VEGETATION MAP AND CLASSIFICATION OF SLINKARD VALLEY AND LITTLE ANTELOPE VALLEY WILDLIFE AREAS, MONO COUNTY, CALIFORNIA

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August 2021

ABSTRACT

The California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) created a fine-scale vegetation map of Slinkard Valley and Little Antelope Valley Wildlife Areas in Mono County, California.

The vegetation classification was derived from data collected in the field during the periods August 28-31, 2017, September 10-14, 2018, and November 5-9, 2018. Vegetation polygons were drawn using heads-up "manual" digitizing using the 2016 National Agricultural Imagery Program (NAIP) true color and color infrared (CIR) 1-meter resolution data as the base imagery. Supplemental imagery included NAIP true color and CIR 1-meter resolution data from 2009-2012, BING imagery, and current and historical imagery from Google Earth. The minimum mapping unit (MMU) is 1 acre, with the exception of wetland and riparian types, which have an MMU of ½ acre. Mapping is to the National Vegetation Classification System (NVCS) hierarchy association, alliance, or group level based on the ability of the photointerpreters to distinguish types based on all imagery available and on the field data.

Field accuracy assessment surveys were collected by CDFW regional and VegCAMP staff in the fall of 2019. It was determined that the map had an overall accuracy of 89.3% before suggested adjustments were made to typing and line-work in response to the accuracy assessment. The map is available through CDFW's BIOS web mapping application, and downloadable here: https://ftp.dfg.ca.gov/Public/BDB/GIS/BIOS/Public_Datasets/2900_2999/ds2940.zip

Drone imagery was captured and utilized for supplemental data during the mapping process. The fine scale imagery collected supported vegetation identification and percent cover verification of map attributes. A story map of this aspect of the project can be found here: http://arcg.is/LWTm8.

PROJECT STAFF AND ACKNOWLEDGMENTS

Field staff included Rachelle Boul, Mary Jo Colletti, Diana Hickson, Todd Keeler-Wolf, Aicha Ougzin, Rosie Yacoub, Jaime Ratchford, Catherine Curley, Adam Hoeft, Raquel Elander, Anne Klein, Alden Schmidt, Daydre Roser, Alisa Ellsworth, Aaron Johnson, and Kristen Pfieler.

GIS and database support were provided by Rosie Yacoub; data entry was completed by Mary Jo Colletti, Catherine Curley, Adam Hoeft, and Raquel Elander. The vegetation classification and hierarchy were determined by Todd Keeler-Wolf, Rachelle Boul, and Rosie Yacoub; mapping and attribution were completed by Rachelle Boul, Diana Hickson, Rosie Yacoub, and Catherine Curley; accuracy assessment scoring, and scoring results tables were completed by Betsy Harbert; the report was written by Rachelle Boul, Rosie Yacoub, Diana Hickson, Catherine Curley, and Betsy Harbert edited by Mary Jo Colletti and Betsy Harbert.

The drone pilots were Rosie Yacoub and Matt Elyash, and the visual observers were Jon Mann, Levi Souza, Catherine Curley, and Raquel Elander.

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APPENDICES

PURPOSE

This classification and vegetation map was created for the Slinkard and Little Antelope Valley Wildlife Areas, California Department of Fish and Wildlife land holdings in central-eastern California (Figure 1). The vegetation classification and map provide an inventory of vegetation types and a measure of the extent of each type on the property for use in assessing the biological resources present and determining other appropriate management strategies. The purpose of the classification and vegetation map is to aid in the development of a grazing plan for Little Antelope Valley and to determine locations of aspen stands and wetlands in Slinkard and Little Antelope Valley Wildlife Areas. In addition, this project will provide a pre-fire inventory to monitor succession following the 2017 Slinkard Fire.

METHODS

FIELD SAMPLING

Field surveys utilizing Rapid Assessment, Relevé, and Reconnaissance protocols were conducted in the Slinkard and Little Antelope Valley Wildlife Areas during August 28-31, 2017, September 10-14, 2018, and November 5-9, 2018. Sample point locations were collected using iPads and stored in a geodatabase. Relevé and Rapid Assessment data were entered into VegCAMP's Microsoft Access database. Four digital photos were taken in the cardinal directions for each Relevé or Rapid Assessment and for most Reconnaissance surveys. These data and field photos can serve as a baseline for monitoring future vegetation change. Databases of survey locations and field collected data as well as field photos are available upon request from VegCAMP.

In order to tie the vegetation mapping classification within the study area to existing vegetation types as described in the online Manual of California Vegetation (CNPS 2021) and enable long term monitoring of vegetation change, Relevé and Rapid Assessment surveys were collected following the protocol and form found in Appendix A. The Relevé protocol utilizes discrete plots within a vegetation stand. For this project, the Relevé protocol was only utilized for herbaceous vegetation and included estimation of the absolute cover of all species within a 100 square meter plot. The Rapid Assessment protocol is plotless as it a variable area assessed. In this protocol data can be collected on the entire vegetation stand or a representative portion of the stand. For this project, the Rapid Assessment protocol was used for vegetation types characterized by tree or shrub cover of at least 2-4%. Absolute cover was estimated for 10-20 of the most common or characteristic species in the stand. Both the Rapid Assessment and Relevé protocols collect the date of sampling, GPS location, environmental characteristics (microtopography, substrate, soil texture, slope, aspect, ground surface characteristics, disturbance type and intensity), vegetation structure (tree, shrub, and herb covers and heights, total vegetation cover), cover by species, site history, and the alliance and association as

determined in the field. Relevé samples were collected from 18 herbaceous vegetation stands and Rapid Assessment (RA) samples were collected from 78 shrub or tree vegetation stands.

To provide mapping support for the distribution of vegetation types across the study area, a Reconnaissance protocol was utilized for collection of observational notes on stand composition and environmental attributes at specific GPS locations in the landscape. The Reconnaissance protocol collected is a subset of the information collected for RAs and Relevés. The Reconnaissance field form and protocol are presented in Appendix B. Reconnaissance samples were collected for 123 stands of vegetation during the 2017 and 2018 field seasons.

Land managers wanted additional information collected for aspen stands when field crews encountered them during sampling. Whenever a *Populus tremuloides* stand was surveyed, data was collected on it following the Bureau of Land Management's Aspen Delineation Project survey protocol and field form (Appendix C). Thirteen aspen stands were encountered during field surveys and were sampled with this protocol. While the results of this effort are not presented here, data collected on aspen stands is available upon request.

Appendix D is a list of all plant species recorded during field data collection.

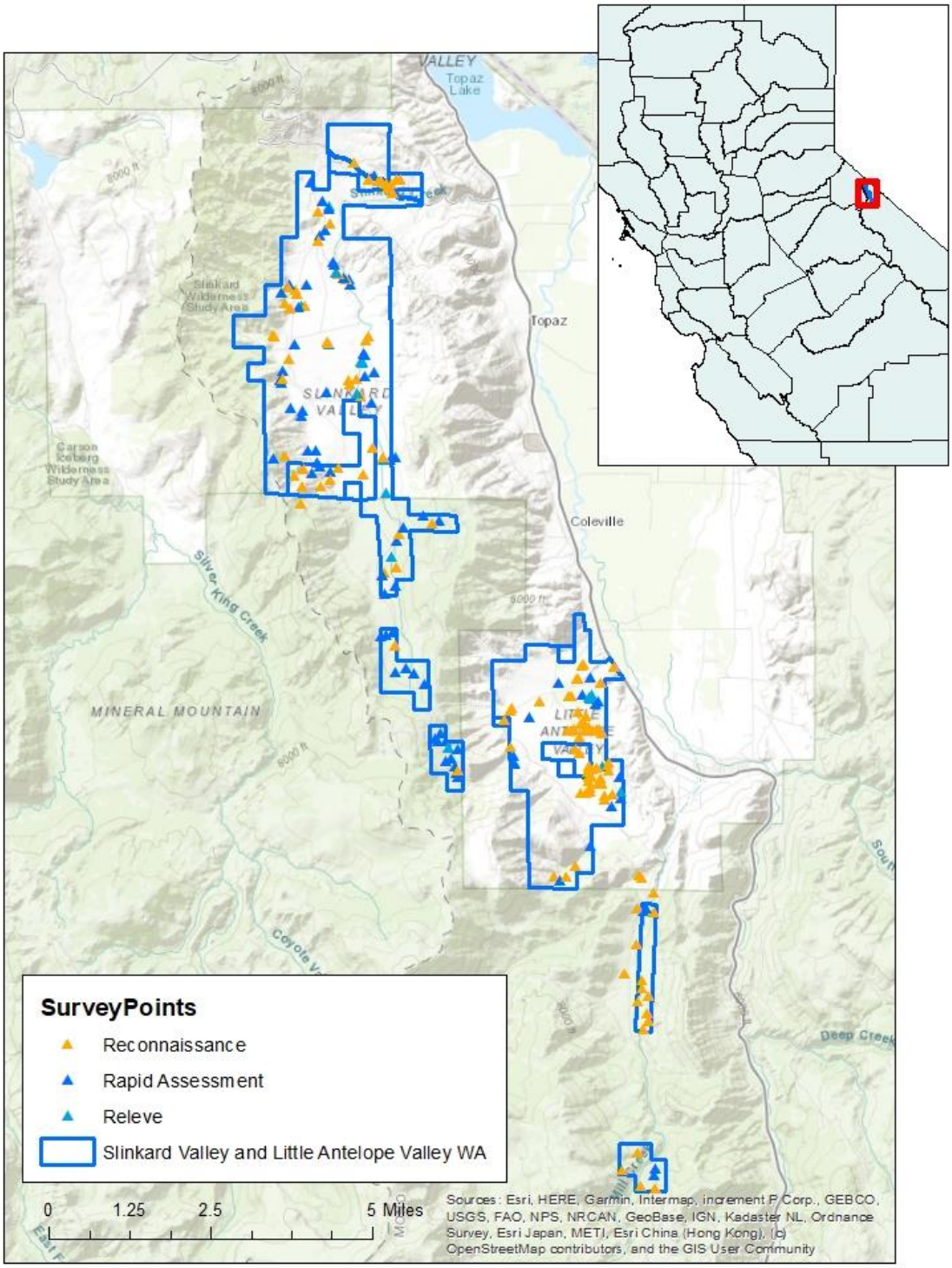
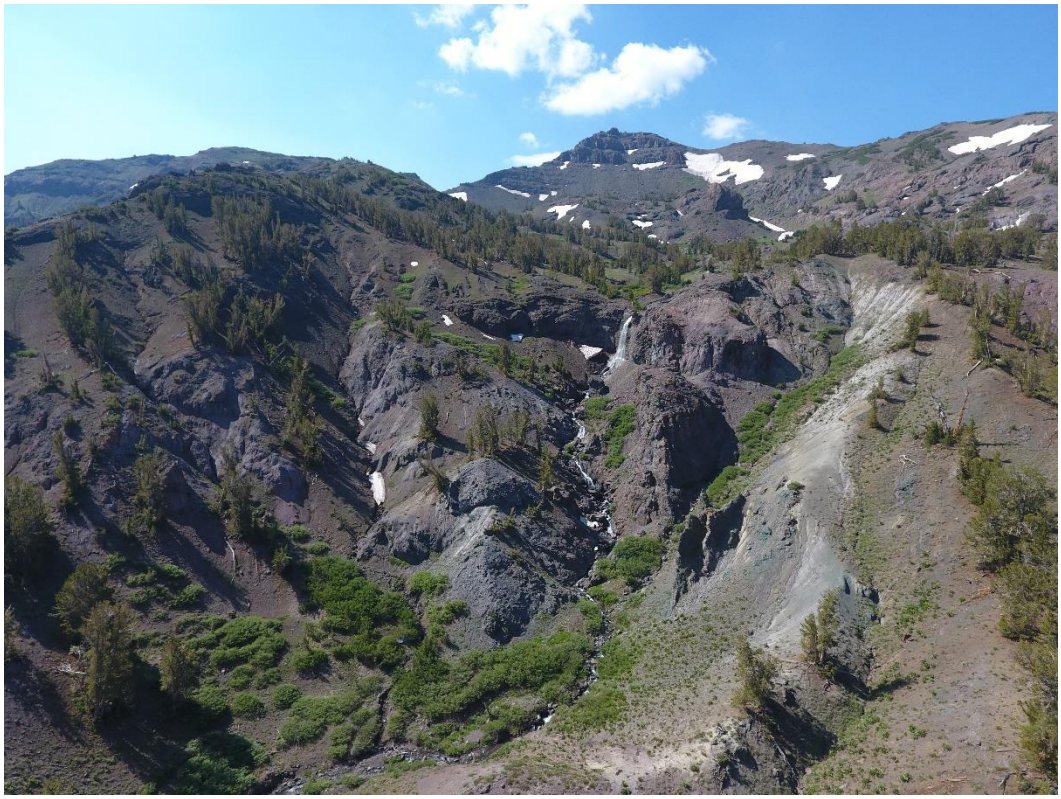


Figure 1: A map showing the boundary of the Slinkard Valley (southern boundary) and Little Antelope Valley (northern boundary) Wildlife Areas property and vegetation mapping project in blue and the distribution of the Reconnaissance, Rapid Assessment, and Relevé survey points collected for the project.

SUPPLEMENTAL DRONE IMAGERY



In 2017, 2018, and 2019 DJI Mavic Pro, DJI Phantom 4, and DJI Phantom 4 Pro drones were used to collect fine scale aerial imagery, and Reconnaissance photos in portions of the wildlife area. These images were used to augment and inform vegetation mapping within the study area. Images collected above a subset of surveys were used to calibrate vegetation cover values included in map attributes. Fine scale imagery and video collected were used to refine and inform delineation of vegetation patterns. Full implementation of drone imagery acquisition was ultimately impeded by a fire in the study area in 2017. More on the drone imagery collection process can be found in the story map here: http://arcg.is/LWTm8.

VEGETATION CLASSIFICATION

Rapid Assessments and Relevés were utilized to verify the vegetation types within the study area. No new or provisional types were identified from the sampling effort. Thus, the classification is based largely on existing vegetation types described in the *Manual of California Vegetation* Online (CNPS 2021) and the classification for the Modoc ecoregion (Boul et al. 2021).

The Hierarchical Vegetation Classification and Vegetation Key used during the mapping of the project area are found in Appendices E and F, respectively.

DELINEATION RULES AND MAP ATTRIBUTES

Mapping rules and all map attributes are listed below. The base imagery for vegetation mapping was NAIP 2016 True Color and Color Infrared (CIR) imagery. Examples of the imagery in 2016 true color NAIP and CIR are shown in Appendix G for the vegetation types that have been mapped. Additional ancillary imagery as well as supplemental, high-resolution drone imagery was used for reference to assist with photo interpretation of vegetation type and structure but was not used for final determination of linework.

The vegetation of the study area was delineated into polygons according to the following rules:

Minimum Mapping Unit (MMU) and minimum width:

1 acre for typical vegetation types
½ acre for special vegetation types (e.g., localized types)
10-meter width for linear features, with exceptions to maintain continuity of riparian corridors, etc.

Polygon cover class breaks:

Vegetation polygons of the same type are broken into smaller polygons with a 5-acre MMU if there is a cover class change in the overstory layer and a 10-acre MMU for a cover class change in the understory, using the following Braun-Blanquet cover classes:

1 = <1%, 2 = 1-5%, 3 = >5-15%, 4 = >15-25%, 5 = >25-50%, 6 = >50-75%, 7 = >75%

For herbaceous vegetation, polygons are broken into smaller polygons with a 5-acre MMU using the cover classes used for the herb cover attribute (see below).

Delineation:

All polygons were drawn at a scale of 1:1000 to 1:2000

Imagery:

Base: NAIP 2016 True Color and Color Infrared (CIR)
Supplemental: 2017, 2018, and 2019 CDFW-acquired drone imagery
Ancillary: Other NAIP years, ESRI Basemap Imagery, Google Earth, Bing

Each mapped polygon has the following attributes:

MapCode

The code assigned to the vegetation type of the polygon. This code corresponds with a map class.

MapClass

The vegetation type of the polygon. Note that the lowest level of the hierarchy that could reasonably be photointerpreted was used.

Conifer, Hardwood, and Total Tree Covers

The cover of conifer and hardwood trees in a polygon was estimated in 1% increments as "bird's-eye cover," taking plant porosity into consideration. This means that if conifer canopies cover 10% of the stand, but are themselves only 50% opaque to the ground, then the cover estimate should be 5%. Conifer and hardwood cover are estimated based on regenerating trees as well as trees >6" dbh. Any overlap of conifer and hardwood is not included in the Total Tree Cover. If tree cover is <1% a cover value of 1% was used.

ShrubCover

The cover of shrubs in a polygon was estimated in 1% increments as "bird's-eye cover," taking plant porosity into consideration. Shrub cover under trees is estimated using cover classes. However, if tree cover is greater than or equal to 40%, shrub cover is not recorded (= not applicable) because it is not possible to estimate under the trees. If shrub cover is <1%, but not zero, a cover value of 1% was used.

HerbCover

Herbaceous cover was estimated using the following cover classes:

1	<2% (used only for naturally sparse herbaceous types, otherwise polygon is not considered vegetated)
2	2-9%
3	10-40%
4	>40%
99	Not applicable (Herb cover is not assessed for developed types and if woody cover is over 40%)

Notes on Cover Estimates: The strata covers are averaged over the entire polygon, that is, if a polygon is roaded or has sub-MMU clearings within it, the cover is averaged including the openings.

Woody height of dominant strata

The height class was estimated for the dominant layer within the polygon. The height class was estimated for natural and developed polygons. Coded values and height classes are as follows:

1	< ½ m
2	½-1 m
3	1-2 m
4	2-5 m

5 5-10 m
6 10-15 m
7 15-20 m
8 20-35 m
9 35-50 m
10 >50 m
99 not applicable

California Wildlife Habitat Relationship (CWHR) The diameter at breast height (dbh) for all treed polygons was estimated using the CWHR tree categories. When estimating the main size class, the mean diameter of all trees was estimated over the entire stand and the mean was weighted toward the larger tree dbh. DBH was applied only when the polygon was a tree type or a developed polygon. Code values and CWHR DBH classes are as follows:

T1 <1" dbh
T2 1" to 6"
T3 >6" to 11"
T4 >11" to 24"
T5 >24"
T6 Multilayer: Mature trees over younger trees
99 not applicable

Exotics

This attribute was used when invasive plant species are visible in the imagery or were noted in the field for a particular polygon.

0 No exotics visible
1 Visible patches, not significant, relative cover <33%
2 Significant; relative cover 33-66%
3 Stand may be characterized by exotics; >66% relative cover
9 Not applicable

Clearing

This attribute was used in vegetated polygons to note removal of overstory, understory, or both.

0 None or none visible.
1 Low: <33% of stand is cleared.
2 Moderate: 33-66% of stand is cleared and there may be a dense concentration of clearing within a single or few parts of the vegetation polygon.
3 High: >66% of the polygon has clearings, with multiple examples evenly distributed. Fully cleared areas over 0.25 acre are mapped separately as the "Anthropogenic areas of little or no vegetation" map class.
9 Not applicable.

Roadedness

Roadedness was estimated as the percent of the stand that did not have roads or one- or two-track vehicle trails, i.e., the area of the largest unroaded (intact) portion of the stand divided by the area of the entire stand. Note that we observed roads in areas of higher tree cover in the field that did not show up on the imagery, and so roadedness is likely underestimated in areas of high tree cover.

0 None or none visible.

1 Low: there is an intact portion of the stand that makes up at least 67% of the entire stand. If a polygon is bounded by or adjacent to a road for more than 10 meters of its perimeter, even if there are no roads within the polygon, this code is used.

2 Moderate: between 33% and 66% of the vegetation polygon is intersected by roads.

3 High: less than 33% of the vegetation polygon lacks roads.

9 Not applicable.

Development

The percent of the polygon affected by sub-MMU occurrences of structures, fences, cement pads, trash piles, etc. is estimated using the following categories. This attribute was applied to vegetated stands. If development was 0.25 acres or above it was mapped using the map class “Developed” and this attribute was not utilized.

0 None or none visible.

1 Low: <2% of polygon affected. Structures, cement pads, trash piles, etc. are widely spaced at very low density.

2 Moderate: 2-5% of polygon affected. Multiple examples of structures, cement pads, trash piles, 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: >5% of polygon affected. Multiple structures, etc., are evenly distributed in a vegetated polygon to cover at least 5% of the polygon, but remain individually isolated and surrounded by the predominant vegetation for which the polygon is labeled. If such an area is 0.25 acres or larger, it is mapped separately as a Developed polygon.

9 Not applicable.

Method of identification (MethodID)

The method in which the polygon delineation and attribution was determined.

1 Photo interpretation.

2 Rapid Assessment or Relevé.

3 Pre-map Reconnaissance form; these are surveys that were taken on field forms.

4 Pre-map Reconnaissance formless; these are surveys that were done by making observations on a notepad or directly into the mobile mapping dataset.

5 Post-linework observation form; these are surveys done to confirm the map class after linework is complete but before an accuracy assessment is done.
6 Post-linework observation formless.
7 Adjacent RA/Relevé.
8 Other information, older surveys; older vegetation surveys, plant observations, etc. were used.
9 Accuracy Assessment; information from the accuracy assessment was used to improve the map after the accuracy assessment was completed.

SurveyID

The Database ID of the Rapid Assessment, Relevé, Reconnaissance, or Accuracy assessment survey used to determine the vegetation type and/or other attributes (if one was used; see Method of identification).

Notes

Text field for additional information.

UID

Unique identifier for each polygon. Calculated at the end of the project

MCVName

Standardized name of the vegetation description used in the National Vegetation Classification System as interpreted in the *Manual of California Vegetation*.

MCVLevel

The standardized level of the vegetation description in the Manual of California Vegetation corresponding with levels of the National Vegetation Classification System

MCVAlliance

The standardized name for the alliance within the NVCS as interpreted in the *Manual of California Vegetation*.

MCVGroup

The standardized name for the group within the NVCS as interpreted in the *Manual of California Vegetation*.

MCVMacrogroup

The standardized name for the macrogroup within the NVCS as interpreted in the *Manual of California Vegetation*.

CalVegName

A crosswalk to the Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) vegetation system (USDA Forest Service). Note that there may be a one-to-many relationship between CalVeg and NVCS, but the best crosswalk for this area is chosen.

CalVegCode

The CalVeg code.

CWHRType

A crosswalk to the California Wildlife Habitat Relationships system. Note that there is usually a one-to-many relationship between CWHR and NVCS. The best fit for this area has been chosen.

CWHRCode

The CWHR code.

GlobalRank

The global rarity ranking of the plant community mapped (ranks are available for all California alliances, and some associations). Ranks are based on a set of criteria including the rarity of the community (extent and occupancy), the threats that the community is subject to, and any known trends in the quality, size, or quantity of stands within the state. Ranks go from G1 which is critically imperiled/has very few occurrences to G5, when a community is demonstrably secure due to broad distribution with area not subject to threats. Ranks G1-G3 are considered sensitive. See: http://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusmethodology_jun12_0.pdf and https://wildlife.ca.gov/Data/VegCAMP/Natural-Communities . Ranks are current as of the publication date or update date.

StateRank

The state rarity ranking of the plant community mapped (ranks are available for all California alliances, and some associations). Ranks are based on a set of criteria including the rarity of the community (extent and occupancy), the threats that the community is subject to, and any known trends in the quality, size, or quantity of stands within the state. Ranks go from S1 which is critically imperiled/has very few occurrences to S5, when a community is demonstrably secure due to security globally. Ranks S1-S3 are considered sensitive. See: http://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusmethodology_jun12_0.pdf and https://wildlife.ca.gov/Data/VegCAMP/Natural-Communities . Ranks are current as of the publication date or update date.

Sensitive

Is the vegetation type considered sensitive? Y= yes, sensitive natural community. Alliances and associations with global ranks of G1-G3 state ranks of S1-S3 are considered sensitive natural communities. Additionally, if an association has not gone through the ranking process, but is estimated to be sensitive, Y will be shown without a G or S rank. Ranks are current as of the publication date or update date.

CaCode

California Natural Community Code - unique code assigned to Alliances and Associations.

ACCURACY ASSESSMENT

To test the accuracy of the vegetation identified and delineated by the mapping process, the vegetation map was ground-truthed using an accuracy assessment approach. This approach included sample allocation of randomly selected polygons within the map, field sampling of allocated polygons to determine the vegetation type, and scoring of the allocated polygon map class (the vegetation type attribute for the map) based on the in-field vegetation type determinations.

SAMPLE ALLOCATION

Accuracy Assessment (AA) sample allocation of vegetation map polygons employed an analysis that balanced three goals: achieving target levels of samples based on budgeted staff time for conducting the Accuracy Assessment, distributing the samples amongst the vegetated mapping classes (also referred to as vegetation types), and facilitating access to vegetation map polygons based on land ownership and access efficiency.

Polygons that overlapped with Reconnaissance, Rapid Assessment, or Relevé field-survey points were not included in the sample allocation process. Only polygons considered accessible were included in the sample allocation. Accessible polygons included those not burned during the Slinkard Fire of 2017, and those within 250 m of an existing survey or within 500 m of a road. Aaron Johnson, an environmental scientist from CDFW Region 6, provided additional input as to whether portions of the Wildlife Areas were accessible and the pool of accessible polygons was further restricted as a result.

The number of polygons that had been mapped for each map class was used to set target numbers of surveys for each class. Then a sample target for each map class that had accessible polygons was created, which took into account an excess of surveys to provide flexibility to the field crews. A python script was utilized to randomly selected a subset of accessible polygons for sampling while also (1) meeting target numbers of polygons specified for each map class and (2) employing a buffer between already selected polygons of the same map class.

After the polygon-selection process was complete, a priority level was assigned to each polygon. Polygons coded with rare vegetation types were given the highest priority. Vegetation types where fewer than ten polygons had been allocated were assigned intermediate priority, and all others were considered low priority. To prevent bias, paper and digital maps prepared for AA field crews did not include the map class or other map attributes assigned by VegCAMP. Additionally, only the polygons to be assessed were shown on the maps so that the shape of surrounding polygons would not influence the field crews.

FIELD DATA COLLECTION

Field data collection for accuracy assessment was conducted between September and November of 2019. Surveys were collected following the protocol and form found in Appendix H. A total of 121 accuracy assessment surveys were collected for testing the accuracy of the mapped vegetation types and entered into a standard access database. Crews identified the vegetation type(s) within the allocated polygons using the hierarchical vegetation classification (Appendix E) and vegetation key (Appendix F). A set of digital photographs was taken from the GPS waypoint within or adjacent to the polygon and archived in folders named with the waypoint identification number. As AAs were collected, they were entered into a Microsoft Access database; quality control was performed on this database prior to analysis.

SCORING

VegCAMP staff reviewed each AA and removed from consideration those samples that had problems associated with 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, senior VegCAMP staff assigned the correct type based on the species covers recorded for the AA, any additional notes taken by the field crews, and sometimes the field photos. All field calls were reviewed and a "final call" was recorded in the database when possible.

The scoring process compared the vegetation label assigned to each polygon in the map (i.e., the photointerpreted map class attribute) with the “final call” for the polygon. Other attributes (cover, disturbance, height) were not scored, but results were utilized during scoring so systematic errors could be corrected in the vegetation map. A closeness-of-fit, or fuzzy logic, method was used to score each field-verified polygon (Gopal and Woodcock 1994; Congalton and Green 1999; Foody 2002; Hagen 2003; Metzler and Sader 2005). To do this, each field-verified polygon was scored according to a set of decision rules (Figure 2), with a total of five possible scores for each polygon. Scores were summed for each vegetation type, then divided by the total possible highest score (5 * number of field-verified polygons with a final score) and multiplied by 100 for a percent accuracy. The scores and reviewers’ notes were provided to the VegCAMP mappers so systematic errors could be corrected. The map was then updated based on scoring results. This included redrawing polygons as recommended by the review, reviewing and updating vegetation types that proved problematic for aerial interpretation, and updating polygons incorrectly identified by the mappers based on the AA scoring results.

Table 1: Decision rules and fuzzy score for each for vegetation map accuracy assessment surveys.

Decision rules for scoring	Score
PI completely correct	5
Correct Group OR next level up in hierarchy	4
Threshold/transition between PI call and Final call	4
Correct Macro Group OR next level up in hierarchy	3
Based on close ecological similarity	3
Correct Division	2
Some floristic/hydrologic similarity	2
Correct only at Lifeform	1
No similarity above Formation and incorrect lifeform	0

RESULTS

ACCURACY ASSESSMENT

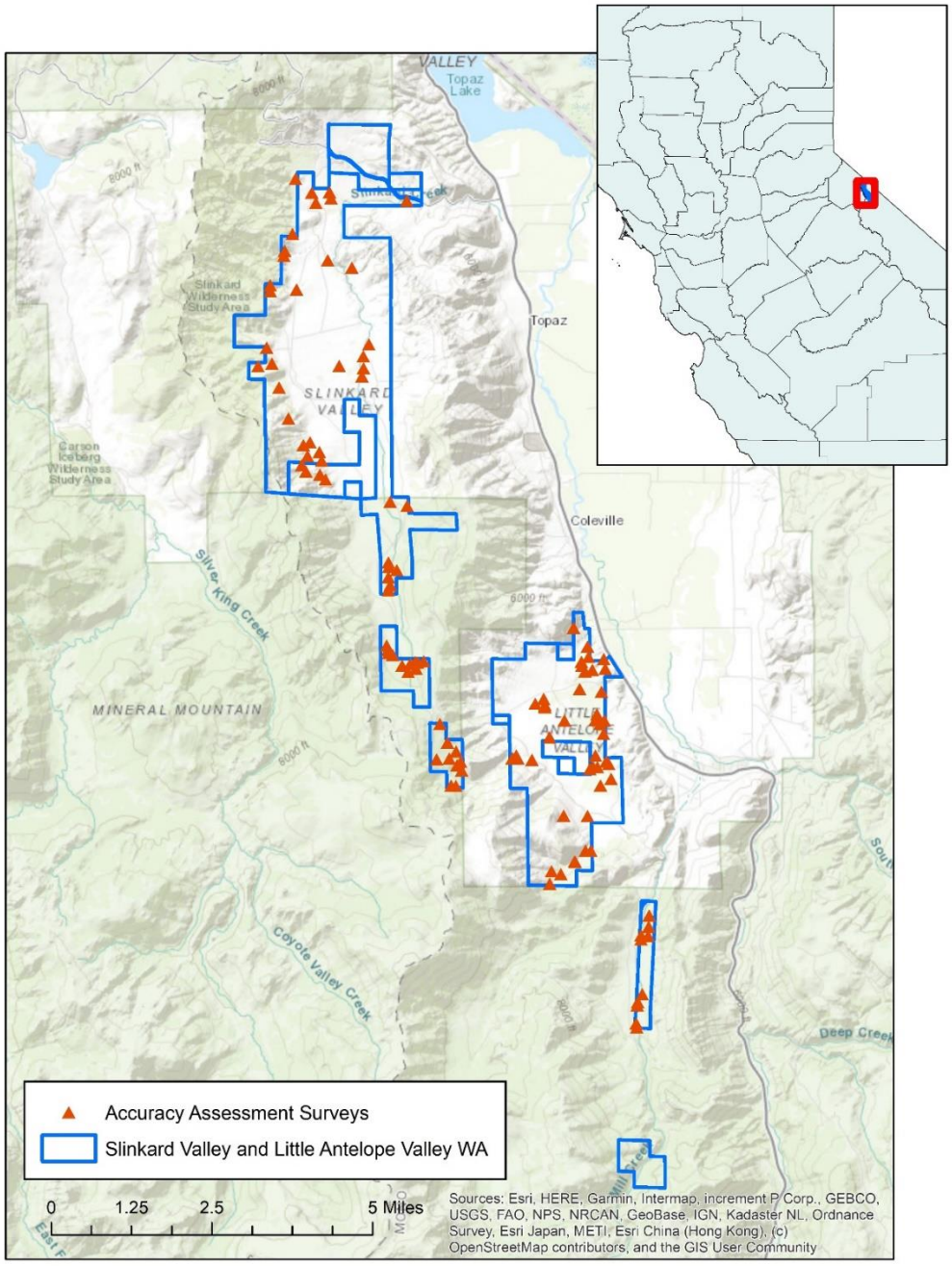


Figure 2: A map showing the boundary of the Slinkard Valley (southern boundary) and Little Antelope Valley (northern boundary) Wildlife Areas property and vegetation mapping project in blue and the distribution of the accuracy assessment surveys collected for the project.

A total of 117 AAs were collected within the mapped area (Figure 2). Of these, one was removed during analysis because the field collected data was incomplete and a final determination of the vegetation type could not be determined. The final 116 AAs addressed 19 of the 40 [1]mapped vegetation types in the area (Table 2). Twenty-six of the original map classes were not sampled and thus did not receive individual accuracy assessments, these unsampled map classes included non-vegetated types (agriculture, urban, bare gravel/sand, and open water).

After the Accuracy Assessment, CDFW made corrections to the map, resulting in changes in the count and acreage of polygons for mapped vegetation types. Note that Table 2 includes both the pre-AA as well as the post-AA count and acreage per vegetation type. The updated counts and acreages per vegetation type are catalogued in Table 2 within the "Final Counts" and "Final Acreages" columns.

Two forms of accuracy (users' and producers') can be estimated from the accuracy assessment data (Story and Congalton 1986). Users' accuracy provides an estimate of commission error, or how well spatial mapping data actually represents what is found on the ground, i.e., if the user goes to a location mapped as a certain class, what is the probability it is in fact that class? Producers' 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. Producers' accuracy may inform the producers of mapped data how easily a mapping class may be recognized on the imagery (Story and Congalton 1986, Lea and Curtis 2010).

A contingency table displaying the users' and producers' accuracy for the map is found in Table 3. Note that the table does not include fuzzy scores, only the numbers of assessed polygons. In some cases, the final call was to Alliance level, when in fact the mapper was only expected to map to Group level, such as for herbaceous types. If the mapper chose the correct Group in such a case, a full score would be given, though the assessment would not show up in Table 3 on the diagonal indicating a correct call.

Overall users' map accuracy was 89.3% and overall producers' accuracy was 89.6%. **Since the preferred accuracy for fine-scale vegetation mapping products is 80%, the map exceeded the standard.** At the individual mapping class scale, we consider accuracy results valid if at least five polygons of a mapping class have been sampled. Due to time and terrain, adequate numbers of AAs were not collected for all mapped types. Of the 19 original map classes in the map sampled

[1] The draft (pre-accuracy assessment) map had a total of 40 types. After corrections were made to the map based upon the results of the Accuracy Assessment, 45 types occurred.

for AA, only 15 of these had 5 or more AAs, these scores and counts are bolded in Table 2. For the valid assessed map classes, the overall users' accuracy averaged 88.4% and producers' accuracy averaged 88.2%. However, users should keep in mind that the accuracy of map classes with fewer than five samples, or those not sampled as a result of the AA effort, may not meet the 80% minimum accuracy standard.

Twelve out of the 15 map classes with ≥ 5 samples for users' accuracy met the 80% minimum standard. However, three map classes with ≥ 5 samples did not meet the standard for producers' accuracy: the *Bromus tectorum - Taeniatherum caput-medusae* Alliance, the *Salix lasiolepis* Alliance, and the *Rosa woodsii* Association.

The *Rosa woodsii* Association and *Salix lasiolepis* Alliance map classes, both within the Western Montane - Subalpine Riparian and Seep Shrubland Group, were over applied in the map. Four of the seven polygons assessed that were originally mapped as the *Salix lasiolepis* Alliance were incorrectly mapped. Five of the eight polygons assessed that were originally mapped as the *Rosa woodsii* Association polygon were incorrectly mapped. However, neither type was detected in any other AA sampled polygons. The *Rosa woodsii* Association and *Salix lasiolepis* Alliance map classes were generally used incorrectly for types within their shared macrogroup, the Western North American Montane - Subalpine - Boreal Marsh, Wet Meadow and Shrubland Macrogroup, including the *Salix exigua* Alliance (n=4), *Shepherdia argentea* map unit (n=1) and the *Cornus sericea - Dasiphora fruticosa* ssp*. floribunda - Ribes* spp. Wet Shrubland Alliance (n=1). The *Rosa woodsii* association was also misapplied to an occurrence of the *Purshia tridentata - Artemisia tridentata* Alliance and the Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group. The *Salix lasiolepis* Alliance was also misapplied to an occurrence of the *Populus tremuloides* Alliance. The hydrogeomorphic position of vegetation in relation to surface water flow and streams is likely a good indicator for where these stands occur, however the photo signature may be difficult to distinguish between these and other shrub types that occur in similar environmental conditions.

Three of the eight *Bromus tectorum - Taeniatherum caput-medusae* Alliance map polygons assessed were correctly mapped. This type was not detected in any other sampled map classes. The *Bromus tectorum - Taeniatherum caput-medusae* Alliance was misapplied once each to an occurrence of the *Ericameria nauseosa* Alliance, Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group, *Leymus cinereus - Leymus triticoides* Alliance, *Festuca idahoensis - Elymus spicatus - Poa secunda* Alliance, and the *Agropyron cristatum* Alliance. Given that these are overwhelmingly herbaceous community types, this over application of the *Bromus tectorum - Taeniatherum caput-medusae* Alliance likely the reflects the difficulty in distinguishing herbaceous communities based on photointerpretation.

Table 2: Producers' and users' polygon count and average closeness-of-fit (fuzzy) scores per map class. In addition to the producers' and users' score per map class, the table includes the number of polygons assessed for accuracy per map class, number and acreage of polygons mapped per map class Pre-AA, as well as the final number of polygons and acreage per map class after the map was updated post scoring.

Mapping Type	Producer's Accuracy (%)	Producer Count	User's Accuracy (%)	Users' Count	Mapped Acreage (Pre-AA)	Count of Polygons (Pre-AA)	Final Count of Polygons	Final Mapped Acres
Abies concolor Alliance	**92.4**	**8**	**97.00**	**7**	388.35	28	30	390.20
Pinus jeffreyi Alliance	**92**	**5**	90.00	4	396.46	27	26	382.59
Pinus monophylla - Juniperus osteosperma / Shrub Understory Woodland Alliance	**100**	**5**	**92.40**	**8**	126.26	12	14	140.13
Pinus monophylla / Artemisia tridentata / Elymus elymoides Association	**97.4**	**8**	**100.00**	**7**	1654.13	75	72	1632.38
Cercocarpus ledifolius Alliance	66.6	3	100.00	1	63.98	10	8	61.20
Populus trichocarpa Alliance	100	1	100.00	1	7.11	5	5	7.11
Populus tremuloides Alliance	**97**	**7**	**91.40**	**7**	180.71	43	42	179.34
Ceanothus velutinus Alliance	**84**	**5**	**92.00**	**5**	256.22	24	21	209.34
Prunus emarginata - Holodiscus discolor Alliance	90	4	86.60	3	53.93	24	23	49.05
Ceanothus velutinus Shrubland Association	–	0	–	0	0	0	2	6.57
Intermountain Big Sagebrush Steppe and Shrubland Group	–	0	–	0	1.79	1	0	0.00
Artemisia tridentata Alliance	**91**	**9**	95.00	4	1866.49	77	82	1778.70
Purshia tridentata - Artemisia tridentata Alliance	**95**	**8**	**75.00**	**8**	4948.14	159	130	4458.34

Mapping Type	Producer's Accuracy (%)	Producer Count	User's Accuracy (%)	Users' Count	Mapped Acreage (Pre-AA)	Count of Polygons (Pre-AA)	Final Count of Polygons	Final Mapped Acres
Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Ruderal Shrubland Association	–	0	100.00	2	49.27	4	7	179.62
Purshia tridentata - Artemisia tridentata -Tetradymia canescens Association	–	0	100.00	3	0	0	4	47.07
Eriogonum sphaerocephalum / Poa secunda Alliance	–	0		0	32.27	4	4	32.27
Artemisia tridentata ssp. vaseyana Alliance	**100**	**5**	**84.40**	**9**	66.53	18	36	359.80
Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Bromus carinatus Association	–	0	100.00	1	0	0	2	8.02
Ericameria nauseosa Alliance	–	0	80.00	1	1.83	1	2	11.35
Keckiella breviflora Map Unit	–	0	–	0	0	0	2	87.47
Salix exigua Alliance	**100**	**9**	**89.20**	**13**	154.63	61	63	158.54
Western Montane - Subalpine Riparian and Seep Shrubland Group	–	0	–	0	5.28	3	3	5.28
Cornus sericea - Dasiphora fruticosa ssp. *floribunda - Ribes* spp. Wet Shrubland Alliance	–	0	80.00	1	0	0	1	0.50
Rosa woodsii Association	**72.4**	**8**	100.00	3	90.31	41	37	80.84
Salix lasiolepis Alliance	**77**	**7**	100.00	3	63.00	41	37	59.40
Shepherdia argentea special stand	100	2	93.20	3	1.59	4	5	3.19
Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group	**92.4**	**8**	**70.00**	**8**	447.42	51	47	441.59

Mapping Type	Producer's Accuracy (%)	Producer Count	User's Accuracy (%)	Users' Count	Mapped Acreage (Pre-AA)	Count of Polygons (Pre-AA)	Final Count of Polygons	Final Mapped Acres
Carex nebrascensis - Carex vesicaria - Carex pellita Alliance	–	0	100.00	2	1.89	2	3	2.21
*Juncus arcticus (*var. *balticus, mexicanus)* Alliance	–	0	–	0	215.58	12	12	215.58
Leymus cinereus - Leymus triticoides Alliance	**83.2**	**6**	90.00	4	24.91	16	13	29.74
Leymus triticoides - Poa secunda Association	–	0	100.00	2	1.19	2	4	2.71
Typha (angustifolia, domingensis, latifolia) Alliance	–	0	–	0	0.20	1	1	0.20
Festuca idahoensis - Elymus spicatus - Poa secunda Alliance	–	0	40.00	1	13.83	1	2	16.70
Californian Ruderal Grassland, Meadow and Scrub Group	–	0	–	0	0.91	1	1	0.91
Conium maculatum - Foeniculum vulgare Alliance	–	0	–	0	14.33	3	3	14.33
Bromus tectorum - Taeniatherum caput-medusae Alliance	**72.4**	**8**	100.00	3	696.98	74	74	765.57
Bromus tectorum Association	–	0	–	0	29.03	6	6	29.03
Western North American Ruderal Marsh, Wet Meadow and Shrubland Group	–	0	60.00	1	0	0	1	4.47
Poa pratensis - Agrostis gigantea - Agrostis stolonifera Ruderal Marsh Alliance	–	0	–	0	2.07	1	1	2.07
Festuca arundinacea Association	–	0	–	0	4.93	1	1	4.93

Mapping Type	Producer's Accuracy (%)	Producer Count	User's Accuracy (%)	Users' Count	Mapped Acreage (Pre-AA)	Count of Polygons (Pre-AA)	Final Count of Polygons	Final Mapped Acres
Thinopyrum intermedium Map Unit	–	0	–	0	23.82	3	3	23.82
Agropyron cristatum Alliance	–	0	60.00	1	77.33	4	5	82.92
Western North American Temperate Freshwater Aquatic Vegetation Group	–	0	–	0	0.19	1	1	0.19
Developed	–	0	–	0	39.83	9	8	37.58
Small Earthen Dam Ponds and Natural Lakes	–	0	–	0	0	0	6	0.44
Bare ground	–	0	–	0	0.44	6	0	0.00
Rock outcrop	–	0	–	0	1.96	2	2	1.96

Figure 3: Contingency table for accuracy assessed polygons. The rows represent the vegetation type mapped while the columns represent the final vegetation type determined based on in-field sampling and scoring. The number of polygons within each vegetation type that were sampled during accruacy assessment are represented within the table. The diagonal line of blue fields indicates when the mapped polygon vegetation type and field verified final determination of the polygon vegetation type agree. For example a value of 3 within a blue field means the mapped vegetation type and the final determination of the vegetation type were the same for 3 surveyed polygons. No value in the blue cell for a particular type may mean that the map and final vegetation types never agreed or it may indicate that the type was never mapped and not encountered in the field. Either scenario can be determined by reviewing the total number of polgyons in the respective row and column for the particular type.

Final Vegetation Type

Map Vegetation Type	Abies concolor Alliance	Pinus jeffreyi Alliance	Great Basin Pinyon - Juniper Woodland Group	Pinus monophylla - Juniperus osteosperma / Shrub Understory Woodland Alliance	Pinus monophylla / Artemisia tridentata / Elymus elymoides Association	Cercocarpus ledifolius Alliance	Populus trichocarpa Alliance	Populus tremuloides Alliance	Cool Interior Chaparral Macrogroup	Ceanothus velutinus Alliance	Prunus emarginata - Holodiscus discolor Alliance	Intermountain Tall and Dwarf Sagebrush Scrub Steppe Macrogroup	Intermountain Big Sagebrush Steppe and Shrubland Group	Artemisia tridentata Alliance	Artemisia tridentata Shrubland Association	Purshia tridentata - Artemisia tridentata Alliance	Purshia tridentata - (Ericameria nauseosa) / Bromus tectorum Ruderal Shrubland Association	Great Basin - Intermountain Dwarf Shrub Steppe Group	Artemisia tridentata ssp. vaseyana Alliance	Ericameria nauseosa Alliance	Western North American Montane - Subalpine - Boreal Marsh, Wet Meadow and Shrubland Macrogroup	Salix exigua Alliance	Western Montane - Subalpine Riparian and Seep Shrubland Group	Cornus sericea - Dasiphora fruticosa ssp. floribunda - Ribes spp. Wet Shrubland Alliance	Rosa woodsii Association	Salix lasiolepis Alliance	Shepherdia argentea special stand	Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group	Carex nebrascensis - Carex vesicaria - Carex pellita Alliance	North American Desert Alkaline-Saline Marsh and Playa Group	Distichlis spicata Alliance	Leymus cinereus - Leymus triticoides Alliance	Leymus triticoides - Poa secunda Association	Arid West Interior Freshwater Marsh Group	Central Rocky Mountain Lower Montane, Foothill and Valley Grassland Group	Festuca idahoensis - Elymus spicatus - Poa secunda Alliance	Californian Ruderal Grassland, Meadow and Scrub Group	Conium maculatum - Foeniculum vulgare Alliance	Bromus tectorum - Taeniatherum caput-medusae Alliance	Western North American Ruderal Marsh, Wet Meadow and Shrubland Group	Agropyron cristatum Alliance	
Abies concolor Alliance	6	1		1																																							8
Pinus jeffreyi Alliance		3		2																																							5
Great Basin Pinyon - Juniper Woodland Group																																											0
Pinus monophylla - Juniperus osteosperma / Shrub Understory Woodland Alliance				5																																							5
Pinus monophylla / Artemisia tridentata / Elymus elymoides Association					7																																						8
Cercocarpus ledifolius Alliance						1				1																																		3
Populus trichocarpa Alliance							1																																					1
Populus tremuloides Alliance	1							6																																				7
Cool Interior Chaparral Macrogroup																																											0
Ceanothus velutinus Alliance									3					2																														5
Prunus emarginata - Holodiscus discolor Alliance									2	2																																		4
Intermountain Tall and Dwarf Sagebrush Scrub Steppe Macrogroup																																												0
Intermountain Big Sagebrush Steppe and Shrubland Group																																												0
Artemisia tridentata Alliance											3			2	2			2																										9
Artemisia tridentata Shrubland Association																																													0
Purshia tridentata - Artemisia tridentata Alliance											1		3		3		1																											8
Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Ruderal Shrubland Association																																													0
Purshia tridentata - Artemisia tridentata -Tetradymia canescens Association																																													0
Great Basin - Intermountain Dwarf Shrub Steppe Group																																													0
Artemisia tridentata ssp. vaseyana Alliance																																													5
Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Bromus carinatus Association																																													0
Ericameria nauseosa Alliance																																													0
Western North American Montane - Subalpine - Boreal Marsh, Wet Meadow and Shrubland Macrogroup																																													0
Salix exigua Alliance																																													9
Western Montane - Subalpine Riparian and Seep Shrubland Group																																													0
Cornus sericea - Dasiphora fruticosa ssp. floribunda - Ribes spp. Wet Shrubland Alliance																																													0
Rosa woodsii Association														1																														8
Salix lasiolepis Alliance								1																																				7
Shepherdia argentea special stand																																													2
Vancouverian - Rocky Mountain Montane Wet Meadow and Marsh Group																																													8
Carex nebrascensis - Carex vesicaria - Carex pellita Alliance																																													0
North American Desert Alkaline-Saline Marsh and Playa Group																																													0
Distichlis spicata Alliance																																													0
Leymus cinereus - Leymus triticoides Alliance																																													6
Leymus triticoides - Poa secunda Association																																													0
Arid West Interior Freshwater Marsh Group																																													0
Central Rocky Mountain Lower Montane, Foothill and Valley Grassland Group																																													0
Festuca idahoensis - Elymus spicatus - Poa secunda Alliance																																													0
Californian Ruderal Grassland, Meadow and Scrub Group																																													0
Conium maculatum - Foeniculum vulgare Alliance																																													0
Bromus tectorum - Taeniatherum caput-medusae Alliance																		1																										8
Western North American Ruderal Marsh, Wet Meadow and Shrubland Group																																													0
Agropyron cristatum Alliance																																													0
Grand Total	7	4	0	8	7	1	1	7	0	5	3	0	0	4	0	8	2	3	0	9	1	1	0	13	0	1	3	3	3	8	2	0	0	4	2	0	0	1	0	0	3	1	1	116

NEW ALLIANCES AND ASSOCIATIONS

The vegetation hierarchy (Appendix E) is consistent with the version of the United States National Vegetation Classification (USNVC) used in the second edition of the *Manual of California Vegetation* (Sawyer et al. 2009). Some alliances and associations have been newly described in the Modoc and Lassen Counties classification project and will not be found in the *Manual*. These vegetation types have been marked with an asterisk (*) in Appendix E.

RARITY RANKINGS

Several vegetation types within this map are assumed to be rare at this time, however their exact global and state rarity rankings are yet to be determined utilizing the most current ranking methodology. Please consider these types to have state ranks of S3 or lower, as per our current understanding of their distribution and/or threat impacts:

- *Carex lasiocarpa* Alliance
- *Eriogonum sphaerocephalum / Poa secunda* Alliance
- *Leymus cinereus - Leymus triticoides* Alliance
- *Leymus triticoides – Poa secunda* Association
- *Muhlenbergia richardsonis – Carex douglasii* Moist Meadow Alliance
- *Populus tremuloides* Alliance
- *Populus trichocarpa* Alliance
- *Purshia tridentata – Artemisia tridentata* Alliance
- *Shepherdia argentea* Special Stands

Please note that the *Muhlenbergia richardsonis – Carex douglasii* Moist Meadow Alliance and *Carex lasiocarpa* Alliance are considered rare and were surveyed, yet both were mapped at the group level under the Vancouverian – Rocky Mountain Montane Wet Meadow and Marsh Group. In addition, the Eriogonum sphaerocephalum / Poa secunda Alliance was sampled and mapping only once although there may be other small stands of this type within the study area that are below the minimum mapping size.

Rarity ranks are subject to change due to changing threats and trends, and as ranking methodologies are further refined. At this time, ranks are updated using the NatureServe Conservation Status Assessments Rank Calculator Version 3.186 and the ranks for this map are current as of August 2021. Please check CDFW's Natural Communities page for the most up-to-date rarity ranks.

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APPENDIX A: RAPID ASSESSMENT / RELEVÉ FIELD FORM AND PROTOCOL

Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised August 23, 2017)

For Office Use:	Final database #:	Final vegetation type:	Alliance Association

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION — circle: **Relevé or RA**

Database #: | **Date:** | **Name of recorder:**

Other surveyors:

Location Name:

GPS name: _____ For Relevé only: **Bearing°**, left axis at ID point_____ **of Long / Short** side

UTME ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ **Zone: 11 NAD83** GPS error: **ft./ m./ PDOP** _____

Decimal degrees: **LAT** ___ ___ . ___ ___ ___ ___ ___ ___ **LONG** ___ ___ ___ . ___ ___ ___ ___ ___ ___

GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____

and record: **Base point ID** _____ **Projected UTMs: UTME** ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___

Camera Name: **Cardinal photos at ID point:**

Other photos:

Stand Size (acres): <1, 1-5, >5 | Plot Size (m²): 100 / _____ | Plot Shape ____ x____ m | RA Radius____ m

Exposure, Actual °: _____ NE NW SE SW Flat Variable | Steepness, Actual °: _____ 0° 1-5° > 5-25° > 25

Topography: Macro: top upper mid lower bottom | Micro: convex flat concave undulating

Geology code: _____ Soil Texture code: _____ | Upland or **Wetland/Riparian** (circle one)

% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)

H_20: BA Stems: Litter: Bedrock: Boulder: Stone: Cobble: Gravel: Fines: =100%

% Current year bioturbation _____ Past bioturbation present? Yes / No | % Hoof punch _____

Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.

Site history, stand age, comments:

Disturbance code / Intensity (L,M,H): ____/___ ____/___ ____/___ ____/___ ____/___ **"Other"** _____ _____ / ___

II. HABITAT DESCRIPTION

Tree DBH : T1 (<1" dbh), **T2** (1-6" dbh), **T3** (6-11" dbh), **T4** (11-24" dbh), **T5** (>24" dbh), **T6** multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), **S2** young (<1% dead), **S3** mature (1-25% dead), **S4** decadent (>25% dead)

Herbaceous: H1 (<12" plant ht.), **H2** (>12" ht.)

III. INTERPRETATION OF STAND

Field-assessed vegetation Alliance name: _____

Field-assessed Association name (optional): _____

Adjacent Alliances/direction: _____/_____, _____/_____

Confidence in Alliance identification: L M H Explain: _____

Phenology (E,P,L): Herb____ Shrub____ Tree____ Other identification or mapping information:

Database #: _____ SPECIES SHEET

IV. VEGETATION DESCRIPTION

% NonVasc cover:____ Total % Vasc Veg cover:_____

% Cover - **Conifer tree / Hardwood tree: _____/_____ Regenerating Tree: _____ Shrub: _____ Herbaceous: _____**

Height Class - Conifer tree / Hardwood tree: _____/_____ Regenerating Tree: _____ Shrub: _____ Herbaceous: _____

Height classes: 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

Stratum categories: T=Tree, A = SApling, E = SEedling, S = Shrub, H= Herb, N= Non-vascular

% Cover Intervals for reference: r = trace, + = <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

Stratum	Species	% cover	C	Final species determination

Unusual species: _____

CDFW-CNPS Protocol for the

Combined Vegetation Rapid Assessment and Relevé Field Form

(April 28, 2016)

Introduction

This protocol describes the methodology for both the Relevé and Rapid Assessment (RA) vegetation sampling techniques as recorded in the Combined Vegetation Rapid Assessment and Relevé Field Form. The same environmental data are collected for both techniques. However, the Relevé sample is a plot demarcated with a measuring tape, and each species in the plot is recorded along with its cover. The Rapid Assessment sample is not based on a taped plot, but is based on a visually estimated, usually circular area within a representative portion of the entire stand, with up to 20 of the dominant or characteristic species and their cover values recorded.

In general, collect rapid assessments in woody vegetation and Relevés in herbaceous vegetation. When working in an area that has not been sampled before, RAs in woody vegetation may list more than 20 species.

Defining a Stand

A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small, such as a portion of a vernal pool, and some may be several square kilometers in size, such as a forest type. All samples should be in stands that meet the minimum mapping unit of 1 acre for upland and 0.5 acre for special stands such as small wetlands, riparian and serpentine barrens.

A stand is defined by two main unifying characteristics:

1) 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 indistinct.

2) It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes but not the lower, would be divided into two stands. Likewise, sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called homogeneity. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous (uniform in structure and composition throughout).

Selecting a bounded plot (Relevé) or representative area (Rapid Assessment) to sample within a stand

Stands to be sampled may be selected by evaluation prior to a site visit (e.g., from aerial photos) or they may be selected on site during Reconnaissance to determine extent and boundaries, location of other similar stands, etc.

Because many stands are large, it may be difficult to summarize the species composition, cover, and structure of an entire stand. We are usually trying to capture the most information as efficiently as possible. Thus, we are typically forced to select a representative portion to sample.

When sampling a stand of vegetation, the main point is to select a sample that, in as many ways possible, is representative of that stand. This means that you are not randomly selecting a plot; on the contrary, you are actively using your own best judgment to find a representative example of the stand.

Selecting a Relevé plot or RA area requires that you see enough of the stand you are sampling to feel comfortable in choosing a representative plot location. Take a brief walk through the stand and look for variations in species composition and in stand structure. In hilly or mountainous terrain, look for a vantage point from which you can get a representative view of the whole stand. Variations in vegetation that are repeated throughout the stand should be included in your plot. Once you assess the variation within the stand, attempt to find an area that captures the stand's common species composition and structural condition to sample.

Tracking sampled vegetation types

For large projects, the number of samples should be tracked daily or weekly by field-assessed Alliance type so that samples are spread as evenly as possible over types and time is not wasted collecting excessive numbers of samples of certain types. When multiple teams are in the field in the same week, daily communication between teams about Alliances sampled can ensure even sampling*. Prior to selecting a stand to sample, determine if what you are going to sample is needed based on this Alliance tracking.*

Selecting plots to avoid spatial autocorrelation

When possible, do not sample adjacent stands. Do not take more than one sample of the same vegetation type within a sub-watershed. Exceptions can be made due to limited access to private lands. For example, samples from different formations, subclasses or classes (e.g., wetlands vs. uplands, lithomorphic vs. mesomorphic) may be sampled in the same sub-watershed, however, avoid sampling a grassland adjacent to an open woodland, even though they are technically different formations.

Plot Size

All Relevés of the same type of vegetation need to be the same size if they are to be analyzed together. Plot shape and size are somewhat dependent on the type of vegetation under study. Therefore, general guidelines for plot sizes of tree, shrub, and herbaceous communities have been established. Sufficient work has been done in temperate vegetation to be confident the following conventions will capture species richness:

Herbaceous communities: 100 m^2 plot
Special herbaceous communities, such as vernal pools, fens: 10 m^2 plot
Shrublands and riparian forest/woodlands: 400 m^2 plot
Open desert and other shrublands with widely dispersed but regularly occurring woody species: 1000 m^2 plot
Upland Forest and woodland communities: 1000 m^2 plot

Plot Shape

A relevé has no fixed shape, though plot shape should reflect the character of the stand and is either a square or a rectangle. Adjust the orientation and dimensions of the plot to incorporate the best approximation of stand homogeneity. If the stand is about the same size as a Relevé, the plot boundaries may be similar to that of the entire stand. If we are sampling streamside riparian or other linear communities, our plot dimensions should not go beyond the community's natural ecological boundaries. Thus, a relatively long, narrow plot capturing the vegetation within the stand, but not outside it, would be appropriate. Species present along the edges of the plot that are clearly part of the adjacent stand should be excluded from the plot.

Location of GPS Points

For Relevés, one corner will be considered the plot Identifier (ID point) and should be in the SW corner, if possible. If it is taken in another corner, this should be noted in the Site History section.

Definitions of fields in the Field Form

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Relevé or RA: Circle the appropriate survey type.

Database #: This is the unique ID number for Relevés and Rapid Assessments, in the form of PPPPxxxx, where PPPP is the 4-character project code and xxxx is a unique 4-digit number (e.g. CARR0001 for Carrizo sample #1). If this is a long-term plot, a character from A to Z can be added to the unique ID for each re-sampling survey; so the first re-sample for CARR0001 would be CARR0001A.

Date: Date of the sampling.

Name of recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full names of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

Location Name: The name of the property or park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to each GPS unit. This can be the serial number if another number is not assigned.

Bearing°, left axis at ID point of <u>Long / Short</u> side: Fill this in for Relevés only. For square or rectangular plots: from the ID Point, looking towards the plot, record the bearing of the axis to your left. If the plot is a rectangle, indicate whether the left side of the plot is the long or short side of the rectangle by circling “long” or “short” side (no need to circle anything for square plots). If there are no stand constraints, set up the plot with boundaries running in the cardinal directions and place the ID Point in the SW corner.

UTM coordinates: Easting (**UTME**) and northing (**UTMN**) location coordinates using the Universal Transverse Mercator (UTM) grid. Record the information from your GPS unit. These coordinates are always the base point of the survey. Soil samples and photos are taken from this point, and exposure, steepness, topography, etc. are measured here. If the GPS is not within the stand (i.e., the point is projected), these are the UTMs of the base point.

For Relevé plots, take the waypoint in the southwest corner of the plot whenever possible or in the center of a circular plot.

Zone: Universal Transverse Mercator zone. Zone 10 is for California west of the 120th longitude; zone 11 is for California east of 120th longitude (the straight portion of California’s eastern boundary).

NAD83: This is the default GPS datum. If you use a different one, cross this out and write in the correct datum.

GPS error: ft./ m./ PDOP: Circle the appropriate unit of measure and record the error reading from the GPS unit.

Decimal degrees: *Use this only if your GPS unit will not record UTM coordinates.* Latitude–Longitude reading in decimal degrees. Record the information from your GPS

unit. These coordinates are always the base point of the survey. Soil samples and photos are taken from this point, and exposure, steepness, topography, etc. are measured here.
For Relevé plots, take the waypoint in the southwest corner of the plot whenever possible or in the center of a circular plot.

GPS within stand? Yes / No: Circle "Yes" to denote that the GPS waypoint was taken directly within or at the edge of the stand being assessed for a Rapid Assessment, or circle "No" if the waypoint was taken at a distance from the stand (such as with a binocular view of the stand). If the point is taken at the edge of the stand, note the direction to the stand.

If No, cite from GPS to stand: distance (m), bearing°, inclination°: From the base GPS point, measure the distance to the projected point using a range finder. Record the compass bearing from the base point to the projected point; record the inclination if the base and projected points are not at the same elevation.
and record Base point ID: This is the waypoint # of the base GPS point, where the surveyors were standing to record the distance survey.
and Projected UTMs: These are the coordinates of the projected point, the point being surveyed. They are generated in the field if the GPS units have the ability to calculate projected points. If the GPS unit does not have this capability, make a note to that effect and leave these fields blank.

Camera Name: Write the camera name.

Cardinal photos at ID point: Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the ID Point, and record the jpeg numbers here. Try to include the horizon in at least some of these photos. If this is a distance survey to a projected point, take the four cardinal photos at the base point and at least one photo of the stand. A digital camera with a minimum 10 megapixel resolution must be used.

Other photos: This may include cardinal photos at additional corners or other relevant photos. Notes regarding photo locations or subjects can go here.

Stand Size: Estimate the size of the entire stand in which the sample is taken. As a measure, one acre is about 4,000 square meters (approximately 64 x 64 m), or 208 feet by 208 feet. One acre is similar in size to a football field.

Plot Size: If this is a Relevé, circle "100" for a $100m^2$ plot, or record the plot size.

Plot Shape: Record the length and width of the Relevé plot in meters.

RA Radius: Enter the radius in meters of the visually estimated sample area for Rapid Assessments (should be a 20-meter radius at minimum). For a large stand, this limits the area covered by the RA. If you can see and assess the entire stand, the length and width should be recorded. If it is a long, narrow stand, note the width of the stand at your location. If your point is on the edge of the stand, record the radius into the stand, but note your location and the direction to which the RA Radius applies in the Site History section.

Exposure: (Enter Actual º and circle general category): While facing in the general downhill direction, read degrees of the compass for the aspect or the direction you are standing, using degrees from north, adjusted for declination. Average the reading over the entire stand, even if you are sampling a Relevé plot, since your plot is representative of the stand. If estimating the exposure, write "N/A" for the actual

degrees, and circle the general category chosen. “Variable” may be selected if the same, homogenous stand of vegetation occurs across a varied range of slope exposures.

Steepness: (Enter Actual º and circle general category): Read degree slope from your compass. If estimating, write “N/A” for the actual degrees, and circle the general category chosen. Make sure to average the reading across the entire stand even if you are sampling in a Relevé plot.

Topography: First assess the broad (**Macro**) topographic feature or general position of the stand in the surrounding watershed, that is, the stand is at the top, upper (1/3 of slope), middle (1/3 of slope), lower (1/3 of slope), or bottom. **Circle *all* of the positions that apply for macrotopography.**
Then assess the local (**Micro**) topographic features or the lay of the area (e.g., surface is flat or concave). **Circle only *one* of the microtopographic descriptors**.

Geology code: Geological parent material of stand. If exact type is unknown, use a more general category (e.g., igneous, metamorphic, sedimentary). *See code list for types*.

Soil Texture code: Record soil texture that is characteristic of the plot (*e.g.,* coarse loamy sand, sandy clay loam). *See soil texture key for types.*

Upland or Wetland/Riparian: Indicate if the stand is in upland or wetland/riparian setting. (Wetland and riparian are one category.) Note that a site need not be officially delineated as a wetland to qualify as such in this context (e.g., seasonally wet meadow).

% Surface cover: The abiotic substrates of the plot. The total should sum to 100%. It is helpful to imagine “mowing off” all of the live vegetation at the base of the plants and removing it – you will be estimating what is left covering the surface. Note that non-vascular cover (lichens, mosses, cryptobiotic crusts) is not estimated in this section.

H_2O:	Percent surface cover of running or standing water, ignoring the substrate below the water.
BA Stems:	Percent surface cover of the basal area of stems at the ground surface. For most vegetation types, BA is 1-3% cover.
Litter:	Percent surface cover of litter, duff, or wood on the ground.
Bedrock:	Percent surface cover of bedrock, including outcrops.
Boulder:	Percent surface cover of rocks >60 cm in the longest dimension.
Stone:	Percent surface cover of rocks >25–60 cm in the longest dimension.
Cobble:	Percent surface cover of rocks >7.5–25 cm in the longest dimension.
Gravel:	Percent surface cover of rocks 2 mm–7.5 cm in the longest dimension.
Fines:	Percent surface cover of bare ground and fine sediment <2 mm in the longest dimension (*e.g.,* dirt, sand).

% Current year bioturbation: Estimate the percent of the plot exhibiting soil disturbance by any organism that lives underground. Do not include disturbance by ungulates. Note that this is a separate estimation from surface cover.

Past bioturbation present? Circle Yes if there is evidence of bioturbation from previous years in the plot.

% Hoof punch: Note the percent of the plot surface that has been punched down by hooves (cattle or native grazers) in wet soil. Depressions must be >2 cm deep.

Fire Evidence: Circle Yes if there is visible evidence of fire within the stand and note the type of evidence in the "Site history, stand age, comments section," for example, "charred dead stems of *Quercus berberidifolia* extending 2 feet above resprouting shrubs." If you are certain of the year of the fire, put this in the Site history section.

Site history, stand age, comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors, such as distribution of species. Examples of disturbance history: fire, landslides, avalanching, drought, flood, animal burrowing, or pest outbreak. Also, try to estimate year or frequency of disturbance. Examples of land use: grazing, timber harvest, or mining. Examples of other site factors: exposed rocks, soil with fine-textured sediments, high litter/duff build-up, multi-storied vegetation structure, or other stand dynamics.

Disturbance code / Intensity (L,M,H): List codes for potential or existing impacts on the stability of the plant community. See code list for impacts and definitions of levels of disturbance. Characterize each impact each as **L** (=Light), **M** (=Moderate), or **H** (=Heavy). Disturbance is evaluated on a stand basis.

II. HABITAT AND VEGETATION DESCRIPTION

California Wildlife Habitat Relationships (CWHR)

For CWHR, identify the size/height class of the plot using the following tree, shrub, and/or herbaceous categories. These categories are based on functional life forms.

Tree DBH: Circle one of the tree size classes provided when the tree canopy closure exceeds 10% of the total cover, or if young tree density indicates imminent tree dominance. Size class is based on the average diameter at breast height (dbh) of each trunk (standard breast height is 4.5ft or 137cm). When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, and weight the mean toward the larger tree dbh's. The "**T6 multi-layered**" dbh size class signifies a multi-layered tree canopy (with a size class T3 and/or T4 layer growing under a T5 layer and a distinct height separation between the classes) exceeding 60% total cover. Stands in the T6 class need also to contain at least 10% cover of size class 5 (>24" dbh) trees growing over a distinct layer with at least 10% combined cover of trees in size classes 3 (>6-11" dbh) or 4 (>11-24" dbh).

Shrub: Circle one of the shrub size classes provided when shrub canopy closure exceeds 10% (except in desert types) by recording which class is predominant in the survey. Shrub size class is based on the average amount of crown decadence (dead standing vegetation on live shrubs when looking across the crowns of the shrubs).

Herbaceous: Circle one of the herb height classes when herbaceous cover exceeds 2% by recording the predominant class in the survey. Note*: This height class is based on the average plant height at maturity, not necessarily at the time of observation.*

III. INTERPRETATION OF STAND

Field-assessed vegetation Alliance name: Enter the name of the Alliance following the Manual of California Vegetation, 2nd Edition (Sawyer, Keeler-Wolf and Evens 2009). Please use scientific nomenclature, *e.g., Quercus agrifolia* forest. An Alliance is based on the dominant or diagnostic species of the stand, and usually reflects the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others.

The field-assessed Alliance name may not exist in the present classification, in which case you can provide a new Alliance name in this field. If this is the case, also make sure to state that it is not in the MCV under "Explain" below.

Field-assessed Association name (optional): Enter the name of the species in the Alliance and additional dominant/diagnostic species from any strata. In following naming conventions, species in differing strata are separated with a slash, and species in the uppermost stratum are listed first (*e.g., Quercus douglasii / Toxicodendron diversilobum*). Species in the same stratum are separated with a dash (*e.g., Quercus lobata – Quercus douglasii)*.

The field-assessed Association name may not exist in the present classification, in which you can provide a new Association name in this field.

Adjacent Alliances/direction: Identify other vegetation types that are directly adjacent to the stand being assessed by noting the dominant species (or known type). Also note the distance in meters from the GPS waypoint and the direction in degrees that the adjacent alliance is found
(*e.g., Amsinckia tessellata* / 50m, 360° N or *Eriogonum fasciculatum* / 100m, 110°).

Confidence in Alliance identification: (L, M, H) With respect to the "Field-assessed Alliance name," note whether you have L (=Low), M (=Moderate), or H (=High) confidence in the interpretation of this Alliance name.

Explain: Please elaborate if your "Confidence in Alliance identification" is low or moderate. Low confidence can occur from such things as a poor view of the stand, an unusual mix of species that does not meet the criteria of any described Alliance, or a low confidence in your ability to identify species that are significant members of the stand.

Phenology: Indicate early (E), peak (P), or late (L) phenology for each of the strata. For herbs, this generally indicates if species are in flower and/or fruit and are therefore identifiable. For shrubs and trees, this attribute generally refers to cover, e.g., a tree that is fully leafed out will be considered peak (P) even if it is not in flower. Phenology is useful for cover estimation and species identification issues and should be elaborated upon in the next field.

Other identification or mapping information: Discuss any further problems with the identification of the assessment or issues that may be of interest to mappers. Note if this sample represents a type that is likely too small to map.

IV. VEGETATION DESCRIPTION

Database #: Copy the database # from Page 1.

Overall Cover of Vegetation

Provide an estimate of cover for the life-form categories below. Record a specific number for the total aerial cover or "bird's-eye view" looking from above for each category, estimating cover for the living plants only. Litter/duff should not be included in these estimates.

The *porosity* of the vegetation should be taken into consideration when estimating percent foliar cover for all categories below: consider how much of the sky you can see when you are standing under the canopy of a tree, or how much light passes through the canopy of the shrub layer to help you estimate foliar cover.

% NonVasc cover: The total cover of all lichens, bryophytes (mosses, liverworts, hornworts), and cryptogamic crust on substrate surfaces including downed logs, rocks and soil, but not on standing or inclined trees or vertical rock surfaces.

Total % Vasc Veg cover: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation, and disregarding overlap[2] of the various tree, shrub, and/or herbaceous layers and species.

% Cover by Layer

Conifer Tree /Hardwood Tree: The total foliar cover (considering porosity) of all live tree species, disregarding overlap[2] of individual trees. Estimate conifer and hardwood covers separately. **Please note:** These cover values should not include the coverage of regenerating tree species (i.e., tree seedlings and saplings).

Regenerating Tree: The total foliar cover of seedlings and saplings, disregarding overlap[2] of individual recruits. See seedling and sapling definitions below.

Shrub: The total foliar cover (considering porosity) of all live shrub species disregarding overlap[2] of individual shrubs.

Herbaceous: The total cover (considering porosity) of all herbaceous species, disregarding overlap[2] of individual herbs.

Height Class by Layer

Modal height for conifer tree / hardwood tree, regenerating tree, shrub, and herbaceous categories. Record an average height value for each category by estimating the mean height for each group. Please use the following height intervals to record a height class:

---

[2] Porosity reduces the total cover of the canopy. Overlapping strata should not be included in the total cover percent; for instance, if a shrub is growing under a tree, only the cover of the tree will be added into the total; the cover of the shrub will be disregarded, except for the amount by which it fills in the porosity of the tree canopy.

1 = <1/2 m, 2 = 1/2-1 m, 3 = 1-2 m, 4 = 2-5 m, 5 = 5-10 m, 6 = 10-15 m, 7 = 15-20 m, 8 = 20-35 m, 9 = 35-50 m, 10 => 50 m.

Note: For the herbaceous layer height, this height class is based on the average plant height at the time of observation, as opposed to how this is recorded in the CWHR section (at maturity).

Species List and Coverage

For Rapid Assessments: List up to 20 species that are dominant or that are characteristically consistent within the assessment area. These species may or may not be abundant, but they should be constant representatives in the survey. When different layers of vegetation occur, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum. There is a heavy line on the form under the 20th line to limit the RA section of the species list. *Note: If constant, diagnostic, or interesting species occur outside the assessment area but in the stand, list the species and estimated stand cover in the Site History section.*

For Relevés: list all species present in the plot, using a second species list page if necessary.
** If using a second species list page, note "Continued" on the bottom of the first page and be sure to note the Database # on the second page.

For both sample types, provide the stratum:

T = Tree. A woody perennial plant that has a single trunk.

A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1" dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6" dbh, then the re-sprouts would be recorded under the "Tree" stratum.

E = SEedling. A tree species clearly of a very young age that is <1" dbh or has not reached breast height. Applies only to trees propagating from seed; resprouts are not recorded here even if they meet the size requirements.

S = Shrub. A perennial, woody plant, that is multi-branched and doesn't die back to the ground every year.

H = Herb. An annual or perennial that dies down to ground level every year.

N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogammic crust, and algae.

Be consistent and don't break up a single species into two separate strata. The only time it would be appropriate to do so is when one or more tree species are regenerating, in which case the SEedling and/or SApling strata should be recorded for that species. These may be noted on the same line, *e.g.:*

Strata	**Species**	**%Cover**	C
T/A/E	Quercus douglasii	40/<1/<1	

In some cases, the stratum of a particular species might not be obvious. Some examples are *Juniperus californica,* which has the size and growth habit of a shrub, but it is considered a tree, and mistletoe, which is considered a shrub. It is useful to have a list of species with ambiguous strata for each project. Consult the MCV or contact VegCAMP if you are unsure.

C. If a species collection is made, it should be indicated in the collection column with a "C" (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, add a "T" to the "C" in the collection column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" in the collection column (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [*e.g., Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a "C" to the existing "C" in the collection column (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a "D" to the existing "C" in the collection column (CD = collected and deposited) and note the receiving herbarium.

Use Jepson Manual nomenclature. Write out the genus and species of the plant. Do not abbreviate except for dominant species that do not have ambiguous codes. If you aren't sure there aren't duplicate codes, don't use a code. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica* (*nigra*) if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

Provide the % absolute foliar cover for each species listed, considering porosity. When estimating, it is often helpful to think of coverage in terms of the following cover intervals at first:

<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%.

Keeping these classes in mind, refine your estimate to a specific percentage. All species percent covers may total over 100% because of overlap.
Include the percent cover of snags (standing dead) of trees and shrubs. Use the code "SNAG." Note their species, if known, in the "Species" column (i.e. SNAG – *Quercus wislizeni*).

For Rapid Assessments, make sure that the major non-native species occurring in the stand also are listed in the space provided in the species list with their strata and % cover.

For Relevés, all non-native species should be included in the species list.

Also for Relevés, record the <1% cover in one of two categories: "r" for trace (i.e., rare in plot, or solitary individuals) and "+" for <1% but not rare or solitary individuals.

Unusual species: List species that are locally or regionally rare, endangered, or atypical (e.g., range extension or range limit) within the stand. This field will be useful to the Program for obtaining data on regionally or locally significant populations of plants.

Note: Field forms are generally filled out in pencil, so that changes may be made easily while working in the plot or stand. Once out of the stand, however, entries on the field

form should not be erased, but should be crossed out and corrected in a different-colored ink.

APPENDIX B: RECONNAISSANCE FIELD FORM AND PROTOCOL

RECON FIELD FORM (March 30, 2017)

Recorder: **Other Surveyors:** **Date:** **Return?** ☐

Waypoint ID:

Location Name:

GPS Name _____ **Projected? Yes / No / Base / Digitized**

If Yes, enter: **Bearing (°):** _____ **Distance (m):** _____ **Inclination (°):** _____

UID:

If Yes or Digitized, enter: **Base Waypoint ID:** _____

Base / Projected (circle one) Record either UTMs or Decimal Degrees GPS error: **ft./ m./ PDOP** _____

UTMs: UTME ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___

Decimal degrees: **LAT** ___ ___ . ___ ___ ___ ___ ___ ___ **LONG** ___ ___ ___ . ___ ___ ___ ___ ___ ___

Stand Size: <1 1–5 >5

View Radius _____

Camera: **Photos:**

Field Alliance name:

Comments:

% Cover: Conifer_____ Hardwood_____ Total Tree_____ Regen Tree_____ Shrub_____ Herb_____ Total Veg_____ Exotics (L,M,H)_____

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Recorder: **Other Surveyors:** **Date:** **Return?** ☐

Waypoint ID:

Location Name:

GPS Name _____ **Projected? Yes / No / Base / Digitized**

If Yes, enter: **Bearing (°):** _____ **Distance (m):** _____ **Inclination (°):** _____

UID:

If Yes or Digitized, enter: **Base Waypoint ID:** _____

Base / Projected (circle one) Record either UTMs or Decimal Degrees GPS error: **ft./ m./ PDOP** _____

UTMs: UTME ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___

Decimal degrees: **LAT** . **LONG** .

Stand Size: <1 1–5 >5

View Radius _____

Camera: **Photos:**

Field Alliance name:

Comments:

% Cover: Conifer Hardwood Total Tree Regen Tree Shrub Herb Total Veg Exotics (L,M,H)

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

California Department of Fish and Wildlife
Protocol for Recon Field Form
(September 5, 2018)

This protocol describes the methodology for the recons and field checks in the Slinkard/Little Antelope WLAs, as recorded in the Recon Field Form dated March 30, 2017. Reconnaissance surveys (recons) are complementary to Relevés and rapid assessments, but contain only a small subset of the data gathered using the more detailed methods. Recons are generally used as an aid to digital vegetation mapping, to determine the boundaries of a stand, or to illustrate a particular vegetation signature.

This form and protocol will also be used for field checks for the Little Antelope Meadow map. Using Collector, navigate to the labelled, purple. Tap the polygon of interest to see what question is being asked, and record your answer in the Comments box. Then collect recon data within the polygon. If the polygon should be divided, collecting multiple points within the polygon would be appropriate. The items marked in red should be entered in Collector.

Definitions of fields in the form

LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full name of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

Date: Date of the sampling.

Return?: Check this box if team members should return to this spot at a later date to take a recon or RA/relevé. This can be used if the phenology is not conducive to identification of the major species, or if there is not enough time to take the survey. In Collector, make the survey a Return Recon.

Waypoint ID: The Waypoint ID in this format: GPS device name + date (yymmdd) + time (hhmm). For example, for a survey taken on iPad “V” on March 27 at 1:45 in the afternoon, the Waypoint ID will be “V1803271345.”

UID: The ID number of a reference point or polygon which this Reconnaissance describes.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to the GPS unit. If you don't have an assignment for your GPS, use your initials.

Projected? Yes / No / Base / Digitized: Circle the appropriate option:

> **Yes** - The point is a projected, or offset point. The surveyor used a bearing and distance to project the point to match what they are describing with the survey.
>
> **No** - The surveyors are in the vegetation they are describing and the point is where the observer was standing for photographs. This location can also be used as a base location for an offset survey.
>
> **Base** - Base point only. This is where a surveyor was standing when taking an offset survey to describe vegetation not at that point. No plant data or vegetation descriptions are associated with this location. However, cardinal photos taken at this point will be stored in a directory of this name.
>
> **Digitized** – An offset point was created on the GPS unit without taking bearing and distance readings. This option should only be used when the imagery on the GPS unit is unique and unmistakable.

Bearing (°): The compass bearing from the Base point to the Projected point.

Distance (m): The distance in meters from the Base point to the Projected point, determined by use of a range finder.

Inclination (°): The vertical offset from the Base point to the Projected point.

Base Waypoint ID: For a projected or digitized point, this is the location where the surveyor was standing when the information was collected. Cardinal photographs will be taken at this point and will be stored on the computer under this ID. Photographs of the stand vegetation will be taken from this point and will be stored on the computer under the Projected point's ID.

Base / Projected UTMs or Decimal degrees: If the point is projected or digitized, circle whether the coordinates of the base point or the offset point have been recorded. These will generally be for the offset point.

GPS error: ft./m./PDOP: The accuracy of the GPS location. Record the error reading and circle the appropriate units.

GPS coordinates: Record either UTM coordinates, easting (**UTME**) and northing (**UTMN**), or decimal degrees, **LAT** (latitude) and **LONG** (longitude). Record this information from a GPS unit.

Stand Size: Estimate the size of the entire stand in which the sample is taken and circle the appropriate range. As a measure, one acre is similar in size to a football field.

View Radius: Enter the radius, in meters, of the viewable area of the stand from the survey point; the radius should be a minimum of 20 meters.

Camera/Photos: Write the name camera, JPG numbers, and direction of photos. Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location. This symbol can be used to indicate the cardinal photos:  . If additional photos are taken in other directions, please note the JPG numbers and a description of each photo. In Collector, enter this into **PhotoDesc**.

HABITAT AND VEGETATION DESCRIPTION

Field alliance name: Name of alliance following the most recent Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens 2009), using scientific nomenclature, e.g., *Populus tremuloides*. An alliance is based on the dominant or diagnostic species of the stand, and usually reflects the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others.

For field checking the Little Antelope Meadow, please also select a **Field Map Code** in Collector, and enter the **Field Association** if known.

Please note: The field-assessed alliance name may not exist in the present classification, in which case you can provide a new alliance name in this field.

Comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors that will aid in the mapping effort. For field checks, answer the questions for the polygon here and make any other notes about polygon linework, etc.

% Cover:

> **Conifer:** The total cover of all the conifer trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute conifer cover, disregarding the overlap[3] of individual trees.
>
> **Hardwood:** The total cover of all the hardwood trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute hardwood tree cover, disregarding the overlap[1] of individual trees.

[3] Porosity reduces the total cover of the canopy. Overlapping strata should not be included in the total cover percent; for instance, if a shrub is growing under a tree, only the cover of the tree will be added into the total; the cover of the shrub will be disregarded, except for the amount by which it fills in the porosity of the tree canopy.

Total Tree: The total cover of all the trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute tree cover, disregarding the overlap[1] of individual trees.

Regen Tree: The total foliar cover of seedlings and saplings, disregarding overlap[1] of individual recruits. See seedling and sapling definitions below.

Shrub: The total cover of all the shrubs taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute shrub cover, disregarding the overlap[1] of individual shrubs.

Herb: The total cover of all the herbs taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute herbaceous cover, disregarding the overlap[1] of individual herbs.

Total Veg: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute vegetation cover, disregarding the overlap[1] of the various tree, shrub, and/or herbaceous layers and species.

Exotics (L,M,H): The extent to which the stand is impacted by exotic/non-native species. Divide the total exotic cover (e.g. 25% Bromus diandrus + 8% Bromus madritensis + 5% Centaurea melitensis = 38% total exotics) by the Total Veg cover (e.g. 80% total) and multiply by 100 to get the % relative cover of exotics (e.g. 38% total exotics / 80% total cover = 48% relative exotic cover). **L** = 0-33% *relative* cover of exotics; **M** =34-66% relative cover, and **H** = >66% relative cover.

Species List and Coverage

List the species that are dominant or that are characteristically consistent throughout the stand. This list is used if there is some uncertainty in the field-assessed alliance name, so the most common species should be listed. In the interests of time and efficiency, this species list should not be exhaustive.

Strata:

T = Tree. A woody perennial plant that has a single trunk.

A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1” dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6” dbh, then the re-sprouts would be recorded under the “Tree” stratum.

E = SEedling. A tree species clearly of a very young age that is < 1" dbh or has not reached breast height. Applies only to trees propagating from seed; re-sprouts are not recorded here even if they meet the size requirements.

S = Shrub. A perennial, woody plant, that is multi-branched and doesn't die back to the ground every year.

H = Herb. An annual or perennial that dies down to ground level every year.

N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogammic crust, and algae.

When one or more tree species are regenerating, the Tree, Seedling and/or Sapling strata may be noted on the same line, e.g.:

Strata	**Species**	**%Cover**	C
T/A/E	Quercus douglasii	40/<1/<1	

Species: Use Jepson Manual nomenclature. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica* (*nigra*) if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

% cover: provide the % absolute aerial cover for each species listed. All species percent covers may total over 100% because of overlap.

Collections: If a species collection is made, it should be indicated in the blank column next to "% cover" with a "C" (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, add a "T" to the "C" in that column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [e.g *Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a "C" to the existing "C" (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a "D" to the existing "C" (CD = collected and deposited) and note the receiving herbarium.

APPENDIX C: ASPEN FIELD FORM AND PROTOCOL

Slinkard / Little Antelope
Aspen Field Form (8/10/17)

Database #:

ASPEN UNDERSTORY (Aspen <1" dbh)		
There is a **distinctive (>500 stems/acre) regeneration** stem age class present ☐		
Regeneration is present (>500 stems/acre) but **growth is being suppressed** ☐ By overstory ☐ By mid-level canopy ☐ By shrubs (<4.5') ☐		
Aspen **regeneration is poor** (<500 stems/acre) ☐	**Young conifers** (<4.5') present (>500/acre) ☐	
Browsing Issues: • Browsing **intense**: current terminal leader growth is completely removed on >20% of stems ☐ • Browsing **light to moderate**: current terminal leader growth is completely removed on <20% of stems ☐ Aspen suckers have **multiple leaders or are "hedged"** (indicating history of intense browsing) ☐ **Browsing of suckers** by: Cattle ☐ Deer ☐ Sheep ☐ Elk ☐ Unknown ☐		
STAND MANAGEMENT ISSUES		
Adjacent to (<15 m): Permanent riparian corridor ☐ Spring/Fen ☐ Meadow ☐ Pond ☐		
Stand within geologic refugia: Solid rock outcrop ☐ Moraine ☐ Lava flow ☐ Talus slope ☐		
Insect damage (>20% of stems) ☐	**Disease damage** (>20% of stems) ☐	**Blowdown** ☐
Sagebrush covers >20% of stand ☐	**Corn lilies** cover >20% of stand ☐	**Conifer ≥30" dbh** ☐
Archeological site within stand: Carvings ☐ Other (describe) ☐		
Human impacts (trails/camping) ☐	Structures (describe) ☐	
Indications of **Previous prescriptive treatments** (describe) ☐		
Indications of **Fire** ☐	**Gully erosion** ☐	**Beaver** presence ☐
Estimated walking distance from **drivable road**		

Protocol

ASPEN UNDERSTORY

Distinctive regeneration: Check this box if >500 stems/acre are present in the stand. This density is equivalent to approximately 1 stem per 10 square meters (a square 3.1 m on a side or a circle with a radius of 1.8 m)

Growth is being suppressed: Check this box if distinctive regeneration is present, but more than 50% of the stems are stressed, then indicate the cause of the suppression. A stressed sucker can be identified by observing that the terminal buds on stems are dying off (as opposed to being browsed).

Regeneration is poor: Check this box if fewer than 500 stems/acre are present.

Young conifers: Check this box if conifer seedlings are present at >500/acre. A conifer seedling for this protocol is <4.5' tall and <1" dbh.

Browsing Issues: Indicate whether browsing of suckers (stems <4.5' in height) is intense or light/moderate. For this measurement, the terminal bud of the primary stem must be completely eaten off.

Aspen suckers are "hedged": Check this box if the suckers have multiple leaders or seem to have been pruned into a hedge shape. This indicates ongoing browsing.

Browsing by: Check the box(es) of the animal suspected of browsing.

STAND MANAGEMENT ISSUES

Adjacent to: Indicate whether the stand is within 50 feet of any of these physical features.

Stand within geologic refugia: Refugia are environments conducive to stand continuation because of their
protection from browsing pressures, conifer encroachment, or because of location on a site with particular characteristics. Indicate which, if any, of these are present.

Insect damage: Indicate if >20% of stems show signs of damage from one insect species. (i.e., does the damage on >20% of the stems look so similar that it likely was caused by one insect species?)

Disease damage: Indicate if >20% of stems show signs of any one pathogen pattern (conks, etc.). (i.e., does the same pathogen pattern show up on >20% of the trees?)

Blowdown: Indicate if >20% of the stand has suffered significant wind damage, i.e. stems fallen in a consistent direction.

Sagebrush: Check this box if >20% of the stand contains sagebrush.

Corn lilies: Check this box if corn lilies (*Veratrum* sp.) are present in >20% of the stand. Corn lilies indicate a high water table, which may affect management decisions.

Conifer ≥30" dbh: Check this box if large conifers are present.

Archeological site: Indicate signs of any heritage issues, i.e. carvings, grinding rocks, structures. Provide descriptions as appropriate.

Human impacts (trails/camping): Indicate if any major impacts on the stand are caused by regulated or non-regulated camping or by trails in or adjacent to the stand.

Human impacts (structures): Indicate if any major impacts on the stand are caused by structures or owners of structures. Describe these as necessary.

Previous prescriptive treatments: Indicate and describe any sign of conifer removal within stand, thinning of the aspen stems themselves, or prescribed burns.

Fire: Indicate any sign of recent wildfire within or adjacent to the stand.

Gully erosion: Indicate any significant erosion (bare soil cuts) greater than three feet.

Beaver: Indicate signs of beaver, current or past.

Drivable road: Give approximate walking distance to the nearest road access.

APPENDIX D: PLANT SPECIES IN THE SLINKARD VALLEY AND LITTLE ANTELOPE VALLEY WILDLIFE AREAS

This is a list of all plant species recorded during field data collection. We use the USDA PLANTS database nomenclature.

Tree

Abies concolor
Acer glabrum
Juniperus grandis
Pinus
Pinus jeffreyi
Pinus monophylla
Populus tremuloides
Populus trichocarpa
Salix lasiandra

Shrub

Acer glabrum ssp. *torreyi*
Amelanchier alnifolia var. *pumila*
Amelanchier pallida
Amelanchier utahensis
Arctostaphylos nevadensis
Artemisia tridentata
Artemisia tridentata ssp. *tridentata*
Artemisia tridentata ssp. *vaseyana*
Artemisia tridentata ssp. *wyomingensis*
Ceanothus velutinus
Cercocarpus ledifolius
Chrysothamnus nauseosus
Chrysothamnus viscidiflorus
Chrysothamnus viscidiflorus ssp. *puberulus*
Chrysothamnus viscidiflorus ssp. *viscidiflorus*
Cornus sericea
Ephedra viridis
Ericameria nauseosa
Ericameria nauseosa ssp. *nauseosa* var. *hololeuca*
Ericameria nauseosa var. *oreophila*
Eriogonum douglasii
Eriogonum sphaerocephalum
Eriogonum sphaerocephalum var. *halimioides*
Eriogonum umbellatum
Eriogonum wrightii
Eriogonum wrightii var. *subscaposum*
Frangula californica ssp. *cuspidata*
Frangula rubra
Holodiscus discolor
Pleiacanthus spinosus
Prunus andersonii
Prunus emarginata
Purshia tridentata
Ribes aureum
Ribes cereum
Ribes lacustre
Ribes velutinum
Ribes viscosissimum
Rosa woodsii
Salix exigua
Salix geyeriana
Salix lasiolepis
Salix lutea
Salix scouleriana
Sambucus
Sambucus nigra
Sambucus nigra ssp. *caerulea*
Shepherdia argentea
Symphoricarpos
Symphoricarpos oreophilus
Symphoricarpos rotundifolius
Symphoricarpos rotundifolius var. *rotundifolius*
Tetradymia canescens

Herb

Achillea millefolium
Achnatherum
Achnatherum hymenoides
Achnatherum nelsonii
Achnatherum speciosum
Aconitum columbianum
Agastache urticifolia
Agoseris
Agropyron cristatum
Agropyron cristatum ssp*. pectinatum*
Agropyron spicatum
Agrostis alba
Agrostis gigantea
Agrostis stolonifera
Allium campanulatum
Allium validum
Apocynum androsaemifolium
Apocynum pumilum
Aquilegia formosa
Arabis
Argemone munita
Artemisia douglasiana
Artemisia dracunculus
Asclepias fascicularis
Asclepias speciosa
Barbarea vulgaris
Boechera puberula
Bromus commutatus
Bromus diandrus
Bromus inermis
Bromus orcuttianus
Bromus tectorum
Calochortus
Cardamine
Carex douglasii
Carex lanuginosa
Carex lasiocarpa
Carex lenticularis
Carex nebrascensis
Carex praegracilis
Castilleja applegatei
Castilleja miniata ssp. miniata
Cerastium glomeratum
Chamerion angustifolium
Chenopodium
Chenopodium album
Chenopodium capitatum var*. parvicapitatum*
Cicuta maculata var*. angustifolia*
Cinna latifolia
Cirsium arvense
Cirsium occidentale
Cirsium vulgare
Collomia grandiflora
Conium maculatum
Convolvulus arvensis
Cordylanthus ramosus
Crepis acuminata
Cryptantha echinella
Dactylis glomerata
Delphinium
Descurainia sophia
Dianthus armeria
Dieteria canescens
Distichlis spicata
Dysphania botrys
Eleocharis
Elymus caput-medusae
Elymus elymoides
Elymus glaucus
Elymus glaucus ssp*. glaucus*
Elymus hispidus
Elymus lanceolatus ssp*. lanceolatus*
Elymus multisetus
Elymus trachycaulus
Epilobium brachycarpum
Epilobium ciliatum
Epilobium ciliatum ssp*. ciliatum*
Epilobium minutum
Leymus cinereus
Leymus triticoides
Linanthus pungens

Herb, continued

Epilobium paniculatum
Equisetum hyemale
Equisetum laevigatum
Eriastrum
Eriogonum caespitosum
Eriogonum davidsonii
Eriogonum nudum
Eriogonum nudum var*. deductum*
Eriogonum wrightii var*. subscaposum*
Erodium cicutarium
Erysimum
Festuca bromoides
Festuca idahoensis
Galium aparine
Galium bifolium
Gayophytum
Gayophytum diffusum ssp*. parviflorum*
Geum macrophyllum
Hackelia floribunda
Heracleum lanatum
Hieracium
Holcus lanatus
Hypericum scouleri
Iris missouriensis
Iva axillaris
Juncus arcticus
Juncus balticus
Juncus balticus ssp*. ater*
Juncus covillei
Juncus howellii
Juncus longistylis
Juncus saximontanus
Lactuca serriola
Lemna
Lepidium campestre
Lepidium densiflorum
Lepidium latifolium
Lepidium virginicum
Leptosiphon ciliatus
Leymus condensatus
Lithospermum ruderale
Lomatium dissectum var*. multifidum*
Lupinus argenteus
Lupinus argenteus var*. montigenus*
Lupinus argenteus var*. palmeri*
Lupinus lepidus var*. confertus*
Machaeranthera canescens
Madia gracilis
Maianthemum racemosum
Melilotus alba
Melilotus indica
Mentha arvensis
Mentha canadensis
Mentha pulegium
Mimulus guttatus
Monardella linoides
Monardella odoratissima
Muhlenbergia richardsonis
Navarretia divaricata ssp*. divaricata*
Navarretia leptalea ssp*. bicolor*
Oenothera elata ssp*. hirsutissima*
Osmorhiza occidentalis
Paeonia brownii
Perideridia
Perideridia lemmonii
Phacelia adenophora
Phacelia hastata
Phacelia hastata ssp*. hastata*
Phacelia heterophylla ssp*. virgata*
Phleum pratense
Phlox diffusa
Phlox stansburyi
Plantago lanceolata
Poa bulbosa
Poa pratensis
Poa secunda
Poa secunda ssp*. juncifolia*
Poa secunda ssp*. secunda*
Stipa nevadensis
Stipa speciosa
Symphyotrichum ascendens

Herb, continued

Polygonum
Polygonum aviculare ssp. neglectum
Potentilla gracilis
Potentilla gracilis var*. elmeri*
Rorippa
Rumex acetosella
Rumex crispus
Salsola tragus
Schedonorus arundinaceus
Schedonorus pratensis
Scirpus microcarpus
Senecio integerrimus
Senecio serra var*. serra*
Senecio triangularis
Sidalcea oregana ssp*. spicata*
Sisymbrium altissimum
Sisymbrium irio
Sonchus asper
Stellaria longipes ssp*. longipes*
Stephanomeria
Stephanomeria spinosa
Stephanomeria tenuifolia
Stipa hymenoides
Stipa nelsonii
Stipa nelsonii var*. dorei*
Symphyotrichum bracteolatum
Symphyotrichum campestre
Symphyotrichum lanceolatum
Symphyotrichum lanceolatum ssp*. hesperium*
Taraxacum officinale
Thalictrum
Thinopyrum intermedium
Toxicoscordion paniculatum
Tragopogon dubius
Trifolium variegatum
Trifolium variegatum var*. major*
Turritis glabra
Typha domingensis
Urtica dioica
Urtica holosericea
Verbascum thapsus
Vicia americana
Vicia americana var*. americana*
Vicia villosa
Viola
Wyethia
Wyethia mollis

APPENDIX E: HIERARCHICAL VEGETATION CLASSIFICATION

This vegetation hierarchy is consistent with the version of the USNVC used in the second edition of the *Manual of California Vegetation* (Sawyer et al. 2009). Some alliances and associations have been newly described in this project or the Modoc-Lassen Counties classification project; they have been marked with an asterisk (*). Types that have been mapped are shown in **bold** type.

Forest & Woodland Class
- Temperate & Boreal Forest & Woodland Subclass
  - Cool Temperate Forest & Woodland Formation
    - Rocky Mountain Forest & Woodland Division
      - Southern Rocky Mountain Lower Montane Forest Macrogroup
        - Southern Rocky Mountain White Fir – Douglas-fir Dry Forest Group
          - ***Abies concolor* Alliance**
      - Rocky Mountain Subalpine – High Montane Conifer Forest Macrogroup
        - Rocky Mountain Subalpine Moist Spruce – Fir Forest & Woodland Group
          - ***Populus tremuloides* Alliance**
    - Vancouverian Forest & Woodland Division
      - Southern Vancouverian Montane – Foothill Forest Macrogroup
        - Californian Montane Conifer Forest & Woodland Group
          - ***Pinus jeffreyi* Alliance**
            - *Pinus jeffreyi – Pinus monophylla* Association
            - *Pinus jeffreyi – Abies concolor / Symphoricarpos rotundifolius / Elymus elymoides* Association
      - Vancouverian Subalpine Forest Macrogroup
        - Sierra-Cascade Cold-Dry Subalpine Woodland Group
          - ***Juniperus grandis* Woodland Alliance***
    - Western North American Pinyon – Juniper Woodland & Scrub Division
      - Intermountain Singleleaf Pinyon – Juniper Woodland Macrogroup
        - Great Basin Pinyon - Juniper Woodland Group
          - ***Pinus monophylla – Juniperus osteosperma* / Shrub Understory Woodland Alliance**
            - *Pinus monophylla / Artemisia tridentata / Elymus elymoides* Association
        - Intermountain Basins Curl-leaf Mountain-Mahogany Woodland & Scrub Group
          - ***Cercocarpus ledifolius* Alliance**
  - Temperate Flooded & Swamp Forest Formation
    - Rocky Mountain – Great Basin Montane Flooded & Swamp Forest Division
      - Rocky Mountain – Great Basin Montane Riparian & Swamp Forest Macrogroup
        - Northern Rocky Mountain Lowland – Foothill Riparian Forest Group
          - ***Populus trichocarpa* Alliance**

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
Intermountain Tall and Dwarf Sagebrush Scrub Steppe Macrogroup
Intermountain Ruderal Steppe and Shrubland Group
***Ericameria nauseosa* Alliance**
Ericameria nauseosa Shrubland Association
Ericameria nauseosa / Bromus tectorum Association*
***Bromus tectorum – Elymus caput-medusae* Alliance**
Bromus tectorum Association
Great Basin – Intermountain Dwarf Shrub Steppe Group
***Artemisia arbuscula* ssp. *arbuscula* Alliance**
Eriogonum sphaerocephalum / Poa secunda Alliance*
Intermountain Big Sagebrush Steppe & Shrubland Group
***Artemisia tridentata* Alliance**
Artemisia tridentata Shrubland Association
Artemisia tridentata – (Ericameria nauseosa) / Bromus tectorum Association*
***Artemisia tridentata* ssp. *vaseyana* Alliance**
Artemisia tridentata ssp. *vaseyana – Symphoricarpos oreophilus / Bromus carinatus* Association*
Purshia tridentata – Artemisia tridentata* Alliance
Purshia tridentata – Artemisia tridentata – Tetradymia canescens Association
Purshia tridentata – Artemisia tridentata Association*
Western North American Cool Semi-Desert Ruderal Scrub & Grassland Macrogroup
Great Basin-Intermountain Ruderal Dry Shrubland & Grassland Group
***Agropyron cristatum* Alliance**
Shrub & Herb Vegetation Formation Class
Temperate & Boreal Grassland & Shrubland Formation Subclass
Temperate Grassland & Shrubland Formation
Western North American Interior Chaparral Division
Cool Interior Chaparral Macrogroup
Western North American Montane Sclerophyll Scrub Group
***Ceanothus velutinus* Alliance**
Ceanothus velutinus Shrubland Association
Prunus emarginata – Holodiscus discolor* Alliance
Prunus emarginata Association*
Western North American Grassland & Shrubland Division
Central Rocky Mountain Montane-Foothill Grassland & Shrubland Macrogroup
Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group
Festuca idahoensis – Elymus spicatus – Poa secunda* Alliance
Mediterranean Scrub & Grassland Formation
Californian Scrub & Grassland Division

Californian Ruderal Grassland, Meadow & Scrub Macrogroup
Californian Ruderal Grassland, Meadow & Scrub Group
***Conium maculatum – Foeniculum vulgare* Alliance**
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
Western North American Montane - Subalpine - Boreal Marsh, Wet Meadow & Shrubland Macrogroup
Rocky Mountain - Great Basin Lowland - Foothill Riparian Shrubland Group
***Salix exigua* Alliance**
Salix exigua / Mesic Forbs Shrubland Association
Western Montane - Subalpine Riparian and Seep Shrubland Group
Cornus sericea – Dasiphora fruticosa ssp. *floribunda – Ribes* spp. Wet Shrubland Alliance*
Rosa woodsii* Wet Shrubland Association
***Salix lasiolepis* Alliance**
Shepherdia argentea* Special Stands
Vancouverian – Rocky Mountain Montane Wet Meadow & Marsh Group
Carex nebrascensis – Carex vesicaria – Carex pellita* Wet meadow Alliance
Carex nebrascensis Association
Carex pellita Association*
Carex (aquatilis, lenticularis) Alliance
***Juncus arcticus* (var. *balticus, mexicanus*) Alliance**
Juncus balticus Association
Muhlenbergia richardsonis – Carex douglasii* Moist Meadow Alliance
Arid West Interior Freshwater Marsh Macrogroup
Arid West Interior Freshwater Marsh Group
***Typha (angustifolia, domingensis, latifolia)* Alliance**
Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup
Western North American Ruderal Marsh, Wet Meadow & Shrubland Group
Poa pratensis – Agrostis gigantea – Agrostis stolonifera* Ruderal Marsh Alliance
***Festuca arundinacea* Ruderal Association**
***Phalaris aquatica – Phalaris arundinacea* Ruderal Marsh Alliance**
***Thinopyrum intermedium* Mapping Unit**
Salt Marsh Formation
North American Western Interior Brackish Marsh, Playa & Shrubland Division
Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland Macrogroup
North American Desert Alkaline-Saline Marsh & Playa Group
***Distichlis spicata* Alliance**
***Leymus cinereus – Leymus triticoides* Alliance**
Leymus triticoides Association
Leymus triticoides – Poa secunda Wet Meadow Association

Aquatic Vegetation Class
Freshwater Aquatic Vegetation Formation Subclass
Temperate to Polar Freshwater Aquatic Vegetation Formation
North American Freshwater Aquatic Vegetation Division
Western North American Freshwater Aquatic Vegetation Macrogroup
Western North American Temperate Freshwater Aquatic Vegetation Group

Developed Mapping Unit
Rock outcrop Mapping Unit
Open water Mapping Unit
Bare ground Mapping Unit

APPENDIX F: VEGETATION KEY

This is the vegetation key for Slinkard Valley and Little Antelope Valley Wildlife Areas. It is based on existing vegetation types from larger vegetation sampling and analysis efforts in similar settings including the Classification of the Vegetation of Modoc and Lassen Counties, the Yosemite National Park Vegetation Classification and Mapping Project, and other. If you want more information about the alliances and associations listed below, please review the reports associated with the aforementioned projects or visit A Manual of California Vegetation Online.

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.

Note: vegetation is generally mapped at the alliance level, with a few groups and associations used. All mapped vegetation types are bold in the key.

I. Trees are evenly distributed and are typically >5% absolute cover in the overstory canopy. When *Pinus monophylla* 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.

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

IV. Vegetative cover is 2% or less; or tree cover <3% and both shrub cover and herbaceous cover are <2%; or area has vegetation but has cultivated/horticultural plants throughout and is characterized by human development.

Sparse vegetation and development

I. FOREST AND WOODLAND

1) Overstory dominated by coniferous tree species. If co-dominant with aspen, key to the *Populus tremuloides* Alliance below.
   a) *Juniperus grandis* is the sole coniferous tree species in the overstory or is co-dominant to dominant with *Pinus jeffreyi*. *Juniperus grandis* may have as little as 3% cover but the trees will be of appreciable age and evenly distributed throughout the stand. Stands dominated by *J. grandis* exist in the vicinity, but are not known within the boundary of the Wildlife Area.

      ***Juniperus grandis* Woodland Alliance (1331)**

   b) Other coniferous tree species characterize the overstory with or without *Juniperus grandis* as a co-dominant.
      i) *Pinus jeffreyi* is dominant to co-dominant with *Pinus monophylla,* and/or *Abies concolor* in the tree layer. *Juniperus grandis* may be present, but it is sub-dominant in the tree layer.

         ***Pinus jeffreyi* Alliance (1101)**

         (1) *Pinus jeffreyi* dominates the overstory tree layer. *Abies concolor,* if present, is <2%.

            Pinus jeffreyi – Pinus monophylla Association (1102)

         (2) *Pinus jeffreyi* and *Abies concolor* are co-dominant in the overstory tree layer.

            Pinus jeffreyi – Abies concolor / Symphoricarpos rotundifolius / Elymus elymoides Association (1103)

      ii) *Pinus monophylla* or *Abies concolor* is dominant and *Pinus jeffreyi* is sub-dominant.
         (1) *Pinus monophylla* is the dominant short tree.

            ***Pinus monophylla – Juniperus osteosperma* / Shrub Understory Woodland Alliance (1311)**

            Pinus monophylla / Artemisia tridentata / Elymus elymoides Association (1313)

         (2) *Abies concolor* is dominant in the tree layer. If *Pinus jeffreyi* is co-dominant then key to the *Pinus jeffreyi* Alliance).

            ***Abies concolor* Alliance (1001)**

2) Overstory dominated or co-dominated by broad-leaved evergreen or deciduous trees.
   a) Trees are deciduous.
      i) *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 (1701)**

ii) *Populus trichocarpa* is dominant to co-dominant in the tree layer. If co-dominant with *Populus tremuloides* key here.

***Populus trichocarpa* Alliance (1601)**

b) "Trees" or tall shrubs are evergreen.

i) *Cercocarpus ledifolius* is dominant to co-dominant in the shrub or tree layer as tall shrubs or small trees. Other shrubs may include various subspecies of *Artemisia tridentata*, *Symphoricarpos rotundifolius*, *Prunus virginiana*, *Ribes velutinum* and/or *Purshia tridentata*. *Juniperus occidentalis* and *Pinus ponderosa* may be present in the tree layer but not at high enough cover to key to those alliances.

***Cercocarpus ledifolius* Alliance (1321)**

II. SHRUBLAND

1) Upland stands dominated by dwarf shrubs including *Artemisia arbuscula* and *Eriogonum* spp. (<0.5 m in height)

Great Basin - Intermountain Dwarf Shrub Steppe Group (2520)

a) Upland subshrub stands dominated or co-dominated by a species of *Eriogonum,* often mixed with annual or perennial grasses and herbs. Species of *Artemisia* or other shrubs sub-dominant.

***Eriogonum sphaerocephalum* / *Poa secunda* Alliance (2517)**

b) Upland shrub stands characterized by the low subshrub *Artemisia arbuscula* (generally <0.5 m tall).

i) *Artemisia arbuscula* is strongly dominant in the shrub layer. Taller shrubs of *Purshia tridentata, Artemisia tridentata, Ericameria* spp., and *Chrysothamnus* spp. may be sub-dominants.

***Artemisia arbuscula* ssp. *arbuscula* Alliance (2521)**

2) Upland shrublands dominated by shrubs generally >0.5 m including *Artemisia tridentata* (ssp. *tridentata* or *vaseyana*) and *Purshia tridentata*.

Intermountain Big Sagebrush Steppe & Shrubland Group (2510)

a) *Artemisia tridentata* ssp. *tridentata* is dominant or co-dominant in the shrub layer. If *Purshia tridentata* is present it is less than 50% relative cover.

i) *Artemisia tridentata* ssp. *tridentata* is dominant in the shrub layer. If *Purshia tridentata* is present it has <50% relative cover. Generally found in less moist conditions than *Artemisia tridentata* ssp. *vaseyana.*

***Artemisia tridentata* Alliance[4] (2511)**

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[4] 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, and *Artemisia tridentata* – Mixed Shrub Dry Steppe & Shrubland Alliance.** We are currently recognizing only *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) Alliance and a more broadly defined *Artemisia tridentata* Alliance as was done in the second edition of *A Manual of California Vegetation* (Sawyer et al. 2009).

(1) *Artemisia tridentata* ssp. *tridentata* is dominant to strongly dominant. The herb layer is sparse to moderately dense with high relative cover of native herbs. Stands are on lower slope to bottom with heavy soils.

Artemisia tridentata Shrubland Association (2512)

(2) *Artemisia tridentata* ssp. *tridentata* dominates the shrub layer with or without *Ericameria* as a sub-dominant. Shrub cover is typically <10% absolute cover 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. Herb layer is characterized by high non-native grass cover and very low nativity.

***Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association (2514)**

b) *Purshia tridentata* may be dominant or co-dominant; or a subspecies of *Artemisia tridentata* and/or *Symphoricarpos rotundifolius* are dominant in the shrub layer, while *Purshia* is absent or of insignificant cover.

i) *Artemisia tridentata* ssp. *vaseyana* dominant or co-dominant. If *Purshia tridentata* is present, it is sub-dominant to co-dominant. Generally found at higher elevations and moister conditions than *Artemisia tridentata* ssp. *tridentata.* Found 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 (2522)**

(1) *Artemisia tridentata* ssp. *vaseyana* and *Symphoricarpos rotundifolius* (ecologically equivalent to *S. oreophilus*) are present and, together, dominate the shrub layer with either one having dominance.

Artemisia tridentata ssp. *vaseyana – Symphoricarpos oreophilus* / *Bromus carinatus* Association (2523)

ii) *Purshia tridentata* has at least 50% relative cover. *Artemisia tridentata* may not always be present. *Pinus monophylla* may be present in the overstory at low cover. If stands are disturbed by clearing or fire, *Purshia tridentata* may consist of small resprouts and have relatively low cover.

***Purshia tridentata – Artemisia tridentata* Alliance (2513)**

(1) *Purshia tridentata* is dominant to co-dominant in the shrub layer with *Artemisia tridentata* ssp*. tridentata*. *Artemisia tridentata* does not need to be present.

Purshia tridentata – Artemisia tridentata Association (2516)

(2) Similar to the association above but with recent disturbance, such as fire. *Tetradymia canescens* does not need to be present. Herb layer is strongly dominated by non-native annual grasses.

Purshia tridentata – Artemisia tridentata – Tetradymia canescens Association (2515)

3) Stands of upland or wetland (riparian, basins, etc.) shrubs without conspicuous presence or dominance of the genus *Artemisia*.

a) Upland shrub stands.

i) Stands are composed of shrubs with evergreen, stiff, or thickened leaves.

(1) *Ceanothus velutinus* is dominant to co-dominant in the shrub layer. Co-dominants may include *Prunus emarginata, Arctostaphylos nevadensis,* and *Artemisia tridentata*. Typically found on moderately steep (>10 degrees), north-facing slopes. Evidence of fire is common (locally after fires, *C. velutinus* germinates from seed bank within stands of conifers or *Cercocarpus*).

***Ceanothus velutinus* Alliance (2012)**

(2) *Ceanothus velutinus* is dominant to co-dominant in the shrub layer with *Prunus emarginata, Arctostaphylos nevadensis*, *Ericameria nauseosa*, or *Symphoricarpos rotundifolius*.

Ceanothus velutinus Shrubland Association (2015)

(3) *Cercocarpus ledifolius* is dominant to co-dominant in the shrub or tree layer as tall shrubs or small trees. Other shrubs may include various subspecies of *Artemisia tridentata, Symphoricarpos rotundifolius, Prunus virginiana, Ribes velutinum,* and/or *Purshia tridentata*. *Juniperus occidentalis* and *Pinus ponderosa* may be present in the tree layer but not at high enough cover to key to those alliances.

***Cercocarpus ledifolius* Alliance (1321)**

ii) Dominant or characteristic shrubs are soft-leaved members of the genus *Ericameria*.

(1) *Ericameria nauseosa* is dominant to co-dominant in the shrub layer with *Artemisia arbuscula*.

***Ericameria nauseosa* Alliance (2531)**

(a) The understory herb layer is characteristically sparse (<10%) and has a decent native component.

Ericameria nauseosa Shrubland Association (2532)

(b) Evidence of disturbance from fire, grazing, or other clearing. Typically, low diversity herbaceous layer dominated by non-native annual herbs.

Ericameria nauseosa / Bromus tectorum Association (2533)

iii) Dominant or characteristic shrubs are winter-deciduous members of the genus *Prunus* or *Holodiscus*.

(1) *Holodiscus discolor* and/or *Prunus emarginata* dominate in the shrub layer. *Symphoricarpos rotundifolius*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, and *Artemisia tridentata* may be present as co-dominants or sub-dominants.

***Prunus emarginata – Holodiscus discolor* Alliance (2013)**

(a) *Prunus emarginata* is dominant in the shrub layer. *Holodiscus discolor* is absent.

Prunus emarginata Association (2014)

b) Wetland shrub stands.

i) 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. *Salix lasiolepis* may be co-dominant. Other shrubs may include *Rosa woodsii* and *Ribes cereum*.

***Salix exigua* Alliance (2702)**

(a) Mesic herbs such as *Scirpus microcarpus, Phleum pretense, Muhlenbergia richardsonis*, or *Eleocharis macrostachya* characterize the herb layer.

Salix exigua / Mesic Forbs Shrubland Association (2703)

(2) *Salix lasiolepis* is strongly dominant in the shrub layer. If *Salix exigua* is present, it is sub-dominant.

***Salix lasiolepis* Alliance (2715)**

ii) Wetland shrub stands with *Rosa woodsii* or *Shepherdia argentea* dominant. Mapped polygons where *Salix lasiolepis*, *Rosa woodsii*, or *Shepherdia argentea* cannot be separated may be mapped to

Western Montane - Subalpine Riparian and Seep Shrubland Group (2710)

(1) *Rosa woodsii* is dominant in the shrub layer. A variety of wetland species can be found in the herb layer including *Carex simulata*, *Artemisia douglasiana*, *Scirpus microcarpus*, and *Achillea millefolium*.

***Rosa woodsii* Wet Shrubland Association (2712)**

of the *Cornus sericea – Dasiphora fruticosa* ssp. *floribunda – Ribes* spp. Wet Shrubland Alliance

(2) *Shepherdia argentea* is dominant or co-dominant in the shrub canopy.

***Shepherdia argentea* Special Stands (2716)**

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 characterized by native perennial grasses such as *Elymus spicatus* (*Pseudoroegneria spicata*), *Elymus elymoides*, *Poa secunda*, or *Festuca idahoensis*.
      Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group (3710)

      i) Stands dominated by *Festuca idahoensis*, *Elymus spicatus*, and/or *Poa secunda*, without significant cover of *Elymus smithii*. Expected, but not surveyed in the study area.
         ***Festuca idahoensis – Elymus spicatus – Poa secunda* Alliance (3711)**

   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 *Pinus monophylla* (evidence of charred stems or snags often found nearby). Stands with high cover of *Elymus elymoides* without any other diagnostic species are also included in this group.
         Intermountain Ruderal Steppe and Shrubland Group (3850)

         (1) Stand with >60% relative cover of non-native annual upland herbs and grasses, locally including *Bromus tectorum*. *Elymus elymoides* may dominate or co-dominate although no other 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 (3851)**

            (a) *Bromus tectorum* is strongly dominant to co-dominant in the herb layer without *Elymus caput-medusae*. *Elymus elymoides* may be strongly dominant in areas with juniper removal.
               Bromus tectorum Association (3852)

      ii) Stands of moist or upland lower slopes locally associated with irrigated (or formerly irrigated) and maintained pastures.
         (1) Stands dominated by non-native perennial bunchgrass, *Agropyron cristatum*. Intentionally seeded stands following fire or on disturbed lands adjacent to upland shrublands, not usually on wetland or moist meadow sites.
            ***Agropyron cristatum* Alliance (3871)**

         (2) Stands dominated by larger non-native perennial pasture grasses (including *Phalaris arundinacea*, *Phleum pratense*, *Poa pratensis*, *Agrostis gigantea*), or by

weedy annual or perennial non-native herbs such as *Lactuca* spp., *Sisymbrium* spp., and *Lepidium* spp.

Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (3860)

(a) *Phalaris arundinacea* or *Thinopyrum intermedium* (intermediate wheatgrass) dominate the herbaceous layer.

***Phalaris aquatica – Phalaris arundinacea* Ruderal Marsh Alliance (3863**)
***Thinopyrum intermedium* Mapping Unit (3864)**

(3) Stands dominated by *Agrostis gigantea, A. stolonifera, Festuca arundinacea*, or *Poa pratensis.*

***Poa pratensis – Agrostis gigantea – Agrostis stolonifera* Ruderal Marsh Alliance (3861)**
***Festuca arundinacea* Ruderal Association (3862)**

(4) Stands dominated by non-native annual and biennial herbs such as *Conium maculatum*, *Lepidium* spp., *Sisymbrium* spp., *Sonchus* spp., and *Lactuca* spp.

Californian Ruderal Grassland, Meadow & Scrub Group (3800)
***Conium maculatum – Foeniculum vulgare* Alliance (3801)**

c) Native 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 look dry, but have evidence of water flow or ponding.

i) Stands composed largely of short to tall perennial grasses associated with alkaline and/or heavy soils of large basins, playas, or flats.

North American Desert Alkaline-Saline Marsh & Playa Group (3110)

(1) Stands characterized by saltgrass, *Distichlis spicata*. If *Juncus balticus* co-dominates then key here.

***Distichlis spicata* Alliance (3111)**

ii) Grassland stands of relatively heavy soils (including clay mounds), not always in obvious alkaline basins, but often moist in early summer. *Leymus triticoides* or *E. cinereus* are obvious and consistent throughout the stand and are dominant to sub-dominant in the herbaceous layer. Stands are on lower slopes, often conspicuous following fires.

***Leymus cinereus – Leymus triticoides* Alliance (3113)**

(1) *Leymus triticoides* and/or *Poa secunda* are dominant to co-dominant with each other. *Poa secunda* may be absent.

Leymus triticoides – Poa secunda Wet Meadow Association (3114)

d) Stands of persistent freshwater 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. Stands typical of slightly alkaline western interior seasonal wetlands such as *Muhlenbergia* spp., *Carex douglasii*, and the moist meadow ecotype of *Poa secunda* (var. *juncifolia*).

Muhlenbergia richardsonis – Carex douglasii **Moist Meadow Alliance (2732)**

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 (2730)

(1) 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* (*balticus*, *mexicanus*, *arcticus*) is dominant to co-dominant with *Trifolium hybridum*, *Poa pratensis*, and other wetland herbs. If co-dominant with *Distichlis spicata* then key to *Distichlis spicata* Alliance.

Juncus arcticus (**var*****. balticus, mexicanus)*** **Alliance (2738)**

Juncus balticus Association (2741)

(2) Stands dominated by wet meadow sedges.

(a) *Carex aquatilis* and/or *Carex lenticularis* dominate the herb layer.

Carex (aquatilis, lenticularis) **Alliance (2731)**

(b) *Carex nebrascensis* is present and conspicuous and is evenly distributed. Stands may be dominated by other meadow species including *Carex pellita*.

Carex nebrascensis Association (2742)

Carex pellita Association (2743)

of the ***Carex nebrascensis - Carex vesicaria - Carex pellita*** **Wet meadow Alliance (2735)**

iii) 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 (3600)

(a) Wetlands (ponds, ditches, lake margins) dominated by *Typha* spp.

Typha (angustifolia, domingensis, latifolia) **Alliance (3604)**

(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 (4000)

IV. SPARSE VEGETATION AND DEVELOPMENT

1) Areas with little or no vegetation cover, resulting from human-related clearing or paving, including the larger roads. Vegetation is <10% cover, or if present, is not evenly or naturally distributed across the polygon. A small area of herbaceous vegetation that is adjacent to a larger cleared area may be included in a polygon mapped as this type.

Developed Mapping Unit (9800)

2) A stream wider than 10 m, pond, reservoir, or lake meeting MMU requirements for riparian/wetland stands.

Open water (9820)

3) Non-rocky areas of bare ground.

Bare ground (9830)

4) Stand is an area dominated by bedrock or other rocky substrate with less than 4% shrub cover, less than 3% tree cover, and less than 2% herbaceous cover.

Rock outcrop (9831)

TERMS AND CONCEPTS USED THROUGHOUT THE KEY

Stand: The basic physical unit of plant communities in a landscape. It has no set size. Some vegetation stands are very small, such as certain wetland types, and some may be several square kilometers in size, such as certain forest types. A stand is defined by two main unifying characteristics:

1. It has compositional integrity. Throughout the stand, the combination of species is similar. The stand is differentiated from adjacent stands by a discernible boundary that may be abrupt or occur indistinctly along an ecological gradient.

2. It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes but not the lower would be divided into two stands. Likewise, a sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The compositional and structural features of a stand are often combined into a term called homogeneity. For an area to meet the definition of a stand, it must be homogeneous at the scale being considered.

United States National Vegetation Classification (USNVC): A central organizing framework for how all vegetation in the United States is inventoried and studied, from broad scale formations (biomes) to fine-scale plant communities. The purpose of the NVC is to produce uniform statistics about vegetation resources across the nation, based on vegetation data gathered at local, regional, or national levels.

The hierarchy units in the USNVC from highest to lowest (i.e., broadest to finest) are:

1. Formation Class
    2. Formation Subclass
        3. Formation
            4. Division
                5. Macrogroup
                    6. Group
                        7. Alliance
                            8. Association

Alliance: Plant communities based on dominant/diagnostic species of the uppermost or dominant stratum. Accepted alliances are part of the USNVC hierarchy. For the Slinkard Vegetation Map, map classes for trees and shrubs are typically at the alliance level of the USNVC hierarchy. Herbaceous stands are mapped at a higher level of the hierarchy.

Association: The most botanically detailed or finest-scale plant community designation based on dominant species and multiple co-dominant or sub-dominant indicator species from any stratum. Associations are also part of the USNVC hierarchy.

Plant community nomenclature: Species separated by "–" are within the same stratum; species separated by "/" are in different strata.

Cover: The primary metric used to quantify the importance/abundance of a particular species or a particular vegetation layer within a stand. It is 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*, *Prunus emarginata*) should be sampled during leaf-on since they will have substantially less cover when leaves are absent and may key to another type.

Absolute cover: The actual percentage of the surface area of the survey that is covered by a species or physiognomic group (trees, shrubs, herbaceous), as in "aspen covers 10% of the area being surveyed." Absolute cover of all species or physiognomic groups, when added together, may total greater than 100%, because this is not a proportional number and plants can overlap with each other. For example, a stand could have 25% tree cover in the upper layer, 40% shrub cover in the middle layer, and 50% herbaceous cover when surveyed on the ground. However, when aerial interpretation is being used, the maximum absolute value is 100%, since lower levels of vegetation cannot be seen through the overstory on aerial photographs.

Relative cover: The percentage of surface area within a survey area that is covered either by one species relative to other species within the same physiognomic stratum (tree, shrub, herbaceous) or one stratum relative to the total vegetation cover in a polygon. Thus, 50% relative cover of *Populus tremuloides* in the tree layer means that *P. tremuloides* comprises half the cover of all tree species within a stand, while 50% relative shrub cover means that shrubs make up half the cover of all vegetation within a stand. Relative cover values are proportional numbers that, when added together, total 100% for all the species within a stratum or each stratum within a stand of vegetation.

Dominance: Dominance refers to the preponderance of vegetation cover in a stand of uniform composition and site history. It may refer to cover of an individual species as in "dominated by aspen," or it may refer to dominance by a physiognomic group, as in "dominated by shrubs." When we use the term in the key, a species is dominant if it is in relatively high cover in each stand. See "dominance by layer," below, for further explanation.

Strongly dominant: A species in the dominant lifeform stratum has 60% or greater relative cover.

Co-dominant: Co-dominance refers to two or more species in a stand with similar cover. Specifically, each species has between 30% and 60% relative cover. For example, in a coastal scrub stand with 5% *Baccharis pilularis*, 4% *Frangula californica*, and 3% *Rubus ursinus* (total 13% shrub cover), technically only the *Baccharis* (5/13 = 39% relative cover) and the *Frangula* (4/13 = 31% relative cover) would be co-dominant because *Rubus* would only have 23% relative cover (3/13 = 23%).

Characteristic/Diagnostic species: Should be present in at least 80% of the stands of the type, with no restriction on cover. Relatively even spacing throughout the stand is important, particularly in vegetation with low total cover, since an even distribution of the diagnostic species is a much better indicator than overall cover. Characteristic species that are evenly distributed are better indicators of a type than species with higher cover and patchy distribution.

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.

Tree: A one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multi-stemmed (ramified due to fire or other disturbance), but the height of mature plants typically exceeds 5 meters. If less than 5 meters tall, undisturbed individuals of these species are usually single-stemmed. Certain species that sometimes resemble shrubs but may be trees in other areas (e.g., *Aesculus californica*) are, out of statewide tradition or by the USNVC, called trees. It behooves one to memorize which species are "traditionally" placed in one life-form or another. We use the accepted lifeforms in the USNVC or the PLANTS Database (USDA NRCS 2015) to do this.

Forest: In the USNVC, a forest is defined as a tree-dominated stand of vegetation with 60% or greater absolute cover of trees. Most forest alliances tend to have average cover of trees >60%, but individual stands under certain conditions may drop lower than 60%.

Woodland: In the USNVC, a woodland is defined as a tree-dominated stand of vegetation with between 25% and 60% absolute cover of trees. Most woodland alliances tend to have average cover of trees with 25-60%, but individual stands under certain conditions may drop higher or lower than this range.

Emergent: A plant (or vegetation layer) is considered emergent if it has low cover and rises above a layer with more cover in the stand. For example, individual *Pseudotsuga menziesii* trees may comprise an emergent tree layer of 2% cover over dense *Gaultheria shallon* and *Rubus parviflorus* in the shrub understory; the stand would be considered within the *Gaultheria shallon – Rubus (ursinus)* Shrubland Alliance because the total tree cover is <10% and the shrub cover is >10%. Medium to tall shrubs are not considered emergent over shorter shrubs, but short trees are considered emergent over tall shrubs.

Shrub: A multi-stemmed woody plant that is usually 0.2-5 meters tall. Definitions are blurred at the low and high ends of the height scales. At the tall end, shrubs may approach tree-size based on disturbance frequencies (e.g., old-growth re-sprouting chaparral species such as *Cercocarpus montanus*, *Fremontodendron californicum*, *Prunus ilicifolia*, and so forth, may frequently attain "tree size", but are still typically multi-stemmed and are considered shrubs in this key). At the short end, woody perennial herbs or sub-shrubs of various species are often difficult to categorize into a consistent life-form (e.g., *Eriogonum latifolium*, *Lupinus chamissonis*); in such instances, we refer to the PLANTS Database or “pick a lane” based on best available definitions.

Sub-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.

Shrub-characterized vegetation: Shrubs, including sub-shrubs, are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component; the stand cannot be characterized as a tree stand; 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.

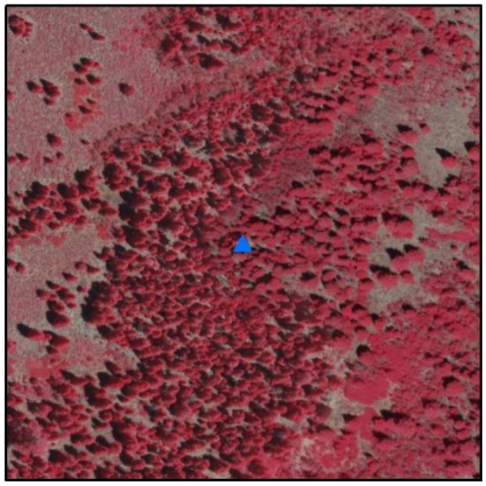
Herbaceous plant: Any species of plant that has no main woody stem development; includes grasses, forbs, and perennial species that die back each year.

Herb-characterized vegetation: Herbs are evenly distributed throughout the stand, providing a consistent (even if sparse) structural component and playing an important role in ecological processes within the stand. The stand cannot be characterized as a tree or shrub stand.

APPENDIX G: EXAMPLES OF VEGETATION MAP SIGNATURES

Below are examples of mapped vegetation types as shown on 2016 true color National Agricultural Imagery Program (NAIP) and 2014 color infrared (CIR) imagery, with notes on identification.

1001 *Abies concolor* Alliance

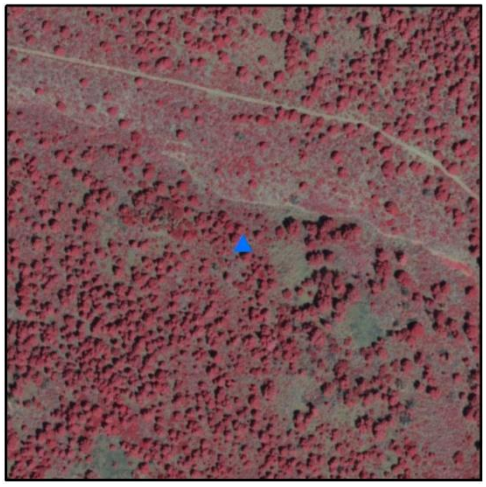


Red fir requires snowpack to make it through the dry summer. In Slinkard and Little Antelope Valleys, this type is only seen at higher elevations (~7000 ft and up).

1101 *Pinus jeffreyi* Alliance

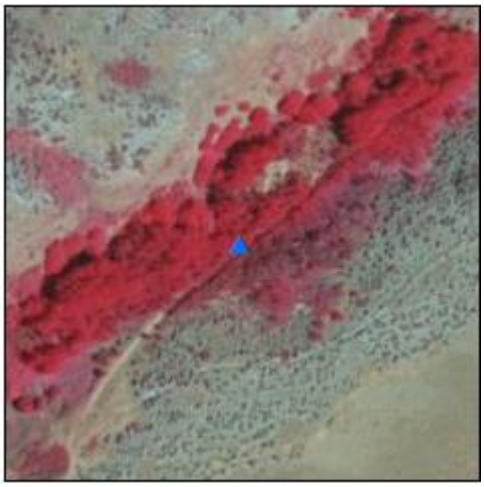
The *Pinus jeffreyi* are the larger bright green trees in the true color imagery with a rounded shadow (rather than pointy like *Abies concolor* or *Juniperus grandis*).

1313 *Pinus monophylla / Artemisia tridentata / Elymus elymoides* Association



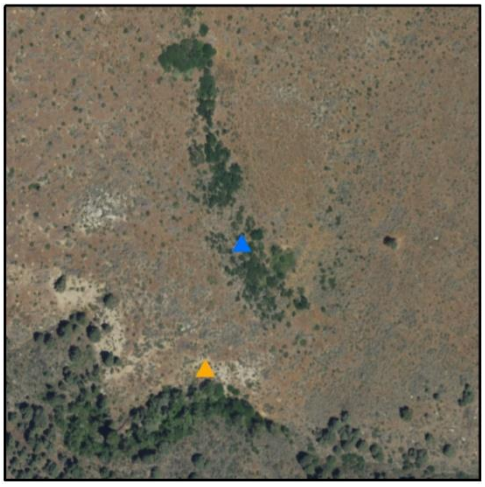
Pinus monophylla are short (~15 ft), rounded conifers with a gray-green signature in the true color imagery. Understory shrub cover can be variable in this association.

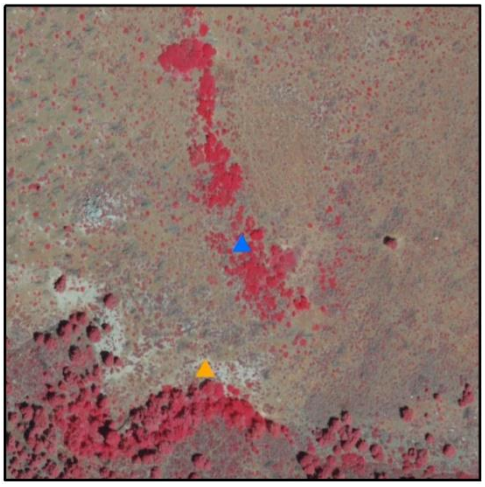
1701 *Populus tremuloides* Alliance



Populus tremuloides has a smooth green signature on the true color imagery. The height of these stands is variable, and they can also have significant conifer cover (up to 60% relative cover) which can make the *P. tremuloides* more difficult to identify.

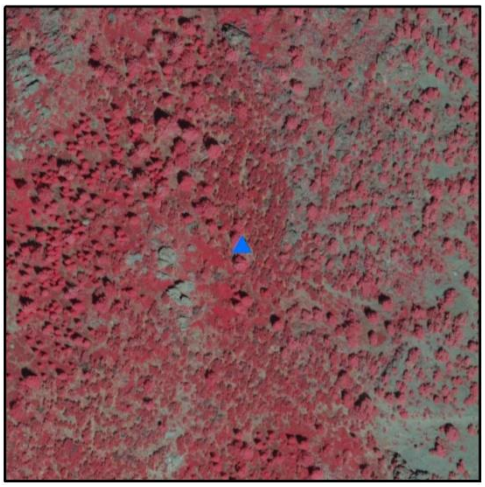
1601 *Populus trichocarpa* Alliance





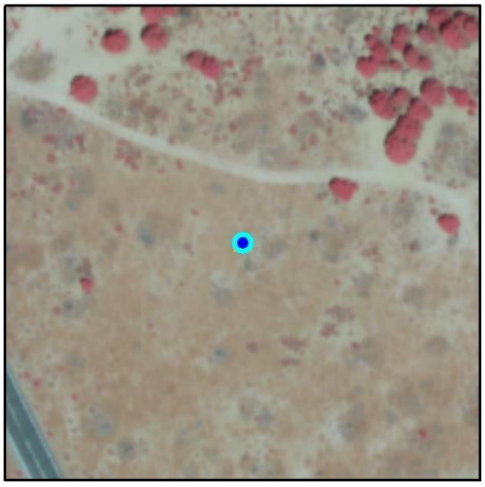
The orange and blue points are both in *Populus trichocarpa* stands, just with different heights and levels of dominance. The blue point is in a stand of resprouting *P. trichocarpa* and the orange point is at the edge of a more mature stand. This is an uncommon type within the study area and the signature can be confused with that of *P. tremuloides,* although *P. trichocarpa* tends to be darker green in the true color imagery.

1321 *Cercocarpus ledifolius* Alliance



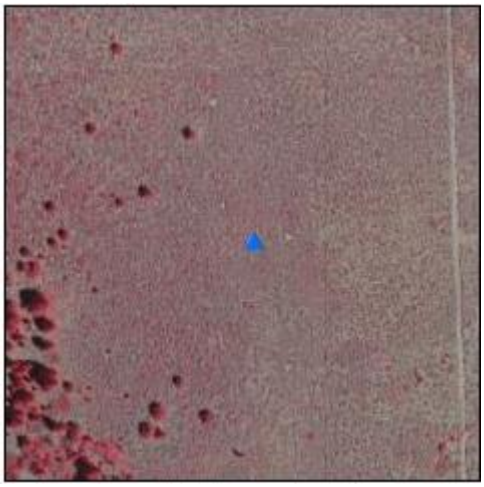
Cercocarpus ledifolius is the shorter, darker signature in the true color imagery. In this stand there are some emergent *Pinus monophylla* scattered throughout, which is typical. In this study area, stands tend to be small and are found on steep slopes and at higher elevations. *C. ledifolius* is fire sensitive and requires somewhat more moist conditions in comparison to the other dominant upland shrubs in the area.

2517 *Eriogonum sphaerocephalum* / *Poa secunda* Alliance

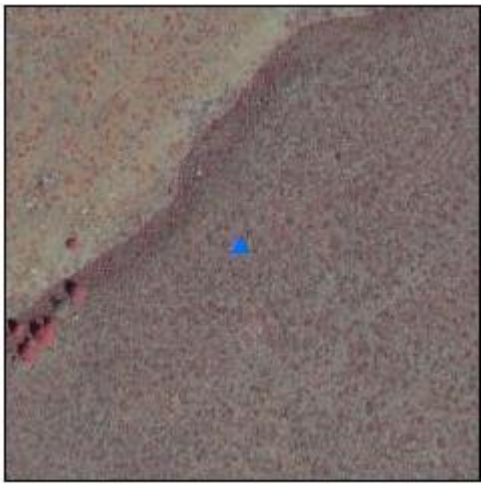
This alliance is not common within the study area and is difficult to decern from the imagery. It was sampled and mapped once although it likely does repeat in small patches (below the minimum mapping unit size) on steep, rocky, south-facing slopes.

2511 *Artemisia tridentata* Alliance

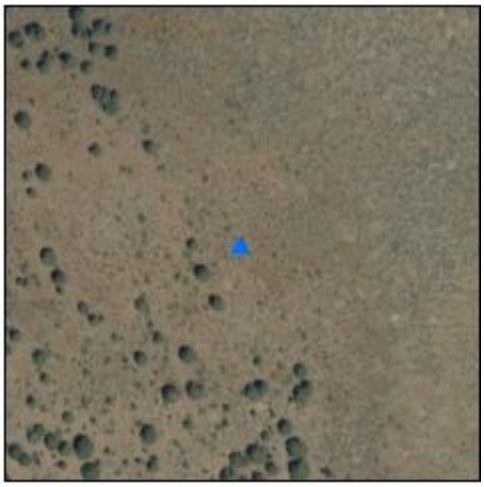
Artemisia tridentata is one of the most abundant alliances found in the study area. It has a grey-green, bumpy to smooth texture in the true color imagery and is a light pink in the CIR imagery. At times, especially in areas that have burned, the signature for this shrub can blend in with the herb layer and can be difficult to identify. However, where it dominates (as opposed to co-dominating with *Purshia tridentata*) it is quite easy to photo interpret.

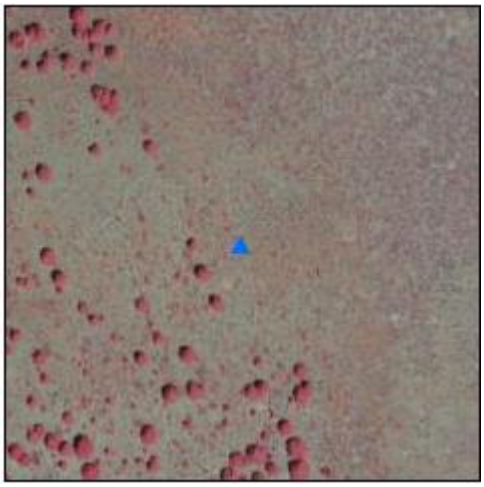
2513 *Purshia tridentata – Artemisia tridentata* Alliance



The *Purshia tridentata – Artemisia tridentata* Alliance is one of the most abundant alliances found in the study area (along with the *Artemisia tridentata* Alliance). It creates vast stands that can cover many acres and its photo signature is variable depending on its site history. The stand above, indicated by the blue point, shows a dense, relatively mature stand of this vegetation type. The *Purshia tridentata* is dark green and the *Artemisia tridentata* is grey-green and less obvious in the true color imagery. The image above also shows a recently burned version of this vegetation type (upper NW corner of the image) where the shrub density is much lower and the *A. tridentata* is even less conspicuous.

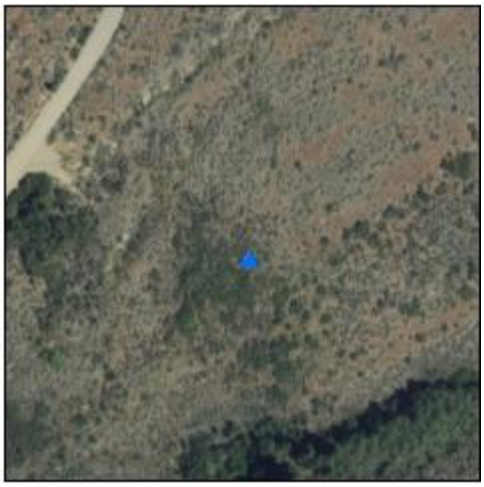
2522 *Artemisia tridentata* ssp. *vaseyana* Alliance

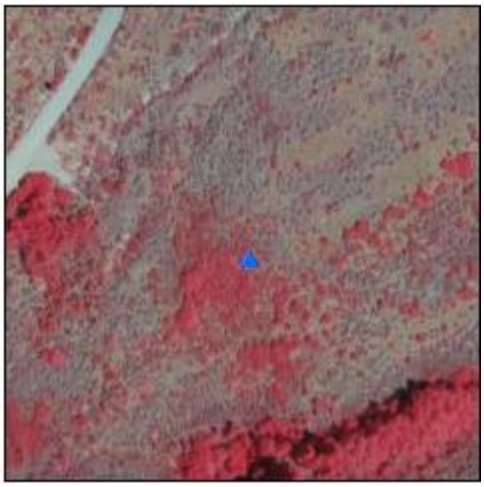




This alliance was surveyed around and between conifer stands at the higher elevations within the study area and tends to have *Symphoricarpos* sp. and other higher elevation shrubs co-occurring. The signature looks exactly like that of the *Artemisia tridentata* Alliance, so elevation and survey data were used to map this type.

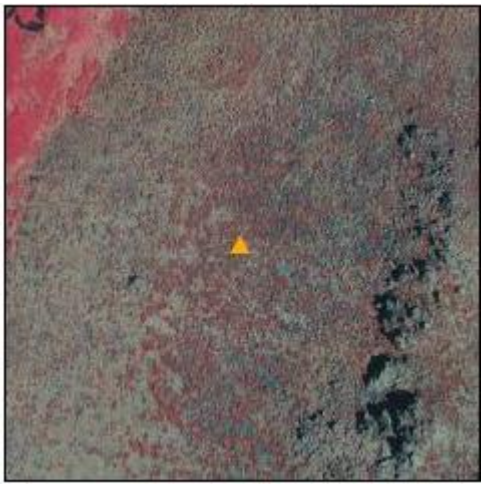
2013 *Prunus emarginata – Holodiscus discolor* Alliance





Prunus emarginata has a dark green signature in the true color imagery and can appear very smooth and short if recently burned.

2012 *Ceanothus velutinus* Alliance

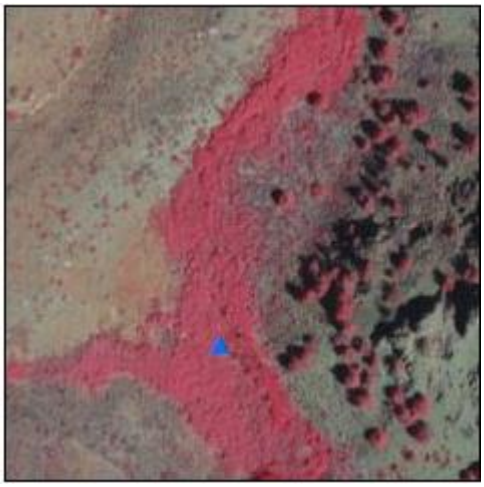


Ceanothus velutinus has a dark, olive-green photo signature in the true color imagery and an orangey-red signature in the CIR. It is found in areas that have burned relatively recently.

2700 Western North American Montane - Subalpine - Boreal Marsh, Wet Meadow & Shrubland Macrogroup

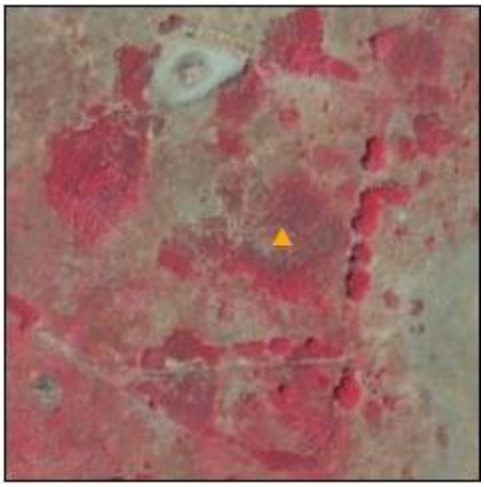
This mapping unit is used when the stand appears to be a mixture of more than one alliance or association in this Macrogroup.

2702 *Salix exigua* Alliance



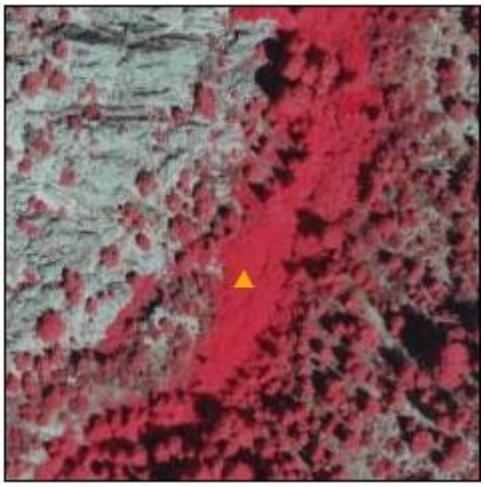
Salix exigua is found in riparian settings and has a smooth, grey-green signature on the true color imagery and is a dusky pink in the CIR. It often intermixes with *Salix lasiolepis* Alliance and can be confused with stands of pure *Shepherdia argentea* (which was rare in the study area).

2712 *Rosa woodsii* Wet Shrubland Association



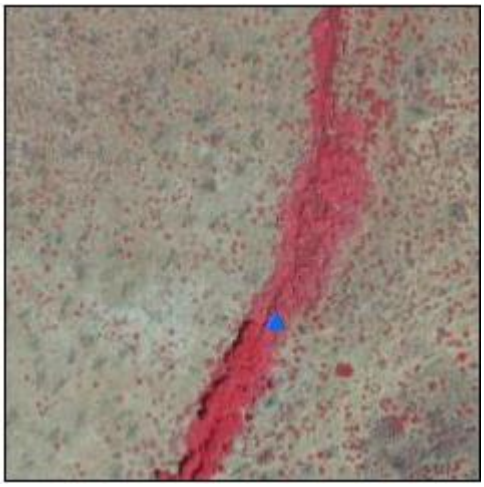
The *Rosa woodsii* Association is found in moist or riparian settings. It has a green to grey-green signature (that can sometimes be mistaken for *Salix exigua*) in the true color imagery and can appear smooth to speckled depending on density. It has a dark pink to dark red signature in the CIR imagery. This is a common type in Little Antelope meadow. Stands of *Rosa woodsia* are often surrounded by moist meadow graminoids.

2715 *Salix lasiolepis* Alliance



Salix lasiolepis is found in riparian settings. It has a dark green signature in the true color imagery and a bright pink to red signature in the CIR. In the example above the *S. lasiolepis* cover is very high and the texture looks smooth and continuous, but where the cover is lower you can often see mounded clumps of individual shrubs. *S. lasiolepis* and *S. exigua* can co-occur in the streams and ditches in Slinkard and Little Antelope Valleys. Polygons of pure stands of each that meet the MMU were delineated when possible; where they co-dominated, they were keyed to the S. *lasiolepis* Alliance.

2716 *Shepherdia argentea* Special Stands



Stands of *Shepherdia argentea* in the study area are very rare and small; they are found in riparian settings. The color is very similar to that of *Salix exigua* and could easily be mistaken for it, but *Shepherdia argentea* has more texture in its photo signature and is taller than *Salix exigua*. In the example above (north of the blue point) the *S. argentea* is co-dominating with *Rosa woodsii*.

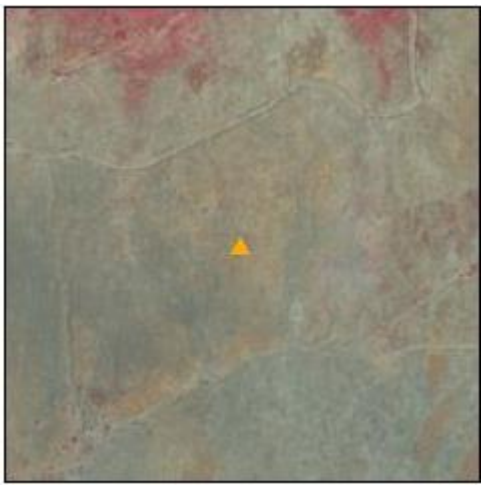
3800 Californian Ruderal Grassland, Meadow & Scrub Group

This mapping unit is used when the stand appears to be a mixture of more than one alliance or association in this Group.

3801 *Conium maculatum – Foeniculum vulgare* Alliance

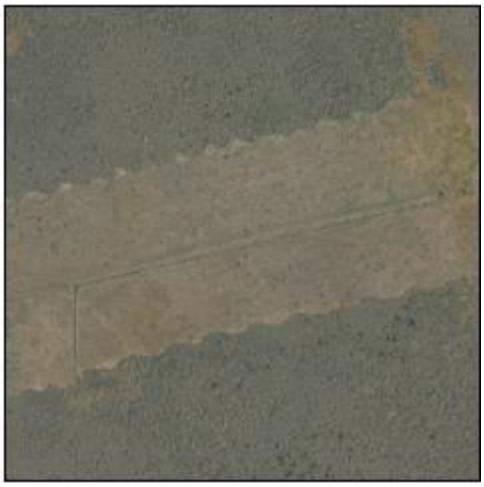

This *Conium maculatum* stand shows two versions of the signature; the higher and drier signature along the N/S ditch that is yellow or tawny colored and the lower lying and wetter signature that is speckled dark green. This is a disturbance-related vegetation type and found mostly in the grazing, irrigated area in Antelope Valley.

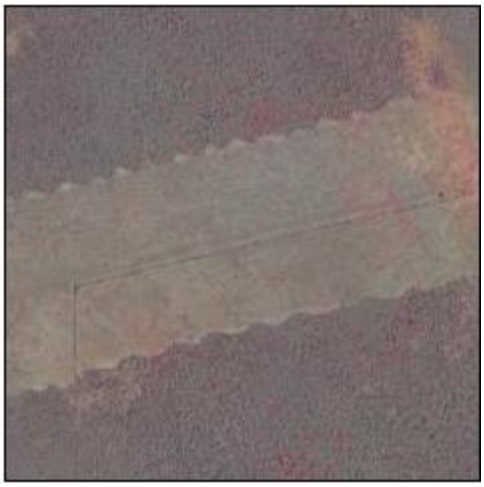
3851 *Bromus tectorum – Elymus caput-medusae* Alliance

Stands mapped at this alliance in this study area are all dominated by *Bromus tectorum* (*Elymus caput-medusae* does not occur within this study area). *B. tectorum* has a very light to yellowish signature in the CIR imagery and a tawny or light tan color in the true color imagery.

3871 *Agropyron cristatum* Alliance



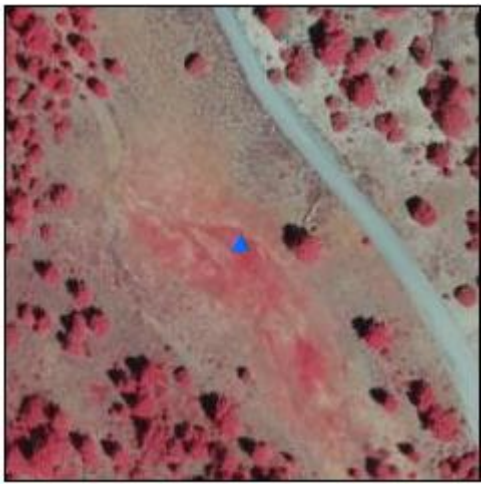


Agropyron cristatum is found in abundance in Slinkard Valley along the roads in the old firebreaks and appears to be spreading into adjacent shrubby stands as a component of the understory herbaceous layer. As the shrubs recover within the firebreaks, this alliance will be replaced by one dominated by shrub species, though *Agropyron cistatum* will likely remain as a component in the herbaceous layer.

2730 Vancouverian - Rocky Mountain Montane Wet Meadow & Marsh Group

This mapping unit is used when the stand appears to be a mixture of more than one alliance or association in this Group.

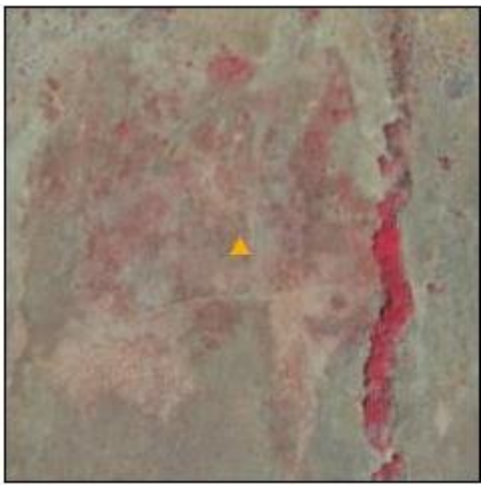
2735 *Carex nebrascensis* Association



Small stands of *Carex nebrascensis* Association are found adjacent to streams and in the wettest parts of meadows, as indicated by the bright green signature in the true color imagery. However, this signature is very similar to other moisture-loving meadow species and can be very difficult to differentiate. For this

reason, this type was not mapped to the association level unless there was a field survey for it. Otherwise, the meadow complex was mapped at the group or macrogroup level.

2738 *Juncus arcticus* (var. *balticus, mexicanus*) Alliance

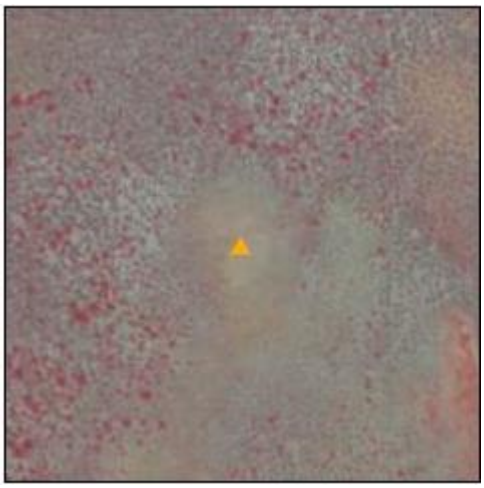
Stands of this type are the most abundant meadow alliance found within Slinkard and Little Antelope Valleys. It is highly variable in its moisture tolerance and therefore has a wide-ranging photo signature. The dryer sites are more likely to be co-dominating with annual grasses and have tan signature mixing with the dark olive green *Juncus arcticus* visible in the true color imagery (as in the example above). In the wettest sites, *Juncus arcticus* can be almost pure and have a dark reddish-brown photo signature. This type is harder to distinguish the dryer the site becomes.

3604 *Typha* (*angustifolia, domingensis, latifolia*) Alliance


One very small *Typha* stand was found in Little Antelope Valley adjacent to Mill Canyon Road running along an East-West running water-filled ditch. The photo signature for this particular stand is not very distinct and is similar to the *Artemisia tridentata* along the road. However, it is obviously taller than the

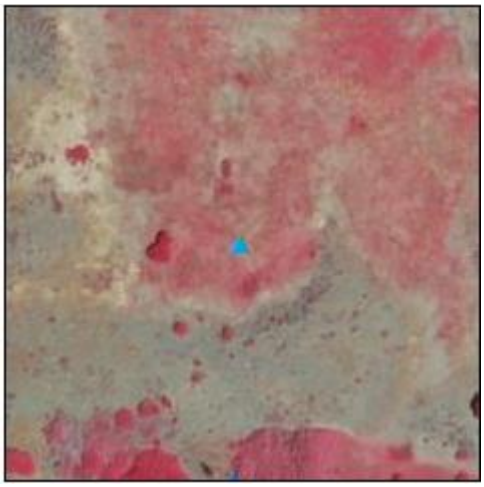
herbaceous vegetation and has a distinctly different color than the bright green *Rosa woodsii* that this stand mixes with at its edges.

3861 *Poa pratensis – Agrostis gigantea – Agrostis stolonifera* Ruderal Marsh Alliance



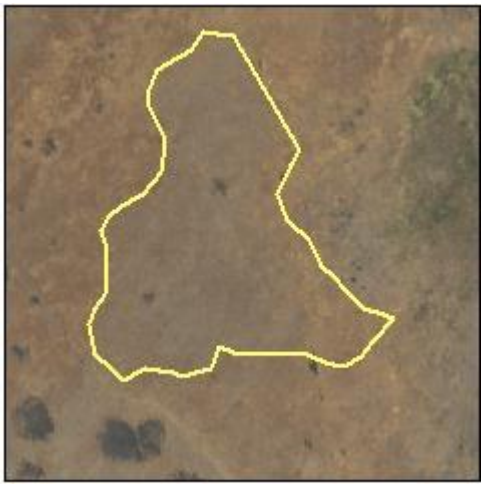
This is the only *Poa pratensis* stand sampled in the study area. This type is difficult to differentiate from other moist meadow herbaceous stands and overlaps in species composition with types that fit in the Vancouverian - Rocky Mountain Montane Wet Meadow & Marsh Group.

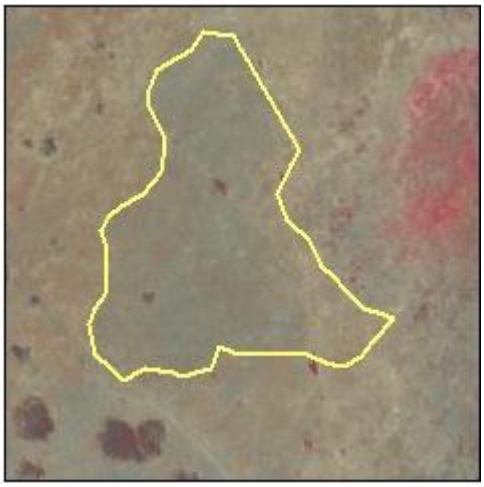
3862 *Festuca arundinacea* Ruderal Association



This is the only *Festuca arundinacea* stand sampled in the study area. This type is difficult to differentiate from other moist meadow herbaceous stands and overlaps in species composition with types that fit in the Vancouverian - Rocky Mountain Montane Wet Meadow & Marsh Group.

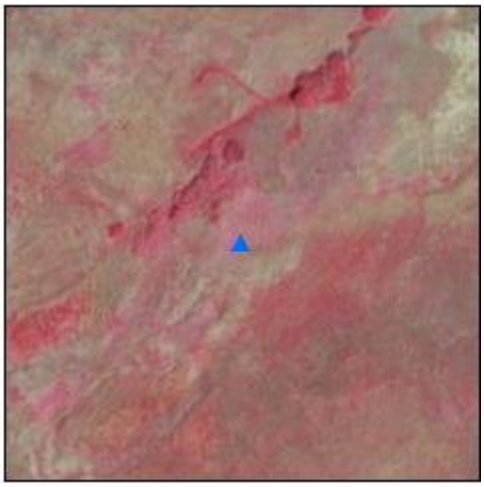
3864 *Thinopyrum intermedium* (*Elymus hispidus*) Mapping Unit





Thinopyrum intermedium is an introduced, moist-meadow species that is often planted to encourage waterfowl into an area. This type was found in several disturbed locations in Slinkard and Little Antelope Valleys, but it rarely forms stands within the study area. It has a grey-brown photo signature in the true color imagery.

3113 *Leymus cinereus – Leymus triticoides* Alliance



The small stand indicated by the blue triangle is dominated by *Leymus triticoides*. It has a light, bright green photo signature in the true color imagery that is smooth in texture. In the CIR imagery it is light pink in color. Most of the *L. triticoides* stands in the study area are small and/or patchy and tend to intermingle with other moist-meadow vegetation types, which can make it difficult to map.

APPENDIX H: ACCURACY ASSESSMENT FIELD FORM AND PROTOCOL

Recorder:	Other Surveyors:	Date:

Waypoint ID:

Polygon UID:

Location Name:

GPS Name _____ **Projected? Yes / No / Base / Digitized**

If Yes, enter: **Bearing (°):** _____ **Distance (m):** _____ **Inclination (°):** _____

If Yes or Digitized, enter: **Base Waypoint ID**: _____

Base UTMs / **Projected** UTMs (circle one) Record either UTMs or Decimal Degrees

UTME ____ ____ ____ ____ ____ ____ **UTMN** ____ ____ ____ ____ ____ ____ ____ **PDOP:** +/-

Decimal degrees: **LAT** __ __ . __ __ __ __ __ __ **LONG** __ __ __ . __ __ __ __ __ __

Strata	Species	% cover	C	Strata	Species	% cover	C

Notes:

Map Unit Name: Secondary:

Confidence in map unit ID: L M H Explain:

Describe above: Linework problems ☐ More than 1 vegetation type in this polygon ☐ Vegetation change since imagery taken ☐

Camera Name: Photo #s:

Conifer Cover: _____ Hardwood Cover: _____ Total Tree Cover: _____ Shrub Cover: _____

Herb Cover <2% 2-9% 10-40% > 40%

Tree Height <0.5m 0.5-1m 1-2m 2-5m 5-10m 10-15m 15-20m 20-35m 35-50m >50 m NA

Tree DBH <1" 1 - 6" >6-11" >11-24" > 24"

Exotics None or not visible 1 2 3 Not Applicable

Estimated area of identifiable vegetation viewed Rough % of polygon viewed from point _____ -OR- Radius (m) _____

Is this a "multiple" point assessment? NO YES if yes: _____ of ____ points for this polygon

This protocol describes accuracy assessment (AA) data collection procedures. The primary purpose of the AA fieldwork is to supply data to test the accuracy of a specific vegetation map. The information collected can also contribute additional data for the classification of vegetation communities. The primary sampling units are the vegetation polygons delineated by photo-interpreters in the creation of the vegetation map.

If an entire AA polygon cannot be fully investigated due to terrain, the extensive size of the polygon, or other reasons, as much of the polygon as can be evaluated should be assessed. The minimum percentage of the polygon that should be reviewed for the assessment is 20%.

Note that a delineated polygon may differ from the conventional definition of a stand of vegetation. A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some stands of vegetation are very small while some may be several square kilometers in size. A stand is defined by two main unifying characteristics:

1) 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 indistinct.

2) It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes, but not the lower, would be divided into two stands. Likewise, sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called homogeneity. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous.

A properly delineated polygon may contain more than one stand. One example is a stand that is below the minimum mapping unit (MMU); it cannot be mapped separately and will be absorbed into the surrounding vegetation type. Another example is vegetation that is difficult to identify accurately on photo imagery. Several similar-looking stands may be grouped into one polygon and assigned a vegetation type at a high level, such as Group.

Selecting a location to sample within a polygon (for subsamples only):

If assessing a large polygon, it may be difficult to summarize the species composition, cover, and structure of the entire area. We are also usually trying to capture the most information as efficiently as possible. Thus, we may be forced to select a representative portion to sample.

When taking a subsample, the main point to remember is to select an area that, in as many ways possible, is representative of that polygon. This means that you are not randomly selecting a sample location; on the contrary, you are actively using your own best judgment to find a representative example of the polygon.

Selecting an assessment site requires that you see enough of the polygon you are sampling to feel comfortable in choosing a representative sample location. If possible, take a brief walk through the polygon and figure out where the boundary lines are drawn. Look for variations in species composition and in stand structure. In the process, decide whether the polygon includes

more than one mappable vegetation type or if the stand boundaries don't seem to match up with the polygon delineation. **If more than one vegetation type is present, fill out an AA form for each type ONLY IF each type is mappable (i.e., it is large enough to meet MMU and can be delineated without creating unreasonably shaped polygons).** For the Slinkard / Little Antelope project, the MMU is 1 acre for upland and is generally 0.5 acre (but may be as low as 0.25 acre) for special stands such as small wetlands and riparian areas. The minimum width is 10 meters. Small variations in vegetation that are repeated throughout the polygon should be included in your subsample. Once you assess the variation within the polygon, attempt to find an area that captures the stand's species composition and structural condition to sample.

How to enter fields on the form:

Recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full names of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

Date: The date the AA point was sampled. Use the standard U.S. format of "month-day-year" or use letters to write out the month.

Waypoint ID: The Waypoint ID in this format: GPS device name + date (yymmdd) + time (hhmm). For example, for a survey taken on iPad "V" on March 27 at 1:45 in the afternoon, the Waypoint ID will be "V1803271345."

Note that the GPS point should be taken away from the edge of the polygon, and near the center of the subsample (if one is used).

Polygon UID: The unique identifier (UID) assigned to each polygon, displayed in the GPS data and on paper maps.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to the GPS unit.

Projected? Yes / No/ Base/ Digitized: Circle the appropriate option

Yes - The point is a projected, or offset point. The surveyors used a bearing, distance, and inclination to project the point into the polygon they are describing.

No - The surveyor is within the boundary of the polygon being assessed and the point is where the observer was standing for photographs. This location can also be used as a base location for an offset survey.

Base - Base point only. This is where a surveyor was standing when taking an offset survey to describe vegetation not at that point. No plant data or vegetation descriptions are associated with this location. However, cardinal photos taken at this point will be stored in a directory of this name.

Digitized – An offset point was created on the GPS unit without taking bearing and distance readings. This option should only be used when the imagery on the GPS unit is unique and unmistakable.

If Projected = Yes

Bearing (°): The compass bearing from the Base point to the Projected point.

Distance (m): The distance in meters from the Base point to the Projected point, determined by use of a range finder.

Inclination (°): The vertical offset from the Base point to the Projected point.

If Projected = Yes or Digitized

Base Waypoint ID: The location where the surveyor was standing when the information was collected. Cardinal photographs will be taken at this point and will be stored on the computer under this ID. Photographs of the stand vegetation will be taken from this point and will be stored on the computer under the Projected point's ID.

Base UTMs / Projected UTMs: If the point is projected or digitized, circle whether the UTM coordinates of the base point or the projected point have been recorded. These will generally be for the base point.

UTM coordinates: Easting (**UTME**) and Northing (**UTMN**) location coordinates using the Universal Transverse Mercator (UTM) grid. Record this information from a GPS unit.

PDOP: The accuracy of the GPS location, when taking the UTM field reading using positional dilution of precision (PDOP). It is typical for commercial GPS units to be accurate with a PDOP value of 1 to 5. The lower the error number, the more accurate the GPS reading.

Note: if your GPS device does not report accuracy in PDOP, cross this out and record the accuracy value and unit instead, e.g. "5m".

Decimal degrees: *Use this only if your GPS unit will not record UTM coordinates.* Latitude–Longitude reading in decimal degrees. Record the information from your GPS unit.

Species list and coverage

List up to twelve species that are dominant or that are characteristically consistent throughout the stand. These species may or may not be abundant, but they should be constant representatives in the survey. When different layers of vegetation occur in the stand, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum.

Strata:

T = Overstory tree. A woody perennial plant that has a single trunk.

A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1" dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6" dbh, then the re-sprouts would be recorded under the "Tree" stratum.

E = SEedling. A tree species clearly of a very young age that is <1" dbh or has not reached breast height. Applies only to trees propagating from seed; re-sprouts are not recorded here even if they meet the size requirements.

S = Shrub A perennial, woody plant that is multi-branched and doesn't die back to the ground every year.

H = Herb An annual or perennial that dies down to ground level every year.

N = Non-vascular Includes mosses, liverworts, hornworts, and algae.

Species: Use Jepson Manual nomenclature. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica* (*nigra*) if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

% cover: provide the % absolute aerial cover for each species listed. All species percent covers may total over 100% because of overlap.

C: If a species collection is made, it should be indicated with a "C" (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, add a "T" to the "C" in that column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [e.g *Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a "C" to the existing "C" (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a "D" to the existing "C" (CD = collected and deposited) and note the receiving herbarium.

Notes: Describe the stand age or seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors. Include recommendations for line-work revision, discernibility of the vegetation based on season and topography, problems with classification interpretation, homogeneity of vegetation, and unusual sightings of plants or animals.

Map Unit Name: Enter the vegetation type name here***.*** Refer to the Slinkard Wildlife Area Vegetation Key to select the type. If the vegetation in this polygon does not exactly match the descriptions in the key, enter the best-fitting vegetation type here and the second-best type in the next field. For further verification of the vegetation, refer to the Stand Tables.

Secondary (Optional): Assign a second-best-fitting name for the vegetation within the polygon. Assign a secondary code **only** if there is some ambiguity in assigning the polygon to a primary vegetation. Note the reason for assigning a secondary call within the "*Confidence in map unit ID"* field below.

Confidence in map unit ID? L M H Explain: Note the level of confidence you feel in the map unit identification by circling **L**ow, **M**oderate, or **H**igh. This is an area to describe how well the stand characteristics match the Vegetation Key. Are all diagnostic species present in proper proportions? If not, how do they differ? If a secondary type is identified, what made the stand type ambiguous? ***Note that if you choose low or moderate confidence, you should have a secondary call, as an alternative way to classify the vegetation.***

Linework problems: Check the box if the polygon boundary line does not surround a distinct vegetation type. Examples for which you would check the box include situations where there is more than one type of mappable vegetation within the polygon, when a portion of the boundary includes part of an adjacent stand, or when the stand continues beyond the polygon boundary. If checked, provide comments in the Notes section to explain.

More than 1 vegetation type in this polygon: Check if there is more than one vegetation type within the polygon. If the polygon includes more than one type, take a separate GPS point and fill out an AA form for each ***mappable*** vegetation type. If these other types are smaller than the MMU, and therefore would not be expected to be mapped, do not check this box - just note the additional vegetation types in the Notes section.

Vegetation change since imagery taken: Check the box if the vegetation in the polygon has changed since the aerial imagery used as the base of the vegetation map was taken. If yes, provide a description in the Notes section of how the vegetation has changed (for example: burned, developed, visible dominance change over time).

Camera name / Photo #s: Write the name or the camera, JPG numbers, and direction of photos. *Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location.* This symbol can be used to indicate the cardinal photos: 

. Make sure to take additional photos of the general composition of the stand if the cardinal photos do not do an adequate job; note the JPG numbers and a description and direction of each additional photo.

Conifer Cover: The total foliar cover (considering porosity) of all live conifer trees, disregarding overlap of individual trees.

Hardwood Cover: The total foliar cover (considering porosity) of all live hardwood trees, disregarding overlap of individual trees.

Total Tree Cover: The total foliar cover (considering porosity) of all live tree species, disregarding overlap of individual trees. This value may be less than the sum of the conifer and hardwood covers due to overlap.

Shrub Cover: The total foliar cover (considering porosity) of all live shrubs, disregarding overlap.

Herb Cover: Circle the appropriate herb cover class.

Tree Height: Circle the height range of the modal tree height.

Tree DBH: Circle one of the tree size classes provided. Size class is based on the average diameter at breast height (dbh) of each trunk (standard breast height is 4.5ft or 137cm). When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, and weight the mean toward the larger tree dbh's.

Exotics: Circle the appropriate level:

None or not visible
1 = Light, less than 33% of total cover is non-native
2 = Moderate, between 33% and 66% of total cover is non-native
3 = Heavy, more than 66% of total cover is non-native
Not Applicable

Estimated area of identifiable vegetation viewed:

Enter a rough estimate of the **percent of the polygon** that you were able to assess from your point AND any additional area that you were able to view while driving or walking around or through the polygon.

-OR-

Enter the **radius in meters** of the area around your GPS point that you were able to assess within the polygon.