Vegetation Map and Classification of Pine Creek and Fitzhugh Creek Wildlife Areas
Modoc County, California

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Department of Fish and Game
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Biogeographic Data Branch

Diana Hickson, Rachelle Boul, and Todd Keeler-Wolf

Abstract

The California Department of Fish and Game Vegetation Classification and Mapping Program (VegCAMP) created a fine-scale vegetation classification and map of the Pine Creek and Fitzhugh Creek Wildlife Areas, Modoc County, California following FGDC and National Vegetation Classification Standards. The map classification is based on a floristic classification that was derived from data collected in the field in June 2006 and analyzed by VegCAMP using cluster analysis to derive the classes. This classification was then translated to a mapping classification, and the map was produced using true-color 2005 1-meter National Agricultural Imagery Program (NAIP) imagery as the base. The minimum mapping unit (MMU) is one acre, with the exception of wetland types, which were mapped down to ½ acre. Field verification of 48% of the mapped polygons was conducted in June 2007; in combination with the 2006 sampling effort, 65% of the polygons were verified in the field.

Purpose

The purpose of the classification and vegetation map is to aid management of the Pine Creek and Fitzhugh Creek Wildlife Area. A separate attribute that notes invasion by Western juniper *(Juniperus occidentalis)* is included at the request of regional staff. We also added an attribute indicating significant presence of the noxious non-native grass, Medusahead *(Taeniatherum caput-medusae).* Note: Medusahead is not the only invasive grass at the Wildlife Areas – North Africa grass *(Ventenata dubia)* and cheatgrass *(Bromus tectorum)* are quite common on Pine Creek in particular – but Medusahead is the most distinguishable on the imagery.

Supplemental Information

Rapid Assessment data were collected from 76 vegetation stands during the periods June 6-9 (Fitzhugh Creek) and June 19-23 (Pine Creek), 2006 following the California Native Plant Society's Rapid Assessment protocol (www.cnps.org/cnps/vegetation/). Data were entered into an Access database ("PineFitzhugh_Analysis_final.mdb" available from VegCAMP). Sample point locations are in a separate shapefile, "RA_pts." The Rapid Assessment data include the date of sampling, GPS location, environmental characteristics of the sampled stands (microtopography, substrate, soil texture, slope, aspect, ground surface characteristics, disturbance type and intensity), vegetation structure (tree, shrub and herb cover and height, total vegetation cover), species cover, site history, and the Alliance and Association. Additionally, four digital photos were taken in the cardinal directions from each sample GPS location are available from

VegCAMP. These Rapid Assessment data and field photos can serve as a baseline for monitoring.

Methods

Species cover data were analyzed using PC-Ord ™ software's cluster analysis. The final analysis used the Sorensen distance and flexible beta linkage method at -0.25 (McCune and Grace 2002). This cluster analysis technique was based on abundance (cover) values converted to seven different classes using the following modified Braun-Blanquet (1932) cover categories: 1=<1%, 2=1-5%, 3=>5-15%, 4=>15-25%, 5=>25-50%, 6=>50-75%, 7=>75%.

The set of data collected in Pine Creek and Fitzhugh Creek WLAs was used as the principal means for defining the Alliance and Association composition and membership rules; however, existing classifications (e.g., Smith 1994, VegCAMP 2006, NatureServe 2006) were consulted to locate similar classifications or descriptions of vegetation.

Naming conventions followed the National Vegetation Classification System (Grossman et al. 1998) and the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995). An Association is defined by a group of samples that have similar dominant and characteristic species in the overstory and other important or indicator species, whereby these species are distinctive for a particular environmental setting. A set of similar Associations is grouped hierarchically to the next higher level in the classification, the Alliance level.

Key to Identification of All Stands of Vegetation Sampled or Encountered in the Field

I. Stand is tree dominated. Stand has at least 3% tree cover [however, if Western juniper *(Juniperus occidentalis)* is < 10% and big sagebrush *(Artemisia tridentata)* or Western chokecherry *(Prunus virginiana)* is greater than 10% cover, then go to shrub part of key].

I.A. Jeffrey pine *(Pinus jeffreyi*) is the dominant tree species…

IA.1. White fir *(Abies concolor*) is at least subdominant and Western juniper *(Juniperus occidentalis)* is present at low cover …

Jeffrey pine - White fir / Roundleaf snowberry / Bluegrass Association
***Pinus jeffreyi – Abies concolor / Symphoricarpos rotundifolia / Poa* spp. Association (Smith 1994)**

IA.2. Western juniper *(Juniperus occidentalis)* is subdominant and Curl-leaf mountain mahogany *(Cercocarpus ledifolius)* occurs in the understory at over 5% cover. Ponderosa pine *(Pinus ponderosa)* may be present or up to co-dominant with Jeffrey pine *(Pinus jeffreyi)*. May be like the *Pinus jeffreyi – Purshia tridentata – Cercocarpus ledifolius – Stipa occidentalis* of Smith (1994), but is closer to her *Pinus jeffreyi* / *Cercocarpus ledifolius* due to constancy of *Juniperus occidentalis* and cover of *Pinus jeffreyi*…

Jeffrey pine / Curl-leaf mountain mahogany Association
***Pinus jeffreyi* / *Cercocarpus ledifolius* Association**

IA.3. Red-osier dogwood *(Cornus sericea)* is present; greenleaf willow *(Salix lucida* ssp. *caudata)* may be present. Riparian habitats…

Jeffrey pine / riparian Association
***Pinus jeffreyi* / riparian Association**

I.B. Western juniper *(Juniperus occidentalis)* is the dominant tree…

IB.1. Jeffrey pine *(Pinus jeffreyi)* is present and generally at least 1% cover. Usually contains antelope bitterbrush *(Purshia tridentata)*, and/or Western chokecherry *(Prunus virginiana)* and may have desert gooseberry *(Ribes velutinum)* and round-leaf snowberry *(Symphoricarpos rotundifolius)*…

Western juniper – Jeffrey pine / (Antelope bitterbrush) – (Western chokecherry) Association
***Juniperus occidentalis – Pinus jeffreyi / (Purshia tridentata) – (Prunus virginiana)* Association**

IB.2. Low sagebrush *(Artemisia arbuscula)* is present and Jeffrey pine *(Pinus jeffreyi)* is absent…

Western juniper / Low sagebrush Association
***Juniperus occidentalis / Artemisia arbuscula* Association**

II. Stand is shrub dominated (with < 3% tree species evenly distributed across the stand and > 3% shrub cover evenly distributed across the stand)…

II.A. Red-osier dogwood (*Cornus sericea)* is the dominant shrub. Greenleaf willow *(Salix lucida* ssp. *caudata)* is present…

Red-osier dogwood – Greenleaf willow Association
***Cornus sericea – Salix lucida* ssp. *caudata* Association**

II.B. Lemmon's willow *(Salix lemmonii)* is the dominant shrub or co-dominates with greenleaf willow *(Salix lucida* ssp. *caudata)*, and red-osier dogwood *(Cornus sericea)* is absent…

Lemmon's willow Association
***Salix lemmonii* Association**

II.C. Big sagebrush *(Artemisia tridentata)* is the dominant or co-dominant shrub…

IIC.1. Low sagebrush *(Artemisia arbuscula)* co-dominates the stand…

Big sagebrush – low sagebrush Association
***Artemisia tridentata – Artemisia arbuscula* Association**

IIC.2. Rubber rabbitbrush *(Chrysothamnus nauseosus)* is present and low sagebrush *(Artemisia arbuscula)* may be present, but is never dominant or co-dominant…

Big sagebrush / Rubber rabbitbrush Association
***Artemisia tridentata – Chrysothamnus nauseosus* Association**
(Ferren and Davis 1991)

II.D. Low sagebrush *(Artemisia arbuscula)* is the sole dominant shrub in the stand with at least 3% cover…

IID.1. One-side bluegrass *(Poa secunda)* is generally the dominant perennial grass, and Idaho fescue *(Festuca idahoensis)* and bluebunch wheatgrass *(Pseudoroegneria spicata)* are generally absent. Native perennials such as Wasatch desertparsley *(Lomatium bicolor)* and low pussytoes *(Antennaria dimorpha)* may be common. Stands of this type are found on the shortest mounds…

Low sagebrush / One-sided bluegrass Association
***Artemisia arbuscula – Poa secunda* Association**

IID.2. Idaho fescue *(Festuca idahoensis)* co-dominates with one-sided bluegrass *(Poa secunda)* and bluebunch wheatgrass *(Pseudoroegneria spicata)* is absent. Stands of this type are found on the low to intermediate mounds…

Low sagebrush / Idaho fescue Association
***Artemisia arbuscula – Festuca idahoensis* Association (Stillman 1980)**

IID.3. Bluebunch wheatgrass *(Pseudoroegneria spicata)* and one-sided bluegrass *(Poa secunda)* are present. Idaho fescue *Festuca idahoensis* is generally absent. Stands of this type are typically on the tallest mounds, often with squirreltail *(Elymus elymoides)* and Basin wildrye *(Leymus cinereus)*…

Low sagebrush / Bluebunch wheatgrass Association
***Artemisia arbuscula – Pseudoroegneria spicata* Association**

II.E. Western chokecherry *(Prunus virginiana)* is the sole dominant shrub…

Western chokecherry Alliance
***Prunus virginiana* Alliance**

III. Herb dominated (with < 3% cover of woody species evenly distributed across the stand)…

III.A. Stand dominated by broad-stemmed onion *(Allium platycaule).* Found on exposed basalt bedrock…

Broad-stemmed onion Unique Stand
***Allium platycaule* Unique Stand**

III.B. Stand dominated by Canada goldenrod *(Solidago canadensis).* Found in moist meadows or seeps and draws*…*

Canada goldenrod Alliance
***Solidago canadensis* Alliance**

III.C. Stand dominated by rushes and sedges…

IIIC.1. Water sedge (*Carex aquatilis)* is the dominant species…

Water sedge Alliance
***Carex aquatilis* Alliance**

IIIC.2. Nebraska sedge *(Carex nebrascensis)* is the dominant species. May support other *Carex* spp…

Nebraska sedge Alliance
***Carex nebrascensis* Alliance**

IIIC.3. Pale spikerush *(Eleocharis macrostachya)* is the dominant species…

Pale spikerush Alliance
***Eleocharis macrostachya* Alliance**

IIIC.4. Few-flowered rush *(Eleocharis pauciflora)* is the dominant species…

Few-flowered rush Alliance
***Eleocharis pauciflora* Alliance**

IIIC.5. Joint-leaf rush (*Juncus articulatus)* is the dominant species…

Joint-leaf rush Alliance
***Juncus articulatus* Alliance**

IIIC.6. Mexican rush *(Juncus mexicanus)* is the dominant species…

Mexican rush Alliance
***Juncus mexicanus* Alliance**

IIIC.7. *Juncus occidentalis* is the dominant species…

Western rush Alliance
***Juncus occidentalis* Alliance**

IIID. Stand dominated by grasses…

IIID.1. Annual hairgrass *(Deschampsia danthonioides* is the dominant species…

Annual hairgrass Alliance
***Deschampsia danthonioides* Alliance (Smith 1994, n=1)**

IIID.2. Basin wildrye *(Leymus cinereus)* is the dominant grass species and other herbaceous species such as one-sided bluegrass *(Poa secunda),* rough eyelash *(Blepharipappus scaber),* and willowweed (*Epilobium minutum)* are present…

Basin wildrye – herbaceous Association
***Leymus cinereus* – Herbaceous Association (NatureServe)**

IIID.3. Timothy *(Phleum pratense)* is the dominant grass species or it may co-dominate with Kentucky bluegrass *(Poa pratense)*. Other wetland species such as slender cinquefoil *(Potentilla gracilis)* and Oregon checkerbloom *(Sidalcea oregana)* are present…

Timothy - Kentucky bluegrass – Brome Association
***Phleum pratense – Poa pratense – Bromus* Association (NatureServe)**

IIID.4. One-sided bluegrass *(Poa compressa)* is the dominant species…

One-sided bluegrass Alliance
***Poa compressa* Alliance**

IIID.5. One-sided bluegrass *(Poa secunda)* is the dominant perennial grass species, or is co-dominant with onespike danthonia *(Danthonia unispicata)*, and Medusahead *(Taeniatherum caput-medusae)* may be dominant (especially in certain years) to absent…

IIID5.a. Onespike danthonia *(Danthonia unispicata)* is codominant or subdominant, without significant cover of nine-leaf desertparsley *(Lomatium triternatum)*…

One-sided bluegrass – Onespike danthonia Association
***Poa secunda – Danthonia unispicata* Association**

IIID5.b. Nine-leaf desertparsley *(Lomatium triternatum)* important to dominant…

One-sided bluegrass – Nine-leaf desertparsley Association
***Poa secunda – Lomatium triternatum* Association**

IIID5.c. White brodiaea *(Triteleia hyacinthina)* is a conspicuous and dominant forb. Other forbs include meadow deathcamas *(Zigadenus venenosus),* cutleaf silverpuffs *(Microseris laciniata)*, and Wasatch desertparsley (*Lomatium bicolor)*…

One-sided bluegrass – White brodiaea Association
***Poa secunda – Triteleia hyacinthina* Association**

IIID5.d. Not as above. In the study area, one stand of a one-sided bluegrass *(Poa secunda)* wet meadow, co-dominated by meadow barley *(Hordeum brachyantherum)* and Mexican rush *(Juncus mexicanus)* was sampled...

One-sided bluegrass Alliance
***Poa secunda* Alliance**

IIID.6. Medusahead *(Taeniatherum caput-medusae)* is the dominant species or it may co-dominate, with one-sided bluegrass *(Poa secunda)* or nine-leaf desertparsley *(Lomatium triternatum)*. Other exotic, annual grass species such as North Africa grass *(Ventenata dubia)* and cheatgrass *(Bromus tectorum)* are present…

Medusahead non-native stands
***Taeniatherum caput-medusae* non-native stands**

Mapping Unit Legend

A mapping classification (legend) was developed based on vegetation types that are distinguishable on the NAIP imagery. Following is the crosswalk between the vegetation classification and the mapping classification:

Alliance - Scientific Name	Association - Scientific Name	Vegetation Type Common Name	Code	Mapping Unit
Pinus jeffreyi		Jeffrey pine Alliance	1100	Pinus jeffreyi Alliance
Pinus jeffreyi	Pinus jeffreyi - Abies concolor / Symphoricarpos rotundifolia / Poa secunda	Jeffrey pine - White fir / Roundleaf snowberry / Bluegrass Association	1101	Pinus jeffreyi - Abies concolor / Symphoricarpos rotundifolius / Poa spp. Association
Pinus jeffreyi	Pinus jeffreyi - Cercocarpus ledifolius	Jeffrey pine / Curl-leaf mountain mahogany Association	1102	Pinus jeffreyi / Cercocarpus ledifolia Association
Pinus jeffreyi	Pinus jeffreyi / riparian	Jeffrey pine / riparian Association	1103	Pinus jeffreyi / riparian Association
Juniperus occidentalis		Western juniper Alliance	1200	Juniperus occidentalis Alliance
Juniperus occidentalis	Juniperus occidentalis - Artemisia arbuscula	Western juniper / Low sagebrush Association	1201	Juniperus occidentalis - Artemisia arbuscula Association
Juniperus occidentalis	Juniperus occidentalis - Pinus jeffreyi / (Purshia tridentata) - (Prunus virginiana)	Western juniper - Jeffrey pine / (Antelope bitterbrush) - (Western chokecherry) Association	1202	Juniperus occidentalis - Pinus jeffreyi / (Purshia tridentata) - (Prunus virginiana) Association

Alliance - Scientific Name	Association - Scientific Name	Vegetation Type Common Name	Code	Mapping Unit
Artemisia arbuscula		Low sagebrush Alliance	2100	Artemisia arbuscula Alliance
Artemisia arbuscula	Artemisia arbuscula / Festuca idahoensis	Low sagebrush / Idaho fescue Association	2101	Artemisia arbuscula / Perennial Native Grasses MU
Artemisia arbuscula	Artemisa arbuscula / Poa secunda	Low sagebrush / One-sided bluegrass Association	2101	Artemisia arbuscula / Perennial Native Grasses MU
Artemisia arbuscula	Artemisia arbuscula / Pseudoroegneria spicata	Low sagebrush / Bluebunch wheatgrass Association	2101	Artemisia arbuscula / Perennial Native Grasses MU
Artemisia tridentata		Big sagebrush Alliance	2200	Artemisia tridentata Alliance
Artemisia tridentata	Artemisia tridentata - Artemisia arbuscula	Big sagebrush / Low sagebrush Association	2201	Artemisia tridentata - Artemisia arbuscula Association
Artemisia tridentata	Artemisia tridentata - Chrysothamnus nauseosus	Big sagebrush / Rubber rabbitbrush Association	2202	Artemisia tridentata (disturbed) MU
Cornus sericea	Cornus sericea - Salix lucida ssp. caudata	Red-osier dogwood - Greenleaf willow Association	2300	Riparian shrub MU
Salix lemmonii		Lemmon's willow Alliance	2300	Riparian Shrub MU
Prunus virginiana		Western chokecherry Alliance	2400	Prunus virginiana Alliance
Chrysothamnus nauseosus		Rubber rabbitbrush Alliance	2500	Chrysothamnus nauseosus Alliance
Poa secunda		One-sided bluegrass Alliance	3100	Poa secunda Alliance
Poa secunda	Poa secunda - Danthonia unispicata	One-sided bluegrass - Onespike danthonia Association	3101	Poa secunda - Danthonia unispicata Association
Poa secunda	Poa secunda - Lomatium triternatum	One-sided bluegrass - nine-leaf desertparsley Association	3102	Poa secunda - Lomatium triternatum Association
Taeniatherum caput-medusae		Medusahead non-native stand	3200	Taeniatherum caput-medusae non-native stand
			3300	Meadow (unclassified) MU
Leymus cinereus	Leymus cinereus - Herbaceous	Basin wildrye - herbaceous Association	3301	Dry meadow MU
Solidago canadensis		Canada goldenrod Alliance	3301	Dry meadow MU
Deschampsia danthonioides		Annual hairgrass Alliance	3302	Mesic meadow MU
Juncus mexicanus		Mexican rush Alliance	3302	Mesic meadow MU
Juncus occidentalis		Western rush Alliance	3302	Mesic meadow MU
Phleum pratense	Phleum pratense - Poa pratense - Bromus spp.	Timothy - Kentucky bluegrass - Brome Association	3302	Mesic meadow MU
Poa compressa		Canada bluegrass Alliance	3302	Mesic meadow MU
Poa secunda	Poa secunda - Triteleia hyacinthina	One-sided bluegrass - White brodiaea Association	3302	Mesic meadow MU
Carex aquatilis		Water sedge Alliance	3303	Wet meadow MU
Carex nebrascensis		Nebraska sedge Alliance	3303	Wet meadow MU
Eleocharis macrostachya		Pale spikerush Alliance	3303	Wet meadow MU
Eleocharis pauciflora		Few-flowered spikerush Alliance	3303	Wet meadow MU
Juncus articulatus		Joint-leaf rush Alliance	3303	Wet meadow MU
Allium platycaule		Broad-stemmed onion (unique stand)	3400	Allium platycaule MU
			3500	Ruderal herbaceous MU

Alliance - Scientific Name	Association - Scientific Name	Vegetation Type Common Name	Code	Mapping Unit
			9100	Water
			9200	Rock Outcrop (undifferentiated) MU

Other map attributions are as follows:

Heterogeneity: (of the mapped polygon)
Code= Heterogeneity
1= Low, <5% heterogeneous (the polygon is mostly homogeneous for type, cover class, and size class)
2= Moderate, 5-40% heterogeneous
3= High, >40% heterogeneous

Height: (of overstory layer)
Code= Height
1= <1m
2= 1-5m
3= 5-20m
4= 20-50m
5= >50m

Diameter at Breast Height:

Code=	dbh	Conifer	Hardwood
1=	dbh<1"	n/a	n/a
2=	dbh1-6"	n/a	<15'
3=	dbh6-11"	<12'	15-30'
4=	dbh11-24"	12-24	'30-45'
5=	dbh>24"	24'	>45'
6=	multilayered	various	various
0=	tree cover <10%	n/a	n/a

Cover: (Total, Conifer, Hardwood, Total Tree, Shrub, Herb)
Code= Cover
1= <2%
2= 2-9%
3= 10-39%
4= 40-59%
5= 60-100%
0= 0 %

Impact/Disturbance:
Code= Impact Type
1= Development
2= OHV activity
3= Exotics
4= Roads/trails
5= Erosion/runoff
6= Disking/grading

7= Grazing
8= Riparian modification

Site Quality: (based on amount/type of impacts as noted in impact field)
Code=Site Quality
1= High
2= Moderate
3= Low
4= Unknown

Method of identification:
Code= Method
1 Rapid assessment
2 Relevé
3 Field reconnaissance
4 Photo-interpretation
5 Other information

Other Conventions Used in the Map Attribute Table

If a polygon contained a Rapid Assessment data point, the database ID of that sampled stand is noted.

Polygons were attributed as being invaded by juniper (*Juniperus occidentalis*) if over 33% of the relative cover of *Juniperus occidentalis* consisted of small, young individuals.

Polygons were attributed as being invaded by medusahead *(Taeniatherum caput-medusae)* when cover of that species was obvious on the imagery or during field reconnaissance. Note that if medusahead was the only disturbance distinguishable on the imagery, site quality was rated Low if medusahead cover was > 66%, Moderate if its cover was 33-66%, and High if it was less than 33%.

Notes about inclusions of types below minimum mapping unit, etc. are in the notes text field. The minimum mapping unit (MMU) is one acre for most types, and ½ acre for wetland types.

The Wildlife Area boundaries used for this project are from the Department Lands coverage in 2006. Vegetation polygons were mapped for an unset distance beyond those WLA boundaries in case the boundaries change. A clipped version of the vegetation layer was also produced. Additionally, inholdings in both Pine Creek (the reservoir) and Fitzhugh Creek were mapped.

Project Staff

Field staff in 2006 were Rachelle Boul, Pete Figura, Diana Hickson, Todd Keeler-Wolf, Teresa LeBlanc, and Kari Lewis (Fitzhugh Creek) and Rachelle Boul and Diana Hickson (Pine Creek). Data entry, mapping and attribution were completed by Rachelle Boul and quality-checked by Diana Hickson, who also wrote this metadata/report. Richard Shinn helped us with field logistics and watched out for our safety, for which we thank him.

Field verification of the original mapping polygons was conducted in June 2007 by Rachelle Boul, Diana Hickson, and Todd Keeler-Wolf. We field checked 64% of the final Pine Creek polygons. Only 32% of the Fitzhugh Creek polygons could be checked because weather and road conditions made access to Fitzhugh Creek even more difficult than usual. When these field checks are combined with rapid assessment data collection in 2006, 78% of the Pine Creek and 53% of the Fitzhugh Creek polygons were visited in the field. We corrected other polygons within Fitzhugh Creek based on the knowledge we gained during the field checking, and so we believe the accuracy of the Fitzhugh Creek mapping equals that of Pine Creek. Additional ground photos were taken during this time and are also available from VegCAMP.

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