curl-leaf mountain mahogany Association



The aerial view shows a dense cover of *Cercocarpus ledifolius*, with canopy openings co-dominated with *Artemisia tridentata* ssp. *vaseyana* in the adjacent polygons.



Dense *Cercocarpus ledifolius* is depicted here as a tall shrub with decadent branching; some *Symphoricarpos* is scattered in the understory.

***Cercocarpus ledifolius* Association (16212)**

DESCRIPTION: *Cercocarpus ledifolius* is strongly dominant with low cover of other shrubs such as *Ribes velutinum*, *Symphoricarpos rotundifolius*, and/or *Prunus virginiana*. *Artemisia tridentata* is usually present at low cover. Typically found on rocky, north facing slopes and/or where *Cercocarpus ledifolius* is dense with a closed canopy.

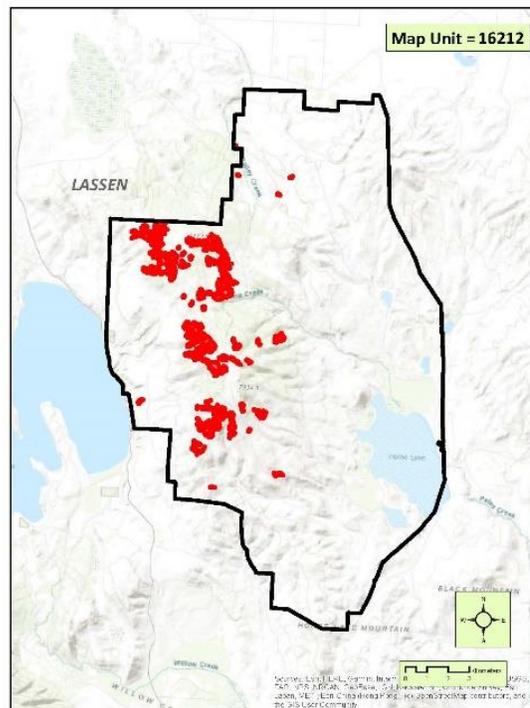
This Association is mapped where the tall shrub layer often is so dense that it can obscure the understory vegetation cover altogether. Mesic shrubs are visible inconsistently across the stand in areas that are in close proximity to rocky outcroppings and talus. This type is less frequently mapped than the more open Association described above, and occurs in more limited but similar locations.

PHOTOINTERPRETATION SIGNATURE: *Cercocarpus ledifolius* has a narrowly defined easy to recognize signature which varies minimally despite settings or location. Crowns are tall for a shrub and irregularly shaped. Color ranges from dark green to dark green with a grayish tint. The tall shrub cover averages 40-55% cover, frequently obscuring the understory. Small patches of *Prunus* spp. adjacent to talus and rock outcroppings contrast fairly well from the drier *Cercocarpus* and are generally a brighter green color.

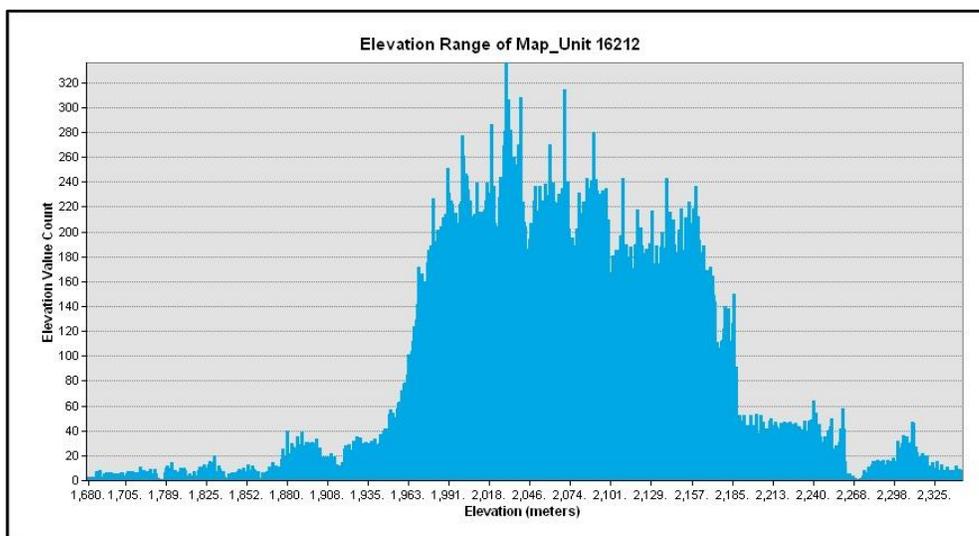
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Cercocarpus ledifolius* – *Artemisia tridentata* ssp. *vaseyana* Association (16211): In this Association shrub cover is more open. Cover densities tend to vary considerably across the stand creating numerous breaks where density changes. Openings in the tall shrub canopy are dominated by *Artemisia tridentata* ssp. *vaseyana*.

***Cercocarpus ledifolius* Association (16212)**



DISTRIBUTION: This Association is mapped on the mid to upper slopes of Fredonyer Peak and the ridgelines to the south and north, as well as the upper Pine Creek watershed below the ridgeline. A few isolated sites are in the hills around Cleghorn Flat.



***Chrysothamnus viscidiflorus* Alliance (24110)**

Yellow rabbitbrush shrubland Alliance

DESCRIPTION: *Chrysothamnus viscidiflorus* dominates in the shrub layer.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Chrysothamnus viscidiflorus* Association (24111)**
Yellow rabbitbrush Association



The aerial view shows an inconsistent shrub cover of *Chrysothamnus viscidiflorus* over a dense herbaceous layer of native and non-native species in a post-fire setting.



Chrysothamnus viscidiflorus (in flower) dominates the shrub layer in a post-fire setting. The stand has numerous downed conifers.

***Chrysothamnus viscidiflorus* Association (24111)**

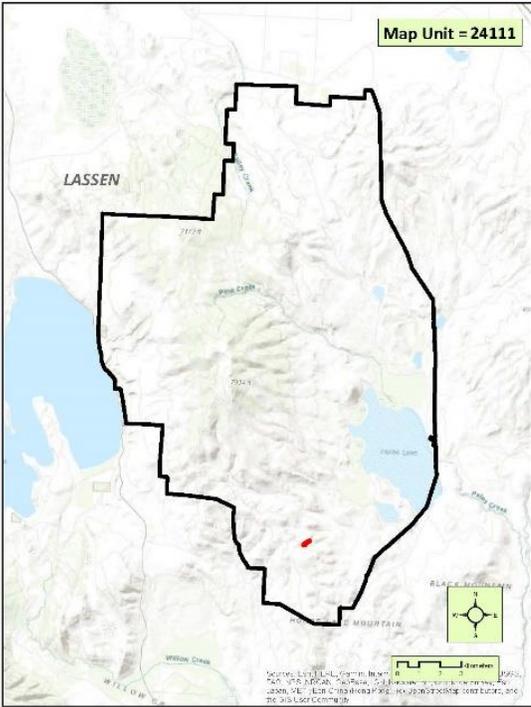
DESCRIPTION: *Chrysothamnus viscidiflorus* dominates in the shrub layer without significant cover of *Artemisia tridentata* or *Purshia tridentata*. *Poa secunda* is generally present in the herb layer. In disturbed sites, *Bromus tectorum* may dominate the herb layer.

PHOTOINTERPRETATION SIGNATURE: *Chrysothamnus viscidiflorus* yields a medium to dark green signature and distinctly contrasts where it shares dominance with *E. nauseosa*. Post-burn tree snags and downed trees can be visible in the stand.

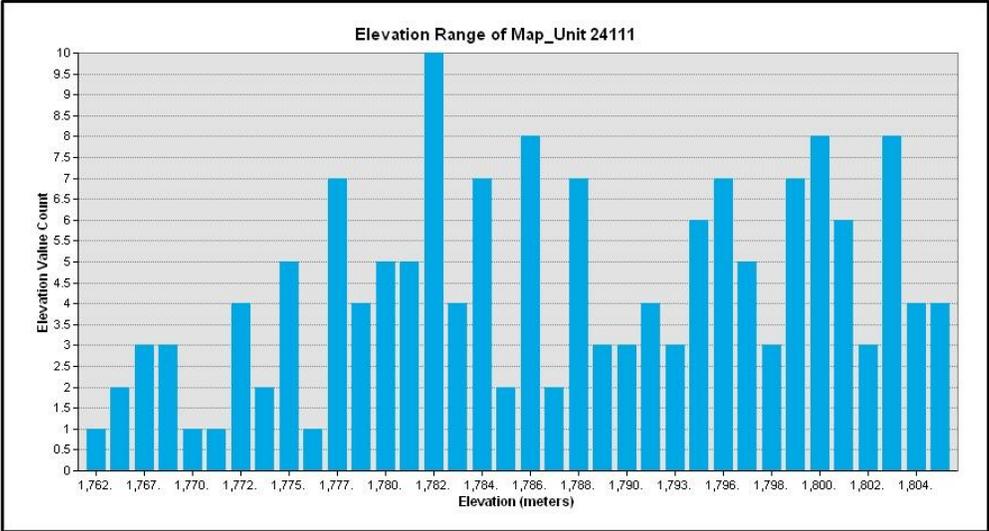
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317): This Association has little or no *C. viscidiflorus* and therefore lacks a green color component to the vegetation. Stands defined to this Association occur in similar post-disturbance settings, although not exclusively in post-burn disturbances as stands characterized by *C. viscidiflorus*.

Chrysothamnus viscidiflorus Association (24111)



DISTRIBUTION: One polygon is mapped on the northeast slope of Horse Lake Mountain.



***Cornus sericea* – *Rosa woodsii* – *Ribes* spp. Alliance (43130)**

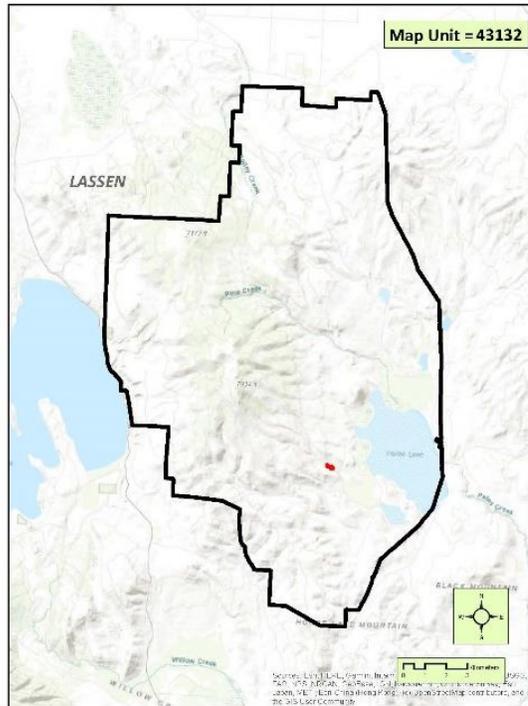
Red osier dogwood – Interior rose – Currant thickets Alliance

DESCRIPTION: *Cornus sericea* or *Rosa woodsii* is dominant or co-dominant in the shrub canopy.

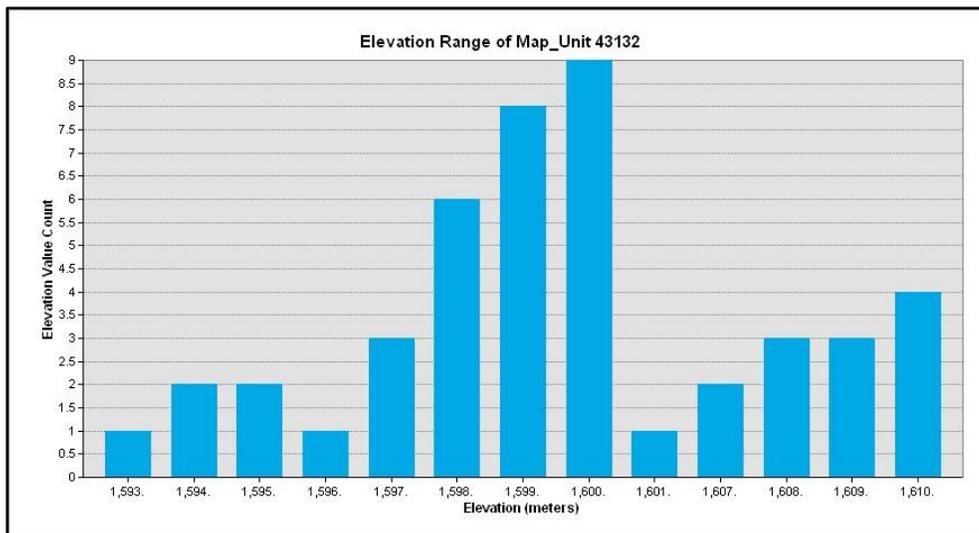
This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

Rosa woodsii Association (43132)
Woods' rose Association

DESCRIPTION: *Rosa woodsii* is greater than 50% relative cover in the shrub layer.



DISTRIBUTION: Two polygons were mapped from field data along lower Shoals Creek. Due to a very limited presence at sizes above MMU in the study area, environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



***Ericameria nauseosa* Alliance (22110)**

Rubber rabbitbrush scrub Alliance

DESCRIPTION: *Ericameria nauseosa* is typically strongly dominant in the shrub layer with or without *Artemisia arbuscula* or *Artemisia tridentata*.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Ericameria nauseosa* Association (22111)**
Rubber rabbitbrush Association



The aerial view shows a large stand of *Ericameria nauseosa* over a grassy understory. There is evidence of clearing in portions of the stand.



The ground view shows *E. nauseosa* with significant dieback in the foreground plants yielding the dark signature on the imagery. A mix of wet meadow grasses characterize the understory vegetation.

***Ericameria nauseosa* Association (22111)**

DESCRIPTION: *Ericameria nauseosa* is typically strongly dominant in the shrub layer. The understory herb layer is characteristically sparse (less than 10% cover) and has a decent native component that may include *Poa secunda*, *Epilobium brachycarpum*, and/or *Pseudoroegneria spicata*.

This Association is mapped where *Ericameria nauseosa* dominates the shrub layer in settings that do not have noticeable disturbance activity. Several stands appear to be along dry meadow edges.

PHOTOINTERPRETATION SIGNATURE: *Ericameria nauseosa* ranges broadly in signature with a blue-green, light silver to dark gray color depending on leaf vigor. Frequently there is substantial plant dieback which yields the common dark gray color contrasting with the substrate. This type is often mapped where *E. nauseosa* contrasts with the sparsely vegetated herbaceous layer.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317): This type is extremely difficult to differentiate, however, the presence of visible *Artemisia* in the shrub layer would be the key in any possible distinctions between the two Associations.
- *Ericameria nauseosa* / *Bromus tectorum* Association (22112): The presence of disturbance and higher herbaceous cover may possibly aid in distinguishing this type. Extremely difficult to differentiate.

***Ericameria nauseosa* / *Bromus tectorum* Association (22112)**
Rubber rabbitbrush / Cheatgrass Association



This aerial view is of the uppermost cliff face between the South Fork of the Pit River drainage and the Likely Tablelands. The stand contains sparse *Ericameria nauseosa* over a dense annual grassland of *Elymus caput-medusae* and *Bromus tectorum*.



Ericameria nauseosa dominates the sparse shrub layer with minimal dieback which yields the blue-gray signature on the above imagery. Non-native annuals dominate the herbaceous layer.

***Ericameria nauseosa* / *Bromus tectorum* Association (22112)**

DESCRIPTION: *Ericameria nauseosa* is typically strongly dominant in the shrub layer. Evidence of disturbance from fire, grazing, or other clearing is present. Typically, the low diversity herbaceous layer is dominated by non-native annual herbs such as *Bromus tectorum*, *Sisymbrium altissimum*, and *Taeniatherum caput-medusae*.

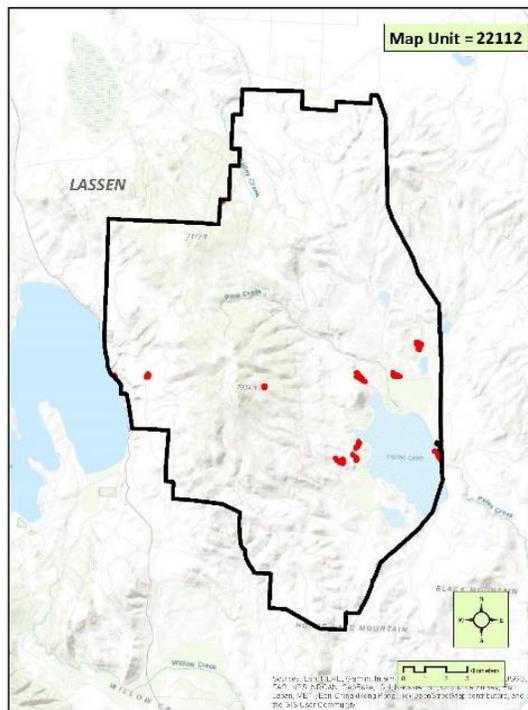
This Association is mapped sparingly, in stands averaging 12-17% shrub cover in settings that appear to have a high component of annual grasses and noticeable disturbance patterns.

PHOTOINTERPRETATION SIGNATURE: *Ericameria nauseosa* in these settings appear light silver to dark gray, individual shrubs are small with a dense crown and yield a distinct small shadow over a smooth light tan colored herbaceous layer.

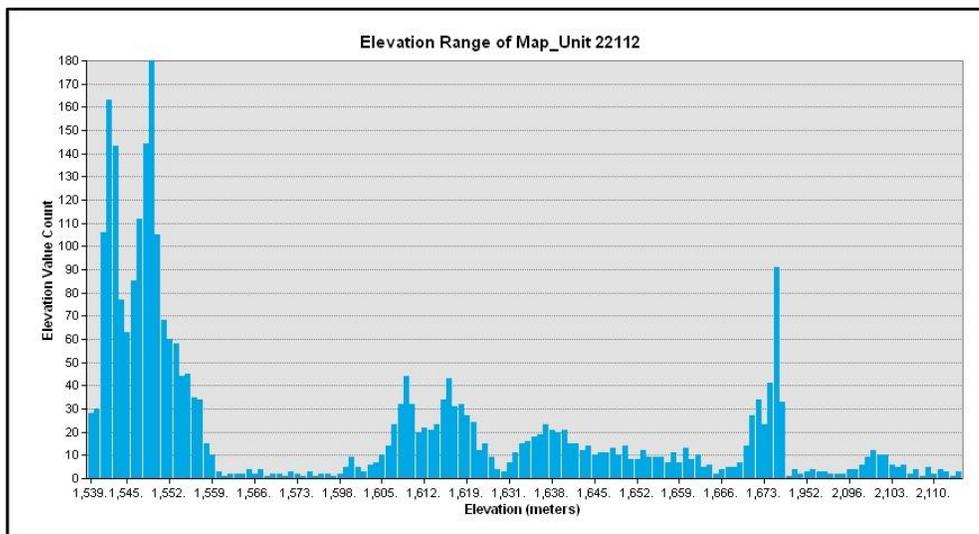
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (22317): This type is extremely difficult to differentiate, however, the presence of visible *Artemisia* in the shrub layer would be the key in any possible distinctions between the two associations.
- *Ericameria nauseosa* Association (22111): The lack of disturbance and lower herbaceous cover may possibly aid in distinguishing this type. Extremely difficult to differentiate.

***Ericameria nauseosa* / *Bromus tectorum* Association (22112)**



DISTRIBUTION: This Association is mapped on scattered sites in the vicinity of Horse Lake near irrigated pasturelands. A few sites are also located to the northeast of Eagle Lake, and on the mid slope east of Fredonyer Peak.



***Eriogonum* spp. / *Poa secunda* Alliance (22230)**

Buckwheat / Bluegrass dwarf shrubland Alliance

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Eriogonum sphaerocephalum* / *Poa secunda* Association (22231)**
Buckwheat / Pine bluegrass Association



At left, the aerial view shows a low cover of *Eriogonum* spp. with isolated *Artemisia arbuscula* over a sparse herbaceous layer of *Poa secunda* and other grasses. The distinct orange substrate color is a fairly reliable indicator of this type.



The photo depicts *Eriogonum* spp. in bloom over a cobbly substrate.

***Eriogonum sphaerocephalum* / *Poa secunda* Association (22231)**

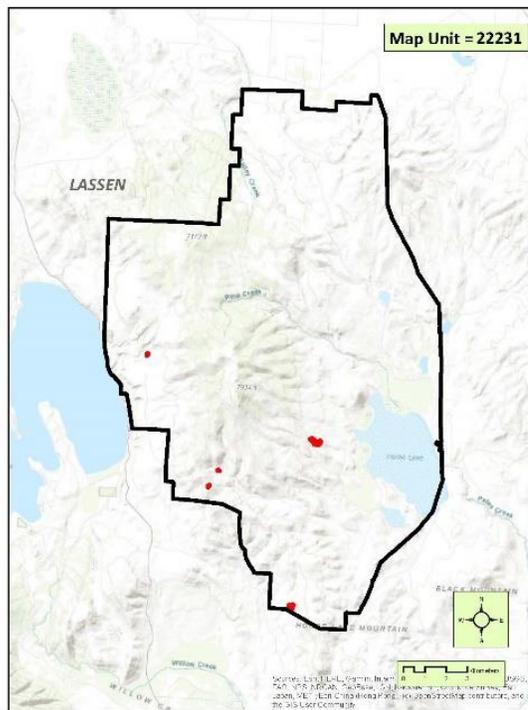
DESCRIPTION: Dwarf shrubs *Eriogonum* spp. (*E. vimineum*, *E. sphaerocephalum*, *E. prociduum*) are characteristically present even as low as less than 1% cover and usually no other shrubs are present with greater cover. Generally, on flats or exposed hilltops with significant volcanic cobble and/or gravel covering the soil surface. Total vegetation cover is usually less than 10% and often less than 5%. This type is related to the *Artemisia arbuscula* – *Eriogonum* (*microthecum*, *sphaerocephalum*) Association, but occurs on harsher sites where an evenly-distributed sub-shrub layer dominated by *Artemisia arbuscula* is unlikely.

PHOTOINTERPRETATION SIGNATURE: This Association is mapped based on its orange- to rust-colored volcanic gravelly substrate. The shrub layer is so sparse that over most of the stand the shrubs are not discernable. In areas where shrub cover becomes more distinct and regular across the landscape, it is most likely to co-dominate with *A. arbuscula*.

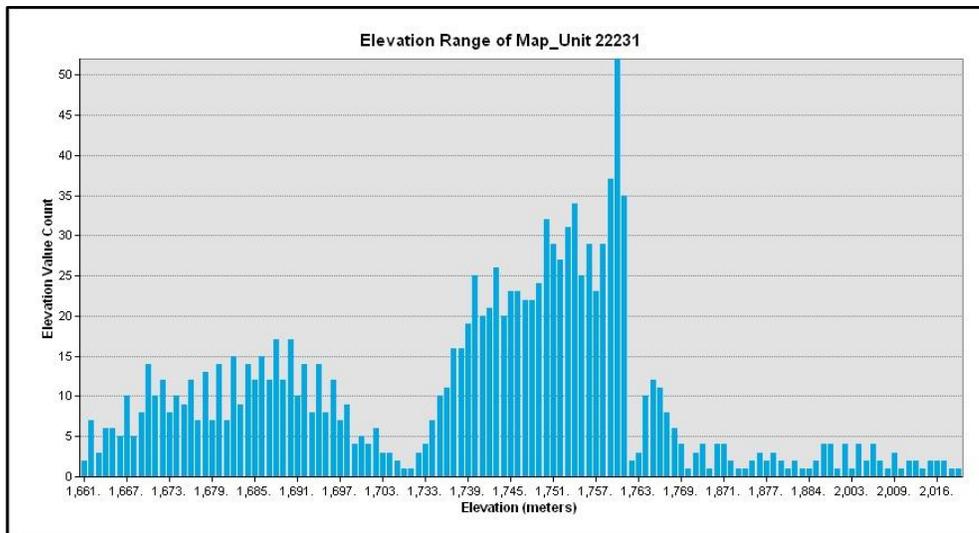
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Artemisia arbuscula* – *Eriogonum* (*microthecum*, *sphaerocephalum*) Association (22214): This Association has similar soil characteristics and has a slightly higher shrub cover that can be visible on the imagery over portions of the stand. Separating out the two Associations is difficult and may not be reliable on shrub cover alone.

***Eriogonum sphaerocephalum* / *Poa secunda* Association (22231)**



DISTRIBUTION: There are few sites of this Association mapped, on mid slopes west of Fredonyer Peak and Horse Lake Mountain, and by Shoals Creek.



***Prunus emarginata* – *Holodiscus discolor* Alliance (31120)**

Bitter cherry – Ocean spray brush Alliance

DESCRIPTION: *Holodiscus discolor*, *Prunus emarginata* and/or *Ribes velutinum* dominate in the shrub layer. *Symphoricarpos rotundifolius*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and *Artemisia tridentata* may be present as co-dominants or sub-dominants. Stands are found in forest openings or on rock outcrops.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Prunus emarginata* Association (31121)**
Bitter cherry Association



The aerial view depicts a small, dense patch of *Prunus emarginata* just below a *Cercocarpus ledifolius* stand. Pines and juniper increase toward the southwest.



The ground view portrays a dense, nearly pure stand of *Prunus emarginata* with a consistent canopy height which yield the smooth to stipple-trending texture on the imagery.

***Prunus emarginata* Association (31121)**

DESCRIPTION: *Prunus emarginata* is dominant in the shrub layer with *Symphoricarpos rotundifolius*, *Ribes velutinum*, and/or *Amelanchier utahensis*. *Holodiscus discolor* is absent.

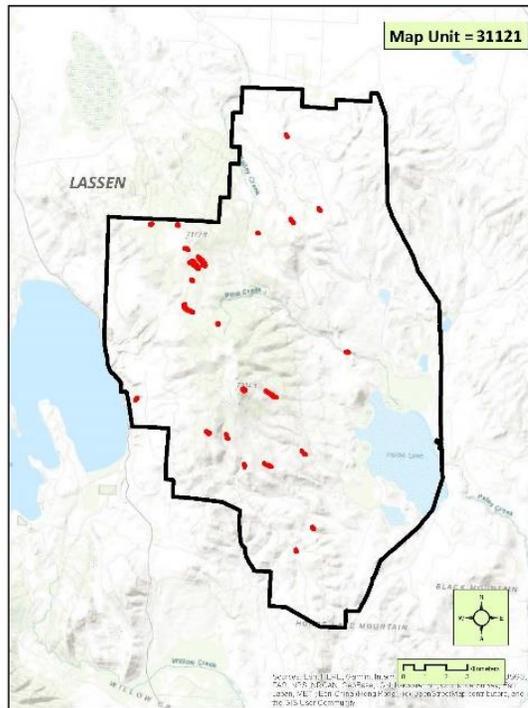
This Association is mapped where *Prunus emarginata* occurs in a wide range of cover averaging from less than 10% over a rocky or talus substrate, to over 50%, where it is found in mesic montane chaparral settings.

PHOTOINTERPRETATION SIGNATURE: *Prunus emarginata* has a medium to dark green signature that is not as bright and distinct as other montane chaparral such as *Arctostaphylos patula* or *Ceanothus velutinus*. Signature texture tends to be smooth to stippled, especially where cover is high.

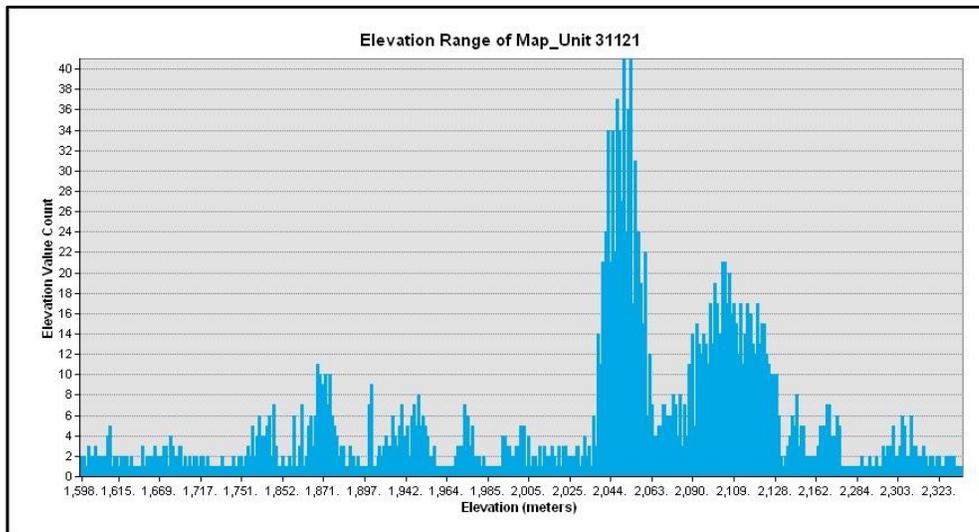
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ceanothus velutinus* Association (31111): Montane chaparral mapped to this Association tends to have a brighter green color with a smooth even texture. This type occurs in less mesic settings and often has a component of *Artemisia tridentata* ssp. *vaseyana*.

Prunus emarginata Association (31121)



DISTRIBUTION: This Association occurs sporadically within the study area. It is mapped on mid to upper slopes straddling along the Fredonyer Peak-Horse Lake Mountain ridgelines, and south and east of Cleghorn Flat.



***Holodiscus discolor* Association (31122)**
Ocean spray Association



The aerial view shows *Holodiscus discolor* with variable cover over a rocky substrate. Highest cover occurs as a narrow band along the rock interface edge where it has a greener color toward the southeastern portion of the polygon.



The aerial view shows *Holodiscus discolor* in post-bloom phenology yielding an orange color. Cover increases toward the lower rock face.

***Holodiscus discolor* Association (31122)**

DESCRIPTION: *Holodiscus discolor* is dominant in the shrub layer with *Ericameria nauseosa*, *Chamaebatiaria millefolium*, *Artemisia tridentata* ssp. *vaseyana*, *Cercocarpus ledifolius*, and/or *Ribes velutinum*.

This Association is mapped in very small stands on or adjacent to rock, talus or scree substrate in settings that normally have an extremely sparse shrub layer. Several well-developed patches along scree and talus margins have a locally dense shrub layer.

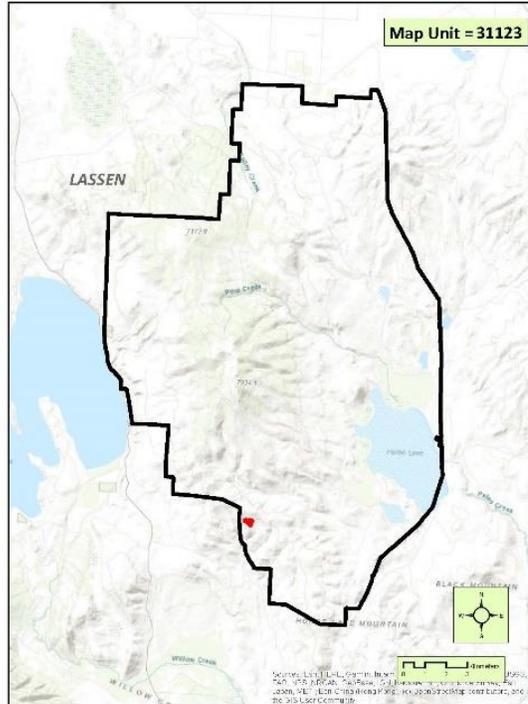
PHOTOINTERPRETATION SIGNATURE: *Holodiscus discolor* has a recognizable signature pattern where shrub cover becomes locally high, especially along the margins of scree and talus. In these settings, it has a medium green stipple-like texture. In rockier areas, the shrub component is often not detected and is modeled based on substrate topography. In these settings, cover is extremely low and no other shrub type can be identified reliably on the imagery.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

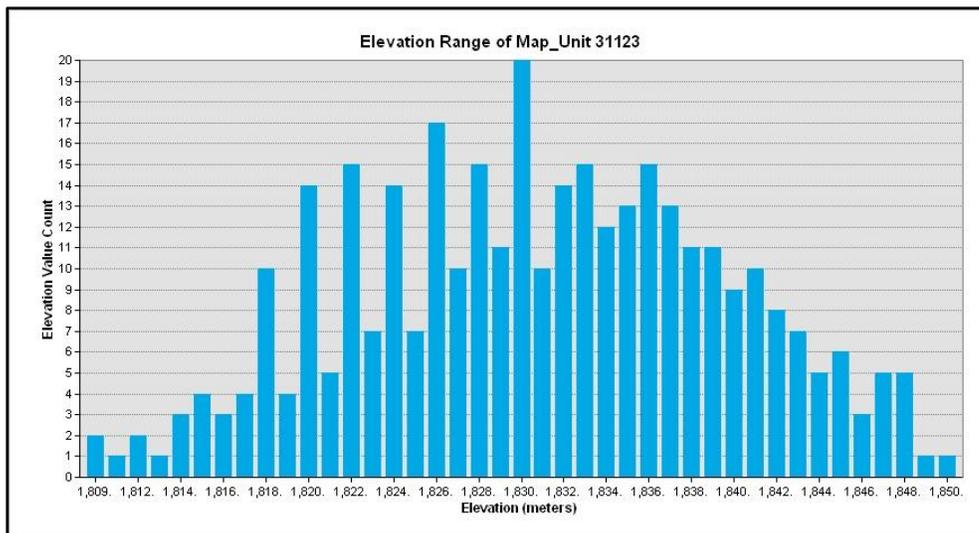
- Other associations on talus and rocky outcroppings that have extremely low cover are similar to this type.

***Ribes velutinum* Provisional Association (31123)**
 Desert gooseberry Association

DESCRIPTION: *Ribes velutinum* is dominant to co-dominant in the shrub layer with *Cercocarpus ledifolius* and/or *Prunus* spp.



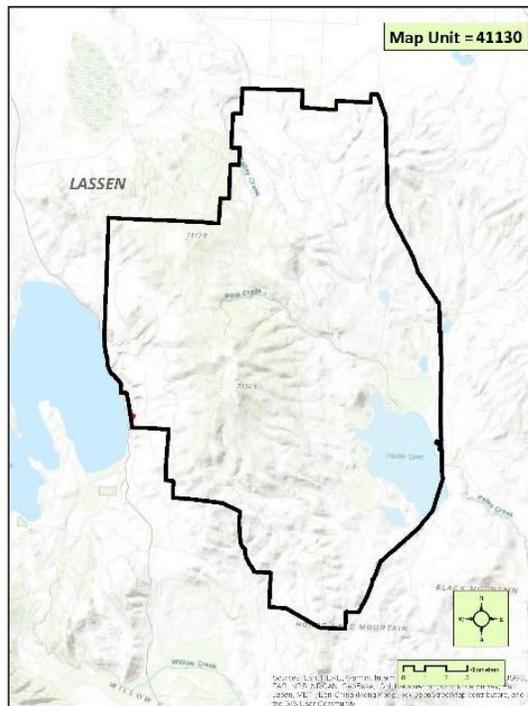
DISTRIBUTION: One stand of this Association was mapped in the study area from field data, on the mid slope of Horse Lake Mountain. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



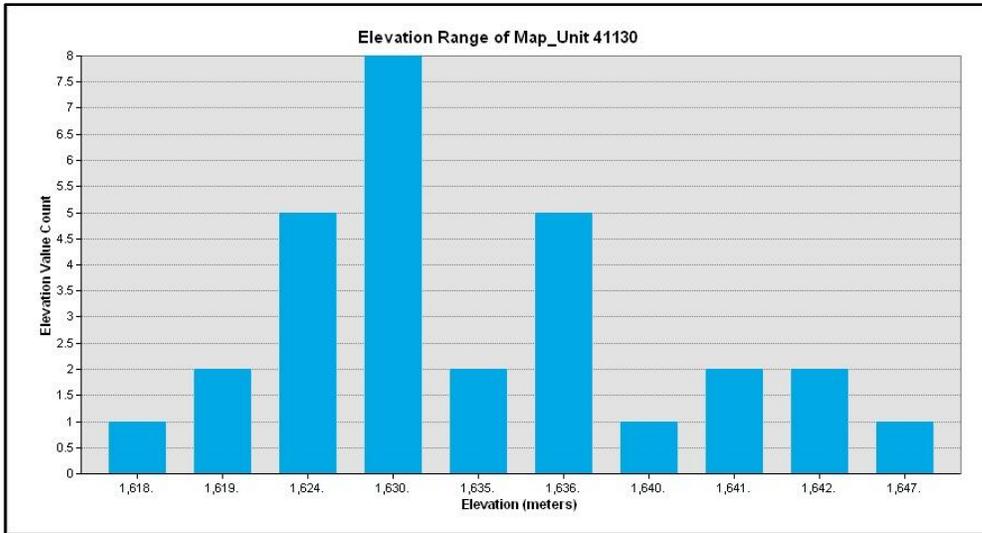
***Prunus virginiana* Alliance (41130)**

Choke cherry thickets Alliance

DESCRIPTION: *Prunus virginiana* or *Prunus subcordata* is dominant to co-dominant in the shrub layer. Typically found on rocky, moderately steep to steep (>10 degrees) north facing slopes. This type is usually mapped to the Association level and typically is not mapped at the more generalized level across the study area.

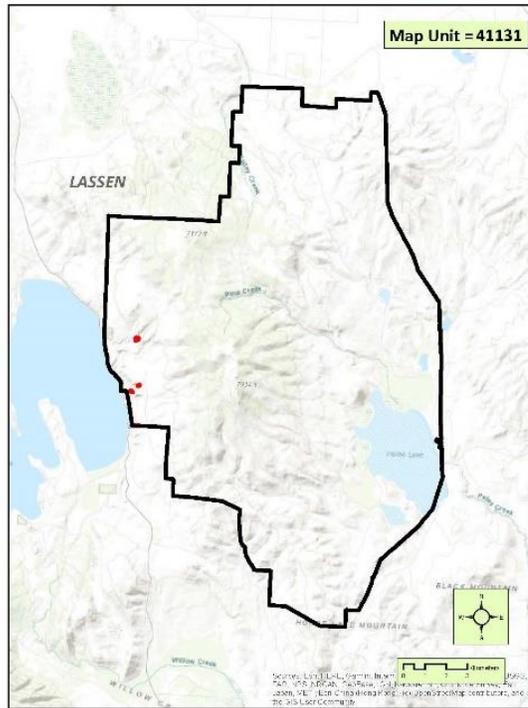


DISTRIBUTION: One polygon is mapped northeast of Eagle Lake from nearby field data. Due to a very limited presence at sizes above MMU in the study area, environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.

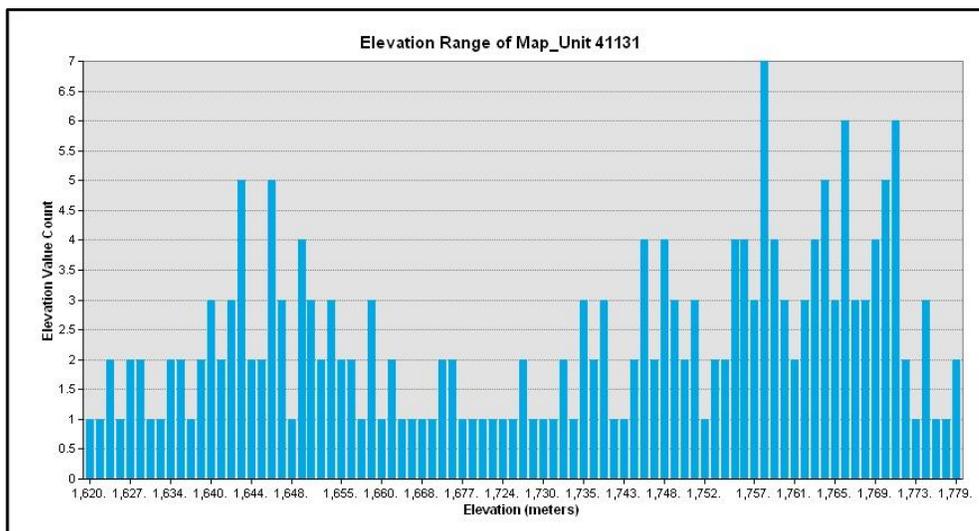


***Prunus virginiana* – *Symphoricarpos rotundifolius* Shrubland Association (41131)**
 Choke cherry / Mountain snowberry Association

DESCRIPTION: *Prunus virginiana* is dominant in the shrub layer with *Symphoricarpos rotundifolius*, *Ribes spp.*, and/or *Cercocarpus ledifolius*. Herb layer is usually sparse and may include *Leymus cinereus*, *Lupinus argenteus*, *Agastache urticifolia*, and/or *Crepis acuminata*.



DISTRIBUTION: Stands of this Association were infrequently mapped just northeast of Eagle Lake. Due to a very limited presence at sizes above MMU in the study area, environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



***Purshia tridentata* - *Artemisia tridentata* Alliance (22330)**

Antelope bitterbrush – Big sagebrush scrub Alliance

DESCRIPTION: *Purshia tridentata* is always present with at least 50% relative cover and dominant to co-dominant in the shrub layer with *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and/or *Tetradymia canescens*. *A. tridentata* may or may not be present in the stand. If *P. tridentata* does not have at least 50% relative cover, and *A. tridentata* is important, then the stand is considered as the *Artemisia tridentata* Alliance. *Juniperus occidentalis* may be present in the overstory at low cover. Typically found on moderately steep, north facing slopes. If stands are disturbed by clearing or fire, *Tetradymia canescens* may replace *P. tridentata* as the dominant shrub as an Association of this Alliance.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Purshia tridentata* – *Artemisia tridentata* Association (22335)**
Antelope bitterbrush – Big sagebrush Association



The aerial view shows a stand where juniper has been removed and *Purshia tridentata* is returning as a dominant to co-dominant shrub with *Artemisia tridentata*.



The aerial view shows *Purshia tridentata* strongly co-dominating the stand with *A. tridentata*. Jeffrey pine and juniper can be seen in the background.

***Purshia tridentata* – *Artemisia tridentata* Association (22335)**

DESCRIPTION: *Purshia tridentata* is dominant to co-dominant in the shrub layer with or without *Artemisia tridentata*. The herb layer is dominated by grasses including *Poa secunda*, *Pseudoroegneria spicata*, *Achnatherum thurberianum*, *Festuca idahoensis*, and/or *Bromus tectorum*.

This Association is mapped where *Purshia tridentata* mixes with and has higher cover than *A. tridentata*. They appear to follow disturbance patterns, possibly caused by fire or where clearing has occurred for rangeland grazing.

PHOTOINTERPRETATION SIGNATURE: *Purshia tridentata* has a dark green color whereas *Artemisia tridentata* varies from silver gray to light blue. In mixed settings, it can be difficult to determine relative cover.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

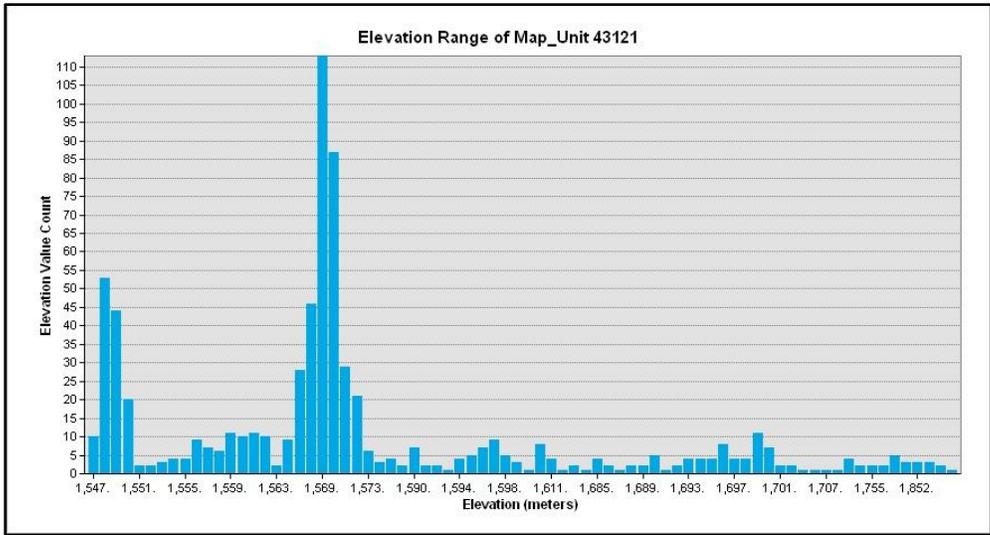
- *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (22323): These types can be difficult to separate out due to a high variability of mixing of the *Artemisia* spp. and *Purshia tridentata* over widespread areas. The green color of the *Purshia tridentata* can be subtle and in larger stands requires extensive review.

***Salix boothii* – *Salix geyeriana* – *Salix lutea* Alliance (43120)**

Booth's willow – Geyer's willow – Yellow willow thickets Alliance

DESCRIPTION: Shrubby *Salix lasiandra* var. *lasiandra* or *S. lasiandra* var. *caudata* (*Salix lucida*, *Salix lasiandra* in some taxonomies) is characteristic of the large shrub layer. *Salix lasiolepis* may be dominant.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.



***Salix exigua* Alliance (41120)**

Sandbar willow thickets Alliance



The aerial view shows a pure stand of *Salix exigua* along the margins of the West Valley Reservoir adjacent to the Likely Tablelands. This example has a high percentage of die-off.



Salix exigua is the sole dominant willow in this stand.

***Salix exigua* Alliance (41120)**

DESCRIPTION: *Salix exigua* is dominant or co-dominant in the shrub layer with *Salix lasiolepis*, *Rosa woodsii* and/or *Ribes cereum*.

PHOTOINTERPRETATION SIGNATURE: *Salix exigua* yields a stipple-like texture that ranges from dull green or dark gray to a light blue. There appears to be die-off along the lake margins as well as new growth.

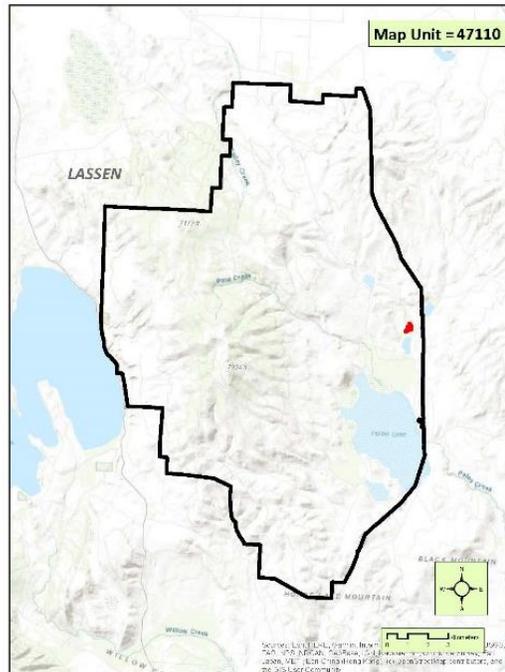
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Salix lasiolepis* – *Rosa woodsii* / Mixed Herbs Association (43111): Most stands have a brighter and greener trending color with a variable texture. *S. exigua* generally has a stipple-like texture. *S. lasiolepis* is more often found in narrow canyons in contrast to *S. exigua* where it occurs along lake margins.

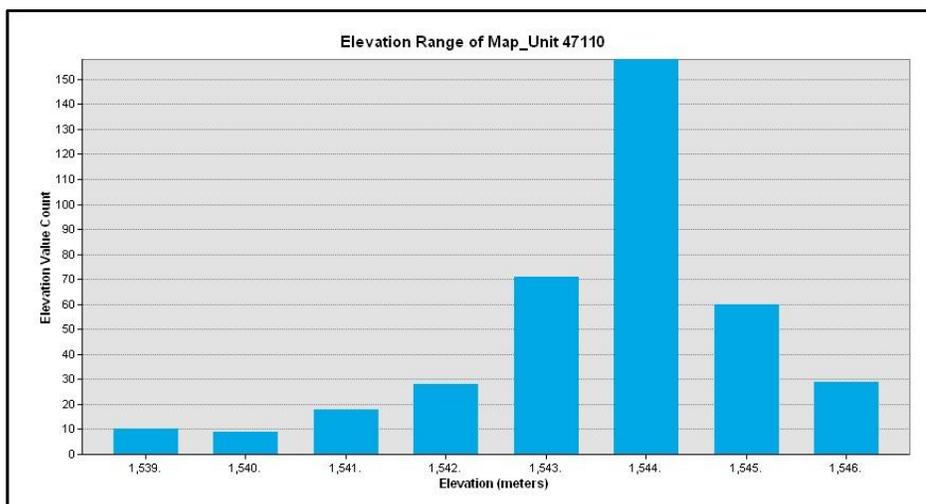
***Sarcobatus vermiculatus* Alliance (47110)**

Greasewood scrub Alliance

DESCRIPTION: Stands associated with larger playas or former Pleistocene lakebeds on fine, clayey soils often with a distinctly light color relative to adjacent upland substrates. *Sarcobatus vermiculatus* is dominant to sub-dominant in the shrub layer with *Artemisia tridentata*, *Atriplex confertifolia*, and/or *Chrysothamnus* spp. Herb layer is sparse, typically <10%. Stands are found on flats adjacent to playas.



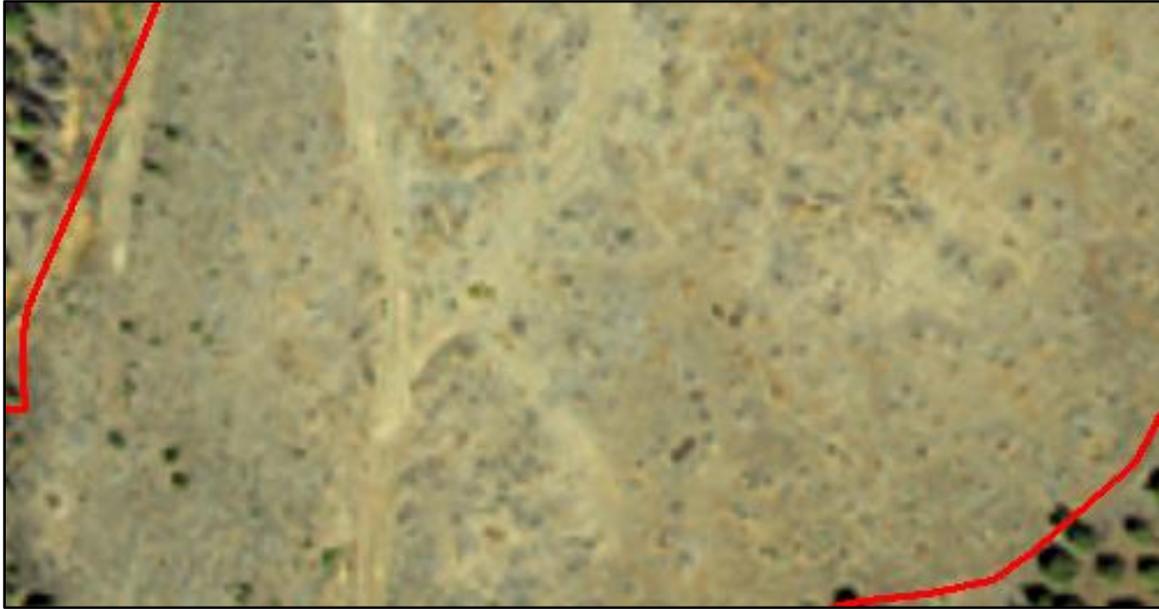
DISTRIBUTION: Stands of this Alliance were infrequently mapped in the study area. Two polygons were mapped in the meadows just north of Horse Lake. Due to a very limited presence at sizes above MMU in the study area, environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



APPENDIX B-3: Herbaceous

- Bromus tectorum* – *Elymus caput-medusae* Alliance (22120)
 - Bromus tectorum* Association (22121)
 - Elymus caput-medusae* Provisional Association (22122)
- Carex (aquatilis, lenticularis)* Alliance (41310)
 - Carex aquatilis* – *Carex lenticularis* Association (41311)
- Carex simulata* Alliance (41320)
- Distichlis spicata* Alliance (48110)
- Eleocharis (acicularis, macrostachya)* Alliance (44110)
 - Eleocharis macrostachya* Provisional Association (44111)
- Elymus cinereus* – *Elymus triticoides* Alliance (48120)
 - Elymus cinereus* Association (48121)
 - Elymus triticoides* – *Poa secunda* Association (48122)
- Festuca idahoensis* – *Pseudoroegneria spicata* – *Poa secunda* Alliance (32110)
 - Pseudoroegneria spicata* – *Poa secunda* Association (32111)
 - Festuca idahoensis* – *Pseudoroegneria spicata* Association (32112)
- Juncus balticus* – *Juncus mexicanus* Alliance (41370)
 - Juncus arcticus* var. *balticus* – (var. *mexicanus*) Association (41371)
- Juncus nevadensis* Alliance (41350)
 - Juncus nevadensis* Association (41351)
- Lotus unifoliolatus* Provisional Alliance (34110)
- Navarretia leucocephala* ssp. *minima* – *Plagiobothrys cusickii* Alliance (44210)
 - Taraxia tanacetifolia* – *Iva axillaris* Provisional Association (41382)
- North American Desert Alkaline – Saline Marsh & Playa Group (48100)
- Oregon – Washington – British Columbia Vernal Pool Group (44200)
- Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance (41380)
- Schoenoplectus americanus* Alliance (45120)
 - Schoenoplectus americanus* Association (45121)
- Typha domingensis* – *Typha latifolia* – *Typha angustifolia* Alliance (45110)
 - Typha domingensis* Association (45111)
- Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group (41300)

***Bromus tectorum* Association (22121)**
Cheatgrass Association



The aerial view shows *Bromus tectorum* in a less recent juniper removal effort. Junipers are visible at both margins of the image.



The ground view depicts an old juniper removal stand with a sparse cover *Bromus tectorum* over a cobbly substrate.

***Bromus tectorum* Association (22121)**

with *Elymus elymoides*, *Sisymbrium altissimum*, *Erodium cicutarium*, and/or *Descurainia sophia*. *Elymus caput-medusae* may be present but only as a sub-dominant. *Elymus elymoides* may be strongly dominant in areas with juniper removal. Low cover of shrubs such as *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and/or *Tetradymia glabrata* may be present but usually patchy.

PHOTOINTERPRETATION SIGNATURE: Most examples tend to have a golden color early in the drying season trending to a light beige towards the end of summer. Texture is finely stippled to smooth.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Elymus caput-medusae* Provisional Association (22122): Possibly found in slightly less xeric topography and perhaps more likely in post fire settings. These two associations are very difficult to tell apart.

***Elymus caput-medusae* Provisional Association (22122)**
Medusa head Association



The aerial view depicts a large stand of *Elymus caput-medusae* near the edge of the Likely Tablelands.



The aerial view shows *Elymus caput-medusae* over thin soil. Overall, the photo portrays a slightly lighter straw color compared to the more golden color of *Bromus tectorum*.

***Elymus caput-medusae* Provisional Association (22122)**

DESCRIPTION: *Elymus caput-medusae* is strongly dominant to co-dominant with *Bromus tectorum*, *Bromus arvensis*, *Erodium cicutarium*, and/or *Lactuca serriola*. If co-dominant with *Ventenata dubia* the stand is considered as the *Ventenata dubia* Provisional Association.

PHOTOINTERPRETATION SIGNATURE: Most examples tend to have a golden color early in the drying season trending to a light beige towards the end of summer. Texture is finely stippled to smooth. Although color overlap between the two associations within the Alliance is high, this association may yield a color trending slightly more towards the beige.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Bromus tectorum* Association (22121): The two Associations are nearly impossible to differentiate although *Bromus tectorum* tends to have a more golden, less straw-like color.

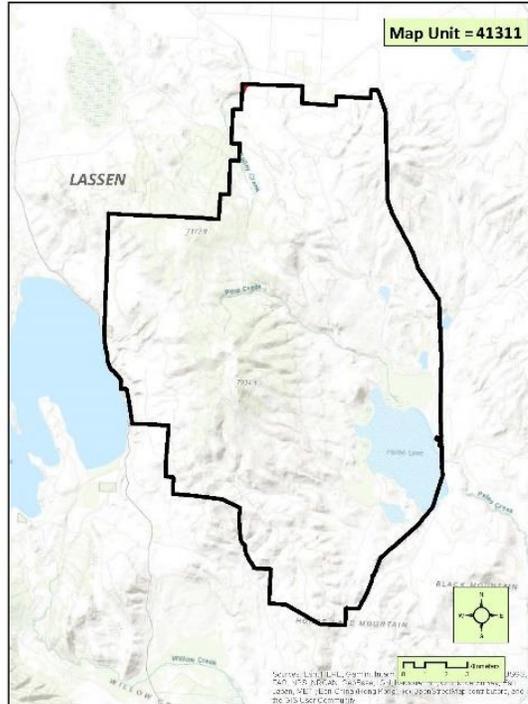
Carex (aquatilis, lenticularis) Alliance (41310)

Water sedge and lakeshore sedge meadows Alliance

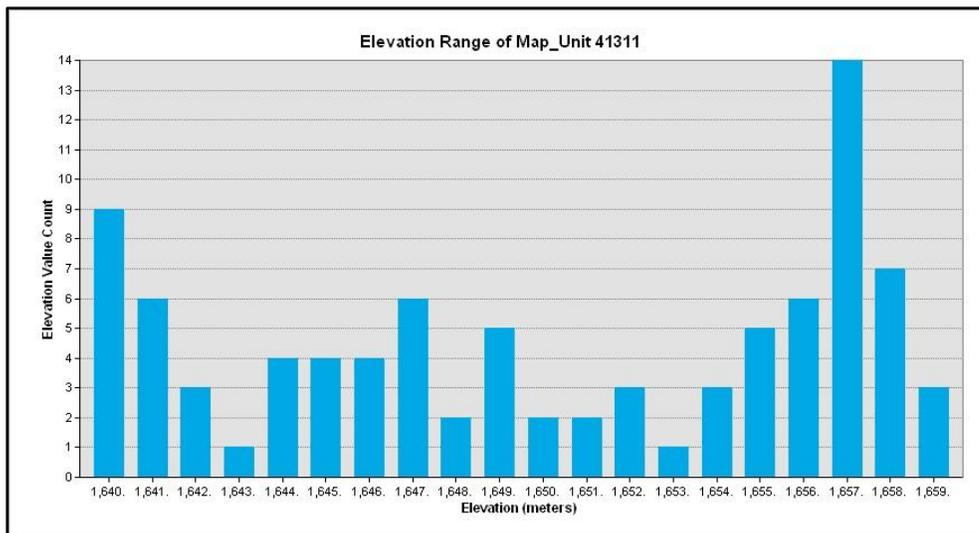
This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

Carex aquatilis – Carex lenticularis Association (41311)
 Water sedge – Lakeshore sedge Association

DESCRIPTION: *Carex aquatilis* and/or *Carex lenticularis* dominate the herb layer.



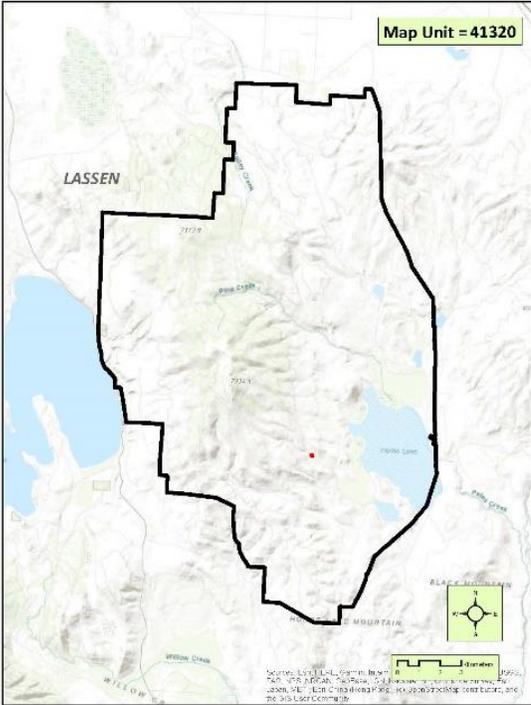
DISTRIBUTION: Only one stand of this Association was mapped in the study, based on field information. The stand is along Bailey Creek just downslope to the north of Bailey Reservoir. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



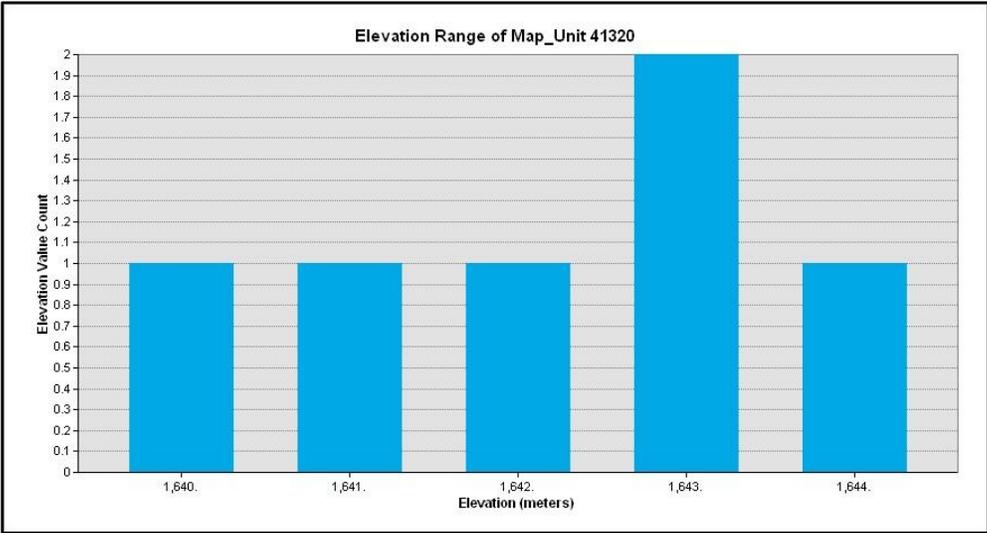
Carex simulata Alliance (41320)

Short-beaked sedge fens Alliance

DESCRIPTION: *Carex simulata* present and conspicuous.



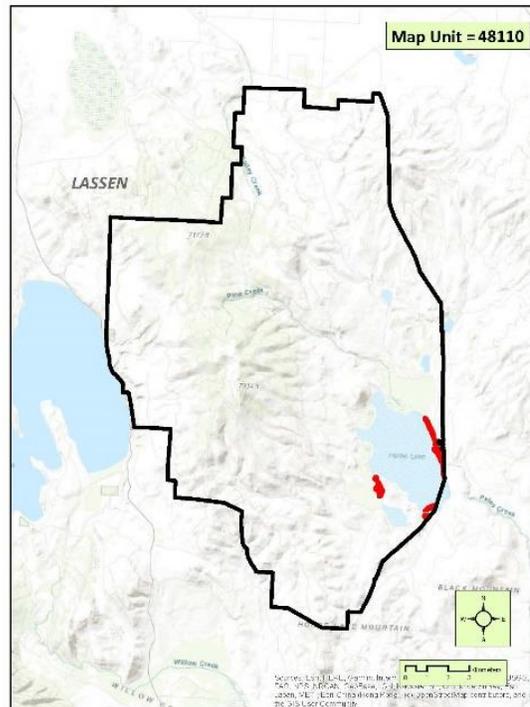
DISTRIBUTION: One stand of this Alliance was mapped in the study area, based on field information. The narrow stand is at the 5400 foot level along Shoals Creek east of Horse Lake. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



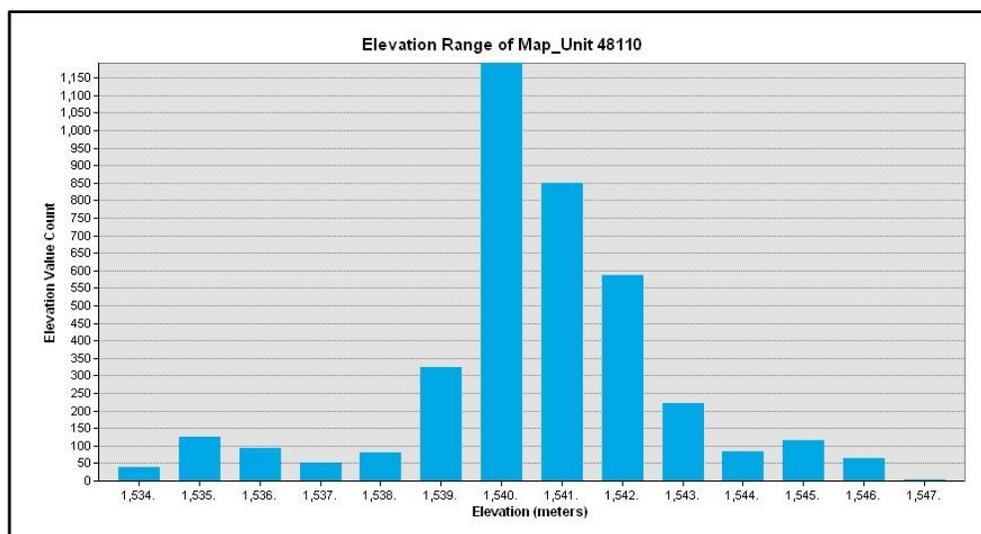
***Distichlis spicata* Alliance (48110)**

Salt grass flats Alliance

DESCRIPTION: Stands characterized by saltgrass, *Distichlis spicata*, though other herbaceous species may have higher cover. May have other halophytes (*Bassia*, *Nitrophila*, etc.). Found at Horse Lake and expected on other Pleistocene alkaline lakebeds/playas. If *Juncus balticus* co-dominates stand also considered as *Distichlis spicata* Alliance.



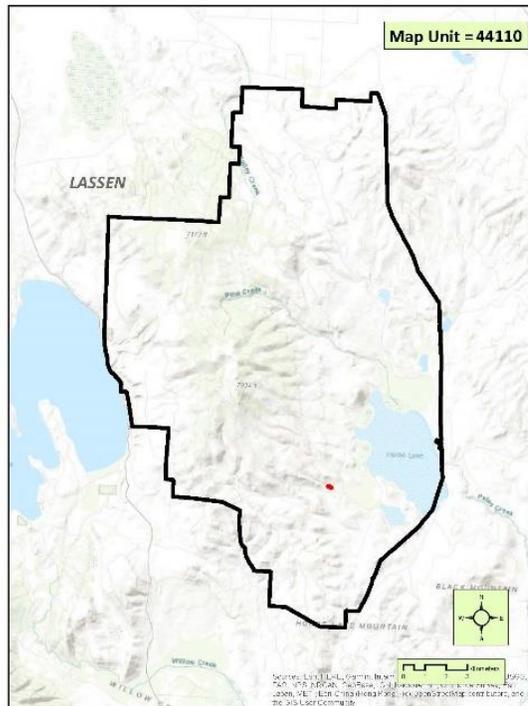
DISTRIBUTION: Stands of this Alliance were infrequently mapped (most likely under mapped) in the study area, based on field data, around Horse Lake. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



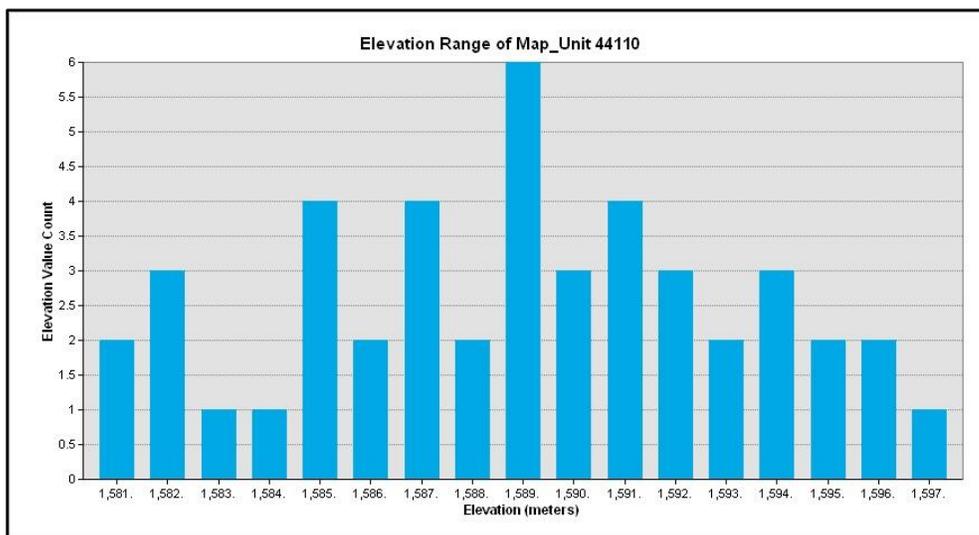
Eleocharis (acicularis, macrostachya) Alliance (44110)

Needle spike rush and pale spike rush marshes Alliance

DESCRIPTION: Stands, in peak phenology, contain several genera typical of California vernal pools, including: *Eleocharis* (especially *E. acicularis*, or *E. macrostachya*), *Psilocarphus*, *Downingia* spp., *Gratiola*, and/or *Epilobium* (subgenus *Boisduvalia*). This type is usually mapped to the Association level and typically is not mapped at the more generalized level across the study area.



DISTRIBUTION: One polygon was mapped at the Alliance level along a minor tributary of Cottonwood Creek.



***Eleocharis macrostachya* Provisional Association (44111)**
Common spike rush Association



The aerial view shows a vernal pool setting within a narrow band from the top center to bottom right of the image. The stand is late phenology with no visible wetness in the soil.



The ground photo shows an *Eleocharis* dominated late phenology vernal meadow with some *Juncus*.

***Eleocharis macrostachya* Provisional Association (44111)**

DESCRIPTION: *Eleocharis macrostachya* is co-dominant with other vernal pool species including *Downingia bacigalupii*, *Marsilea vestita*, and *Trifolium cyathiferum*.

PHOTOINTERPRETATION SIGNATURE: Image color varies considerably depending on how late in the season water is present. Mapped primarily in setting where photointerpreters focus on swale-like topography where the likelihood that vernal pools would occur. In these swale settings, features are subtle, however, in marginal settings non-vernal pool species area also frequently present. It is difficult to ascertain a direct link to vernal pool species using phenology & topographical setting from the imagery.

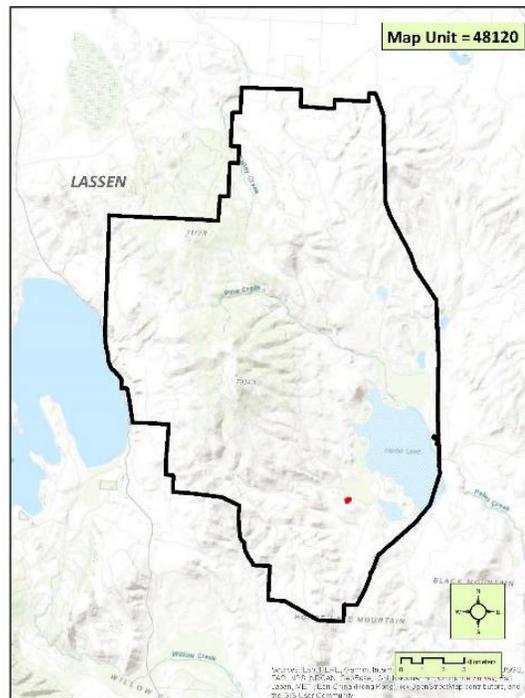
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Non-vernal seasonal drying meadow types that are difficult to ascertain as a classic vernal pool setting of late spring evaporation.

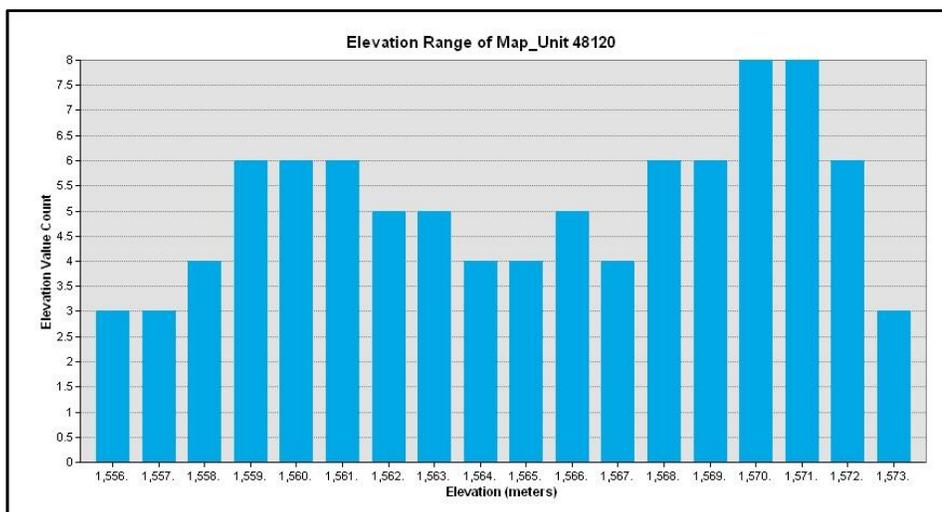
***Elymus cinereus* – *Elymus triticoides* Alliance (48120)**

Ashy ryegrass – Creeping wildrye turfs Alliance

DESCRIPTION: Grassland stands of relatively heavy soils (including clay mounds), not always in obvious alkaline basins, but often moist in early summer. *Elymus triticoides* or *E. cinereus* are obvious and consistent throughout stand and are dominant to sub-dominant in the herbaceous layer with *Bromus tectorum*, *Poa secunda*, and/or *Descurainia sophia*. Stands are on lower slopes, often conspicuous following fires.

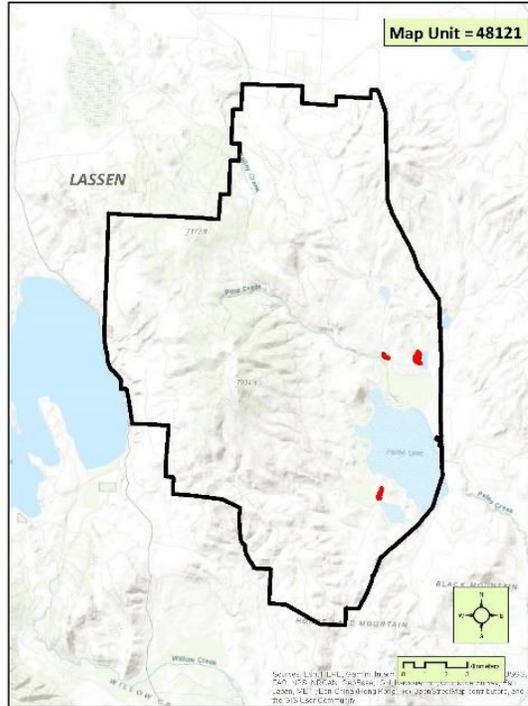


DISTRIBUTION: Only one stands was mapped at the Alliance level, based on field information. Large tufts were noted in the one example, just west of Craemer Reservoir. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.

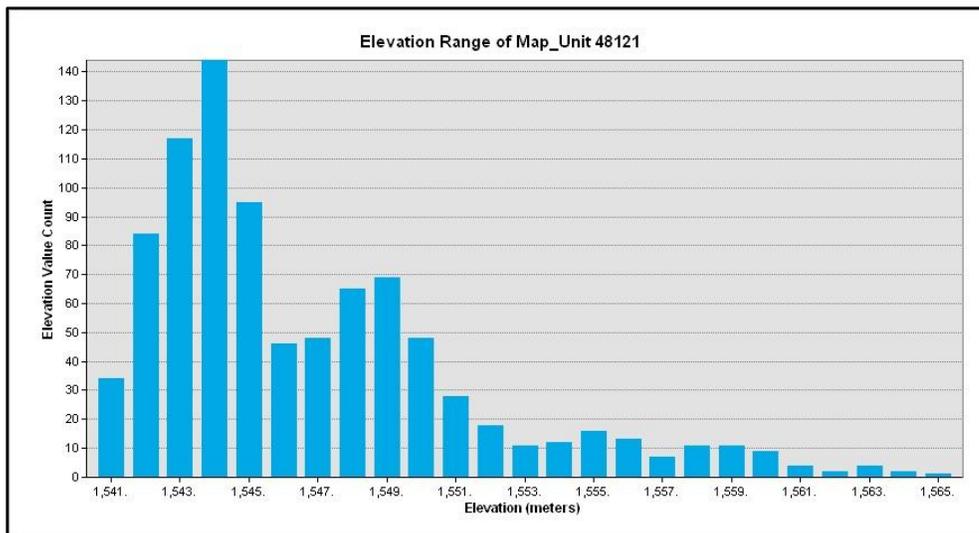


***Elymus cinereus* Provisional Association (48121)**
 Ashy ryegrass Association

DESCRIPTION: The large tufted perennial grass *Elymus (Leymus) cinereus* is dominant to co-dominant with *Poa secunda* and/or *Bromus tectorum*.

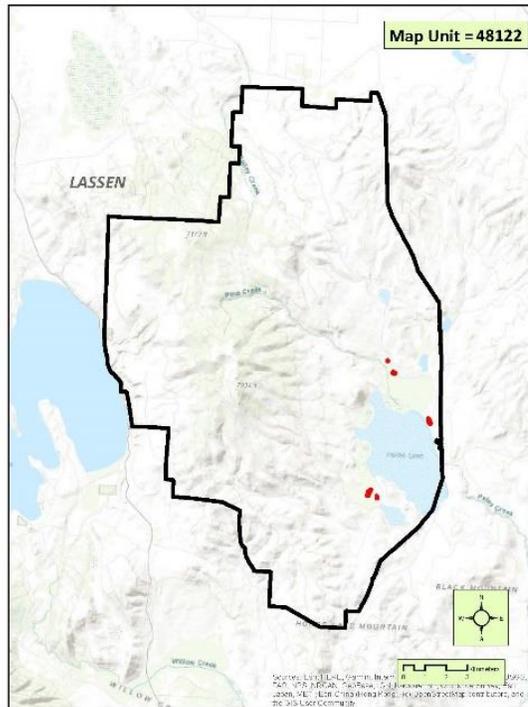


DISTRIBUTION: Three stands of this Association were mapped based on field information, at the edge of meadows surrounding Horse Lake. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.

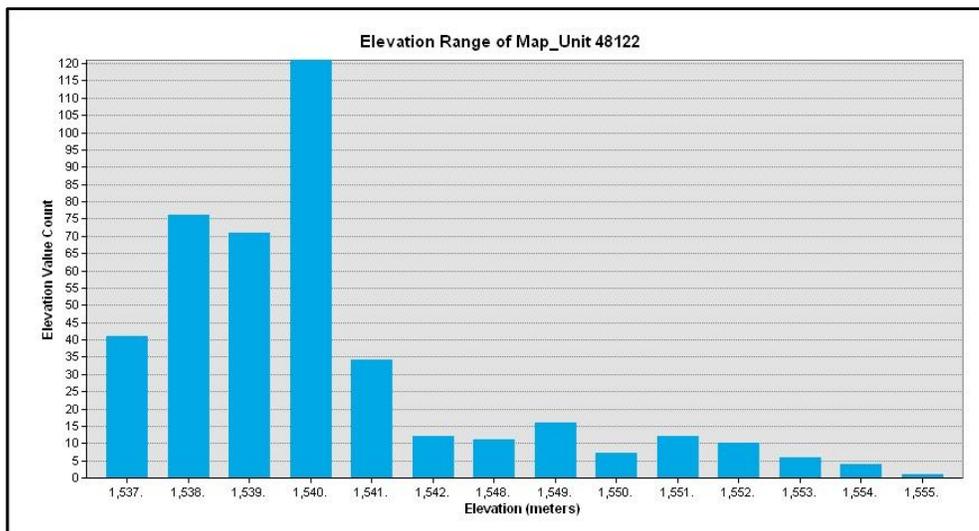


***Elymus triticoides* – *Poa secunda* Association (48122)**
 Creeping wildrye – Pine bluegrass Association

DESCRIPTION: *Elymus triticoides* dominant to co-dominant with *Poa secunda*. *Poa secunda* may be absent.



DISTRIBUTION: Five stands of this Association were mapped in the study area, based field information, on meadow edges surrounding Horse Lake. Environmental correlates, and/or photointerpretation signature attributes cannot reliably be established for this project.



***Festuca idahoensis* – *Pseudoroegneria spicata* – *Poa secunda*
Alliance (32110)**

Idaho fescue – Bluebunch wheatgrass – Pine bluegrass grassland Alliance



Aerial image shows dense *Festuca* grassland stand with a few *Juniperus occidentalis*.



Ground photo depicting dense grass with *Festuca idahoensis*, with *Elymus caput-medusae*.

***Festuca idahoensis* – *Pseudoroegneria spicata* – *Poa secunda* Alliance (32110)**

DESCRIPTION: Stands dominated and/or characterized by *Festuca idahoensis*, *Elymus spicatus*, *Pseudoroegneria spicata*, and/or *Poa secunda*, without significant cover of *Elymus smithii*. Non-native annual grasses such as *Bromus tectorum* and *Taeniatherum caput-medusae* may exceed the cover of native grasses but total herbaceous nativity is usually greater than 20% relative cover.

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Pseudoroegneria spicata* – *Poa secunda* Association (32111)**
Bluebunch wheatgrass – Pine bluegrass Association



The aerial view shows a stand of sparse herbaceous vegetation in a small opening in the *Artemisia* along a rocky sloping ridgeline. The grassland is dominated by *Poa secunda*.



The ground view depicts a small rocky portion of the *Poa* stand. An example of the *E. nauseosa* component is visible in the upper left portion of the photo.

***Pseudoroegneria spicata* – *Poa secunda* Association (32111)**

DESCRIPTION: Stands are characterized by *Pseudoroegneria spicata* and/or *Poa secunda*, usually on warmer aspects with rocky substrate. Non-native species such as *Bromus tectorum* or *Elymus caput-medusae* often co-dominate or dominate the herb layer, but native cover is usually greater than 20%. Other native herb species present include *Elymus elymoides*, *Epilobium brachycarpum*, *Blepharipappus scaber*, *Achnatherum thurberianum*, and/or *Lomatium* spp. *Festuca idahoensis* may be present but sub-dominant. Stands have typically burned within the past 10 years.

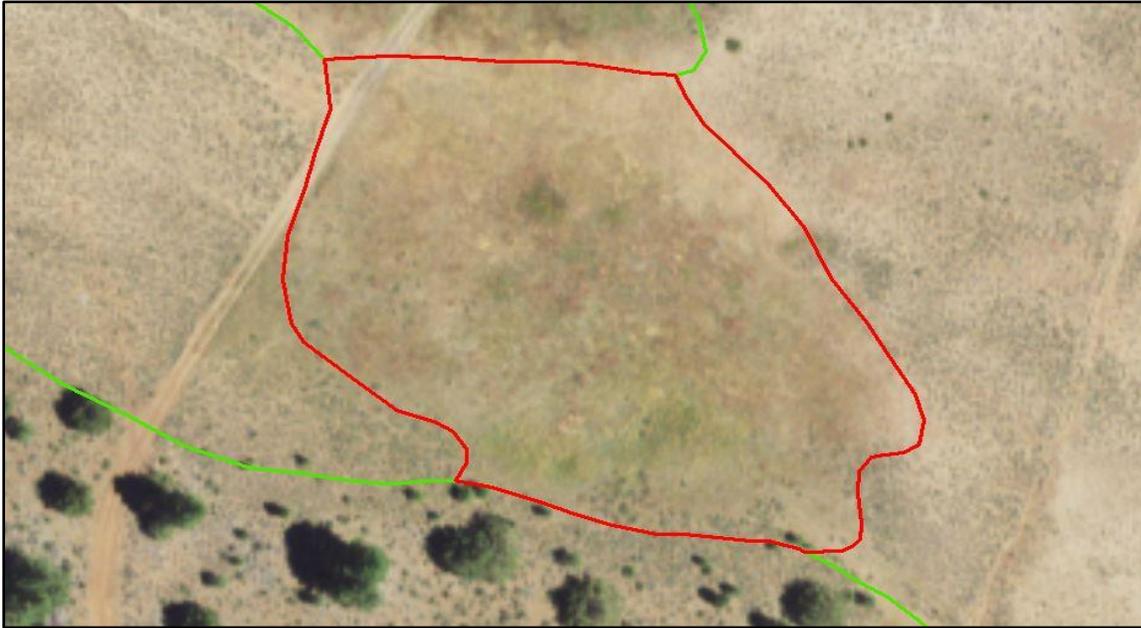
This Association was mapped based on 2019 and 2020 reconnaissance observations, and 2019 classification survey point data.

PHOTOINTERPRETATION SIGNATURE: Late spring-early summer season imagery yields typical upland grass patterns with colors ranging from light tan or beige to medium brown. Texture is smooth but mottled, possibly due to non-native grass components common in this Alliance. The Associations are modeled on elevation and adjacent vegetation. This particular Association generally occurs at elevations below 5500-6000 feet.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Bromus tectorum* – *Elymus caput-medusae* Alliance (22120): Very similar in color, texture, and patterning. Photointerpreters look for disturbance, especially post-fire and scraping, however, these disturbance indicators are at best only partially reliable.
- *Festuca idahoensis* – *Pseudoroegneria spicata* Association (32112): Modeled at elevations above 5500-6000 feet and by their associated woody vegetation. This Association is more likely to have adjacent woodlands with a component of *Pinus jeffreyi* or *Cercocarpus ledifolius* than the Association co-dominated with *Poa secunda*.

***Festuca idahoensis* – *Pseudoroegneria spicata* Association (32112)**
Idaho fescue – Bluebunch wheatgrass Association



This aerial view shows a fairly uniform stand of *Festuca idahoensis*, *Elymus*, and *Poa*.



The ground photo shows *Festuca idahoensis* in the foreground with a stand of *Pinus ponderosa* and *Juniperus occidentalis* in the background.

***Festuca idahoensis* – *Pseudoroegneria spicata* Association (32112)**

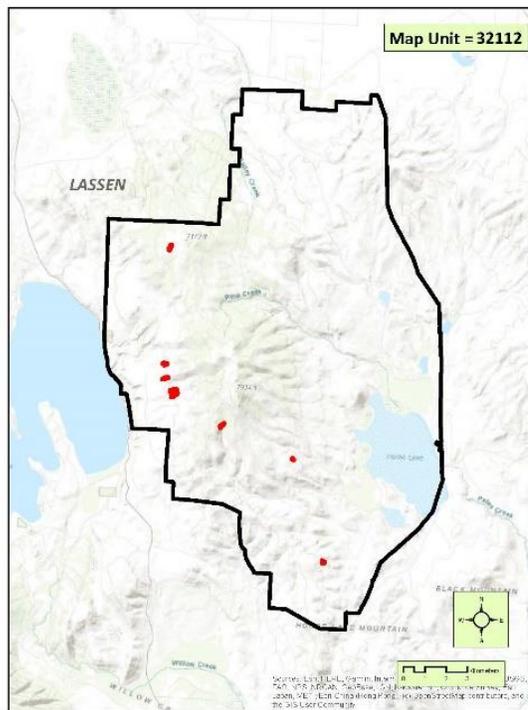
DESCRIPTION: Stands dominated or co-dominated by *Festuca idahoensis* with *Bromus tectorum*, *Elymus elymoides*, *Pseudoroegneria spicata*, and/or *Achnatherum thurberianum*. Compared to the *Pseudoroegneria spicata* – *Poa secunda* Grassland Association, stands are generally found on upper slopes on neutral to cooler aspects above 5500 feet.

PHOTOINTERPRETATION SIGNATURE: Similar to the lower elevation *Pseudoroegneria spicata* – *Poa secunda* Association, but more limited in distribution and smaller stand size. Stands dominated by the tall shrub *Cercocarpus ledifolius* can indicate the presence of this high elevation grassland nearby.

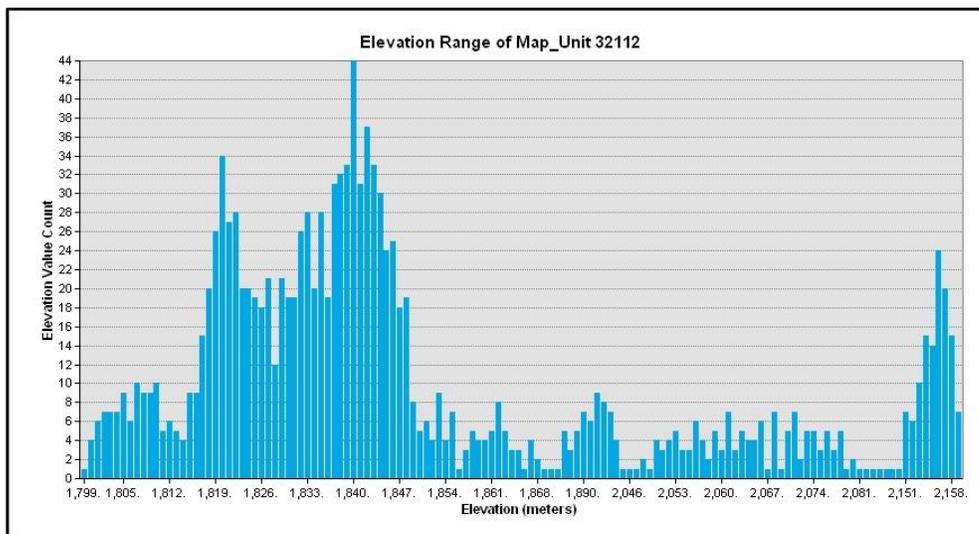
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pseudoroegneria spicata* – *Poa secunda* Association (32111): Not separable based on the imagery alone; it is modeled out at lower elevations where adjacent shrubs are dominated frequently by *Artemisia tridentata* or *A. arbuscula*.

***Festuca idahoensis* – *Pseudoroegneria spicata* Association (32112)**



DISTRIBUTION: This Association is infrequently mapped and is primarily limited to several mid slope polygons west of the Fredonyer Peak ridgeline, and on Horse Lake Mountain.



***Juncus balticus* – *Juncus mexicanus* Alliance (41370)**

Baltic and Mexican rush marshes Alliance



This aerial view shows a broad drainage with *Juncus balticus*, *Poa*, *Hordeum brachyantherum*, and *Epilobium* in a grazing rangeland.



Ground view along a meadow, with *Juncus balticus* in the foreground.

***Juncus balticus* – *Juncus mexicanus* Alliance (41370)**

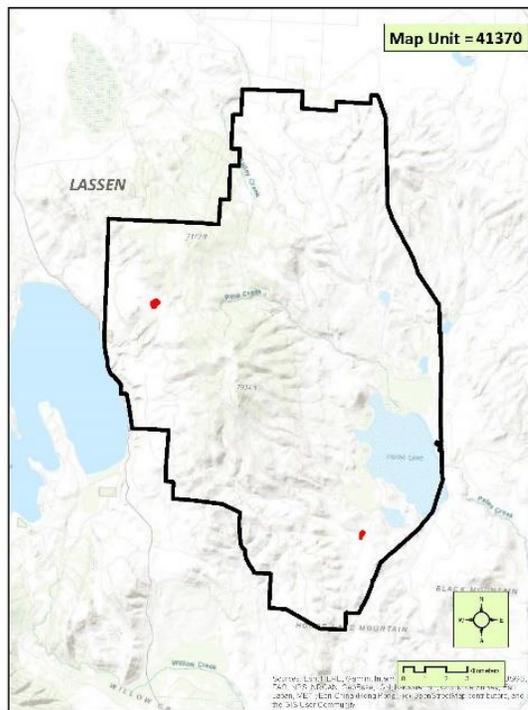
DESCRIPTION: Mapped to the Alliance level in stands that appear to have components of vegetation that may be characteristic of other types.

PHOTOINTERPRETATION SIGNATURE: *Juncus* spp. has a wide range of signature attributes depending on species composition and phenology. Healthy stands with plenty of near-surface water tend to be medium to dark green. Mottling patterns in the stand are the result of variable water presence near the surface. Older late-season and drier stands tend to have either a light green to yellow or orange-brown color patterns. Texture is smooth to slightly mottled. Flooding characteristics tend to favor lateral movement of water and therefore many of the *Juncus* dominated meadows tend to be long and fairly narrow with sloping terrain often near and along the margins of the stand.

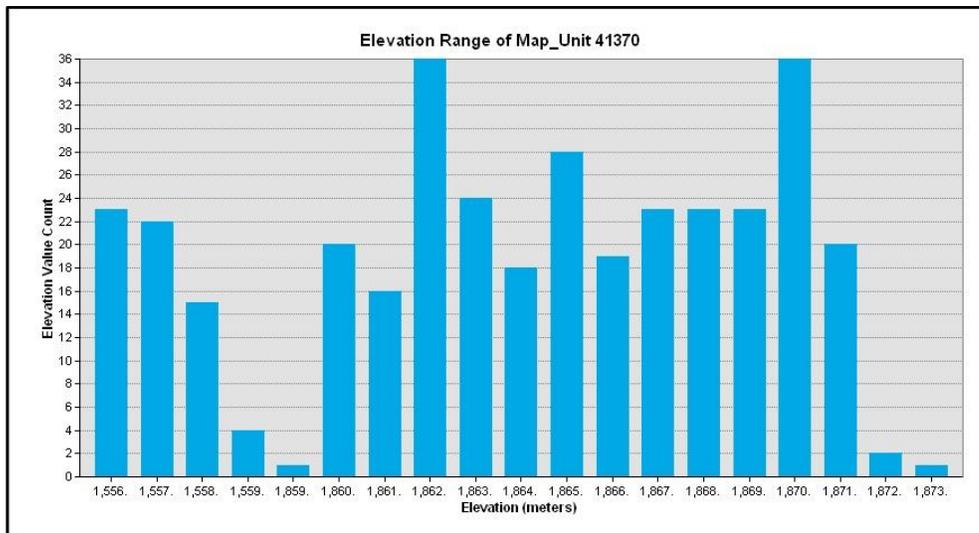
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Most other meadow types that remain wet through most of the growing season. The key in mapping this wetland meadow from other types lies in determining the flooding characteristics described above and the ability to observe them on the imagery.

***Juncus balticus* – *Juncus mexicanus* Alliance (41370)**



DISTRIBUTION: Two polygons were mapped to the Alliance level, one mid slope between Eagle Lake and Fredonyer Peak, the other south of Horse Lake.



***Juncus arcticus* var. *balticus* – (var. *mexicanus*) Association (41371)**
Baltic rush – (Mexican rush) Association



The aerial view shows a late season relatively wet meadow with regenerating juniper/sagebrush toward the upper portions of the image. Some of the juniper saplings are encroaching into the northeastern portion of the meadow.



The aerial view shows a wet meadow dominated by *Juncus* spp. with some *Poa* and vernal pool species.

***Juncus arcticus* var. *balticus* – (var. *mexicanus*) Association (41371)**

DESCRIPTION: *Juncus* (*balticus*, *mexicanus*, *arcticus*) is dominant to co-dominant with *Trifolium hybridum*, *Poa pratensis*, *Achillea millefolium*, and other wetland herbs. If co-dominant with *Deschampsia cespitosa* then the stand is considered as the *Deschampsia cespitosa* Association in the *Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance. If co-dominant with *Distichlis spicata* then the stand is considered as the *Distichlis spicata* Alliance.

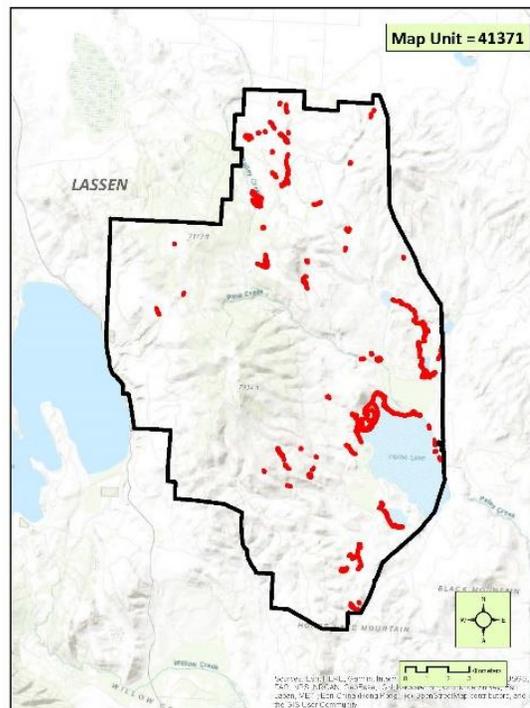
The *Juncus balticus* – *Juncus mexicanus* Association and the closely related Alliance is the most frequently mapped wetland in both the study area.

PHOTOINTERPRETATION SIGNATURE: *Juncus* spp. has a wide range of signature attributes depending on species composition and phenology. Healthy stands with plenty of near-surface water tend to be medium to dark green. Mottling patterns in the stand are the result of variable water presence near the surface. Older late-season and drier stands tend to have either a light green to yellow or orange-brown color patterns. Texture is smooth to slightly mottled. Flooding characteristics tend to favor lateral movement of water and therefore many of the *Juncus* dominated meadows tend to be long and fairly narrow with sloping terrain often near and along the margins of the stand.

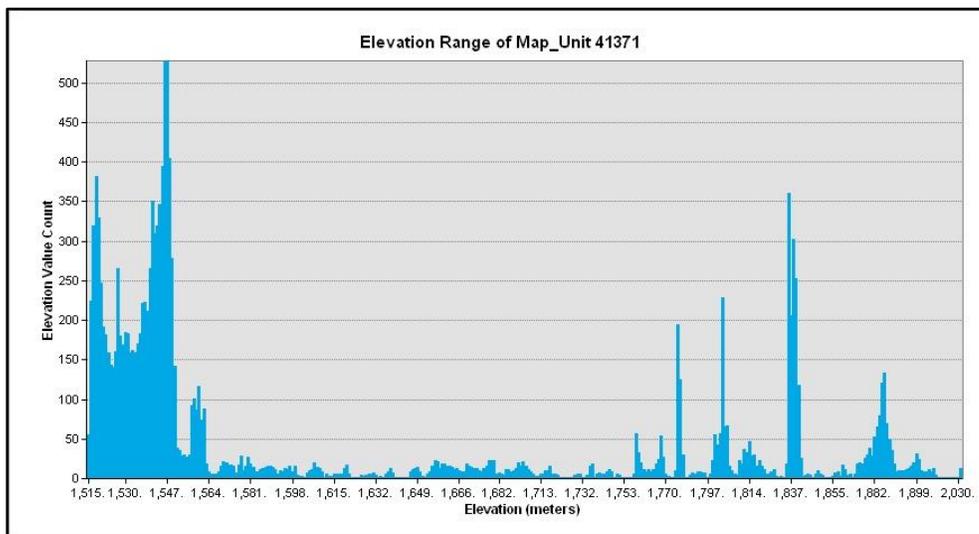
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Most other meadow types that remain wet through most of the growing season. The key in mapping this wetland meadow from other types lies in determining the flooding characteristics described above and the ability to observe them on the imagery.

***Juncus arcticus* var. *balticus* – (var. *mexicanus*) Association (41371)**



DISTRIBUTION: This Association is found in lower elevations below 5500 feet. It is mapped throughout the study area, on basin bottoms, edges of water bodies, and along creeks and swales.



***Juncus nevadensis* Alliance (41350)**

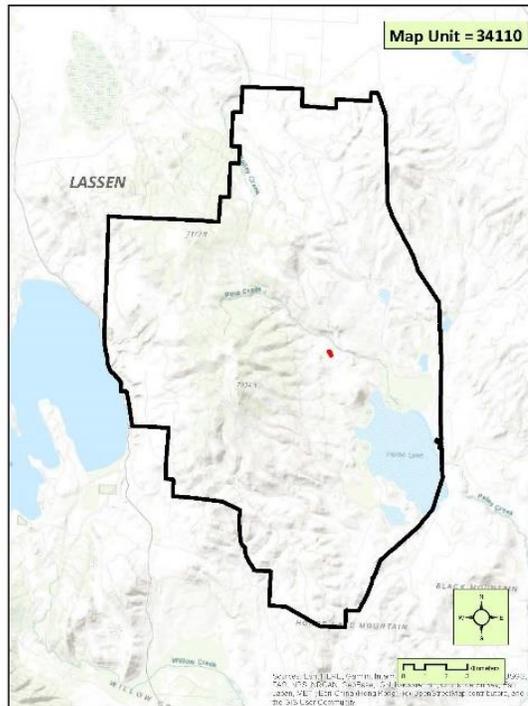
Sierra rush marshes Alliance

DESCRIPTION: *Juncus nevadensis* is dominant to co-dominant with *Juncus arcticus*.

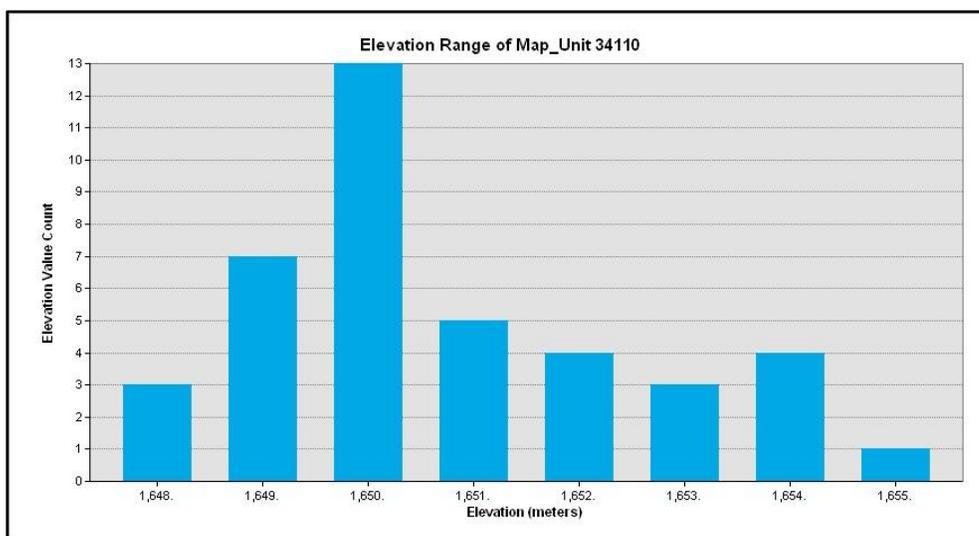
This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Lotus unifoliolatus* Provisional Alliance (34110)**

DESCRIPTION: Small moist meadow stands dominated by the conspicuous trifoliate, hairy-leaved, pink-flowered, annual *Lotus unifoliolatus* (*Lotus purshianus*; *Acmispon americanus*).



DISTRIBUTION: One polygon of this Alliance was mapped in a small meadow northwest of Fredonyer Reservoir. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



***Navarretia leucocephala* ssp. *minima* – *Plagiobothrys cusickii* Alliance
(44210)**

Little white Navarretia – Cusick’s popcorn flower vernal pools Alliance



The aerial view shows a wet meadow with open water dominated by *Eleocharis*, *Juncus*, *Plagiobothrys*, and other vernal pool indicators.



The aerial view depicts series of small vernal pools described by a Relevé sample around the margins of Steep Post Reservoir.

***Navarretia leucocephala* ssp. *minima* – *Plagiobothrys cusickii* Alliance (44210)**

DESCRIPTION: Stands, in peak phenology, contain several genera typical of seasonal or ephemeral wetlands of the Great Basin, from montane eastern California, to eastern Oregon, and eastern Washington. Settings include vernal saturated or flooded flats and smaller vernal pools. The key species include *Navarretia leucocephala*, *Muhlenbergia richardsonis*, *Polygonum aviculare*, and/or *Downingia bacigalupii*.

PHOTOINTERPRETATION SIGNATURE: Characteristic of early season drying, most stands tend to have a light beige or light to medium tan signature with a smooth to slightly mottled texture.

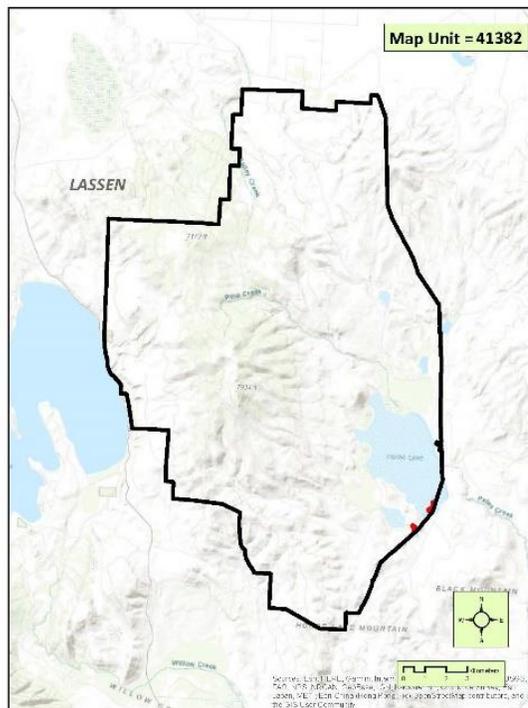
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Other meadow types in the Oregon-Washington-British Columbia Vernal Pool Group or the Californian Vernal Pool Group.

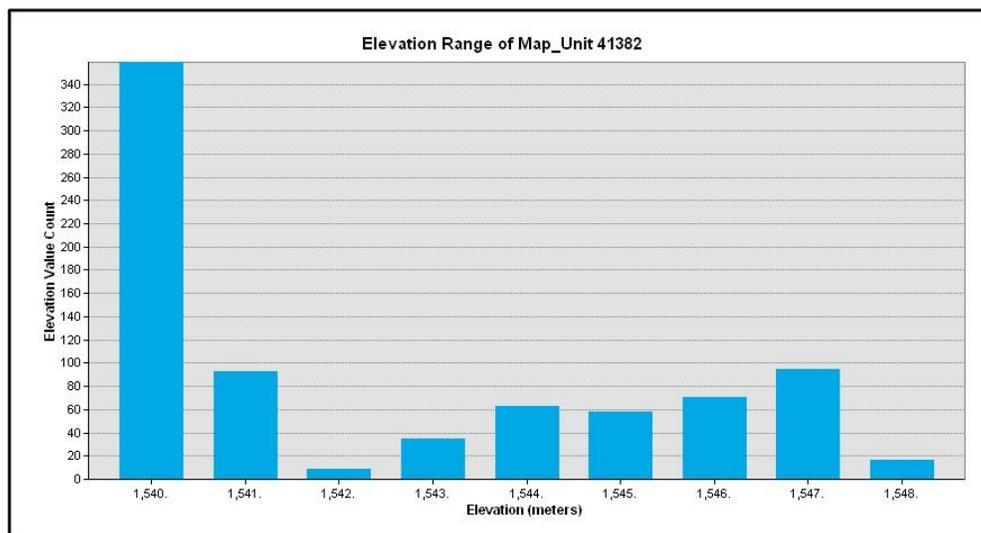
Taraxia tanacetifolia – Iva axillaris Provisional Association (41382)

Tansy leaf evening primrose – Povertyweed Association

DESCRIPTION: *Taraxia tanacetifolia* and/or *Iva axillaris* dominate to co-dominate with other Great Basin vernal pool species such as *Polygonum aviculare*, *Psilocarphus brevissimus*, and/or *Muhlenbergia richardsonis*. Stands were mapped based field information, and GIC vegetation database edge-match polygons along the margins of the study area.

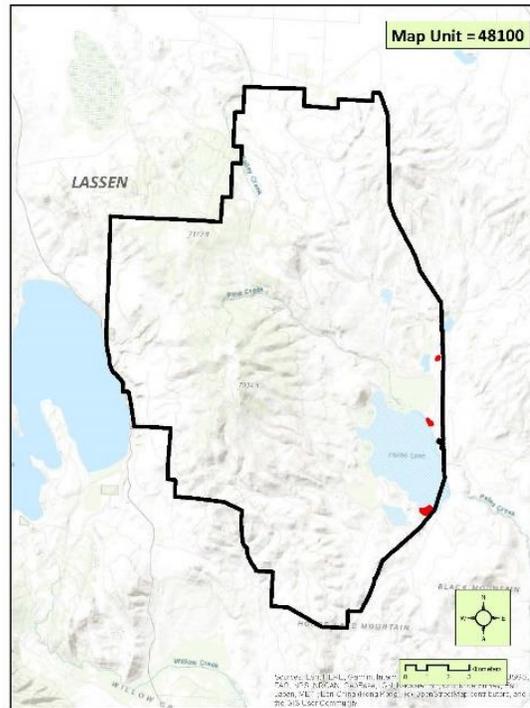


DISTRIBUTION: Only two polygons were mapped in the study area, near the southern margins of Horse Lake.

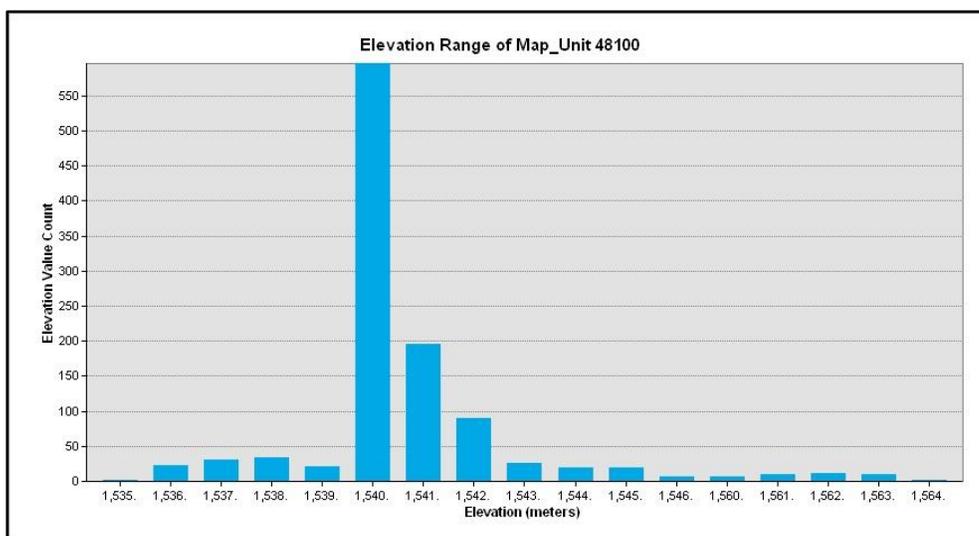


North American Desert Alkaline – Saline Marsh & Playa Group (48100)

DESCRIPTION: Stands composed largely of short to tall perennial grasses and/or graminoids associated with alkaline and/or heavy soils of large basins, playas, or flats. Mapping represents sparsely vegetated playas.

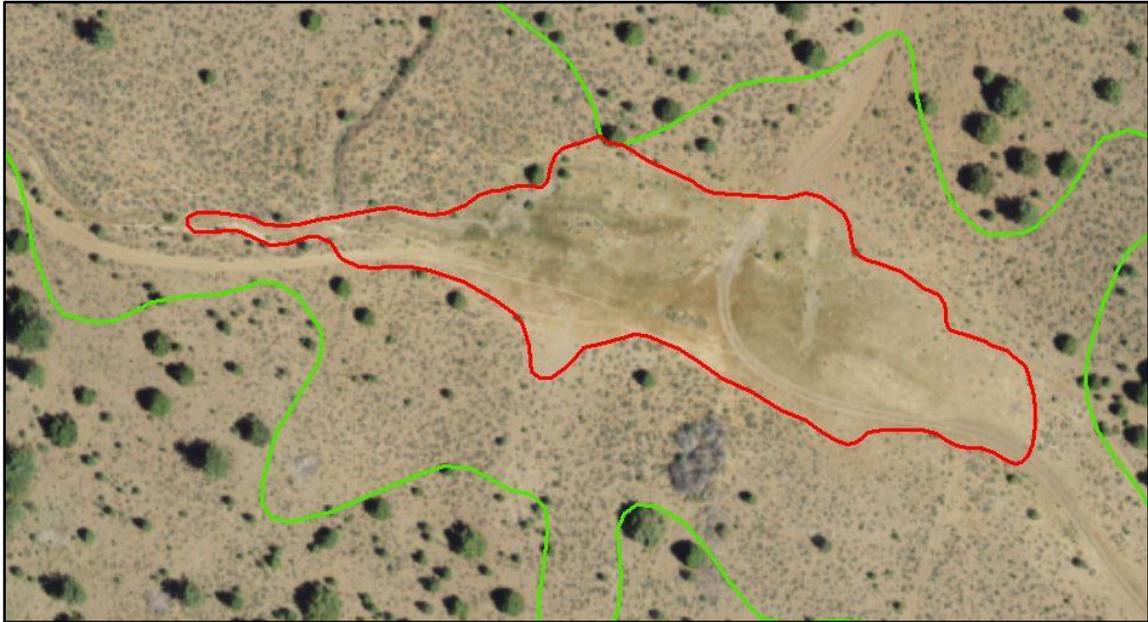


DISTRIBUTION: Four polygons were mapped from field data, primarily at the edges and in the vicinity of Horse Lake.



***Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance
(41380)**

Pine bluegrass – Mat muhly – Douglas' sedge moist meadow Alliance



The aerial view shows a dry meadow consisting of *Carex douglasii*, *Muhlenbergia richardsonis*, and *Poa secunda*.



Extensive dry meadow with *Carex douglasii* in the foreground, Note *Artemisia cana* lightly scattered.

***Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance (41380)**

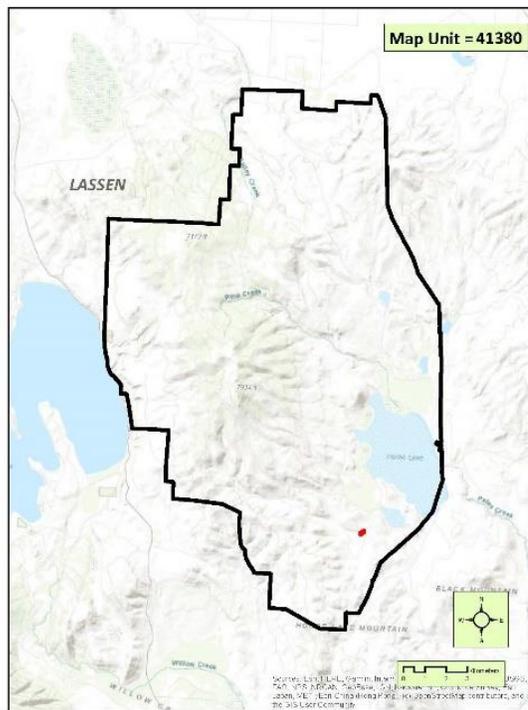
DESCRIPTION: Stands without strong representatives from either the Californian or Eastern Oregon/Washington Vernal Pool Groups, but species more widespread and typical of slightly alkaline western interior seasonal wetlands such as *Muhlenbergia* spp., *Carex douglasii*, *Poa secunda* (moist meadow ecotypes), and *Taraxia tanacetifolia*.

PHOTOINTERPRETATION SIGNATURE: Colors are intermediate between those of the ephemeral and vernal drying meadows and meadows that are wet through the growing season. Their modal color trends tan or light beige (indicating dryness) but can have numerous light green inclusions indicative of late season moisture. Their flooding regime is more like those where *Juncus* spp. dominates in that they are adjacent to sloping land where water seeps or migrates into the lower wetland.

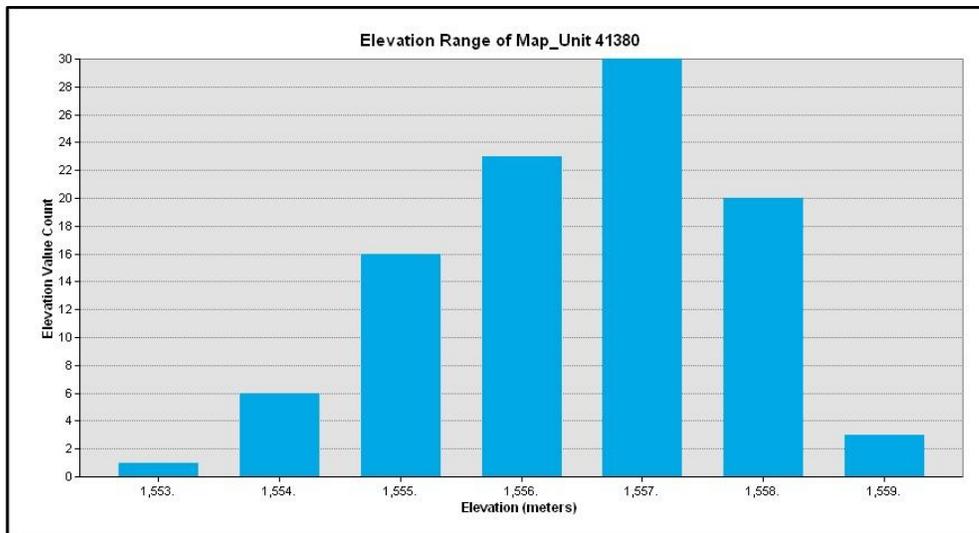
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juncus balticus* – *Juncus mexicanus* Alliance (4137): Stands in this Alliance are in similar settings but are wetter and yield more of a medium to dark green signature.
- Vernal pool groups: Meadows in these groups tend to dry in late spring around swales or ephemeral lake margins. Image color indicate drier conditions, with no visible green colors shown on the imagery.

***Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance (41380)**



DISTRIBUTION: One polygon of this Alliance is mapped from field data. It is located in a drainage bottom south of Horse Lake.

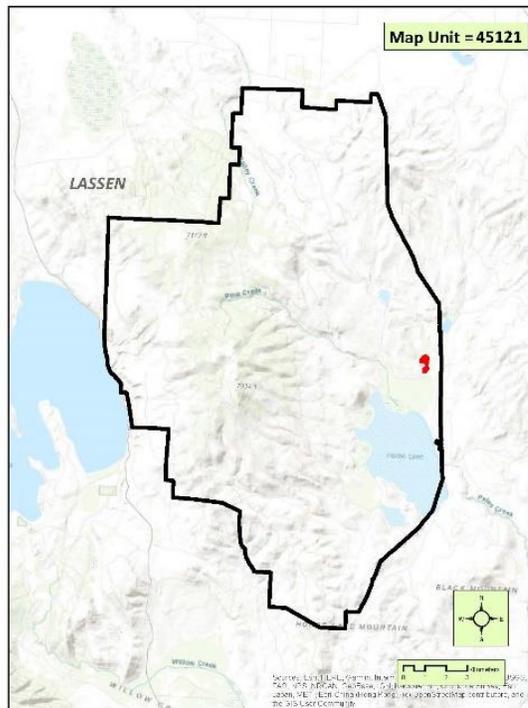


***Schoenoplectus americanus* Alliance (45120)**

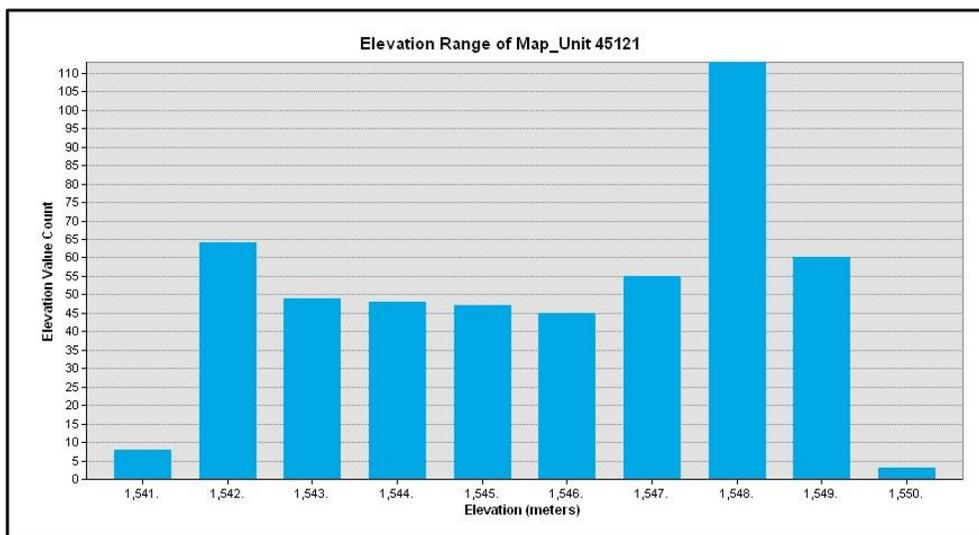
Common three-square bulrush marsh Alliance

This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Schoenoplectus americanus* Association (45121)**
 Common three-square bulrush Association



DISTRIBUTION: Two stands of this Association were mapped in the study area, based on field information. Both stands are mapped in a marsh north of Horse Lake. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



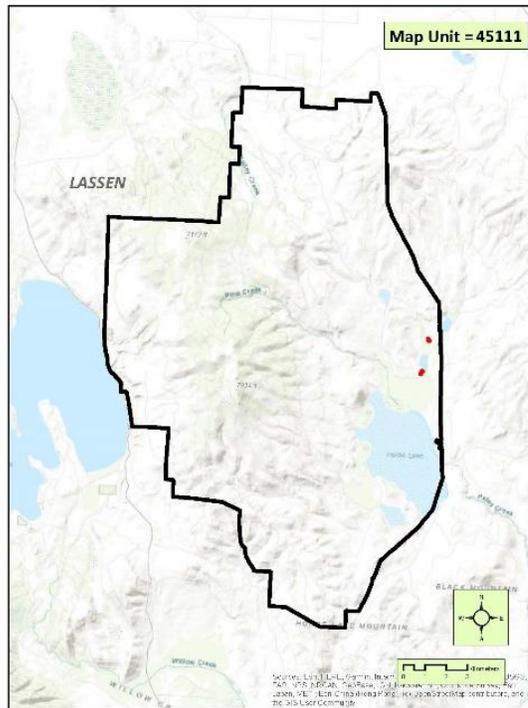
***Typha domingensis* – *Typha latifolia* – *Typha angustifolia* Alliance
(45110)**

Cattail marshes Alliance

DESCRIPTION: Wetlands (ponds, ditches, lake margins) dominated by *Typha* species.

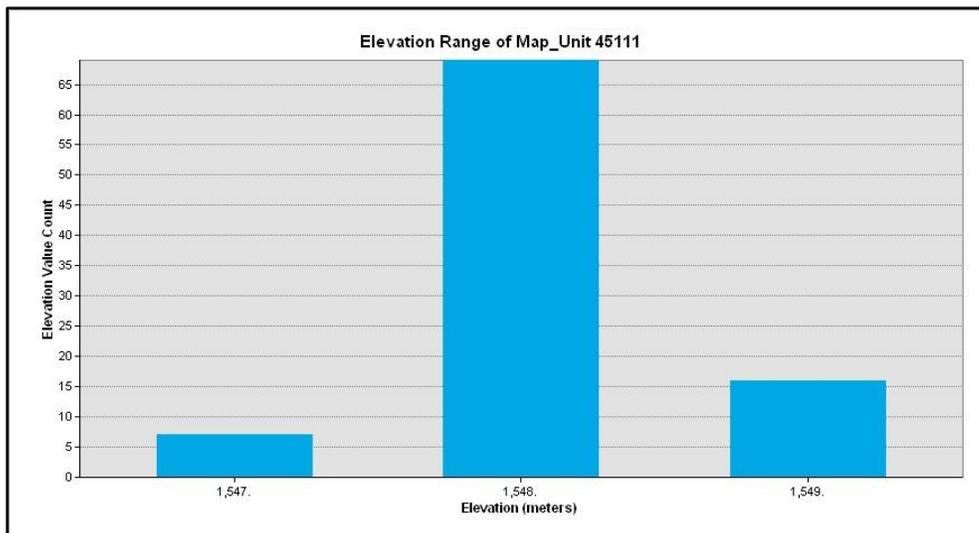
This Alliance was mapped at the Association level and not at the Alliance level. The Association descriptions follow.

***Typha domingensis* Association (45111)**
 Cattail marshes Association



DESCRIPTION: Wetlands (ponds, ditches, lake margins) dominated by *Typha* species.

DISTRIBUTION: Two stands of this Association were mapped in the study area, assisted by field information. Both stands are mapped in marshes north of Horse Lake. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.



Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group (41300)



The aerial imagery depicts a small relatively wet meadow in peak phenology similar to the ground photo below.



The ground view depicts dense herbaceous cover. Based on the ground data, the meadow is dominated by *Eleocharis*, *Deschampsia*, *Trifolium*, and *Ranunculus*.

Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group (41300)

DESCRIPTION: Stands occurring in flooded, wet, moist, or saturated meadows, stream-sides, springs, or swales. Water is usually fresh and not strongly alkaline or salty. This is a large group that encompasses stands that hold moisture in the soil until mid to late summer, or stands that dry out before mid-summer. Dominated by wet meadow sedges, rushes, and grasses.

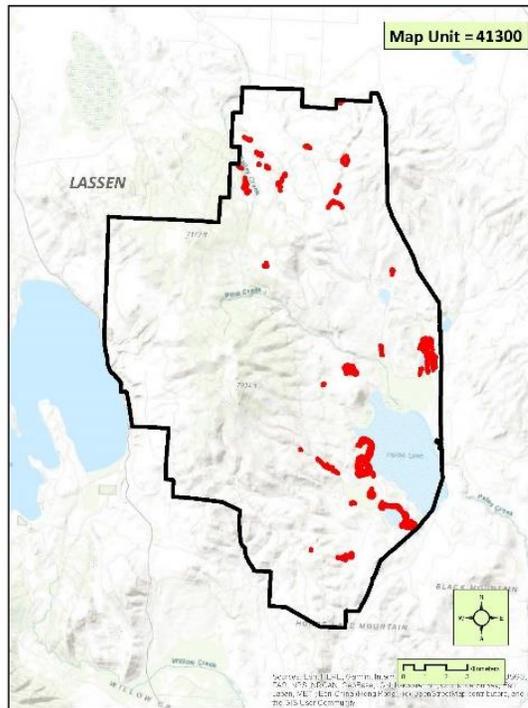
This is the most frequently mapped Group in the study area. It is mapped where the photointerpreters are reasonably certain of the flooding mechanisms (not vernal, ephemeral or evaporating). Beyond that, there are rarely any distinct color patterns that can be used to identify Alliances or Associations within the Group.

PHOTOINTERPRETATION SIGNATURE: Stands are more often linear or linear-trending than not. Most meadows are bounded by some topography along or near the meadow edges. Color patterning ranges from light yellow-green to dark green, often with a high degree of variability in one polygon.

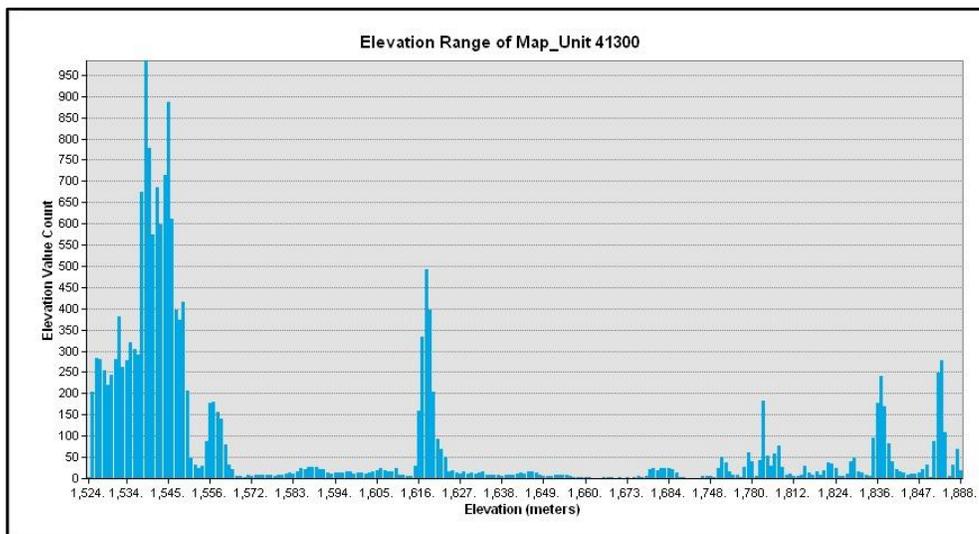
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Unidentified vegetation in non-vernal meadows that are indiscernible at the Alliance or Association levels of the hierarchy can in many cases be defined to this particular group.

Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group (41300)



DISTRIBUTION: Stands of this Group are scattered throughout the east half of the study area. Stands occur in drainages in and near Cleghorn Flat, near Glade Reservoir, Pinecone Reservoir, and on broad flats to the north and southwest of Horse Lake.



Sparse Vegetation

Columbia Plateau cliff, scree and rock Mapping Unit (61100)

Columbia Plateau cliff, scree and rock Mapping Unit (61100)



The aerial view shows a steep scree slope on slopes above Lower Alkaline Lake; *Artemisia tridentata* lines the margins of the scree in dense narrow strips.



The ground view depicts a steep sparsely vegetated surface of larger cobbles and boulders below the finer scree upslope.

Columbia Plateau cliff, scree and rock Mapping Unit (61100)

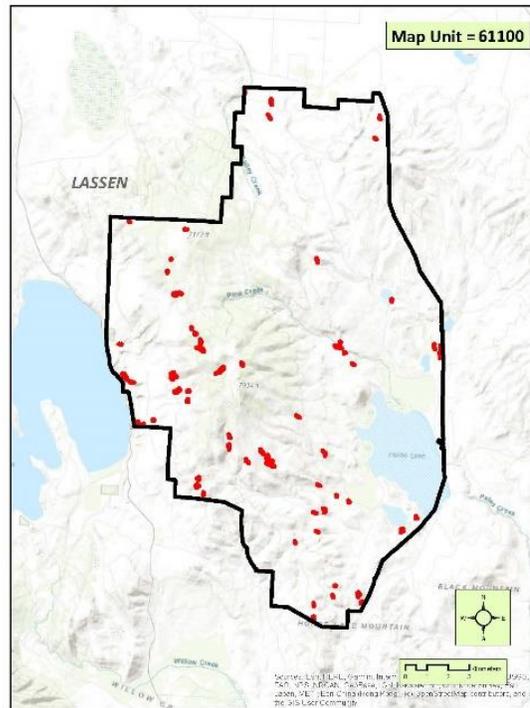
DESCRIPTION: Stands are on steep slopes, rock outcrops or cliff faces where there is very little soil for plants to inhabit and therefore, living vegetation is very sparse, not evenly distributed, and does not meet the minimum cover required to fit any of the tree, shrub, or herbaceous vegetation types listed above.

PHOTOINTERPRETATION SIGNATURE: Usually mapped where overall vegetative cover is less than 3-4%. Settings include differing formations of rocky substrate including talus, scree, rock outcroppings, and cliff-escarpments.

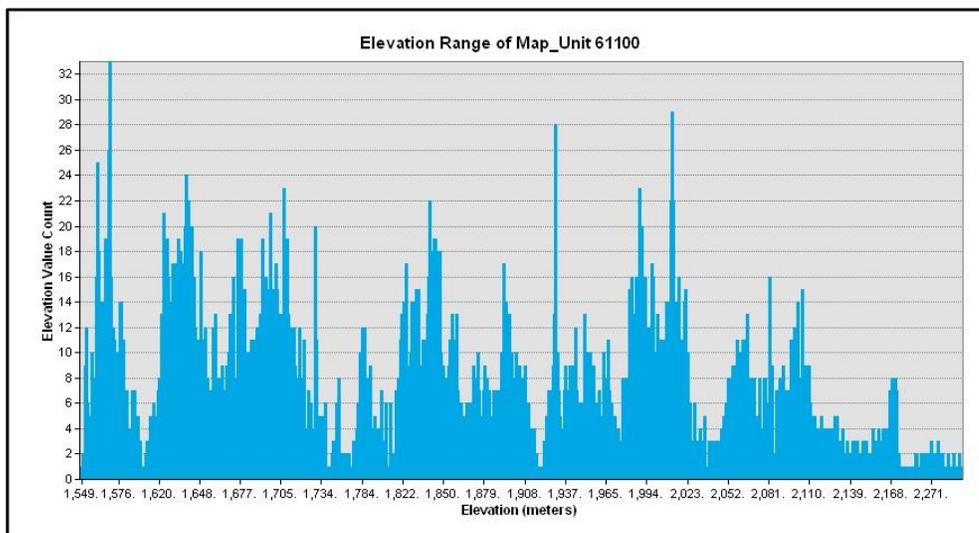
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Sparse vegetation that is slightly above 3-4% cover, over rocky substrate; includes sparse stands of *Holodiscus*, *Prunus* spp., or other types occurring on rocky substrate.

Columbia Plateau cliff, scree and rock Mapping Unit (61100)



DISTRIBUTION: This Mapping Unit occurs throughout the study area, primarily on cliffs and escarpments on slopes above the western edge of Eagle Lake to the Fredonyer Peak and Horse Lake Mountain ridgelines. Additional sites are mapped just south of the Madeline Plains, and north and south of Horse Lake.



Miscellaneous Classes

Irrigated Pastures (92300)

Built-up & Urban Disturbance (93000)

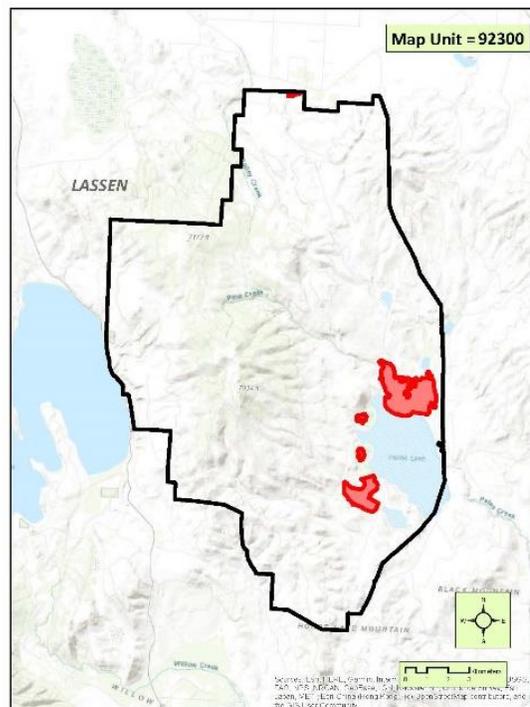
Anthropogenic Areas of Little or No Vegetation (93200)

Water (98000)

Small Earthen-Dammed Ponds & Natural Lakes (98030)

Irrigated Pastures (92300)

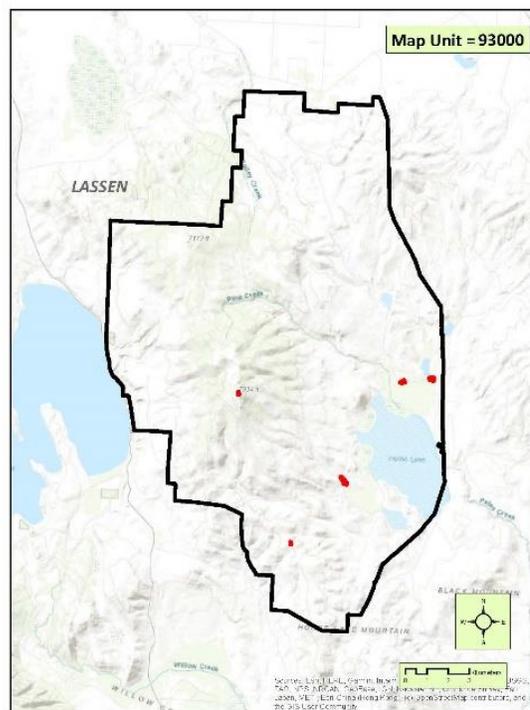
DESCRIPTION: This class of agriculture consists of annual non-woody herbaceous crops that are used for grazing purposes. In the Modoc-Lassen study area, this category is used primarily for pasturelands that are irrigated during the growing season. Water is diverted from small streams that are channeled into ditches and flumes that parallel the contours of the landscape. Herbaceous cover may consist of *Lolium* spp., *Phleum* spp., *Trifolium* spp., alfalfa, or other species used for feed. In most settings, these grazing lands are mapped when the landscape is currently under irrigation. Emergent shrubs including *Ericameria nauseosa*, or *Rosa* spp. can occur in cover as high as 3 to 5 percent.



DISTRIBUTION: Irrigated Pastures Mapping Unit is mapped primarily on the broad meadows surrounding Horse Lake. One site is also mapped on the edge of the Madeline Plains.

Built-up & Urban Disturbance (93000)

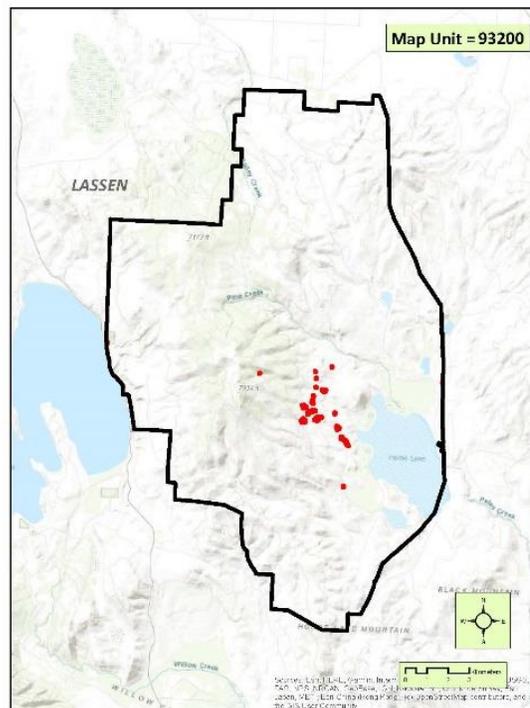
DESCRIPTION: Built-up areas include permanent and semi-permanent structures that are occupied/used or abandoned. Built-up areas can include residential, commercial and services, industrial, and transportation uses, as well as their associated disturbed lands. Areas under construction are also included. Associated impervious surfaces such as parking lots and playgrounds are normally included in the built-up area. Small areas of naturally occurring vegetation may be included in the built-up area. Examples are scattered across all study areas and primarily consist of ranches, small residences, open pit mines, and major highways.



DISTRIBUTION: These sites are typically ranches or residences, located at scattered sites north and west of Horse Lake, and one site on the edge of the Madeline Plains.

Anthropogenic Areas of Little or No Vegetation (93200)

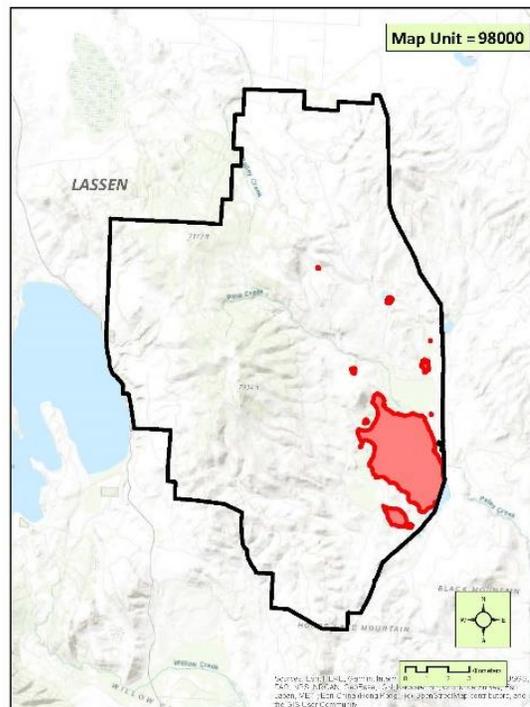
DESCRIPTION: Anthropogenically cleared areas contain less than 2 percent vegetative cover and have been cleared by human impact. These areas can be temporal in nature and are based on the project base imagery timeframe. Surfaces are generally permeable and can either be covered by fill dirt from another source or contain the original soil and/or substrate layer. Small remnant impervious pavement surfaces can make up a portion of the site. Examples include areas which have recently been cleared for construction, demolition sites which have most of their impervious surface removed. In the Modoc-Lassen study area, most of the examples are of recent juniper removal which are totally denuded of vegetation and often have piles of cut juniper throughout. They generally don't contain permanent structures. Examples are scattered across all of the study areas except east of the Warner Mountains.



DISTRIBUTION: A number of sites are mapped concentrated northwest of Horse Lake.

Water (98000)

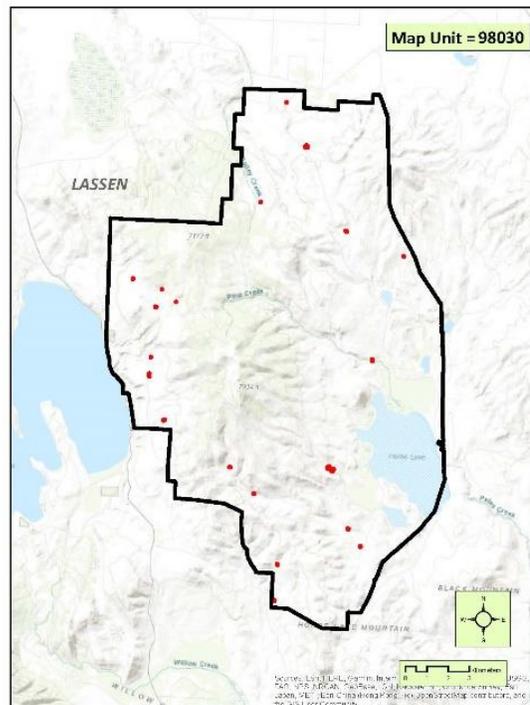
DESCRIPTION: The Water map unit includes open water bodies, either natural or artificially created, that may or may not contain water at the time of the project base imagery. For this project, water was further broken down into two categories: perennial stream channels (9801) and small earthen-dammed ponds and naturally occurring lakes (9803). However, in this project the more generalized 9800 code is applied to artificially created water bodies containing water supplied from sources other than the watershed upslope from the mapped feature. Examples in this study include the larger reservoirs.



DISTRIBUTION: Water bodies are widely scattered throughout the east side of the study area. Sites include Horse Lake, Craemer Reservoir, Fredonyer Reservoir, and Branham Reservoir.

Small Earthen-Dammed Ponds & Natural Lakes (98030)

DESCRIPTION: This class includes perennial or seasonally flooded water bodies, either occurring naturally in the landscape or impounded by earthen dams that receive their water completely from the upstream watershed. Most of these features are seasonal and become completely dry usually in the late summer to early fall. Bermed ponds in agricultural areas are not included.



DISTRIBUTION: These types of water bodies are widely scattered throughout most of the study area, however, not on the upper elevations of the Fredonyer Peak ridgeline.

APPENDIX C: Summaries of Acreage and Polygon Count by Map Unit

Three tables are presented on the following pages. The first table lists each of the map units occurring in the final database of the current Eagle Lake project, in numerical order by code value. The number of polygons is presented, followed by four columns relating to area: the total area covered by the map unit in the study area expressed in hectares; total area in acres; the percent of the total study area mapped as the given map unit; and the map unit's average polygon size in acres. The second table is identical to the first, except the map units are presented in alphabetical order. The third table lists the map units in order by total area from highest to lowest.

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
11110	Abies concolor Alliance	22	54.5	134.7	0.2%	6.1
11111	Abies concolor - Pinus ponderosa / Amelanchier alnifolia Association	49	955.6	2,361.3	3.6%	48.2
12111	Populus tremuloides / Symphoricarpos rotundifolius Association	31	25.1	62.0	0.1%	2.0
14100	Central Rocky Mountain Ponderosa Pine Open Woodland Group	11	5.6	13.9	0.0%	1.3
14111	Pinus ponderosa – Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	1	5.0	12.4	0.0%	12.4
14112	Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata) Association	18	335.8	829.7	1.2%	46.1
14120	Pinus ponderosa / Shrub Understory Alliance	2	3.8	9.4	0.0%	4.7
15123	Pinus ponderosa / Arctostaphylos patula – Purshia tridentata Association	5	16.9	41.8	0.1%	8.4
15124	Pinus jeffreyi / Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	39	440.1	1,087.5	1.6%	27.9
16110	Juniperus occidentalis Alliance	3	14.7	36.4	0.1%	12.1
16117	Juniperus occidentalis – (Pinus jeffreyi – Pinus ponderosa) / Cercocarpus ledifolius Association	234	2,320.0	5,732.6	8.6%	24.5

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
16118	Juniperus occidentalis / Artemisia arbuscula / Poa secunda Association	205	1,544.0	3,815.1	5.7%	18.6
16119	Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	541	7,834.4	19,358.6	29.2%	35.8
16211	Cercocarpus ledifolius – Artemisia tridentata ssp. vaseyana Association	313	943.9	2,332.4	3.5%	7.5
16212	Cercocarpus ledifolius Association	66	528.6	1,306.2	2.0%	19.8
19110	Pinus contorta ssp. murrayana Alliance	1	2.1	5.1	0.0%	5.1
22111	Ericameria nauseosa Association	34	93.5	231.0	0.3%	6.8
22112	Ericameria nauseosa / Bromus tectorum Association	11	29.7	73.4	0.1%	6.7
22120	Bromus tectorum – Elymus caput-medusae Alliance	1	2.2	5.5	0.0%	5.5
22121	Bromus tectorum Association	12	36.3	89.7	0.1%	7.5
22122	Elymus caput-medusae Provisional Association	1	1.9	4.8	0.0%	4.8
22210	Artemisia arbuscula Alliance	2	1.9	4.8	0.0%	2.4
22211	Artemisia arbuscula / Poa secunda Association	347	1,333.7	3,295.4	5.0%	9.5

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
22213	Artemisia arbuscula / Bromus spp. – Elymus caput-medusae Association	14	57.1	141.1	0.2%	10.1
22214	Artemisia arbuscula – Eriogonum (microthecum, sphaerocephalum) Association	26	57.6	142.4	0.2%	5.5
22231	Eriogonum sphaerocephalum / Poa secunda Association	5	12.4	30.6	0.0%	6.1
22311	Artemisia tridentata / Distichlis spicata Provisional Association	3	10.6	26.2	0.0%	8.7
22313	Artemisia tridentata Association	90	931.8	2,302.4	3.5%	25.6
22317	Artemisia tridentata – (Ericameria nauseosa) / Bromus tectorum Association	53	788.2	1,947.6	2.9%	36.7
22320	Artemisia tridentata ssp. vaseyana Alliance	1	2.2	5.4	0.0%	5.4
22321	Artemisia tridentata ssp. vaseyana – Symphoricarpos oreophilus / Bromus carinatus Association	43	194.7	481.0	0.7%	11.2
22322	Symphoricarpos oreophilus Association	6	12.0	29.7	0.0%	4.9
22323	Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	352	4,814.7	11,896.9	17.9%	33.8
22335	Purshia tridentata – Artemisia tridentata Association	107	504.9	1,247.6	1.9%	11.7

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
24111	Chrysothamnus viscidiflorus Association	1	1.6	3.9	0.0%	3.9
31111	Ceanothus velutinus Association	9	11.3	28.0	0.0%	3.1
31112	Ceanothus velutinus – Prunus emarginata – Artemisia tridentata Association	37	75.4	186.4	0.3%	5.0
31121	Prunus emarginata Association	24	21.5	53.1	0.1%	2.2
31122	Holodiscus discolor Association	16	14.7	36.3	0.1%	2.3
31123	Ribes velutinum Provisional Association	1	3.4	8.5	0.0%	8.5
31131	Arctostaphylos patula Association	3	5.4	13.4	0.0%	4.5
31132	Arctostaphylos patula – Ceanothus velutinus Association	57	189.8	469.1	0.7%	8.2
32111	Pseudoroegneria spicata – Poa secunda Association	47	57.1	141.1	0.2%	3.0
32112	Festuca idahoensis – Pseudoroegneria spicata Association	8	13.2	32.5	0.0%	4.1
34110	Lotus unifoliolatus Provisional Alliance	1	0.4	1.0	0.0%	1.0
41111	Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda Association	12	30.7	75.7	0.1%	6.3
41120	Salix exigua Alliance	1	0.3	0.8	0.0%	0.8

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
41130	Prunus virginiana Alliance	1	0.3	0.7	0.0%	0.7
41131	Prunus virginiana / Symphoricarpos rotundifolius Association	4	2.1	5.2	0.0%	1.3
41300	Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group	28	184.1	455.0	0.7%	16.3
41311	Carex aquatilis – Carex lenticularis Association	1	0.9	2.2	0.0%	2.2
41320	Carex simulata Alliance	1	0.1	0.1	0.0%	0.1
41351	Juncus nevadensis Association	1	1.7	4.3	0.0%	4.3
41370	Juncus balticus – Juncus mexicanus Alliance	2	3.5	8.7	0.0%	4.3
41371	Juncus arcticus var. balticus – (var. mexicanus) Association	75	152.0	375.6	0.6%	5.0
41380	Poa secunda – Muhlenbergia richardsonis – Carex douglasii Alliance	1	1.0	2.4	0.0%	2.4
41382	Taraxia tanacetifolia – Iva axillaris Provisional Association	2	7.9	19.6	0.0%	9.8
43120	Salix boothii – Salix geyeriana – Salix lutea Alliance	1	2.1	5.2	0.0%	5.2
43121	Salix lucida / Poa pratensis Association	9	7.1	17.7	0.0%	2.0
43132	Rosa woodsii Association	2	0.5	1.1	0.0%	0.6

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
44110	Eleocharis (acicularis, macrostachya) Alliance	1	0.4	1.1	0.0%	1.1
44111	Eleocharis macrostachya Provisional Association	12	91.1	225.0	0.3%	18.8
44200	Oregon-Washington-British Columbia Vernal Pool Group	1	1.3	3.3	0.0%	3.3
44210	Navarretia leucocephala ssp. minima – Plagiobothrys cusickii Alliance	6	42.6	105.3	0.2%	17.5
45111	Typha domingensis Association	2	0.9	2.2	0.0%	1.1
45121	Schoenoplectus americanus Association	2	4.8	12.0	0.0%	6.0
47110	Sarcobatus vermiculatus Alliance	2	3.9	9.5	0.0%	4.8
48100	North American Desert Alkaline-Saline Marsh & Playa Group	4	11.0	27.2	0.0%	6.8
48110	Distichlis spicata Alliance	5	38.2	94.4	0.1%	18.9
48120	Elymus cinereus – Elymus triticoides Alliance	1	0.9	2.3	0.0%	2.3
48121	Elymus cinereus Association	3	8.9	22.0	0.0%	7.3
48122	Elymus triticoides – Poa secunda Association	5	4.1	10.2	0.0%	2.0
61100	Columbia Plateau cliff, scree and rock mapping unit	72	46.4	114.6	0.2%	1.6
92300	Irrigated Pastures	6	591.1	1,460.5	2.2%	243.4

Table C-1: Map Unit Acreage, Listed Numerically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
93000	Built-up & Urban Disturbance	6	9.6	23.8	0.0%	4.0
93200	Anthropogenic Areas of Little or No Vegetation	19	26.5	65.5	0.1%	3.4
98000	Water	9	1,280.9	3,165.0	4.8%	351.7
98030	Small Earthen-dammed Ponds & Natural Lakes	21	6.3	15.6	0.0%	0.7
	Totals	3,171	26,873.0	66,402.3	100.0%	20.9

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
11110	Abies concolor Alliance	22	54.5	134.7	0.2%	6.1
93200	Anthropogenic Areas of Little or No Vegetation	19	26.5	65.5	0.1%	3.4
31132	Arctostaphylos patula – Ceanothus velutinus Association	57	189.8	469.1	0.7%	8.2
31131	Arctostaphylos patula Association	3	5.4	13.4	0.0%	4.5
22214	Artemisia arbuscula – Eriogonum (microthecum, sphaerocephalum) Association	26	57.6	142.4	0.2%	5.5
22213	Artemisia arbuscula / Bromus spp. – Elymus caput-medusae Association	14	57.1	141.1	0.2%	10.1
22211	Artemisia arbuscula / Poa secunda Association	347	1,333.7	3,295.4	5.1%	9.5
22210	Artemisia arbuscula Alliance	2	1.9	4.8	0.0%	2.4
41111	Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda Association	12	30.7	75.7	0.1%	6.3
22317	Artemisia tridentata – (Ericameria nauseosa) / Bromus tectorum Association	53	788.2	1,947.6	3.0%	36.7
22311	Artemisia tridentata / Distichlis spicata Provisional Association	3	10.6	26.2	0.0%	8.7

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
22313	Artemisia tridentata Association	90	931.8	2,302.4	3.6%	25.6
22321	Artemisia tridentata ssp. vaseyana – Symphoricarpos oreophilus / Bromus carinatus Association	43	194.7	481.0	0.8%	11.2
22323	Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	352	4,814.7	11,896.9	18.6%	33.8
22320	Artemisia tridentata ssp. vaseyana Alliance	1	2.2	5.4	0.0%	5.4
22120	Bromus tectorum – Elymus caput-medusae Alliance	1	2.2	5.5	0.0%	5.5
22121	Bromus tectorum Association	12	36.3	89.7	0.1%	7.5
93000	Built-up & Urban Disturbance	6	9.6	23.8	0.0%	4.0
41311	Carex aquatilis – Carex lenticularis Association	1	0.9	2.2	0.0%	2.2
41320	Carex simulata Alliance	1	0.1	0.1	0.0%	0.1
31112	Ceanothus velutinus – Prunus emarginata – Artemisia tridentata Association	37	75.4	186.4	0.3%	5.0
31111	Ceanothus velutinus Association	9	11.3	28.0	0.0%	3.1
14100	Central Rocky Mountain Ponderosa Pine Open Woodland Group	11	5.6	13.9	0.0%	1.3

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
16211	Cercocarpus ledifolius – Artemisia tridentata ssp. vaseyana Association	313	943.9	2,332.4	3.6%	7.5
16212	Cercocarpus ledifolius Association	66	528.6	1,306.2	2.0%	19.8
24111	Chrysothamnus viscidiflorus Association	1	1.6	3.9	0.0%	3.9
61100	Columbia Plateau cliff, scree and rock mapping unit	72	46.4	114.6	0.2%	1.6
48110	Distichlis spicata Alliance	5	38.2	94.4	0.1%	18.9
44110	Eleocharis (acicularis, macrostachya) Alliance	1	0.4	1.1	0.0%	1.1
44111	Eleocharis macrostachya Provisional Association	12	91.1	225.0	0.4%	18.8
22122	Elymus caput-medusae Provisional Association	1	1.9	4.8	0.0%	4.8
48120	Elymus cinereus – Elymus triticoides Alliance	1	0.9	2.3	0.0%	2.3
48121	Elymus cinereus Association	3	8.9	22.0	0.0%	7.3
48122	Elymus triticoides – Poa secunda Association	5	4.1	10.2	0.0%	2.0
22112	Ericameria nauseosa / Bromus tectorum Association	11	29.7	73.4	0.1%	6.7
22111	Ericameria nauseosa Association	34	93.5	231.0	0.4%	6.8

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
22231	Eriogonum sphaerocephalum / Poa secunda Association	5	12.4	30.6	0.0%	6.1
32112	Festuca idahoensis – Pseudoroegneria spicata Association	8	13.2	32.5	0.1%	4.1
31122	Holodiscus discolor Association	16	14.7	36.3	0.1%	2.3
92300	Irrigated Pastures	6	591.1	1,460.5	2.3%	243.4
41371	Juncus arcticus var. balticus – (var. mexicanus) Association	75	152.0	375.6	0.6%	5.0
41370	Juncus balticus – Juncus mexicanus Alliance	2	3.5	8.7	0.0%	4.3
41351	Juncus nevadensis Association	1	1.7	4.3	0.0%	4.3
16117	Juniperus occidentalis – (Pinus jeffreyi – Pinus ponderosa) / Cercocarpus ledifolius Association	234	2,320.0	5,732.6	9.0%	24.5
16118	Juniperus occidentalis / Artemisia arbuscula / Poa secunda Association	205	1,544.0	3,815.1	6.0%	18.6
16119	Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	541	7,834.4	19,358.6	30.2%	35.8
16110	Juniperus occidentalis Alliance	3	14.7	36.4	0.1%	12.1
34110	Lotus unifoliolatus Provisional Alliance	1	0.4	1.0	0.0%	1.0

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
44210	Navarretia leucocephala ssp. minima – Plagiobothrys cusickii Alliance	6	42.6	105.3	0.2%	17.5
48100	North American Desert Alkaline-Saline Marsh & Playa Group	4	11.0	27.2	0.0%	6.8
44200	Oregon-Washington-British Columbia Vernal Pool Group	1	1.3	3.3	0.0%	3.3
14112	Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata) Association	18	335.8	829.7	1.3%	46.1
19110	Pinus contorta ssp. murrayana Alliance	1	2.1	5.1	0.0%	5.1
15124	Pinus jeffreyi / Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	39	440.1	1,087.5	1.7%	27.9
14111	Pinus ponderosa – Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	1	5.0	12.4	0.0%	12.4
15123	Pinus ponderosa / Arctostaphylos patula – Purshia tridentata Association	5	16.9	41.8	0.1%	8.4
14120	Pinus ponderosa / Shrub Understory Alliance	2	3.8	9.4	0.0%	4.7
41380	Poa secunda – Muhlenbergia richardsonis – Carex douglasii Alliance	1	1.0	2.4	0.0%	2.4
12111	Populus tremuloides / Symphoricarpos rotundifolius Association	31	25.1	62.0	0.1%	2.0

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
31121	Prunus emarginata Association	24	21.5	53.1	0.1%	2.2
41131	Prunus virginiana / Symphoricarpos rotundifolius Association	4	2.1	5.2	0.0%	1.3
41130	Prunus virginiana Alliance	1	0.3	0.7	0.0%	0.7
32111	Pseudoroegneria spicata – Poa secunda Association	47	57.1	141.1	0.2%	3.0
22335	Purshia tridentata – Artemisia tridentata Association	107	504.9	1,247.6	1.9%	11.7
31123	Ribes velutinum Provisional Association	1	3.4	8.5	0.0%	8.5
43132	Rosa woodsii Association	2	0.5	1.1	0.0%	0.6
43120	Salix boothii – Salix geyeriana – Salix lutea Alliance	1	2.1	5.2	0.0%	5.2
41120	Salix exigua Alliance	1	0.3	0.8	0.0%	0.8
43121	Salix lucida / Poa pratensis Association	9	7.1	17.7	0.0%	2.0
47110	Sarcobatus vermiculatus Alliance	2	3.9	9.5	0.0%	4.8
45121	Schoenoplectus americanus Association	2	4.8	12.0	0.0%	6.0
98030	Small Earthen-dammed Ponds & Natural Lakes	21	6.3	15.6	0.0%	0.7
22322	Symphoricarpos oreophilus Association	6	12.0	29.7	0.0%	4.9

Table C-2: Map Unit Acreage, Listed Alphabetically

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
41382	Taraxia tanacetifolia – Iva axillaris Provisional Association	2	7.9	19.6	0.0%	9.8
45111	Typha domingensis Association	2	0.9	2.2	0.0%	1.1
41300	Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group	28	184.1	455.0	0.7%	16.3
98000	Water	9	1,280.9	3,165.0	4.9%	351.7
	Totals	3,122	25,917.4	64,041.0	100.0%	20.5

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
16119	Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	541	7,834.4	19,358.6	30.2%	35.8
22323	Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	352	4,814.7	11,896.9	18.6%	33.8
16117	Juniperus occidentalis – (Pinus jeffreyi – Pinus ponderosa) / Cercocarpus ledifolius Association	234	2,320.0	5,732.6	9.0%	24.5
16118	Juniperus occidentalis / Artemisia arbuscula / Poa secunda Association	205	1,544.0	3,815.1	6.0%	18.6
22211	Artemisia arbuscula / Poa secunda Association	347	1,333.7	3,295.4	5.1%	9.5
98000	Water	9	1,280.9	3,165.0	4.9%	351.7
16211	Cercocarpus ledifolius – Artemisia tridentata ssp. vaseyana Association	313	943.9	2,332.4	3.6%	7.5
22313	Artemisia tridentata Association	90	931.8	2,302.4	3.6%	25.6
22317	Artemisia tridentata – (Ericameria nauseosa) / Bromus tectorum Association	53	788.2	1,947.6	3.0%	36.7
92300	Irrigated Pastures	6	591.1	1,460.5	2.3%	243.4

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
16212	Cercocarpus ledifolius Association	66	528.6	1,306.2	2.0%	19.8
22335	Purshia tridentata – Artemisia tridentata Association	107	504.9	1,247.6	1.9%	11.7
15124	Pinus jeffreyi / Artemisia tridentata ssp. vaseyana / Festuca idahoensis Association	39	440.1	1,087.5	1.7%	27.9
14112	Pinus (jeffreyi, ponderosa) / (Ceanothus prostratus – Purshia tridentata) Association	18	335.8	829.7	1.3%	46.1
22321	Artemisia tridentata ssp. vaseyana – Symphoricarpos oreophilus / Bromus carinatus Association	43	194.7	481.0	0.8%	11.2
31132	Arctostaphylos patula – Ceanothus velutinus Association	57	189.8	469.1	0.7%	8.2
41300	Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group	28	184.1	455.0	0.7%	16.3
41371	Juncus arcticus var. balticus – (var. mexicanus) Association	75	152.0	375.6	0.6%	5.0
22111	Ericameria nauseosa Association	34	93.5	231.0	0.4%	6.8
44111	Eleocharis macrostachya Provisional Association	12	91.1	225.0	0.4%	18.8
31112	Ceanothus velutinus – Prunus emarginata – Artemisia tridentata Association	37	75.4	186.4	0.3%	5.0

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
22214	Artemisia arbuscula – Eriogonum (microthecum, sphaerocephalum) Association	26	57.6	142.4	0.2%	5.5
32111	Pseudoroegneria spicata – Poa secunda Association	47	57.1	141.1	0.2%	3.0
22213	Artemisia arbuscula / Bromus spp. – Elymus caput-medusae Association	14	57.1	141.1	0.2%	10.1
11110	Abies concolor Alliance	22	54.5	134.7	0.2%	6.1
61100	Columbia Plateau cliff, scree and rock mapping unit	72	46.4	114.6	0.2%	1.6
44210	Navarretia leucocephala ssp. minima – Plagiobothrys cusickii Alliance	6	42.6	105.3	0.2%	17.5
48110	Distichlis spicata Alliance	5	38.2	94.4	0.1%	18.9
22121	Bromus tectorum Association	12	36.3	89.7	0.1%	7.5
41111	Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda Association	12	30.7	75.7	0.1%	6.3
22112	Ericameria nauseosa / Bromus tectorum Association	11	29.7	73.4	0.1%	6.7
93200	Anthropogenic Areas of Little or No Vegetation	19	26.5	65.5	0.1%	3.4

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
12111	Populus tremuloides / Symphoricarpos rotundifolius Association	31	25.1	62.0	0.1%	2.0
31121	Prunus emarginata Association	24	21.5	53.1	0.1%	2.2
15123	Pinus ponderosa / Arctostaphylos patula – Purshia tridentata Association	5	16.9	41.8	0.1%	8.4
16110	Juniperus occidentalis Alliance	3	14.7	36.4	0.1%	12.1
31122	Holodiscus discolor Association	16	14.7	36.3	0.1%	2.3
32112	Festuca idahoensis – Pseudoroegneria spicata Association	8	13.2	32.5	0.1%	4.1
22231	Eriogonum sphaerocephalum / Poa secunda Association	5	12.4	30.6	0.0%	6.1
22322	Symphoricarpos oreophilus Association	6	12.0	29.7	0.0%	4.9
31111	Ceanothus velutinus Association	9	11.3	28.0	0.0%	3.1
48100	North American Desert Alkaline-Saline Marsh & Playa Group	4	11.0	27.2	0.0%	6.8
22311	Artemisia tridentata / Distichlis spicata Provisional Association	3	10.6	26.2	0.0%	8.7
93000	Built-up & Urban Disturbance	6	9.6	23.8	0.0%	4.0
48121	Elymus cinereus Association	3	8.9	22.0	0.0%	7.3

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
41382	Taraxia tanacetifolia – Iva axillaris Provisional Association	2	7.9	19.6	0.0%	9.8
43121	Salix lucida / Poa pratensis Association	9	7.1	17.7	0.0%	2.0
98030	Small Earthen-dammed Ponds & Natural Lakes	21	6.3	15.6	0.0%	0.7
14100	Central Rocky Mountain Ponderosa Pine Open Woodland Group	11	5.6	13.9	0.0%	1.3
31131	Arctostaphylos patula Association	3	5.4	13.4	0.0%	4.5
14111	Pinus ponderosa – Juniperus occidentalis / Artemisia tridentata – Purshia tridentata Association	1	5.0	12.4	0.0%	12.4
45121	Schoenoplectus americanus Association	2	4.8	12.0	0.0%	6.0
48122	Elymus triticoides – Poa secunda Association	5	4.1	10.2	0.0%	2.0
47110	Sarcobatus vermiculatus Alliance	2	3.9	9.5	0.0%	4.8
14120	Pinus ponderosa / Shrub Understory Alliance	2	3.8	9.4	0.0%	4.7
41370	Juncus balticus – Juncus mexicanus Alliance	2	3.5	8.7	0.0%	4.3
31123	Ribes velutinum Provisional Association	1	3.4	8.5	0.0%	8.5
22120	Bromus tectorum – Elymus caput-medusae Alliance	1	2.2	5.5	0.0%	5.5

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
22320	Artemisia tridentata ssp. vaseyana Alliance	1	2.2	5.4	0.0%	5.4
43120	Salix boothii – Salix geyeriana – Salix lutea Alliance	1	2.1	5.2	0.0%	5.2
41131	Prunus virginiana / Symphoricarpos rotundifolius Association	4	2.1	5.2	0.0%	1.3
19110	Pinus contorta ssp. murrayana Alliance	1	2.1	5.1	0.0%	5.1
22122	Elymus caput-medusae Provisional Association	1	1.9	4.8	0.0%	4.8
22210	Artemisia arbuscula Alliance	2	1.9	4.8	0.0%	2.4
41351	Juncus nevadensis Association	1	1.7	4.3	0.0%	4.3
24111	Chrysothamnus viscidiflorus Association	1	1.6	3.9	0.0%	3.9
44200	Oregon-Washington-British Columbia Vernal Pool Group	1	1.3	3.3	0.0%	3.3
41380	Poa secunda – Muhlenbergia richardsonis – Carex douglasii Alliance	1	1.0	2.4	0.0%	2.4
48120	Elymus cinereus – Elymus triticoides Alliance	1	0.9	2.3	0.0%	2.3
41311	Carex aquatilis – Carex lenticularis Association	1	0.9	2.2	0.0%	2.2
45111	Typha domingensis Association	2	0.9	2.2	0.0%	1.1

Table C-3: Map Units By Total Area

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
43132	Rosa woodsii Association	2	0.5	1.1	0.0%	0.6
44110	Eleocharis (acicularis, macrostachya) Alliance	1	0.4	1.1	0.0%	1.1
34110	Lotus unifoliolatus Provisional Alliance	1	0.4	1.0	0.0%	1.0
41120	Salix exigua Alliance	1	0.3	0.8	0.0%	0.8
41130	Prunus virginiana Alliance	1	0.3	0.7	0.0%	0.7
41320	Carex simulata Alliance	1	0.1	0.1	0.0%	0.1
Totals		3,122	25,917.4	64,041.0	100.0%	20.5

APPENDIX D: Field Forms for Vegetation Sampling and Accuracy Assessment

CNPS RECON FIELD FORM (March 6, 2019, with slope/aspect)

Recorder: _____		Other Surveyors: _____		Date: _____		Return? <input type="checkbox"/>																																																																																	
Waypoint ID: _____		GPS Name _____ Projected? No / Yes / Base / Digitized																																																																																					
UID: _____		If Yes, enter: Bearing (°): _____ Distance (m): _____ Inclination (°): _____																																																																																					
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APPENDIX E: Key to the Vegetation of Modoc and Lassen Counties

This is the vegetation key for Modoc and Lassen Counties. It is based on 2,050 vegetation samples; 627 surveys collected between 2016 and 2019 specifically for the classification and 1,192 surveys collected for other projects and/or by other agencies. This key follows the hierarchy from the most current National Vegetation Classification System (NVCS). This is not a dichotomous key. Follow the instructions in each section carefully and sequentially to arrive at the correct vegetation type. Note that this vegetation key may include types that are not accurately detectable in remotely sensed imagery.

Alliance and association names are frequently followed by a number, e.g. (n=5). This is the number of vegetation samples that were classified to the type. If there is not a number following the vegetation type, then none of the samples collected thus far have classified to that type. In some cases, the number of samples recorded for an alliance will equal the sum of the samples recorded for the associations below it. If this is not the case, then some samples could not be classified below the alliance level.

I. Trees are evenly distributed and are typically >5% absolute cover in the overstory canopy. When *Juniperus occidentalis* is the sole tree species present it may have as low as 3% cover, but the trees will be of appreciable age, evenly distributed throughout the stand, there will be obvious regenerating juniper in the understory, and shrub cover will be sparse as well (usually <10% absolute cover) **Forest and Woodland**

II. Shrubs are evenly distributed throughout the stand and >4% cover. If the stand is characterized by very low overall vegetation cover (<10%) the shrub cover can be as low as 2%. Trees average less than 5% and are not evenly distributed..... **Shrubland**

III. Annual or perennial herbs, including grasses, graminoids (sedges and rushes), and forbs, average >2% cover and are evenly distributed across the stand. Trees and shrubs, if present, each average less than 4% cover and/or are not evenly distributed..... **Herbaceous stands**

I. Forest and Woodland

- 1) Overstory dominated by coniferous tree species.
 - a) *Juniperus occidentalis* is the sole coniferous tree species in the overstory or is strongly dominant with *Pinus jeffreyi*. *Juniperus occidentalis* may have as little as 3% cover but the trees will include mature individuals, be evenly distributed throughout the stand, there will be obvious regenerating juniper in the understory, and the shrub layer will usually be less than 10% absolute cover.

***Juniperus occidentalis* Alliance (n=343)**

- i) *Juniperus occidentalis* is dominant with sub-dominant *Pinus jeffreyi* and/or *Pinus ponderosa* or has a shrub understory that is indicative of higher elevations. Pines may have as little as 1% cover or occasionally may not be present. Shrub understory is variable. When pines are present the understory can be dominated by *Artemisia tridentata* and *Purshia tridentata* with some *Cercocarpus ledifolius* and/or may include other higher elevation shrub species. When pines are not present, higher elevation shrub species such as *Cercocarpus ledifolius*, *Ribes* spp., *Artemisia tridentata* ssp. *vaseyana*, and *Symphoricarpos* spp. are present in the understory which differentiate this type from *Juniperus occidentalis* / *Artemisia tridentata* – *Purshia tridentata* Association. If pines are strongly dominant (>60% relative cover in the tree layer) then key to *Pinus ponderosa* / Shrub Understory Alliance.

Juniperus occidentalis – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association (n=112)

- ii) Pines are typically absent, and stands are at lower elevations compared to *Juniperus occidentalis* – (*Pinus jeffreyi* – *Pinus ponderosa*) / *Cercocarpus ledifolius* Association. *Artemisia tridentata* present with at least 1% cover but typically dominates or co-dominates the shrub layer. *Purshia tridentata* usually present with *A. tridentata* and may dominate. However, *A. tridentata* is commonly the dominant shrub. *Cercocarpus ledifolius* and *Prunus* spp. are typically absent.

Juniperus occidentalis / *Artemisia tridentata* – *Purshia tridentata* Association (n=87)

- iii) *Artemisia arbuscula* is strongly dominant to co-dominant in the shrub layer with *Purshia tridentata* and *Eriogonum* spp. Rarely, *A. arbuscula* is absent (usually disturbance-related), but associated herbs will still be present. Native grasses are common and diverse, including *Poa secunda*, *Festuca idahoensis*, *Pseudoroegneria spicata*, *Achnatherum thurberianum*, and *Danthonia unispicata*. Other herbs may include *Blepharipappus scaber*, *Epilobium brachycarpum*, and *Lomatium* spp. Stands are rocky with typically >30% cover of surficial rocks (cobble-bedrock).

Juniperus occidentalis / *Artemisia arbuscula* / *Poa secunda* Association (n=112)

- iv) *Juniperus occidentalis* stands with minimal shrub component (typically <4% absolute cover). Juniper cover is usually greater than 10% and trees are of mixed age classes. Herb layer is sparse to moderate, sometimes with significant cover of non-native grasses such as *Bromus tectorum*. However, native grasses including *Poa secunda*, *Pseudoroegneria spicata*, *Festuca*

idahoensis, and/or *Achnatherum thurberianum* are characteristic in the herb layer. If shrubs are present, they are patchy and insignificant.

Juniperus occidentalis / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Association (n=30)

b) Other coniferous tree species characterize the overstory with or without *Juniperus occidentalis* as a co-dominant.

i) *Quercus kelloggii* is dominant to co-dominant with pines.

***Quercus kelloggii* Alliance** (n=3)

ii) *Pinus ponderosa*¹ and/or *Pinus jeffreyi* is characteristic in the tree layer and are dominant to co-dominant with either *Calocedrus decurrens* or *Juniperus occidentalis*. If *Abies concolor* is present, it is typically sub-dominant in the tree layer and is not evenly distributed

(1) *Pinus ponderosa* and/or *Pinus jeffreyi* is dominant to co-dominant with *Juniperus occidentalis* in the overstory. *Calocedrus decurrens* is absent.

***Pinus ponderosa* / Shrub Understory Alliance** (n=179)

(a) *Juniperus occidentalis* is often sub-dominant with *Pinus ponderosa* and/or *Pinus jeffreyi*. Shrub layer is sparse to moderately dense with a variety of higher elevation, cold-tolerant shrubs present including *Amelanchier utahensis*, *Cercocarpus ledifolius*, *Ceanothus prostratus*, *Prunus virginiana*, and *Symphoricarpos* spp. *Artemisia tridentata* is typically absent or only a small component of the shrub layer.

Pinus (jeffreyi, ponderosa) / (*Ceanothus prostratus* – *Purshia tridentata*) Association (n=105)

(b) *Juniperus occidentalis* is typically present to co-dominant with *Pinus ponderosa* and lower elevation shrub species such as *Purshia tridentata*, *Artemisia tridentata*, and *Cercocarpus ledifolius* dominate the shrub layer. *Arctostaphylos patula* is typically absent or insignificant.

¹ Treatment of Ponderosa pine in this study: Based on recent taxonomy, “Washoe” pine (formerly *Pinus washoensis*) as discussed by Calliham (2013) is now subsumed into *Pinus ponderosa* ssp. *ponderosa*, Columbia Ponderosa pine. although we use the name here, *Pinus ponderosa* ssp. *ponderosa* is the most widespread subspecies in the study area, although some individuals on the northwest side of the Likely Tableland are probably more closely related to *P. ponderosa* ssp. *critchfieldiana*, Pacific Ponderosa pine.

Pinus ponderosa – *Juniperus occidentalis* / *Artemisia tridentata* –
Purshia tridentata Association (n=22)

(c) *Pinus jeffreyi* is dominant in the overstory while *Juniperus occidentalis* may just be present. Though there may be high shrub diversity, *Artemisia tridentata* ssp. *vaseyana* is the dominant shrub. *Festuca idahoensis* is characteristically present and typically the dominant herb. *Pinus jeffreyi* / *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association (n=6)

(d) *Pinus ponderosa* is dominant in the overstory while *Juniperus occidentalis* may be present to co-dominant. *Artemisia tridentata* is absent or insignificant in the understory and *Purshia tridentata*, *Ceanothus prostratus*, and *Arctostaphylos patula* dominate the shrub layer. Stands occur at higher elevations in the western portions of the study area or the Warner Mtns., where winter precipitation is relatively greater and persistent snow is more frequent.

Pinus ponderosa / *Arctostaphylos patula* – *Purshia tridentata*
Association (n=37)

(e) *Pinus ponderosa* var. *washoensis* is dominant in the tree layer with *Arctostaphylos nevadensis* in the understory.

Pinus ponderosa var. *washoensis* / *Arctostaphylos nevadensis*
Association (n=1)

(f) *Pinus ponderosa* var. *washoensis* is dominant in the tree layer with *Abies concolor* and/or *Pinus contorta*. *Symphoricarpos* spp. is characteristically present in the shrub layer and *Pseudostellaria jamesiana* is characteristically present in the herb layer. Stands of this type are more typical of higher elevation sites in the Warner Mountains (>6500 ft) and are, therefore, not common in the study area.

Pinus ponderosa var. *washoensis* / *Symphoricarpos* spp. /
Pseudostellaria jamesiana Association (n=6)

(2) *Calocedrus decurrens* is dominant to co-dominant with *Pinus ponderosa*. *Abies concolor* may be present but is sub-dominant to the other conifers. *Juniperus occidentalis* is absent or <1% cover. *Pseudotsuga menziesii* is not likely to occur in these stands within the study area.

Pinus ponderosa – *Calocedrus decurrens* – *Pseudotsuga menziesii* Alliance
(n=17)

(a) The mat-forming shrub *Ceanothus prostratus* may be present in the understory, though it may have very little cover.

Pinus ponderosa – *Calocedrus decurrens* / *Ceanothus prostratus*
Association (n=17)

iii) *Abies concolor* is dominant to co-dominant in the tree layer with *Pinus ponderosa* or *Pinus jeffreyi*.

***Abies concolor* Alliance (n=32)**

(1) *Pinus ponderosa* or *Pinus jeffreyi* is co-dominant to absent. *Juniperus occidentalis* may be present but insignificant. *Cercocarpus ledifolius* may or may not be present in the understory. Other higher elevation, cold-tolerant shrubs are present and may include *Ribes* spp., *Symphoricarpos rotundifolius*, *Amelanchier utahensis*, *Artemisia tridentata* ssp. *vaseyana*, and *Prunus* spp. The shrub and herb layers are characteristically sparse (<10% absolute cover) and are low in species diversity.

Abies concolor – *Pinus ponderosa* / *Cercocarpus ledifolius* Association
(n=28)

2) Overstory dominated by broad-leaved evergreen or deciduous trees.

a) Trees are deciduous and depending upon site conditions, may be short and shrubby.

i) *Quercus kelloggii* is dominant to co-dominant with pines.

***Quercus kelloggii* Alliance (n=3)**

ii) *Quercus garryana* is dominant to co-dominant with *Juniperus occidentalis*, *Quercus kelloggii*, and/or *Pinus sabiniana*. *Ceanothus cuneatus* is co-dominant in the shrub layer with *Cercocarpus montanus* and *Rhus trilobata*.

Quercus garryana / *Ceanothus cuneatus* / *Festuca idahoensis*
Association (n=4)

of the *Quercus garryana* Alliance (n=4)

iii) *Populus tremuloides* is dominant to co-dominant in the tree layer (note: stands may be short, resprouting, shrubby “trees”). If co-dominating with *Populus trichocarpa*, then key to *Populus trichocarpa* Alliance.

***Populus tremuloides* Alliance (n=26)**

(1) *Symphoricarpos rotundifolius* and/or other mesic shrubs are characteristic in the shrub layer. Stands are usually in concavities or on steep sheltered and rocky slopes

Populus tremuloides / *Symphoricarpos rotundifolius* Association (n=20)

iv) *Populus trichocarpa* is dominant to co-dominant in the tree layer along persistent streams. If co-dominant with *Populus tremuloides* key here.

***Populus trichocarpa* Alliance (n=2)**

b) Trees are evergreen.

i) Tall shrubs or small trees of *Cercocarpus ledifolius* dominant to co-dominant in the mid/shrub layer. Other shrubs may include *Artemisia tridentata* (various subspecies), *Symphoricarpos rotundifolius*, *Prunus virginiana*, *Ribes velutinum* and/or *Purshia tridentata*. *Juniperus occidentalis* and *Pinus ponderosa* may be emergent in the tree layer but do not have enough cover to key to the *Juniperus occidentalis* Alliance or the *Pinus ponderosa* / Shrub Understory Alliance.

***Cercocarpus ledifolius*² Alliance (n=49)**

(1) *Artemisia tridentata* ssp. *vaseyana* is typically co-dominant in the shrub layer with *Cercocarpus ledifolius*, and no other shrub species are present with comparable cover.

Cercocarpus ledifolius – *Artemisia tridentata* ssp. *vaseyana*
Association (n=16)

(2) *Cercocarpus ledifolius* is strongly dominant with low cover other shrubs such as *Ribes velutinum*, *Symphoricarpos rotundifolius*, and/or *Prunus virginiana*. *Artemisia tridentata* is typically present at low cover.

Cercocarpus ledifolius Association (n=25)

² *Cercocarpus ledifolius* is considered under separate tree and shrub alliances in the NVCS. However, there is much overlap in California so we put it in one shrub alliance following Sawyer et al. (2009).

II. Shrubland

1) Upland shrub stands dominated or co-dominated by a species of *Artemisia* and/or *Purshia tridentata*.

a) Stands characterized by the low subshrub *Artemisia arbuscula* and/or *A. nova* (dominant layer is generally < 0.5 m tall).

i) *Artemisia arbuscula* is strongly dominant to co-dominant in the shrub layer. *Purshia tridentata*, *Artemisia tridentata*, *Ericameria* spp., and *Chrysothamnus* spp. may be co-dominant to sub-dominant. *A. arbuscula* stands tend to grow on flats or gradual slopes and tolerate heavier clay soils ("pimpled plains" clay accretion mounds), or otherwise more impervious (shallow, or very rocky) soil than the various subspecies of *A. tridentata*. Stands are susceptible to type conversion. Many stands are in transition between *Artemisia arbuscula* and non-native annual grasses (*Bromus tectorum*, *Ventenata dubia*, and *Elymus caput-medusae*) or are sites of rapid and recent colonization by *Juniperus occidentalis*. *Artemisia arbuscula* ssp. *arbuscula* dominates. *Artemisia nova* is absent.

***Artemisia arbuscula* Alliance (n=192)**

(1) *Artemisia arbuscula* is dominant and evenly distributed in the shrub layer and is usually >10% absolute cover although it may be as low as 3% absolute cover. Herb layer is sparse to moderately dense and is usually dominated by native grasses such as *Poa secunda* and *Pseudoroegneria spicata* although non-native annual grasses can exceed cover of natives. Other herbs may include *Blepharipappus scaber*, *Epilobium brachycarpum*, and *Antennaria dimorpha*. Typically found on flats or gentle slopes (0-5 degrees) with variable cover (0- >35%) of surficial rock (cobble, stone, boulder, and/or bedrock).

Artemisia arbuscula / *Poa secunda* Association (n=130)

(2) Stands are in a degraded state from clearing, grazing, fire, or other disturbances (although the mode of disturbance may not be obvious). *A. arbuscula* is dominant in the shrub layer although it may be as low as 5% absolute cover. The herbaceous layer typically has higher cover than more pristine stands of the alliance and is dominated by non-native annual grasses such as *Bromus tectorum* and *Elymus caput-medusae*. Native herbaceous cover is usually insignificant.

Artemisia arbuscula / *Bromus* spp. – *Elymus caput-medusae* Association (n=19)

(3) *Artemisia arbuscula* is the dominant shrub and one or more *Eriogonum* spp. subshrubs is characteristically present. Soils are very shallow with insignificant organic content, and the substrate is often derived from ash flows or pumice and may often be less weathered than other local subshrub vegetation. Herb layer is very sparse but typically high in

native forb diversity including *Phlox hoodii*, *Balsamorhiza hookeri*, *Phoenicaulis cheiranthoides*, *Lomatium* spp., and annual *Eriogonum* spp.

Artemisia arbuscula – *Eriogonum* (*microthecum*, *sphaerocephalum*)
Association (n=27)

(4) *Festuca idahoensis* dominates the herb layer. Stands occur in the northern portion of the study area at higher elevations where it is cooler and there is more precipitation.

Artemisia arbuscula ssp. *arbuscula* / *Festuca idahoensis* Shrub
Grassland (n=15)

ii) *Artemisia nova* is dominant to co-dominant in the shrub layer with *Artemisia arbuscula*. Overall shrub cover may be as low as 3% and is often under 10%. Although stands are ecologically similar and often co-dominate with *Artemisia arbuscula*, *A. nova* is much less common than *A. arbuscula* in the study area.

***Artemisia nova* Alliance** (n=11)

(1) *Poa secunda* is characteristically present in the herb layer. Other common herbs may include *Antennaria dimorpha*, *Blepharipappus scaber*, and *Pseudoroegneria spicata*.

Artemisia nova / *Poa secunda* Association (n=8)

b) *Artemisia tridentata* (ssp. *tridentata* or *vaseyana*) is dominant to co-dominant with *Purshia tridentata*, *Ericameria nauseosa*, *Symphoricarpos rotundifolius*, *Artemisia arbuscula*, or *Chrysothamnus viscidiflorus* in the shrub layer. If *Purshia tridentata* is >50% relative cover then key to *Purshia tridentata* – *Artemisia tridentata* Alliance. *Juniperus occidentalis* may occur at <3% cover in the overstory. Shrub cover is often >10% absolute cover and herb cover often <10% absolute cover with high relative cover of native herbs.

i) *Artemisia tridentata* is dominant to co-dominant in the shrub layer (if *A. tridentata* ssp. *vaseyana* is present see associations in the *Artemisia tridentata* ssp. *vaseyana* Alliance). *Purshia tridentata* may be present as a co-dominant but if it is >50% relative cover then key to *Purshia tridentata* – *Artemisia tridentata* Alliance.

***Artemisia tridentata* Alliance³** (n=179)

³ In the NVCS, *Artemisia tridentata* and its subspecies have been divided into multiple alliances in the cool deserts of Western North America. Thus, the names for some of the associations technically fall within multiple alliances, including ***Artemisia tridentata* ssp. *tridentata* – *Artemisia tridentata* ssp. *xericensis* Mesic Shrubland & Steppe Alliance**, ***Artemisia tridentata* ssp. *tridentata* – *Artemisia tridentata* ssp. *xericensis* Dry Steppe & Shrubland Alliance**, ***Artemisia tridentata***

- (1) *Artemisia tridentata* is strongly dominant to co-dominant with *Chrysothamnus viscidiflorus* or *Purshia tridentata* (if *P. tridentata* is >50% relative cover key to *Purshia tridentata* – *Artemisia tridentata* Alliance). The herb layer is sparse to moderately dense with high relative cover of native herbs. Stands are on lower slopes to bottom topographic positions with heavy soils. Many have significant regeneration of *Juniperus occidentalis*. If *A. tridentata* is co-dominating with *Chrysothamnus viscidiflorus* or *Ericameria nauseosa* then the herb layer has high relative nativity and signs of disturbance are minimal.
Artemisia tridentata Association (n=118)
- (2) *Artemisia tridentata* is dominant to co-dominant with or without *Ericameria nauseosa* and/or *Chrysothamnus viscidiflorus*. Shrub cover averages around 10% cover but may be as low as 2% and herb cover is typically >10% absolute cover, with very low relative cover of native herbs. Signs of disturbance such as fire, grazing, and roads/trails are present and typically severe. Herb layer is characterized by high non-native grass cover and very low nativity in general.
Artemisia tridentata – (*Ericameria nauseosa*) / *Bromus tectorum* Association (n=35)
- (3) *Ephedra viridis* is characteristically present in the shrub layer, sub-dominant to dominant with *Artemisia tridentata*. *E. viridis* may be <1%. *Artemisia tridentata* may not be present if the stand has had recent disturbance. *Pseudoroegneria spicata* may co-dominate in the herb layer.
Artemisia tridentata – *Ephedra viridis* / *Pseudoroegneria spicata* Provisional Association (n=21)
- (4) *Artemisia tridentata* is dominant to co-dominant with alkali- or salt-tolerant species such as *Distichlis spicata* and *Iva axillaris*. Stands are restricted to valleys or Pleistocene lakebeds with somewhat alkaline soils. Type is uncommon in the study area.
Artemisia tridentata / *Distichlis spicata* Provisional Association (n=3)

– **Mixed Shrub Dry Steppe & Shrubland Alliance and *Artemisia tridentata* ssp. wyomingensis Mesic Steppe & Shrubland Alliance.** The gradational nature of infraspecific taxa in *A. tridentata*, outside of subsp. *vaseyanana*, seem insufficiently differentiated in the California botanical collections and the currently accepted associations in the USNVC lack strongly diagnostic species. We currently follow the second edition of *A Manual of California Vegetation* (Sawyer et al. 2009) by recognizing only *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) Alliance and a more broadly defined *Artemisia tridentata*.

- ii) *Artemisia tridentata* ssp. *vaseyana* and/or *Symphoricarpos rotundifolius* dominate in the shrub layer. Found at higher elevations on slopes and ridges, often associated with *Cercocarpus ledifolius*, *Abies concolor*, and the winter-deciduous shrubs *Holodiscus discolor*, *Prunus virginiana*, *P. emarginata*, and shrubby *Populus tremuloides*.

***Artemisia tridentata* ssp. *vaseyana* Alliance (n=92)**

- (1) *Artemisia tridentata* ssp. *vaseyana* is strongly dominant to co-dominant in the shrub layer with *Purshia tridentata*, *Tetradymia canescens*, and/or *Chrysothamnus viscidiflorus*. Emergent *Pinus jeffreyi* and *Juniperus occidentalis* are often present although at low cover. *Festuca idahoensis* is dominant to co-dominant in the herb layer with *Poa secunda*, *Achnatherum thurberianum*, *Pseudoroegneria spicata* and/or *Achillea millefolium*.

Artemisia tridentata ssp. *vaseyana* / *Festuca idahoensis*
Association (n=33)

- (2) The sparse shrub layer is co-dominated by *Artemisia tridentata*, *Salvia dorrii* and/or *Chamaebatiaria millefolium*. Shrub diversity can be high but other shrub species will usually have very little cover. Herb cover is usually <10% absolute cover and may include *Penstemon deustus*, *Achnatherum thurberianum*, and *Mimulus suksdorfii*. Stands are on lava breaks or small escarpments where jumbled boulders of basalt and other volcanic rock are present.

Artemisia tridentata – *Salvia dorrii* – *Chamaebatiaria millefolium*
Association (n=19)

- (3) *Artemisia tridentata* ssp. *vaseyana* dominates or co-dominates with mesic shrubs such as *Symphoricarpos rotundifolius* (a synonym for the Jepson manual's *S. oreophilus*), *Ribes velutinum*, and/or *Prunus virginiana*. *Bromus carinatus* and other mesic herbs are found in the understory.

Artemisia tridentata ssp. *vaseyana* – *Symphoricarpos oreophilus*
/ *Bromus carinatus* Association (n=29)

- (4) *Symphoricarpos rotundifolius* (a synonym for the Jepson manual's *S. oreophilus*) co-dominates in the shrub layer with *Chrysothamnus viscidiflorus*, but without *Artemisia tridentata* ssp. *vaseyana*. Stands with high cover of *Wyethia mollis* and low shrub cover key here. This type is indicative of disturbance (fire, grazing, clearing) and is successional related to stands formerly dominated or co-dominated by *Artemisia tridentata* ssp. *vaseyana*.

Symphoricarpos oreophilus Association (n=10)

- c) *Artemisia cana* (ssp. *bolanderi*) is strongly dominant in the shrub layer. *Chrysothamnus* species may co-dominate in disturbed versions of this type. Herb layer may include vernal pool indicators such as *Psilocarphus brevissimus* and *Navarretia* spp. or more generally moist herbs such as *Hordeum brachyantherum*, *Muhlenbergia richardsonis*, and *Juncus* spp. Stands of this type occur on mesic sites including basin bottoms, stream terraces, swales, and flats.

***Artemisia cana* Alliance (n=55)**

Artemisia cana (ssp. *bolanderi*, ssp. *viscidula*) / *Poa secunda* Association
(n=44)

- d) *Purshia tridentata* is always present with at least 50% relative cover and dominant to co-dominant in the shrub layer with *Artemisia tridentata* and/or *Tetradymia canescens*. If *P. tridentata* does not have at least 50% relative cover, and *A. tridentata* is important, key to *Artemisia tridentata* Alliance. *A. tridentata* may or may not be present. *Juniperus occidentalis* may be present in the overstory at low cover. Typically found on moderately steep, north facing slopes. If stands are disturbed by clearing or fire, *Tetradymia canescens* may replace *P. tridentata* as dominant shrub.

***Purshia tridentata* – *Artemisia tridentata* Alliance (n=51)**

- i) *Purshia tridentata* is dominant to co-dominant in the shrub layer with or without *Artemisia tridentata*. The herb layer is dominated by grasses including *Poa secunda*, *Pseudoroegneria spicata*, *Achnatherum thurberianum*, *Festuca idahoensis*, and/or *Bromus tectorum*.

Purshia tridentata – *Artemisia tridentata* Association (n=31)

- ii) *Purshia tridentata* is dominant to co-dominant with *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and/or *Artemisia tridentata* in the shrub layer. Substrate is very sandy and supports a very sparse herb layer that may include *Achnatherum hymenoides*, *Phacelia ramosissima*, and/or *Hesperostipa comata*. Locally stands are best represented on the stabilized dunes on the east side of the Madeline Plain.

Purshia tridentata – *Artemisia tridentata* / *Achnatherum hymenoides*
Association (n=4)

- iii) *Tetradymia canescens* or *Tetradymia glabrata* are strongly dominant in the shrub layer with other disturbance related species such as *Chrysothamnus viscidiflorus* and *Ericameria nauseosa*. Severe disturbance is indicated by lack of *Purshia tridentata* and *Artemisia tridentata* cover. The herb layer is dominated by non-natives such as *Bromus tectorum*, *Tragopogon dubius*, and/or *Sisymbrium altissimum*.

Tetradymia canescens Provisional Association (n=11)

2) Stands of upland or wetland (riparian, basins, etc.) shrubs without conspicuous presence or dominance of the genus *Artemisia*.

a) Upland shrub stands.

i) *Amelanchier utahensis* or *Cercocarpus montanus* are dominant in the shrub layer.

***Amelanchier utahensis* – *Cercocarpus montanus* – *Cercocarpus intricatus* Alliance (n=2)**

(1) *Amelanchier utahensis* is strongly dominant in the shrub layer.

Amelanchier utahensis Association (n=1)

(2) *Cercocarpus montanus* is co-dominant to dominant in the shrub layer with *Artemisia arbuscula*.

Cercocarpus montanus / *Pseudoroegneria spicata* Association (n=1)

ii) *Tetradymia canescens* or *Tetradymia glabrata* are strongly dominant in the shrub layer with other disturbance related species such as *Chrysothamnus viscidiflorus* and *Ericameria nauseosa*. Significant recent disturbance is indicated by lack of *Purshia tridentata* and *Artemisia tridentata* cover. The herb layer is dominated by non-natives such as *Bromus tectorum*, *Tragopogon dubius*, and/or *Sisymbrium altissimum*.

Tetradymia canescens Provisional Association (n=11)
of the ***Purshia tridentata* – *Artemisia tridentata* Alliance**

iii) *Ribes velutinum* is dominant in the shrub layer with *Cercocarpus ledifolius*, *Ericameria nauseosa*, *Prunus virginiana*, and/or *Prunus subcordata*. *Leymus cinereus* may be dominant in the herb layer.

Ribes velutinum Provisional Association (n=3)
of the ***Prunus emarginata* – *Holodiscus discolor* Alliance**

iv) *Chrysothamnus viscidiflorus* dominates in the shrub layer without significant cover of *Artemisia tridentata* or *Purshia tridentata*. *Poa secunda* is generally present in the herb layer. In disturbed sites, *Bromus tectorum* may dominate the herb layer.

Chrysothamnus viscidiflorus Association (n=13)
of the ***Chrysothamnus viscidiflorus* Alliance (n=13)**

v) Stands are composed of shrubs with evergreen, stiff or thickened leaves.

(1) *Ceanothus velutinus* is dominant to co-dominant in the shrub layer with *Prunus emarginata*, *Symphoricarpos rotundifolius*, and *Artemisia tridentata*. If *C. velutinus* is co-dominating with *Arctostaphylos patula* then key to the *Arctostaphylos patula* – *Ceanothus velutinus* Association (*Arctostaphylos patula* – *Arctostaphylos nevadensis* Alliance). Typically found on moderately steep (>10 degrees), north-facing slopes. Emergent *Abies concolor* may be present. Herb layer

may include *Bromus carinatus*, *Wyethia angustifolia*, and/or *Crepis acuminata*. Evidence of fire is common (locally after fires, *C. velutinus* germinates from seed bank within burned stands of conifers or *Cercocarpus*).

***Ceanothus velutinus* Alliance (n=16)**

- (a) *Ceanothus velutinus* is strongly dominant in the shrub layer. *Prunus emarginata* and *Artemisia tridentata* (ssp. *vaseyana*) might be present as sub-dominants.

Ceanothus velutinus Association (n=11)

- (b) *Ceanothus velutinus* is co-dominant with *Prunus emarginata*. Other shrubs like *Symphoricarpos rotundifolius* and *Artemisia tridentata* (ssp. *vaseyana*) are often present.

Ceanothus velutinus – *Prunus emarginata* – *Artemisia tridentata*
Association (n=5)

- (2) Tall shrubs or small trees of *Cercocarpus ledifolius* dominant to co-dominant in the mid/shrub layer. Other shrubs may include *Artemisia tridentata* (various subspecies), *Symphoricarpos rotundifolius*, *Prunus virginiana*, *Ribes velutinum* and/or *Purshia tridentata*. *Juniperus occidentalis* and *Pinus ponderosa* may be emergent in the tree layer but do not have enough cover to key to the *Juniperus occidentalis* Alliance or the *Pinus ponderosa* / Shrub Understory Alliance

***Cercocarpus ledifolius*⁴ Alliance (n=49)**

- (a) *Artemisia tridentata* ssp. *vaseyana* is typically co-dominant in the shrub layer with *Cercocarpus ledifolius*, and no other shrub species are present with comparable cover.

Cercocarpus ledifolius – *Artemisia tridentata* ssp. *vaseyana*
Association (n=16)

- (b) *Cercocarpus ledifolius* is strongly dominant with low cover of other shrubs such as *Ribes velutinum*, *Symphoricarpos rotundifolius*, and/or *Prunus virginiana*. *Artemisia tridentata* is typically present at low cover. Typically found on rocky, north facing slopes and/or where *Cercocarpus ledifolius* is dense with a closing canopy.

Cercocarpus ledifolius Association (n=25)

⁴ *Cercocarpus ledifolius* is considered under separate tree and shrub alliances in the NVCS. However, there is much overlap in California so we put it in one shrub alliance following Sawyer et al. (2009).

- (3) *Arctostaphylos patula* is strongly dominant to co-dominant in the shrub layer with *Ceanothus velutinus*, *Cercocarpus ledifolius*, and/or *Artemisia tridentata* ssp. *vaseyana*.

***Arctostaphylos patula* – *Arctostaphylos nevadensis* Alliance**
(n=13)

- (a) *Arctostaphylos patula* is strongly dominant in the shrub layer though many other shrub species may be present at low cover including *Cercocarpus ledifolius*, *Purshia tridentata*, and/or *Ceanothus velutinus*. Herb layer is usually sparse and may include *Poa secunda*, *Achillea millefolium* or *Castilleja applegatei*.

Arctostaphylos patula Association (n=6)

- (b) *Arctostaphylos patula* and *Ceanothus velutinus* co-dominate in the shrub layer with *Cercocarpus ledifolius*, *Prunus emarginata*, and/or *Ceanothus prostratus*. Herb layer is sparse and variable in species composition but may include *Viola purpurea*, *Wyethia mollis*, or *Elymus elymoides*.

Arctostaphylos patula – *Ceanothus velutinus* Association (n=7)

- (4) *Chrysolepis sempervirens* is dominant in the shrub layer. Stands of this type are rare in this study area.

Chrysolepis sempervirens Association (n=1)
of the *Chrysolepis sempervirens* Alliance (n=1)

- vi) Dominant or characteristic shrubs are soft-leaved members of the genus *Ericameria* or *Eriogonum*.

- (1) *Ericameria nauseosa* is typically strongly dominant in the shrub layer with or without *Artemisia arbuscula* or *Artemisia tridentata*.

***Ericameria nauseosa* Alliance** (n=64)

- (a) The understory herb layer is characteristically sparse (<10%) and has a decent native component that may include *Poa secunda*, *Epilobium brachycarpum*, and/or *Pseudoroegneria spicata*.

Ericameria nauseosa Association (n=45)

- (b) Evidence of disturbance from fire, grazing, or other clearing is present. Typically, the low diversity herbaceous layer is dominated by non-native annual herbs such as *Bromus tectorum*, *Sisymbrium altissimum*, and *Taeniatherum caput-medusae*.

Ericameria nauseosa / *Bromus tectorum* Association (n=18)

- (2) Dwarf shrub *Eriogonum* spp. (*E. vimineum*, *E. sphaerocephalum*, *E. prociduum*) are characteristically present even as low as <1% cover and usually no other shrubs are present with greater cover. Generally,

on flats or exposed hilltops with significant volcanic cobble and/or gravel covering the soil surface. Total vegetation cover is usually <10% and often <5%. This type is related to the *Artemisia arbuscula* – *Eriogonum* (*microthecum*, *sphaerocephalum*) Association, but occurs on harsher sites where an evenly-distributed subshrub layer dominated by *Artemisia arbuscula* is unlikely.

***Eriogonum* spp. / *Poa secunda* Alliance** (n=36)

Eriogonum sphaerocephalum / *Poa secunda* Association (n=35)

vii) Dominant or characteristic shrubs are associated with old playas or lakeshores occurring on semi-alkaline, sandy, or clayey soils. Stands are only known from the southern portion of the study area.

(1) *Krascheninnikovia lanata* is dominant to co-dominant in the shrub layer.

***Krascheninnikovia lanata* Alliance** (n=1)

(2) *Atriplex canescens* is dominant to co-dominant in the shrub layer with *Psoralea polydenia* and *Tetradymia glabrata*.

***Atriplex canescens* Alliance** (n=1)

viii) Dominant or characteristic shrubs are winter-deciduous members of the genus *Prunus* or *Holodiscus*.

(1) *Holodiscus discolor*, *Prunus emarginata* and/or *Ribes velutinum* dominate in the shrub layer. *Symphoricarpos rotundifolius*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and *Artemisia tridentata* may be present as co-dominants or sub-dominants. Stands are found in forest openings or on rock outcrops.

***Prunus emarginata* – *Holodiscus discolor* Alliance** (n=12)

(a) *Ribes velutinum* is dominant to co-dominant in the shrub layer with *Cercocarpus ledifolius* and/or *Prunus* spp.

Ribes velutinum Provisional Association (n=3)

(b) *Holodiscus discolor* is dominant in the shrub layer with *Ericameria nauseosa*, *Chamaebatiaria millefolium*, *Artemisia tridentata* ssp. *vaseyana*, *Cercocarpus ledifolius*, and/or *Ribes velutinum*.

Holodiscus discolor Association (n=4)

(c) *Prunus emarginata* is dominant in the shrub layer with *Symphoricarpos rotundifolius*, *Ribes velutinum*, and/or *Amelanchier utahensis*. *Holodiscus discolor* is absent.

Prunus emarginata Association (n=8)

(2) *Prunus virginiana* or *Prunus subcordata* is dominant to co-dominant in the shrub layer. Typically found on rocky, moderately steep to steep (>10 degrees) north facing slopes.

***Prunus virginiana* Alliance** (n=22)

(a) *Prunus virginiana* is dominant in the shrub layer with *Symphoricarpos rotundifolius*, *Ribes* spp., and/or *Cercocarpus ledifolius*. Herb layer is usually sparse and may include *Leymus cinereus*, *Lupinus argenteus*, *Agastache urticifolia*, and/or *Crepis acuminata*.
Prunus virginiana – *Symphoricarpos rotundifolius* Association (n=14)

(b) *Prunus subcordata* is strongly dominant in the shrub layer with *Ericameria nauseosa*, *Prunus virginiana*, and/or *Ribes velutinum*.
Prunus subcordata Provisional Association (n=4)

b) Wetland shrub stands.

i) Stands associated with larger playas or former Pleistocene lakebeds on fine, clayey soils often with a distinctly light color relative to adjacent upland substrates. *Sarcobatus vermiculatus* is dominant to sub-dominant in the shrub layer with *Artemisia tridentata*, *Atriplex confertifolia*, and/or *Chrysothamnus* spp. Herb layer is sparse, typically <10%. Stands are found on flats adjacent to playas.

***Sarcobatus vermiculatus* Alliance** (n=26)

(1) *Sarcobatus vermiculatus* is dominant to sub-dominant with *Chrysothamnus viscidiflorus* and/or *Artemisia tridentata* in the shrub layer.

Sarcobatus vermiculatus – *Artemisia tridentata* Association (n=15)

(2) *Sarcobatus vermiculatus* is dominant to sub-dominant with *Picrothamnus desertorum* and/or *Atriplex confertifolia*.

Sarcobatus vermiculatus – *Atriplex confertifolia* – (*Picrothamnus desertorum*, *Suaeda moquinii*) Association (n=7)

ii) Shrub stands associated with non-alkaline wetlands such as streams, lakes, sloughs, or ditches. The genus *Salix* is dominant.

(1) *Salix exigua* is dominant or co-dominant in the shrub layer with *Salix lasiolepis*, *Rosa woodsii* and/or *Ribes cereum*.

***Salix exigua* Alliance** (n=6)

(2) *Salix lasiolepis* is strongly dominant to co-dominant with *Cornus sericea* in the shrub layer. If *Salix exigua* is present, it is sub-dominant. *Salix lasiandra* var. *lasiandra* is absent.

***Salix lasiolepis* Alliance** (n=9)

(a) *Rosa woodsii* may be present in the shrub layer. A variety of wetland species can be found in the herb layer including *Carex simulata*, *Artemisia douglasiana*, *Scirpus microcarpus*, or *Achillea millefolium*.
Salix lasiolepis – *Rosa woodsii* / Mixed Herbs Association (n=9)

(3) Shrubby *Salix lasiandra* var. *lasiandra* or *S. lasiandra* var. *caudata* (*Salix lucida*, *Salix lasiandra* in some taxonomies) is characteristic of the large shrub layer. *Salix lasiolepis* may be dominant.
***Salix boothii* – *Salix geyeriana* – *Salix lutea* Alliance** (n=10)

(a) *Poa pratensis* is often in the herb layer although it may have very low cover. Other herbaceous species may include *Epilobium ciliatum*, *Agrostis gigantea*, *Mimulus guttatus*, and/or *Equisetum arvense*.

Salix lucida / *Poa pratensis* Association (n=9)

(4) *Betula occidentalis* is dominant in the shrub layer with *Salix lasiolepis* and *Rosa woodsii*.

***Betula occidentalis* Alliance** (n=1)

(5) *Cornus sericea* or *Rosa woodsii* is dominant or co-dominant in the shrub canopy.

***Cornus sericea* – *Rosa woodsii* – *Ribes spp.* Alliance** (n=5)

(a) *Cornus sericea* is dominant to co-dominant in the shrub layer with *Prunus virginiana* or *Salix scouleriana*.

Cornus sericea Association (n=4)

(b) *Rosa woodsii* is greater than 50% relative cover in the shrub layer.

Rosa woodsii Association (n=1)

III. Herbaceous stands

- 1) Upland stands without any long-term accumulation of water. Stands may be on slopes, flats, or ridges, but are not typical of concave drainages or basins.
 - a) Stands dominated and/or characterized by native perennial grasses such as *Elymus smithii*, *Pseudoroegneria spicata*, *Elymus elymoides*, *Poa secunda*, and/or *Festuca idahoensis*.

Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group

- i) *Elymus smithii* is present, with at least 20% relative cover, with other mesic herbs such as *Juncus balticus* and *Eleocharis* spp. The most extensive stands of this vegetation occur on the northern slopes of Shinn Mountain and adjacent areas to the north between 6000 and 7000 ft elevation. Stands range from concavities and swales to mesic middle slopes. Much of this area was affected by the 2012 Rush fire and the grasslands dominated or co-dominated by *E. smithii* as sampled 4-6 years after the fire appear successional to *Purshia tridentata*-*Artemisia tridentata*, or *A. tridentata* var. *vaseyana* alliance stands.

Elymus smithii Stands (n=1)

- ii) Stands dominated and/or characterized by *Festuca idahoensis*, *Elymus spicatus*, and/or *Poa secunda*, without significant cover of *Elymus smithii*. Non-native annual grasses such as *Bromus tectorum* and *Taeniatherum caput-medusae* may exceed the cover of native grasses but total herbaceous nativity is usually >20% relative cover.

Festuca idahoensis – *Pseudoroegneria spicata* – *Poa secunda* Alliance (n=137)

- (1) Stands are characterized by *Pseudoroegneria spicata* and/or *Poa secunda*, usually on warmer aspects with rocky substrate. Non-native species such as *Bromus tectorum* or *Elymus caput-medusae* often co-dominate or dominate the herb layer but native cover is usually >20%. Other native herb species present include *Elymus elymoides*, *Epilobium brachycarpum*, *Blepharipappus scaber*, *Achnatherum thurberianum*, and/or *Lomatium* spp. *Festuca idahoensis* may be present but sub-dominant. Stands have typically burned within the past 10 years.

Pseudoroegneria spicata – *Poa secunda* Association (n=128)

- (2) Stands dominated or co-dominated by *Festuca idahoensis* with *Bromus tectorum*, *Elymus elymoides*, *Pseudoroegneria spicata*, and/or *Achnatherum thurberianum*. Compared to the *Pseudoroegneria spicata* – *Poa secunda* Grassland Association, stands are generally found on upper slopes on neutral to cooler aspects above 5500 ft.

Festuca idahoensis – *Pseudoroegneria spicata* Provisional Association
(n=6)

- b) Upland stands dominated by non-native annual grasses and/or herbs.
- i) Stands widespread and not solely associated with pastures or human habitation. Usually associated with recent fire or clearing and often formerly dominated by woody plants including *Artemisia arbuscula*, *Artemisia tridentata*, *Cercocarpus ledifolius*, or *Juniperus occidentalis* (evidence of charred stems or stumps is often found nearby).

Intermountain Ruderal Steppe and Shrubland Group

- (1) Stand with >75% relative cover of non-native herbs and grasses such as *Bromus tectorum*, *Elymus caput-medusae*, *Ventenata dubia*, *Poa bulbosa*, and *Sisymbrium altissimum*. *Elymus elymoides* may dominate or co-dominate although no single native species with significant cover is present. Signs of disturbance are typically present, such as fire, roads or trails, grazing, or *Juniperus occidentalis* removal.

***Bromus tectorum* – *Elymus caput-medusae* Alliance** (n=109)

- (a) *Bromus tectorum* is usually strongly dominant to co-dominant in the herb layer with *Elymus elymoides*, *Sisymbrium altissimum*, *Erodium cicutarium*, and/or *Descurainia sophia*. *Elymus caput-medusae* may be present but only as a sub-dominant. *Elymus elymoides* may be strongly dominant in areas with juniper removal. Low cover of shrubs such as *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and/or *Tetradymia glabrata* may be present but usually patchy.

Bromus tectorum Association (n=53)

- (b) *Elymus caput-medusae* is strongly dominant to co-dominant with *Bromus tectorum*, *Bromus arvensis*, *Erodium cicutarium*, and/or *Lactuca serriola*. If co-dominant with *Ventenata dubia* key to *Ventenata dubia* Provisional Association.

Elymus caput-medusae Provisional Association (n=33)

- (c) *Ventenata dubia* is dominant to co-dominant with *Elymus caput-medusae*, *Bromus tectorum*, *Bromus arvensis*, and/or *Elymus caput-medusae*. Stands are in slightly more mesic sites compared to stands of *Elymus caput-medusae* Intermontane Provisional Association, including small swales and rocky flats with some water accumulation possible from spring to early summer.

Ventenata dubia Provisional Association (n=20)

- ii) Stands strongly dominated by *Elymus elymoides* with all other herbaceous species with very little cover. Species diversity is very low and may have obvious signs of disturbance such as fire and/or Juniper removal.

Intermountain Semi-Desert Grassland Group
Aristida purpurea – *Elymus elymoides* – *Poa secunda* Alliance
Elymus elymoides Provisional Association (n=4)

- iii) Stands of moist or upland lower slopes locally associated with ranch buildings and maintained pastures.
- (1) Stands dominated by non-native *Lolium perenne* (*Festuca perennis*), with the bright-yellow flowered *Lotus corniculatus* conspicuous. Uncommon. Found in heavily grazed or disturbed lands adjacent to human modification.

Californian Ruderal Grassland, Meadow & Scrub Group
***Lolium perenne* Alliance** (n=1)

Lolium perenne – *Lotus corniculatus* Association (n=1)

- 2) Stands of marshes, bottomlands, basins, swales, meadows, vernal pools, or other areas that are moist, wet, or saturated for much of the growing season. Depending on the year some areas may be dry but have evidence of water flow or ponding.

- a) Stands composed largely of short to tall perennial grasses and/or graminoids associated with alkaline and/or heavy soils of large basins, playas, or flats.

North American Desert Alkaline-Saline Marsh & Playa Group

- i) Stands characterized by saltgrass, *Distichlis spicata*, though other herbaceous species may have higher cover. May have other halophytes (*Bassia*, *Nitrophila*, etc.). Found at Horse Lake and expected on other Pleistocene alkaline lakebeds/playas. If *Juncus balticus* co-dominates then key here.

***Distichlis spicata* Alliance** (n=4)

- ii) *Eleocharis rostellata* is dominant in the herb layer. Rare and local at mineralized springs, forming a raised peat fen strongly dominated by *E. rostellata*. This species is a strong indicator of basic pH wetlands and is only locally represented from a few known sites in California.

Eleocharis rostellata Association (n=1)
of the ***Eleocharis (palustris, rostellata)* Alliance** (n=1)

- iii) Grassland stands of relatively heavy soils (including clay mounds), not always in obvious alkaline basins, but often moist in early summer. *Elymus triticoides* or *E. cinereus* are obvious and consistent throughout stand and are dominant to sub-dominant in the herbaceous layer with *Bromus tectorum*, *Poa secunda*, and/or *Descurainia sophia*. Stands are on lower slopes, often conspicuous following fires.

***Elymus cinereus* – *Elymus triticoides* Alliance** (n=19)

(1) The large tufted perennial grass *Elymus (Leymus) cinereus* is dominant to co-dominant with *Poa secunda* and/or *Bromus tectorum*.
Elymus cinereus Association (n=14)

(2) *Elymus triticoides* dominant to co-dominant with *Poa secunda*. *Poa secunda* may be absent.
Elymus triticoides – *Poa secunda* Association (n=3)

b) Stands of persistent fresh-water wetlands (wet meadows and stream-sides) or stands of seasonal fresh or somewhat alkaline wetlands.

i) Stands of seasonally drying edges of reservoirs, lakes, livestock ponds, or vernal pools and swales.

(1) Stands, in peak phenology, contain several genera typical of California vernal pools, including: *Eleocharis* (especially *E. acicularis*, or *E. macrostachya*), *Psilocarphus*, *Downingia* spp., *Gratiola*, and/or *Epilobium* (subgenus *Boisduvalia*).

***Eleocharis macrostachya* Alliance** (n=17)
of the **Californian Vernal Pool Group**

(a) *Eleocharis macrostachya* is co-dominant with other vernal pool species including *Downingia bacigalupii*, *Marsilea vestita*, and *Trifolium cyathiferum*.

Eleocharis macrostachya Vernal Pool Provisional Association
(n=12)

(2) Stands, in peak phenology, contain several genera typical of seasonal or ephemeral wetlands of the Great Basin, from montane Eastern California, to E Oregon, and E Washington. Settings include vernal saturated or flooded flats and smaller vernal pools. The key species include *Navarretia leucocephala*, *Muhlenbergia richardsonis*, *Polygonum aviculare*, and/or *Downingia bacigalupii*.

Navarretia leucocephala* ssp. *minima* – *Plagiobothrys cusickii
Alliance (n=37)
of the **Oregon-Washington-British Columbia Vernal Pool Group**

(a) *Taraxia tanacetifolia* and/or *Iva axillaris* dominate to co-dominate with other Great Basin vernal pool species such as *Polygonum aviculare*, *Psilocarphus brevissimus* and/or *Muhlenbergia richardsonis*.

Taraxia tanacetifolia – *Iva axillaris* Provisional Association (n=24)

(3) Stands without strong representatives from either the Californian or Eastern Oregon/Washington Vernal Pool Groups, but species more widespread and typical of slightly alkaline western interior seasonal

wetlands such as *Muhlenbergia* spp., *Carex douglasii*, *Poa secunda* (moist meadow ecotypes), *Taraxia tanacetifolia*.

(a) Stands characterized by the presence of *Carex douglasii*.

Carex douglasii Association (n=5)
of the ***Poa secunda* – *Muhlenbergia richardsonis* – *Carex douglasii* Alliance** (n=6) of the **Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group**

ii) Stands occurring in flooded, wet, moist, or saturated meadows, stream-sides, springs, or swales. Water is usually fresh and not strongly alkaline or salty. This is a large group that encompasses stands that hold moisture in the soil until mid to late summer or stands that dry out before mid-summer. Dominated by wet meadow sedges, rushes, and grasses.

Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group

(1) Stands dominated by *Solidago canadensis*.

***Solidago canadensis* Alliance** (n=1)

(2) Stands dominated or co-dominated by *Scirpus microcarpus*.

***Scirpus microcarpus* Alliance** (n=1)

(3) Stands dominated or co-dominated by rushes (*Juncus* spp.) of several species. May be mixed with sedges or grasses, but rushes are most conspicuous.

(a) *Juncus nevadensis* is dominant to co-dominant with *Juncus arcticus*.

Juncus nevadensis Association (n=3)
of the ***Juncus nevadensis* Alliance**

(b) *Juncus* (*balticus*, *mexicanus*, *arcticus*) is dominant to co-dominant *Trifolium hybridum*, *Poa pratensis*, *Achillea millefolium* and other wetland herbs. If co-dominant with *Deschampsia cespitosa* then key to *Deschampsia cespitosa* Association in the *Deschampsia cespitosa* Alliance. If co-dominant with *Distichlis spicata* then key to *Distichlis spicata* Alliance.

Juncus arcticus var. *balticus* – (var. *mexicanus*) Association
(n=27)

of the ***Juncus balticus* – *Juncus mexicanus* Alliance**
(n=29)

(4) Stands not clearly dominated by sedges or rushes. May be moist to relatively dry later in the growing season. Dominated by grasses or herbs of small to large stature.

- (a) Stands dominated by relatively short native grasses.
- (i) *Hordeum brachyantherum* dominant to co-dominant in herb layer with *Juncus arcticus*, *Poa secunda*, and/or *Phleum pratense*.
Hordeum brachyantherum Association (n=4)
of the ***Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance** (n=4)
- (ii) Moist meadow stands with *Danthonia unispicata*, and/or broad-leaved bulbiferous monocots such as *Triteleia hyacinthina* or *Camassia* spp. conspicuous. *Poa secunda* is usually present to co-dominant. Other herbs may include *Lomatium bicolor*, *Blepharipappus scaber*, and *Epilobium minutum*.
Danthonia unispicata – *Poa secunda* Association (n=25)
of the ***Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance** (n=32)
- (5) Stands dominated by wet meadow sedges or spike rushes.
- (a) *Carex aquatilis* and/or *Carex lenticularis* dominate the herb layer.
Carex aquatilis – *Carex lenticularis* Association (n=4)
of the ***Carex (aquatilis, lenticularis)* Alliance** (n=4)
- (b) *Carex simulata* present and conspicuous.
Carex simulata Association (n=3)
of the ***Carex simulata* Alliance** (n=3)
- (c) *Carex scopulorum* is dominant in the herb layer.
Carex scopulorum Association (n=1)
of the ***Carex scopulorum* Alliance** (n=1)
- (d) *Carex praegracilis* is dominant to co-dominant in the herb layer.
Carex praegracilis Association (n=2)
of the ***Carex (pansa, praegracilis)* Alliance** (n=2)
- (e) *Carex nebrascensis* is present and conspicuous and is evenly distributed. Stands may be dominated by other meadow species including *Juncus bufonius*.
Carex nebrascensis Association (n=5)
of the ***Carex nebrascensis* Alliance** (n=5)
- (f) *Eleocharis quinqueflora* is dominant in the herb layer, stands are small and often associated with fens.
***Eleocharis quinqueflora* Alliance** (n=1)
- (6) Stands with co-dominant *Deschampsia cespitosa* with other wet meadow herbs including *Juncus balticus*, *Eleocharis macrostachya*, and *Juncus nevadensis*.

Deschampsia cespitosa Association (n=3)
of the ***Danthonia californica* – *Deschampsia cespitosa* – *Camassia quamash* Alliance** (n=3)

- iii) Stands dominated by larger non-native perennial pasture grasses (including *Phalaris arundinacea*, *Phleum pratense*, *Poa pratensis*, *Agrostis gigantea*).

Western North American Ruderal Marsh, Wet Meadow & Shrubland Group

- (1) *Phalaris arundinacea* is dominant in the herb layer with *Juncus arcticus*, *Carex lenticularis*, and/or *Euthamia occidentalis*.

Phalaris arundinacea Association (n=2)
of the ***Phalaris aquatica* – *Phalaris arundinacea* Alliance** (n=2)

- (2) Stands dominated by *Agrostis gigantea*, *A. stolonifera*, *Alopecurus pratensis*, *Phleum pratense*, or *Poa pratensis*.

***Poa pratensis* – *Agrostis gigantea* – *Agrostis stolonifera* Alliance**
(n=4)

- (a) *Agrostis gigantea* is dominant in the herb layer.

Agrostis (gigantea, stolonifera) Association (n=1)

- (b) *Phleum pratense* and/or *Poa pratense* dominate or co-dominate in the herb layer.

Poa pratensis Association (n=3)

- iv) Stands dominated by broad-leaved annual or perennial herbs. These often have a shorter early season saturation period than typically adjacent meadows of the *Juncus balticus* – *Juncus mexicanus* and the *Danthonia* spp. – *Camassia* spp. Wet Meadow alliances.

- (1) Small moist meadow stands dominated by the conspicuous trifoliolate, hairy-leaved, pink-flowered, annual *Lotus unifoliolatus* (*Lotus purshianus*).

Californian Annual Grassland & Forb Meadow Group
***Lotus unifoliolatus* Provisional Alliance** (n=4)

- (2) Stands dominated by *Artemisia douglasiana*. Only known along an intermittent stream channel surrounded by coniferous forest on the western edge of the study area.

Temperate Pacific Freshwater Wet Mudflat Group
***Bidens cernua* – *Euthamia occidentalis* – *Ludwigia palustris* Alliance** (n=1)

Artemisia douglasiana Provisional Association (n=1)

v) Stands perennially flooded or saturated during the summer. Plants either emergent or floating at peak phenology.

(1) Stands of plants with stems or leaves emergent out of water during peak growing season, but not supported by water.

Arid West Interior Freshwater Marsh Group

(a) Wetlands (ponds, ditches, lake margins) dominated by *Typha* species.

Typha domingensis Association (n=1)

of the ***Typha domingensis* – *Typha latifolia* – *Typha angustifolia* Alliance** (n=1)

(b) Wetlands dominated by *Schoenoplectus americanus*.

***Schoenoplectus americanus* Alliance**

(2) Stands composed of anchored or unanchored floating-leafed hydrophytes on ponds, shallow lakes, or in slow moving streams or sloughs.

Western North American Temperate Freshwater Aquatic Vegetation Group (n=2)

3) Stands are on steep slopes, rock outcrops or cliff faces where there is very little soil for plants to inhabit and therefore, living vegetation is very sparse, not evenly distributed, and does not meet the minimum cover required to fit any of the tree, shrub, or herbaceous vegetation types listed above

Columbia Plateau cliff, scree and rock mapping unit

APPENDIX F: Glossary

The following terms with their respective definitions have been established in developing the vegetation classification, keys, and descriptions.

- **Constancy, Cover-Abundance, and Related Terms** – Used in the key, descriptions and the vegetation constancy tables (codes from tables in parentheses):
 - **Constancy** (Con) – Number of occurrences divided by the number of samples X 100%
 - **Diagnostic** – A species or group of species whose relative constancy or abundance differentiates one vegetation type from another; the term can include character, constant, differential, and indicator species (Jennings et al. 2006).
 - **Strongly dominant** – A species in the dominant lifeform stratum has 60% or greater relative cover.
 - **Dominant** – A species in the dominant lifeform stratum has 50% or greater relative cover.
 - **Co-dominant** – Each species has between 30% and 60% relative cover.
 - **Characteristic** – Present in at least 80% of the samples for that vegetation type, with no restriction on cover.
 - **Abundant** – Present in 50 to 75% of the samples, with at least 50% relative cover.
 - **Usually/Often** – Present in 50 to 75% of the samples, with no restriction on cover.
 - **Sometimes** – Present in 25 to 50% of the samples, with no restriction on cover.
 - **Average (Avg) and Relative Cover** – Average cover for a taxon in a vegetation type is calculated as the sum of its 'absolute' cover values divided by the total sample size; relative cover is calculated as the comparative sum of cover values for one taxon compared to the sum of cover values of other taxa, in which proportional numbers are derived (see **Cover** section for more details).
 - **Minimum** (Min) and **Maximum** (Max) – The minimum and maximum cover values that a taxon had from the surveys of a vegetation type. Values could be an absolute cover value (e.g., 1%) and/or a mid-point value of a cover class (e.g., 2.5% for a cover class of 1–5 %) depending on data available
- **Cover** – The primary metric used to quantify the abundance of a particular species or a particular vegetation layer within a plot. It was measured by estimating the aerial extent of the living plants, or the "bird's-eye view" looking from above for each category. Cover in this mapping project uses the concept of "porosity" or foliar cover rather than "opacity" or crown cover. Thus, field crews are trained to estimate the amount of light versus shade produced by the canopy of a plant or a stratum by taking into account the amount of shade it casts excluding the openings it may have in the interstitial spaces (e.g., between leaves or branches). This is assumed to provide a more realistic estimate of the actual amount of shade cast by the individual or stratum which, in turn, relates to the

actual amount of light available to individual species or strata beneath it. However, as a result, cover estimates can vary substantially between leaf-on versus leaf-off conditions. Stands dominated by deciduous species (e.g., *Populus tremuloides*, *Toxicodendron diversilobum*) should be sampled during leaf-on since they will have substantially less cover when leaves are absent and may key to another type. Various subcategories of cover for species and vegetation are defined as follows:

- **Absolute cover** – Refers to the actual percentage of the ground (surface of the plot or stand) that is covered by a species or group of species. For example, *Pinus jeffreyi* covers between 5% and 10% of the stand. Absolute cover of all species or groups if added in a stand or plot may total greater or less than 100% because it is not a proportional number.
 - **Relative cover** – Refers to the amount of the surface of the plot or stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the amount of surface of the plot or stand covered by all species (in that group). Thus, 50% relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Relative cover values are proportional numbers and, if added, total 100% for each stand (sample).
 - **Dense/Continuous cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is greater than 66 percent absolute cover.
 - **Intermittent cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is 33-66 percent absolute cover.
 - **Open cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is less than 33 percent absolute cover.
 - **Sparse cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the *average* cover value is <2% absolute cover (though the range in cover could be <1-9% cover).
 - **Emergent** – A plant (or vegetation layer) is considered emergent if it includes plants that rises above a predominant vegetation layer, but that are sparse in cover. It is considered as a member of the next tallest layer, but typically has an absolute cover < 10%.
- **Lifeform terms:**
 - **Tree** – Is a one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multiple-stemmed (ramifying) after fire or other disturbance, but size of mature plants is typically greater than 5 m and undisturbed individuals of these species are usually single stemmed.
 - **Shrub** – Is normally a multi-stemmed woody plant that generally has several erect, spreading, or prostrate stems and that is usually between 0.2 meters and 5 meters tall, giving it a bushy appearance. Definitions are blurred at the low and the high ends of the height scales. At the tall end, shrubs may approach trees based on disturbance frequencies (e.g., old-growth re-sprouting shrub species such as *Cercocarpus ledifolius*, etc., may frequently attain “tree size”). At the low end, woody perennial herbs or sub-shrubs of

- various species are often difficult to categorize into a single life-form; usually sub-shrubs (per USDA-NRCS 2011) were categorized in the “shrub” category.
- **Subshrub (or Dwarf shrub):** A multi-stemmed plant with noticeably woody stems less than 0.5 meter tall. May be easily confused with a perennial herb or small shrub. We lump them into the “shrub” category in stand tables and descriptions of vegetation types.
 - **Herb** – Is any vascular plant species that has no main woody stem-development, and includes grasses, forbs, and perennial species that die-back seasonally.
 - **Cryptogam** - Is a nonvascular plant or plant-like organism without specialized water or fluid conducting vascular tissue (i.e., xylem and phloem). Includes mosses, lichens, liverworts, hornworts, and algae.
- **Stand** – Is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small such as wetland seeps, and some may be several square kilometers in size such as desert or forest types. A stand is defined by two main unifying characteristics:
 - It has *compositional* integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or gradual.
 - It has *structural* integrity. It has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest formerly dominated by the same species, but that has burned on the upper part of the slope and not the lower is divided into two stands. Likewise, a sparse woodland occupying a slope with shallow rocky soils is considered a different stand from an adjacent slope of a denser woodland/forest with deep moister soil and the same species.
 - **Dominance by layer/stratum:** Tree, shrub, and herbaceous layers are considered physiognomically distinct. Alliances are usually named by the dominant and/or characteristic species of the tallest characteristic layer (see tree-characterized, shrub-characterized, and herb-characterized vegetation definitions below). Average covers within the dominant layer reflect the "modal" concept of the health/age/environment of a particular vegetation type. For example, a higher average cover of woody plants within a stand not recently affected by disturbance reflects a mode of general availability of water, nutrition, and equitable climate, while lower average cover under similar conditions would reflect lower availability of these things.
 - **Vegetation:**
 - **Woodland and forest vegetation:** In the National Vegetation Classification, a woodland is defined as a tree-dominated stand of vegetation with between 25 and 60 percent cover of trees and a forest is defined as a tree-dominated stand of vegetation with 60 percent or greater cover of trees.
 - **Shrubland vegetation:** Shrubs (including dwarf-shrubs) are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component, and one or both of the following criteria are met: (1) Shrubs influence the distribution or population dynamics of other plant species;

- (2) Shrubs play an important role in ecological processes within the stand. Shrub alliances typically have at least 10% absolute shrub cover.
- **Herbaceous vegetation:** Herbs are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component, and play an important role in ecological processes within the stand, and the stand cannot be characterized as a tree or shrub stand.
 - **Nonvascular vegetation:** Nonvascular organisms provide a consistent (even if sparse) structural component and play an important role in ecological processes within the stand.
 - **Semi-natural/ruderal vegetation:** Stands characterized by naturalized non-native species. Examples include *Tamarix* spp., and *Brassica* spp. Note: the terminology for semi-natural versus ruderal plant communities is still under discussion with ESA Vegetation Panel and Hierarchy Review Working Group, and in the last 5 years the classification names have gone back and forth between these two terms.
- **National Vegetation Classification Hierarchy Levels:**
 - **Class** – A vegetation classification unit of high rank (1st level) defined by a broad combination of dominant general growth forms adapted to basic moisture, temperature, and/or substrate or aquatic conditions (FGDC 2008).
 - **Subclass** – A vegetation classification unit of high rank (2nd level) defined by a combination of general dominant and diagnostic growth forms that reflect global mega- or macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate or aquatic conditions (FGDC 2008).
 - **Formation** – A vegetation classification unit of high rank (3rd level) defined by a combination of dominant and diagnostic growth forms that reflect global macroclimatic conditions as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions (FGDC 2008).
 - **Division** – A vegetation classification unit of intermediate rank (4th level) defined by a combination of dominant and diagnostic growth forms and a broad set of diagnostic plant species that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (FGDC 2008).
 - **Macrogroup** – A vegetation classification unit of intermediate rank (5th level) defined by a moderate set of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (FGDC 2008).
 - **Group** – A vegetation classification unit of intermediate rank (6th level) defined by combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (FGDC 2008).
 - **Alliance** – A classification unit of vegetation of low rank (7th level), containing one or more associations and defined by one or more diagnostic species, often of high cover, in the uppermost layer or the layer with the highest canopy cover. Alliances reflect physiognomy as well as regional to subregional climates, substrates, hydrology, and disturbance regimes (Jennings et al.

2006, FGDC 2008).

- **Association** – A vegetation classification unit of low rank (8th level) defined by a diagnostic species, a characteristic range of species composition, physiognomy, and distinctive habitat conditions (Jennings et al. 2006). Associations reflect local topo-edaphic climates, substrates, hydrology, and disturbance regimes.
- **Other Classification Terms:**
 - **Provisional Type** – A vegetation type that is not yet formally described, but expected to be an addition to the existing list of USNVC types for a project area. The type may be represented by plot samples (e.g, <10 samples), while it may or may not be particularly common or because it is localized in extent; however, it could be documented in additional location(s) outside of the study area.
- **Conservation Rank** – Listed by the state Nature Conservancy Heritage Programs, including the California Department of Fish and Wildlife’s Vegetation Classification and Mapping Program, these are the "Global" and "State" ranks, as seen below:
 - **G1 and S1** – Critically Imperiled—At very high risk of extinction due to extreme rarity. Often 5 or fewer viable occurrences and/or up to 518 hectares.
 - **G2 and S2** – Imperiled—At high risk of extinction due to very restricted range, very few occurrences, steep declines, or other factors. Often 6–20 viable occurrences, and/or 518–2,590 hectares
 - **G3 and S3** – Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations, recent and widespread declines, or other factors. Often 21–100 viable occurrences and/or 2,590–12,950 hectares.
 - **G4 and S4** – Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors. Often greater than 100 viable occurrences and/or more than 12,950 hectares.
 - **G5 and S5** – Secure—Common; widespread and abundant.
- **Abbreviations and Other Characters:**
 - **Parentheses “()”** – When parentheses are used around a species name within a vegetation type name, it indicates that the species is often present as an indicator of that association or alliance, but it does not meet a threshold of 75% or more constancy. The parentheses may be used around the full scientific name or only around the species epithet. An example is the *Juniperus occidentalis* / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Woodland Association. If parentheses are only around the species epithet, it means that the genus is consistently present but another species could also be present from that genus. An example is the *Artemisia arbuscula* – *Eriogonum* (*microthecum*, *sphaerocephalum*) Shrubland Association, where the genus may be represented by one or more species found within the parentheses.
 - **Em dash “–”** – Separates taxa in a community name that are within the same stratum.
 - **Slash “/”** – Separates taxa in a community name that are in different strata

APPENDIX G: Contingency Tables for the Applegate-Eagle Lake Subareas

The following contingency tables include both the Eagle Lake and the Applegate subareas to give the user a regional perspective of the types encountered in the region. Contingency tables are included for both the Alliance and the Association levels of the classification.

