VEGETATION MAP AND CLASSIFICATION OF FISH SLOUGH

INYO AND MONO COUNTIES, CALIFORNIA

Vegetation Classification and Mapping Program

Biogeographic Data Branch

California Department of Fish and Wildlife

January 2014

ABSTRACT

A fine-scale vegetation classification and map of a portion of the Fish Slough Area of Critical Environmental Concern (ACEC) (including the California Department of Fish and Wildlife (CDFW) Fish Slough Ecological Reserve) in Inyo and Mono Counties, California, was created by the CDFW Vegetation Classification and Mapping Program (VegCAMP). The vegetation classification is derived from floristic field survey data collected during September 2011, November 2012 and June 2013 and is based on previously described Alliances and Associations, with a few new provisional types included. The map was produced using heads-up digitizing using true-color 2012 1-meter National Agricultural Imagery Program (NAIP) imagery as the base. Supplemental imagery included 2012 1-meter NAIP Color Infrared and imagery available through Bing Maps and Google Earth. The minimum mapping unit (MMU) is 1 acre for upland habitats and ¼-acre for wetland habitats. Field reconnaissance and field verification enhanced map quality. The final map includes a total of 365 polygons representing 40 vegetation map classes.

ACKNOWLEDGEMENTS

California Department of Fish and Wildlife and the VegCAMP program wish to thank the following individuals for their assistance:

Mark Bagley
Joy Fatooh, BLM
Sally Manning and Daniel Pritchett
Troy Kelly, DFW
Steve Nelson, BLM
Martin Oliver, BLM

We apologize to anyone we may have left off this list unintentionally.

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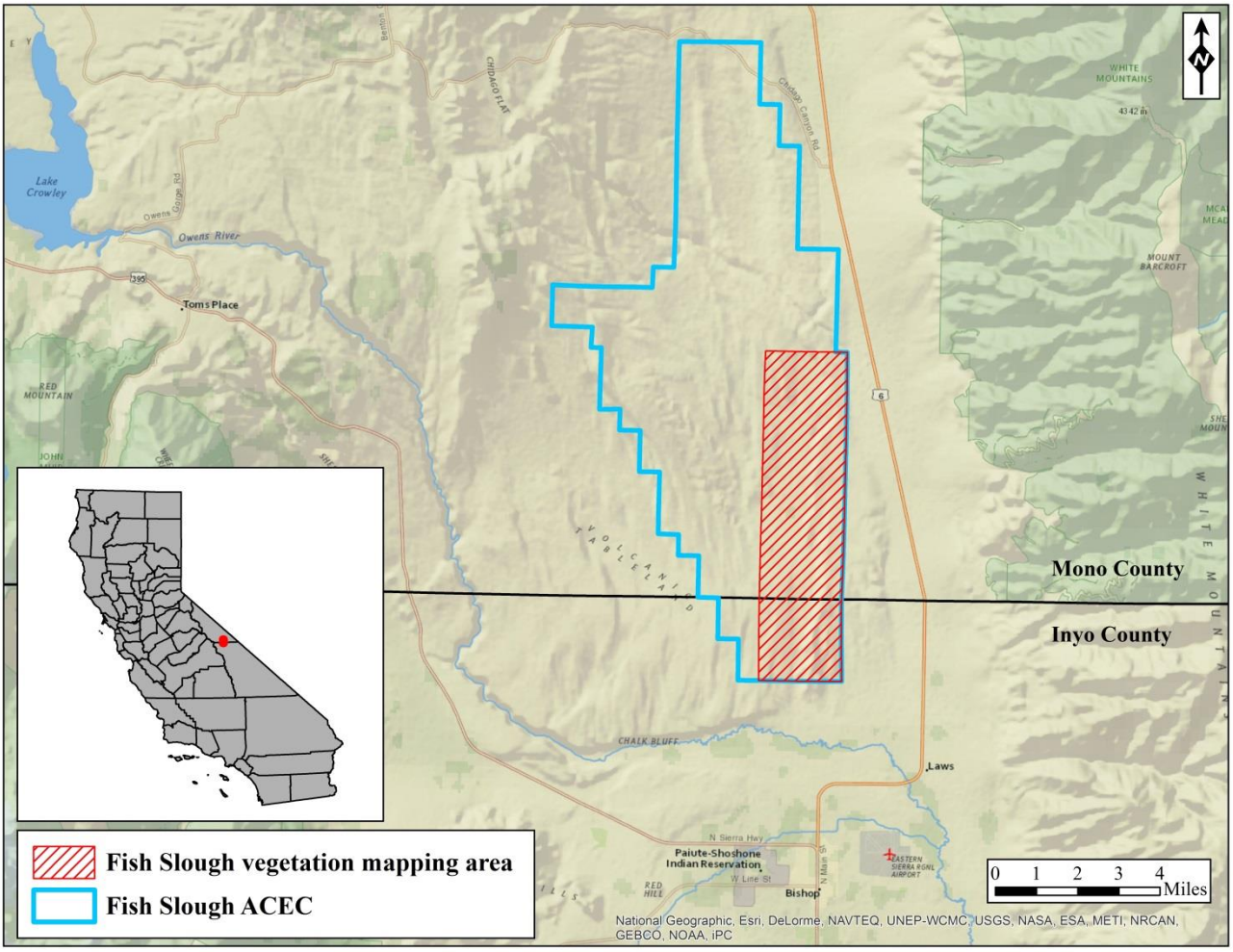
PURPOSE

The purpose of this vegetation map and classification is to assist in management and long-term vegetation monitoring of the Fish Slough Ecological Reserve and ACEC. This effort will help document spatial and temporal changes in vegetation composition, including response to management actions. The map was requested by the Fish Slough ACEC Joint Management Committee. The mapping area (Figure 1) is "Zone 1" of the ACEC; the Fish Slough Ecological Reserve is completely included within this zone.

Figure 1: Location of the Fish Slough mapping area



METHODS

FIELD DATA SAMPLING METHODS AND DATA STORAGE

Relevé data from 17 vegetation stands and Rapid Assessment (RA) data from 30 vegetation stands were collected during initial field work conducted September 12-16, 2011, using the California Native Plant Society's Combined Rapid Assessment and Relevé Sampling Protocol (Appendix A). These data include the date of sampling, GPS location,

environmental characteristics of the sampled stands, vegetation, site history, and the field-assessed vegetation type. Additionally, four digital photos were taken in the cardinal directions from the GPS point for each survey location. Complete species lists were recorded for plot-based Relevé surveys, while the most dominant and/or characteristic species were recorded for stand-based Rapid Assessment surveys. Percent cover estimates were recorded for all species listed in Relevés and RAs. A number of the relevé and rapid assessment samples were taken at points that were previously sampled by Odion et al. (1991) to see if we could determine any obvious vegetation change over the 20 years. To recreate these point locations, the map in the published report was scanned and georeferenced in ArcGIS, and the point labels interpreted off this map.

During the September, 2011 sampling effort, 73 field reconnaissance data points were collected to aid in identifying vegetation signatures and to determine where to delineate polygons. At each reconnaissance location, a GPS point was taken and observations were recorded for vegetation type. Sometimes additional data, such as photos, site history, observational notes on stand composition and environmental attributes, cover by stratum ,and/or cover by dominant/indicator species were recorded as well. Reconnaissance points were frequently taken to mark the transition from one vegetation type to another, in order to help the photointerpreter locate the boundaries of stands.

A preliminary vegetation map was produced using the data collected in 2011. During two subsequent field sampling trips (November 6-8, 2012 and June 24-28, 2013), 377 field verification points were collected to validate and revise the initial map product. Field verification survey data included percent cover estimates for dominant and/or indicator species with homogeneous distribution across a stand, photographs, cover estimates by stratum, categorical ranking of exotic species cover in a stand, and approximate percentage of the polygon viewed. Appendix B includes samples of the three different field data collection forms used in this project.

All sample point locations were collected with GPS-enabled PDAs, either Trimble “Junos” or F4 Devices “Flints.” Spatial data were stored in a single ESRI geodatabase feature class. Relevé and RA data from paper field forms, including plant species and cover information, were entered into VegCAMP’s Combined Rapid Assessment and Relevé Database (MS Access format). Reconnaissance and field verification data were entered directly into the geodatabase feature class, with plant species information in a separate table in the geodatabase. Ground photos as described above were filed by the unique identifying code for each sample location and are available from VegCAMP. See Appendix C for a complete list of plant species observed at the Fish Slough mapping area.

CLASSIFICATION METHODS

The map classification is based largely on existing vegetation types described in the Manual of California Vegetation (Sawyer et al. 2009), but includes new provisional types supported by this project and the California Desert Vegetation Map and Accuracy Assessment effort in support of the Desert Renewable Energy Conservation Plan

(VegCAMP and AIS, 2013). The Relevé and RA data collected in September 2011 (47 surveys total) were used to create a preliminary classification and map for Fish Slough study area. These data were analyzed together using multivariate cluster analysis, performed by PC-ORD version 5 software. The cluster analysis was based on abundance (cover) values converted to seven different classes using the following modified Braun-Blanquette (1932) cover categories: 1=<1%, 2=1-5%, 3=>5-15%, 4=>15-25%, 5=>25-50%, 6=>50-75%, 7=>75%. For the analysis, VegCAMP used the Sorensen distance measure and flexible beta linkage method at -0.25 (McCune and Grace 2002). Floristic data collected in 193 field verification points from November 6-8, 2012, were used to refine and validate the final classification for the map.

Naming conventions for vegetation types follow the National Vegetation Classification System (Grossman et al. 1998) and the Manual of California Vegetation (Sawyer et al. 2009). 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. For this map, vegetation was mapped to the Association level if possible, but some polygons were only mapped to Alliance.

Appendix D shows the Hierarchical Field and Mapping Key used to classify the vegetation types for this project.

CLASSIFICATION

The hierarchical classification that follows includes all vegetation types mapped at the Fish Slough study area.

1000 = TEMPERATE FOREST SUBCLASS
- **1400 = Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup MG036**
  - 1410 = Southwestern North American riparian evergreen and deciduous woodland Group
    - 1411 = *Populus fremontii* Alliance
      - 1411a = *Populus fremontii* Association
- **1500 = Western Cordilleran Montane-Boreal Riparian Scrub and Forest Macrogroup MG034**
  - 1520 = Great Basin montane riparian scrub Group
    - 1521 = *Rosa woodsii* Provisional Alliance

3000 = TEMPERATE AND BOREAL SHRUBLAND AND GRASSLAND SUBCLASS
- **3100 = Western North American Temperate Grassland and Meadow Macrogroup MG048**
  - 3120 = Western dry upland perennial grassland Group
    - 3122 = *Poa secunda* Alliance
      - 3122a = *Poa secunda* ssp. *juncifolia* Association
- **3400 = Western North American Freshwater Marsh Macrogroup MG073**
  - 3410 = Arid West freshwater emergent marsh Group
    - 3411 = *Phragmites australis* Alliance
      - 3411a = *Phragmites australis* Association
    - 3412 = *Schoenoplectus (acutus,californicus)* Mapping Unit
      - 3413 = *Schoenoplectus acutus* Alliance
        - 3413a = *Schoenoplectus acutus* Association

3413b = *Schoenoplectus acutus-Typha domingensis* Association

3415 = *Typha (angustifolia, domingensis, latifolia) Alliance*

3415a = *Typha* (*angustifolia, domingensis, latifolia*) Association

3415b = *Typha* (*angustifolia, domingensis, latifolia*)-*Schoenoplectus americanus* Association

3500 = Western North America Vernal Pool Macrogroup MG074

3510 = Californian mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group

3512 = *Eleocharis macrostachya* Alliance

3512a = *Eleocharis macrostachya* Association

3600 = Western North America Wet Meadow and Low Shrub Carr Macrogoup MG075

3610 = Californian warm temperate marsh/seep Group

3611 = *Juncus arcticus (*var*. balticus, mexicanus)* Alliance

3611a = *Juncus arcticus* Association

3650 = North American Pacific Coastal Salt Marsh Macrogroup MG081

3660 = Temperate Pacific tidal salt and brackish meadow Group

3661 = *Distichlis spicata* Alliance

3661a = *Distichlis spicata* Association

3661b = *Distichlis spicata-Juncus arcticus* Association

3700 = Warm Semi-Desert/Mediterranean Alkali–Saline Wetland Macrogroup MG083

3710= Southwestern North American alkali marsh/seep vegetation Group

3712 = *Sporobolus airoides* Alliance

3712a = *Sporobolus airoides* Association

3713 = *Anemopsis californica* Alliance

3713a = *Anemopsis californica-Juncus arcticus* Association

3715 = *Schoenoplectus americanus* Alliance

3715a = *Schoenoplectus americanus* Association

3715b = *Schoenoplectus americanus-Schoenoplectus acutus* Association

3716 = *Eleocharis rostellata* Alliance

3716a = *Eleocharis rostellata* Association

3717 = *Muhlenbergia asperifolia* Provisional Alliance

3718 = *Ivesia kingii* Provisional Alliance

3718a = *Ivesia kingii* Provisional Association

3719 = *Spartina gracilis* Alliance

3719a = *Spartina gracilis* Association

3720 = Southwestern North American salt basin and high marsh Group

3721 = *Allenrolfea occidentalis* Alliance

3721a = *Allenrolfea occidentalis/Sporobolus airoides* Association

3725 = *Suaeda moquinii* Alliance

3725a = *Suaeda moquinii* Association

3729 = *Atriplex parryi* Provisional Alliance

3729a = *Atriplex parryi* Provisional Association

4000 = Warm Semi-Desert Scrub and Grassland

4100 = Mojavean–Sonoran Desert Scrub MG088

4110 = Mojavean upper desert scrub Group

4111 = Menodora spinescens Alliance

4111a = Menodora spinescens-Atriplex confertifolia Association

5000 = COOL SEMI-DESERT SCRUB AND GRASS SUBCLASS

5100 = Western North American Cool Semi-Desert Shrubland, Shrub-Steppe Macrogroup MG093

5110 = Shadscale-saltbush cool semi-desert scrub Group

5111 = *Atriplex canescens* Alliance

5111a = *Atriplex canescens-Psorothamnus (arborescens, polydenius)* Provisional Association

5112 = *Atriplex confertifolia* Alliance

5112a = *Atriplex confertifolia-Krascheninnikovia lanata* Association

5112b = *Atriplex confertifolia-Psorothamnus (arborescens, polydenius) Provisional Association*

5112c = *Atriplex confertifolia* Association

5200 = Cool Semi-desert wash and disturbance scrub Macrogroup MG095

5210 = Intermontane seral shrubland Group

5212 = *Ericameria nauseosa* Alliance

5212a = *Ericameria nauseosa* Association

5212b = *Ericameria nauseosa/Sporobolus airoides* Association

5215 = *Ericameria cooperi* Provisional Alliance

5217 = *Ericameria teretifolia* Alliance

5217a = *Ericameria teretifolia* Association

5300 = Western North America Tall Sage Shrubland and Steppe Macrogroup MG096

5310 = Inter-Mountain West mesic tall sagebrush shrubland and steppe Group

5311 = *Artemisia tridentata* Alliance

5311a = *Artemisia tridentata-Ephedra nevadensis* Association

5400 = Inter-Mountain Dry Shrubland and Grassland Macrogroup MG098

5410 = Intermontane deep or well-drained soil scrub Group

5411 = *Grayia spinosa* Alliance

5411a = *Grayia spinosa-Atriplex confertifolia* Association

5413 = *Ephedra nevadensis* Alliance

5420 = Mojave and Great Basin upper bajada and toeslope Group

5427 = *Psorothamnus* (*arborescens, polydenius*) Alliance

5500 = Cool Semi-Desert Alkali-Saline Wetlands Macrogroup MG082

5510 = Great Basin cool semi-desert alkali basin Group

5511 = *Sarcobatus vermiculatus* Alliance

5511a = *Sarcobatus vermiculatus* Association

5511b = *Sarcobatus vermiculatus-Atriplex confertifolia* Association

5512 = *Ericameria albida* Alliance

5512a = *Ericameria albida* Association

6000 = NORTH AMERICAN WARM SEMI-DESERT CLIFF, SCREE AND ROCK VEGETATION DIVISION

6100 = North American Warm Semi-Desert Cliff, Scree, and Other Rock Vegetation Macrogroup MG117

6110 = North American warm desert bedrock cliff and outcrop Group

6115 = Massive sparsely vegetated rock outcrop Mapping Unit

6116 = Unvegetated alkali scald

9000 = MISCELLANEOUS CLASSES

9300 = Built-up & Urban Disturbance

9800 = Water

DELINEATION RULES AND MAP ATTRIBUTES

The minimum mapping unit (MMU) is different for wetland versus upland vegetation.

For wetland vegetation MMU are as follows:

- ¼-acre for delineating between vegetation types
- ¼-acre for delineating between cover class breaks in the overstory vegetation cover within a single type
- ¼-acre for delineating between cover class breaks in the understory vegetation cover within a single type

For upland vegetation MMUs are as follows:

- 1 acre for delineating between vegetation types
- 3 acres for delineating between cover class breaks in the overstory vegetation cover within a single type

Delineations were not made in upland polygons based on breaks in herbaceous vegetation cover due to seasonality and high variability of herbaceous growth between years.

Each mapped polygon has the following attributes:

NVCSName
Standardized name of the vegetation description used in the National Vegetation Classification System. Since the NVCS does not have categories for human land use or otherwise unvegetated land, those descriptions were drawn from the California Wildlife Habitat Relationship.

NVCSLevel
The level of the National Vegetation Classification System Hierarchy to which the vegetation type corresponds.

MapClass
The finest level of vegetation type mapped (alliance, association, group or macrogroup); or land use for polygons that are not natural vegetation, per the mapping classification.

MapClassCode
Code for each vegetation type mapped.

TotalTreeCover:

Code=	Cover Class
1=	0-1%
2=	>1-5%
3=	>5-15%
4=	>15-25%
5=	>25-50%
6=	>50-75%
7=	>75%
9=	N/A

TotalShrubCover:

Code=	Cover Class
1=	0-1%
2=	>1-5%
3=	>5-15%
4=	>15-25%
5=	>25-50%
6=	>50-75%
7=	>75%
9=	N/A

Total HerbaceousCover:

Code=	Cover Class
1=	0-1%
2=	>1-5%
3=	>5-25%
4=	>25-50%
5=	>50-75%
6=	>75%
9=	N/A

Impact: Exotics

Code=	Level of Impact
0=	None Visible
1=	Patches, but not significant; relative cover < 33%
2=	Significant cover, may exceed dominant strata; relative cover <66%
3=	Stand characterized by exotics; relative cover >66%

Impact: Roadedness

Code=	Level of Impact
0=	No visible roads or trails through the polygon (the polygon is “whole”)
1=	Low (roads or trails bisecting the polygon so that from 2/3 to just below the entire polygon is “whole”)
2=	Medium (roads or trails bisecting the polygon so that 1/3-2/3 of the polygon is “whole”)
3=	High (roads or trails bisecting the polygon so that <1/3 of the polygon is “whole”)

Notes

Text field for additional information

Method of identification:

Code=	Method
1=	Rapid assessment field data
2=	Relevé field data
3=	Field verification or Accuracy Assessment
4=	Photo-interpretation
5=	Adjacent stand information or photo
6=	Reconnaissance

7= Other information
8= Older plot data
9= Older reconnaissance data

UID
Unique identifier for each polygon

CalVegName
A crosswalk to the CalVeg vegetation system. Note that there may be a one-to-many relationship between CalVeg and NVCS.

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.

CWHRCode
The CWHR code.

GlobalRank
The global rarity rank of the plant community mapped (only for alliances). G1 and S1: Fewer than 6 viable occurrences worldwide and/or 2000 acres; G2 and S2: 6-20 viable occurrences worldwide and/or 2000-10,000 acres; G3 and S3: 21-100 viable occurrences worldwide and/or 10,000-50,000 acres; G4 and S4: Greater than 100 viable occurrences worldwide and/or greater than 50,000 acres; G5 and S5: Community demonstrably secure due to secure worldwide and statewide abundance.

StateRank
The state rarity rank of the plant community mapped (only for alliances). G1 and S1: Fewer than 6 viable occurrences worldwide and/or 2000 acres; G2 and S2: 6-20 viable occurrences worldwide and/or 2000-10,000 acres; G3 and S3: 21-100 viable occurrences worldwide and/or 10,000-50,000 acres; G4 and S4: Greater than 100 viable occurrences worldwide and/or greater than 50,000 acres; G5 and S5: Community demonstrably secure due to secure worldwide and statewide abundance.

CaCode
California Natural Community Codes - unique code assigned to alliances and associations.

NVCSAlliance
The standardized name for the alliance within the National Vegetation Classification System.

NVCSGroup
The standardized name for the group within the National Vegetation Classification System.

NVCS_Macrogroup
The standardized name for the macrogroup within the National Vegetation Classification System.

RESULTS

The following (Table 1) is a summary of the mapped vegetation types and their corresponding acreages.

Table 1: Summary of mapped vegetation types and corresponding acreage

MapUnit	Alliance / Association	Acres	Total Acres
1411	*Populus fremontii* Alliance		**7.5**
	Populus fremontii Association	7.5	
1521	*Rosa woodsii* Provisional Alliance		**4.3**
	Rosa woodsii Provisional Alliance (Unable to map to association level)	4.3	
3122	*Poa secunda* Alliance		**4.4**
	Poa secunda ssp. *juncifolia* Association	4.4	
3411	*Phragmites australis* Alliance		**20.0**
	Phragmites australis Association	20.0	
3413	*Schoenoplectus acutus* Alliance		**32.7**
	Schoenoplectus acutus Association	12.2	
	Schoenoplectus acutus-Typha domingensis Association	20.5	
3415	*Typha (angustifolia, domingensis, latifolia*) Alliance		**105.0**
	Typha domingensis Association	28.2	
	Typha (*angustifolia, domingensis, latifolia*)–*Schoenoplectus americanus* Association	76.8	
3512	*Eleocharis macrostachya* Alliance		**10.1**
	Eleocharis macrostachya Association	10.1	
3611	*Juncus arcticus* (var. *balticus, mexicanus)* Alliance		**113.8**
	Juncus arcticus (var. *balticus, mexicanus*) Alliance (Unable to map to association)	2.8	
	Juncus arcticus Association	111.0	
3661	*Distichlis spicata* Alliance		**161.2**
	Distichlis spicata Association	54.5	
	Distichlis spicata-Juncus arcticus Association	106.7	
3712	*Sporobolus airoides* Alliance		**69.2**
	Sporobolus airoides Association	69.2	
3713	*Anemopsis californica* Alliance		**17.4**
	Anemopsis californica-Juncus arcticus Association	17.4	
3715	*Schoenoplectus americanus* Alliance		**143.8**
	Schoenoplectus americanus Alliance (Unable to map to association level)	11.9	
	Schoenoplectus americanus Association	26.7	
	Schoenoplectus americanus-Schoenoplectus acutus Association	105.1	
3716	*Eleocharis rostellata* Alliance		**69.3**
	Eleocharis rostellata Association	69.3	
3717	*Muhlenbergia asperifolia* Provisional Alliance		**10.2**
	Muhlenbergia asperifolia Provisional Alliance (Unable to map to association level)	10.2	

MapUnit	Alliance / Association	Acres	Total Acres
3718	*Ivesia kingii* Provisional Alliance		**129.0**
	Ivesia kingii Provisional Alliance (Unable to map to association level)	7.5	
	Ivesia kingii Provisional Association	121.5	
3719	*Spartina gracilis* Alliance		**1.8**
	Spartina gracilis Association	1.8	
3721	*Allenrolfea occidentalis* Alliance		**164.5**
	Allenrolfea occidentalis/Sporobolus airoides Association	164.5	
3725	*Suaeda moquinii* Alliance		**14.1**
	Suaeda moquinii Association	14.1	
3729	*Atriplex parryi* Provisional Alliance		**22.3**
	Atriplex parryi Provisional Association	22.3	
4111	*Menodora spinescens* Alliance		**542.3**
	Menodora spinescens-Atriplex confertifolia Association	542.3	
5111	*Atriplex canescens* Alliance		**975.4**
	Atriplex canescens-Psorothamnus (arborescens, polydenius) Provisional Association	975.4	
5112	*Atriplex confertifolia* Alliance		**3448.7**
	Atriplex confertifolia Alliance (Unable to map to association level)	1717.7	
	Atriplex confertifolia-Krascheninnikovia lanata Association	746.4	
	Atriplex confertifolia-Psorothamnus (arborescens, polydenius) Provisional Association	962.4	
	Atriplex confertifolia Association	22.2	
5212	*Ericameria nauseosa* Alliance		**63.7**
	Ericameria nauseosa Alliance (Unable to map to association level)	19.4	
	Ericameria nauseosa Association	16.0	
	Ericameria nauseosa/Sporobolus airoides Association	28.4	
5215	*Ericameria cooperi* Provisional Alliance		**22.9**
	Ericameria cooperi Provisional Alliance (Unable to map to association level)	22.9	
5217	*Ericameria teretifolia* Alliance		**7.9**
	Ericameria teretifolia Association	7.9	
5311	*Artemisia tridentata* Alliance		**302.3**
	Artemisia tridentata-Ephedra nevadensis Association	302.3	
5411	*Grayia spinosa* Alliance		**1805.0**
	Grayia spinosa-Atriplex confertifolia Association	1805.0	
5413	*Ephedra nevadensis* Alliance		**33.2**
	Ephedra nevadensis Alliance (Unable to map to association level)	33.2	
5427	*Psorothamnus* (*arborescens, polydenius*) Alliance		**531.6**
	Psorothamnus (*arborescens, polydenius*) Alliance (Unable to map to association level)	531.6	
5511	*Sarcobatus vermiculatus* Alliance		**946.3**
	Sarcobatus vermiculatus Alliance (Unable to map to association level)	23.2	
	Sarcobatus vermiculatus Association	69.6	
	Sarcobatus vermiculatus-Atriplex confertifolia Association	853.4	
5512	*Ericameria albida* Alliance		**447.8**
	Ericameria albida Association	447.8	

MapUnit	Alliance / Association	Acres	Total Acres
6115	Massive sparsely vegetated rock outcrop		**77.0**
	Massive sparsely vegetated rock outcrop (Unable to map to association level)	77.0	
6116	Unvegetated alkali scald		**6.5**
	Unvegetated alkali scald (Unable to map to association level)	6.5	
9300	Built-up and Urban Disturbance		**2.5**
	Built-up and Urban Disturbance (Unable to map to association level)	2.5	
9800	Water		**9.6**
	Water (Unable to map to association level)	9.6	

MAP VERIFICATION

This map deviates from Federal Geographic Data Committee National Vegetation Classification Standards (FGDC 2008) in only one respect: there was no formal accuracy analysis performed. However, after completing map delineation and interpretation, 63% of all polygons were validated by field verification survey data. When RA, Relevé, and reconnaissance data are included, 80% of all map polygons were directly visited by field personnel, and 90% had field-based descriptions or photographs. This exceeds the requirement for the national standards. Due to the inability to distinguish aerial signatures for some sparse desert shrub types and some herbaceous types, much of the map was created based solely on field data and field photographs. All field data aided in the validation and final revision of the map.

DISCUSSION

The field work for this project occurred over an exceptionally dry 22-month period in the project area. From September 1, 2011 to June 30, 2013, the nearby Bishop Airport recorded just 4.99 inches of rain (Record of Climatological Observations for Bishop, California - June 2010 to September 2013, 2013), barely more than half of the average annual total for that station, 5.18 inches (South Lahontan Hydrologic Region, 2013). Due to this extremely dry weather during the sampling periods, percent cover values, especially for upland vegetation, are likely to be much lower than in years with normal or above normal precipitation.

We were unable to determine any significant trends in vegetation change based on comparison with the earlier work on the vegetation of Fish Slough by Odion et al. (1991 and 1992). Limitations included: 1) the spatial accuracy of the points as originally mapped is unknown; 2) inaccuracy is compounded by geospatial referencing we performed on the original Odion mapped locations; and 3) the lack of a crosswalk between the mapped points and the plot numbers in the Twinspan table(Table 2 in Odion et al. (1992)), which provides species cover data.

Some of the earlier points that are on the three transects discussed in Odion (1991) can be identified to vegetation type using Figures VI-10, 11 and 12 in that report. The correlation between the point labels (e.g., 1, 2, 3) in the tables and the point labels on the map (e.g., W74, W79) are straightforward only for Transect 3, however. Transect 1 shows 12 points in a row but 10 points are in the table, and Transect 3 shows 6 points in a row but 8 points are in the table. Table 2 and Figure 2 provide our best translation of the Odion vegetation type compared to the vegetation as we classified and mapped it. We have included the points from Odion et al. (1991, 1992) in the geodatabase in case the crosswalk to the Twinspan table is re-located or can be reconstructed. These points may be more useful for interpreting the typically larger stands of upland vegetation, given the fine-scale patchiness of the wetland vegetation of Fish Slough.

Figure 2: Map showing the current vegetation, and the locations and vegetation types of the transect points from Odion (1991).

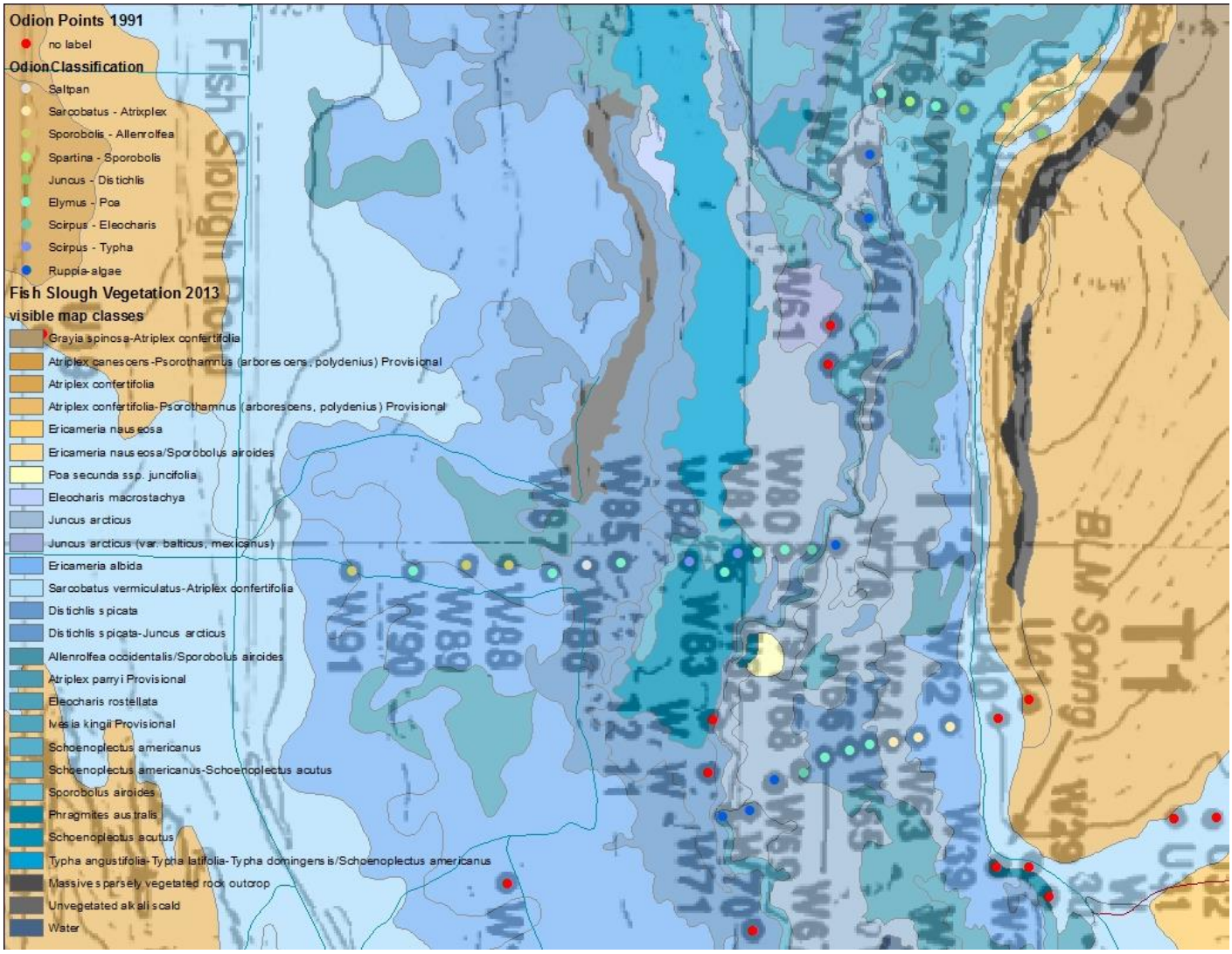
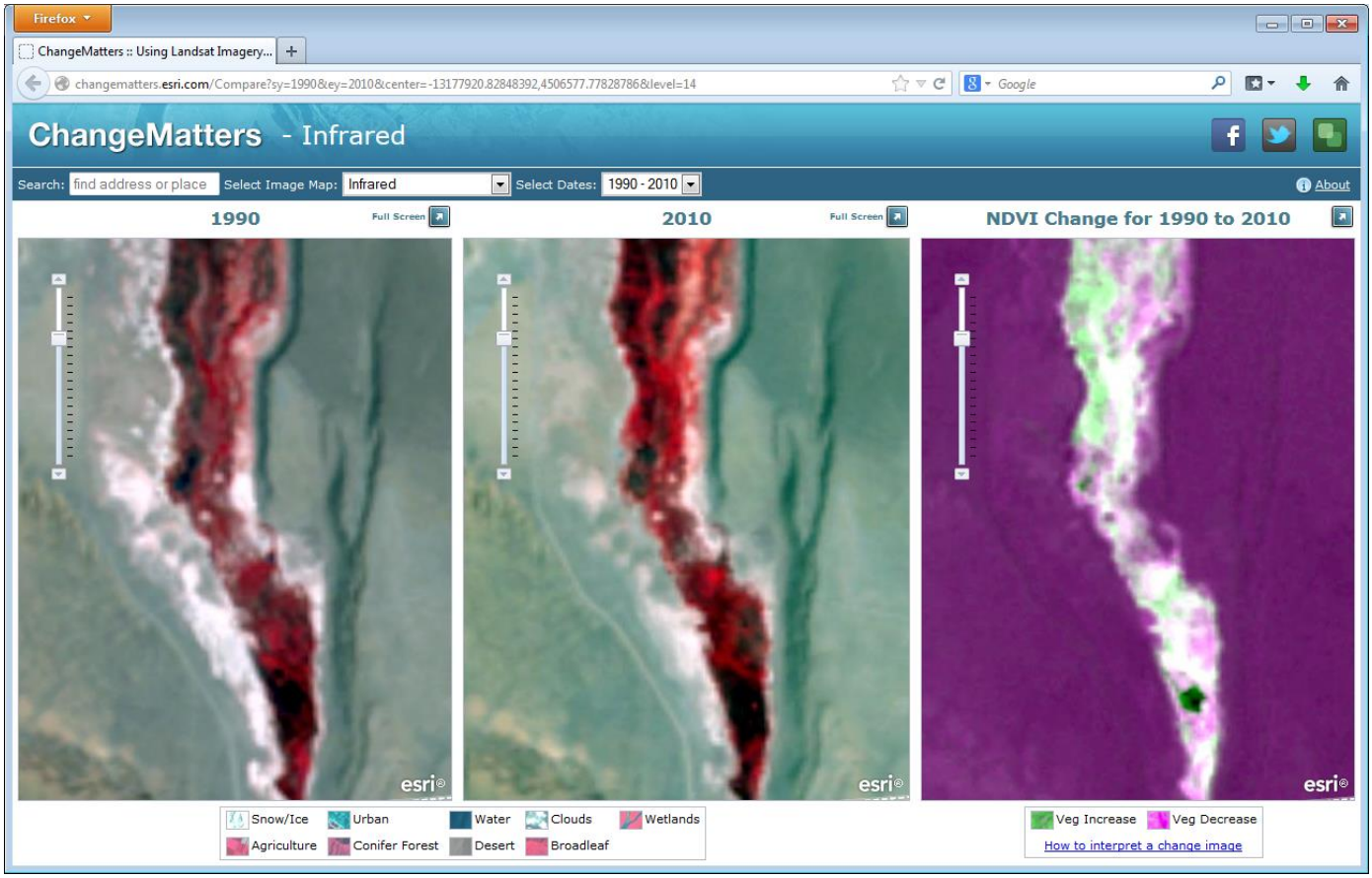


Table 2: Comparison between vegetation types from the Odion et al (1991) study and current mapped types

Map Name	Transect	Odion et al. (1991) name	2013 Map Type
Transect 1			
W71	T1-1	Ruppia-algae	Juncus arcticus
W70	T1-2	Ruppia-algae	Juncus arcticus
W69	T1-3	Ruppia-algae	Juncus arcticus
W68	T1-4	Scirpus - Eleocharis	Distichlis spicata-Juncus arcticus
W67	T1-5	Elymus - Poa	Distichlis spicata-Juncus arcticus
W66	T1-6	Elymus - Poa	Distichlis spicata-Juncus arcticus
W65	T1-7	Elymus - Poa	Distichlis spicata-Juncus arcticus
W64	T1-8	Sarcobatus - Atriplex	Juncus arcticus
W63	T1-9	Sarcobatus - Atriplex	Ericameria albida
W62	T1-10	Sarcobatus - Atriplex	Ericameria albida
Transect 2			
U30	T2-1	Juncus - Distichlis	Sarcobatus vermiculatus - Atriplex confertifolia
U46	T2-2	Juncus - Distichlis	Ericameria nauseosa / Sporobolus airoides
W74	T2-3	Juncus - Distichlis	Sporobolus airoides
W75	T2-4	Elymus - Poa	Ivesia kingii
W76	T2-5	Spartina - Sporobolus	Ivesia kingii
W77	T2-6	Elymus - Poa	Juncus arcticus
W42	T2-7	Ruppia-algae	Juncus arcticus
W41	T2-8	Ruppia-algae	Sporobolus airoides
Transect 3			
W78	T3-1	Ruppia-algae	Juncus arcticus
W79	T3-2	Scirpus - Eleocharis	Distichlis spicata-Juncus arcticus
W80	T3-3	Elymus - Poa	Juncus arcticus
W81	T3-4	Elymus - Poa	Schoenoplectus
W82	T3-5	Scirpus - Typha	Schoenoplectus acutus
W83	T3-6	Elymus - Poa	Schoenoplectus acutus
W84	T3-7	Scirpus - Typha	Schoenoplectus acutus
W85	T3-8	Elymus - Poa	Distichlis spicata
W86	T3-9	saltpan	Distichlis spicata
W87	T3-10	Elymus - Poa	Ericameria albida
W88	T3-11	Sporobolus - Allenrolfea	Atriplex parryi
W89	T3-12	Sporobolus - Allenrolfea	Ericameria albida
W90	T3-13	Elymus - Poa	Ericameria albida
W91	T3-14	Sporobolus - Allenrolfea	Ericameria albida

Another source of information about vegetation change, while generalized, can be found on [ESRI's ChangeMatters website](), from which Figure 3 was created. This illustration shows a vegetation increase in the 2010 image where open water had been detected in 1990. Comparisons between other years can be easily accomplished using this web site.

Figure 3: Vegetation change at Fish Slough, 1990 - 2010



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Appendix A

CNPS and CDFW Combined Vegetation

Rapid Assessment and Relevé Protocol

CALIFORNIA NATIVE PLANT SOCIETY / DEPARTMENT OF FISH AND GAME
PROTOCOL FOR COMBINED VEGETATION RAPID ASSESSMENT
AND RELEVÉ SAMPLING FIELD FORM
(May 13, 2011)

Introduction

This protocol describes the methodology for both the relevé and rapid assessment vegetation sampling techniques as recorded in the combined relevé and rapid assessment field survey form dated March 22, 2010. The same environmental data are collected for both techniques. However, the relevé sample is plot-based, with each species in the plot and its cover being recorded. The rapid assessment sample is based not on a plot but on the entire stand, with 12-20 of the dominant or characteristic species and their cover values recorded. For more background on the relevé and rapid assessment sampling methods, see the relevé and rapid assessment protocols at www.cnps.org.

Selecting stands to sample:

To start either the relevé or rapid assessment method, a stand of vegetation needs to be defined. 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 alpine meadow or tundra types, and some may be several square kilometers in size, such as desert or forest types. 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).

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

Depending on the project goals, you may want to select just one or a few representative stands of each homogeneous vegetation type for sampling (*e.g.*, for developing a classification for a vegetation mapping project), or you may want to sample all of them (*e.g.*, to define a rare vegetation type and/or compare site quality between the few remaining stands).

For the rapid assessment method, you will collect data based on the entire stand.

Selecting a plot to sample within in a stand (for relevés only):

Because many stands are large, it may be difficult to summarize the species composition, cover, and structure of an entire stand. We are also 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 vegetation stand, the main point to remember 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 plot 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 many cases 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.

Plot Size

All relevés of the same type of vegetation to be analyzed in a study need to be the same size. 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 sq. m plot
Special herbaceous communities, such as vernal pools, fens: 10 sq m plot
Shrublands and Riparian forest/woodlands: 400 sq. m plot
Open desert and other shrublands with widely dispersed but regularly occurring woody species: 1000 sq. m plot
Upland Forest and woodland communities: 1000 sq. m plot

Plot Shape

A relevé has no fixed shape, though plot shape should reflect the character of the stand. 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.

If we are sampling broad homogeneous stands, we would most likely choose a shape such as a circle (which has the advantage of the edges being equidistant to the center point) or a square (which can be quickly laid out using perpendicular tapes).

Definitions of fields in the protocol

Relevé or Rapid Assessment Circle the method that you are using.

LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #: Number assigned either in the field or in the office prior to sampling. It is usually denoted with a four-letter abbreviation of the sampling location and then a four-number

sequential number of that locale (*e.g.* CARR0001 for Carrizo sample #1). The maximum number of letters/numbers is eight.

Air photo #: The number given to the aerial photo in a vegetation-mapping project, for which photo interpreters have already done photo interpretation and delineations of polygons. If the sample site has not been photo-interpreted, leave blank.

Date: Date of the sampling.

Name(s) of 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. Please note: The person recording the data on the form should circle their name/initials.

GPS waypoint #: The waypoint number assigned by a Global Positioning System (GPS) unit when marking and storing a waypoint for the sample location. Stored points should be downloaded in the office to serve as a check on the written points and to enter into a GIS.

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

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

Datum: (NAD 83) The standard GPS datum used is NAD 83. If you are using a different datum, note it here.

Bearing, left axis at SW pt (note in degrees) of <u>Long or Short</u> side: For square or rectangular plots: from the SW corner (= the GPS point location), 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 circular or square plots). If there are no stand constraints, you would choose a circular or square plot and straight-sided plots should be set up with boundaries running in the cardinal directions. If you choose a rectangular plot that is not constrained by the stand dimensions, the short side should run from east to west, while the long side should run from north to south.

UTM coordinates: Easting (UTME) and northing (UTMN) location coordinates using the Universal Transverse Mercator (UTM) grid. Record in writing the information from a GPS unit or a USGS topographic map.

UTM zone: Universal Transverse Mercator zone. Zone 10 is for California west of the 120th longitude, zone 11 is for California east of 120th longitude, which is the same as the straight portion of California's eastern boundary.

Error: ± The accuracy of the GPS location, when taking the UTM field reading. Please record the error units by circling feet (ft), meters (m), or positional dilution of precision (pdop). If your GPS does not determine error, insert N/A in this field.

Is GPS within stand? <u>Yes / No</u> 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 No, cite from waypoint to stand, distance (note in meters) & bearing (note in degrees): An estimate of the number of meters and the compass bearing from the GPS waypoint to the stand.

Elevation: Recorded from the GPS unit or USGS topographic map. Please circle feet (ft) or meters (m).

Photograph #s: Write the name or initials of the camera owner, JPG/frame number, and direction of photos (note the roll number if using film). *Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location.* If additional photos are taken in other directions, please note this information on the form.

Stand Size: Estimate the size of the entire stand in which the sample is taken. As a measure, one acre is about 4000 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 the size of the plot.

Plot Shape: Record the length and width of the plot and circle measurement units (i.e., ft or m). If it is a circular plot, enter radius (or just put a check mark in the space).

Exposure: (Enter actual º and circle general category): With your back to the general uphill direction of the slope (i.e., by facing downhill of the slope), 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. Select "all" if stand is on top of a knoll that slopes in all directions or if the same, homogenous stand of vegetation occurs across all ranges of slope.

Steepness: (Enter actual º and circle general category): Read degree slope from a compass or clinometer. 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: Geological parent material of site. If exact type is unknown, use a more general category (*e.g.,* igneous, metamorphic, sedimentary). *See code list for types.*

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

Upland or Wetland/Riparian (circle one): Indicate if the stand is in an upland or a wetland. There are only two options. 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 (abiotic substrates). 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. **The total should sum to 100%.** Note that non-vascular cover (lichens, mosses, cryptobiotic crusts) is not estimated in this section.

% Water: Estimate the percent surface cover of running or standing water, ignoring the substrate below the water.
% BA Stems: Percent surface cover of the plant basal area, *i.e.*, the basal area of stems at the ground surface. Note that 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.
% Boulders: Percent surface cover of rocks > 60 cm in diameter.
% Stone: Percent surface cover of rocks 25-60 cm in diameter.
% Cobble: Percent surface cover of rocks 7.5 to 25 cm in diameter.
% Gravel: Percent surface cover of rocks 2 mm to 7.5 cm in diameter.
% Fines: Percent surface cover of bare ground and fine sediment (e.g. dirt) < 2 mm in diameter.

% Current year bioturbation: Estimate the percent of the sample or stand exhibiting soil disturbance by fossorial organisms (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.

% Hoof punch: Note the percent of the sample or stand surface that has been punched down by hooves (cattle or native grazers) in wet soil.

Fire Evidence: Circle Yes if there is visible evidence of fire, and note the type of evidence in the "Site history, stand age and 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, and comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors. 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. Characterize each impact each as **L** (=Light), **M** (=Moderate), or **H** (=Heavy). For invasive exotics, divide the total exotic cover (e.g. 25% Bromus diandrus + 8% Bromus madritensis + 5% Centaurea melitensis = 38% total exotics) by the total % cover of all the layers when added up (e.g. 15% tree + 5% low tree + 25% shrub + 40% herbs = 85% total) and multiply by 100 to get the % relative cover of exotics (e.g. 38% total exotics/85% total cover = 45% relative exotic cover). L = 0-33% *relative* cover of exotics; M =34-66% relative cover, and H = > 66% relative cover. *See code list for impacts.*

II. HABITAT AND VEGETATION DESCRIPTION

California Wildlife-Habitat Relationships (CWHR)

For CWHR, identify the size/height class of the stand 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 percent 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 if there are some larger tree dbh's. The "**T6 multi-layered**" dbh size class contains 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 or 4 (>11-24" dbh).

Shrub: Circle one of the shrub size classes provided when shrub canopy closure exceeds 10 percent (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).

Herb: Circle one of the herb height classes when herbaceous cover exceeds 2 percent 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.*

Desert Palm/Joshua Tree: Circle one of the palm or Joshua tree size classes by averaging all the stem-base diameters (*i.e.* mean diameter of all stem-base sizes). Diameter is measured at the plant's base above the bulge near the ground.

Desert Riparian Tree/Shrub: Circle one of the size classes by measuring mean stem height (whether tree and/or shrub stand).

Overall Cover of Vegetation

Provide an estimate of cover for the following categories below (based on functional life forms). 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 cover (how much of the sky can you see when you are standing under the canopy of a tree, or how much light passes through the canopy of the shrub layer?).

To come up with a specific number estimate for percent cover, first use generalized cover classes as reference aids such as the CWHR cover classes (<2%, 2-9%, 10-24%, 25-39%, 40-59%, 60-100%) or the modified Braun-Blanquet cover-abundance scale (<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%). While keeping these intervals in mind, you can then refine your estimate to a specific percentage for each category below.

% Total NonVasc cover: The total cover of all lichens, bryophytes (mosses, liverworts, hornworts), and cryptogrammic 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. This is an estimate of the absolute vegetation cover, disregarding overlap 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 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 of individual recruits. See seedling and sapling definitions below.

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

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

Height Class by Layer

Modal height for conifer tree /hardwood tree, shrub, and herbaceous categories: Provide an estimate of height for each category listed. Record an average height value per each category by estimating the mean height for each group. Please use the following height intervals to record a height class: 01 =< 1/2m, 02=1/2-1m, 03 = 1-2 m, 04 = 2-5 m, 05 = 5-10 m, 06 = 10-15 m, 07 = 15-20 m, 08 = 20-35 m, 09 = 35-50 m, 10 => 50m.

Species List and Coverage

For rapid assessments, list the 10-20 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.

For relevés, list all species present in the plot, using the second species list page if necessary.

For both sample types, provide the stratum:
T = Tree. A woody perennial plant that has a single trunk.
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.
E = SEedling. A tree species clearly of a very young age that is < 1" dbh.
A = SApling. 1" - <6" dbh and young in age, OR small trees that are < 1"diameter at breast height, are clearly of appreciable age, and kept short by repeated browsing, burning, or other disturbance.
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/E/A	Quercus douglasii	40/<1/<1	

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, the "C" in the collection column should crossed out. 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).

Use Jepson Manual nomenclature. Write out the genus and species of the plant. Do not abbreviate. 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 aerial cover for each species listed. 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, then 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. Note their species, if known, in the "Stand history, stand age and comments" section.

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, you can record the <1% cover in two categories: r = trace (i.e., rare in plot, or solitary individuals) and + = <1% (few individuals at < 1% cover, but common in the plot).

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.

INTERPRETATION OF STAND

Field-assessed vegetation alliance name: Name of alliance or habitat following the most recent CNPS classification system or the Manual of California Vegetation (Sawyer J.O., Keeler-Wolf T.,

and Evens, J. 2009). Please use scientific nomenclature, *e.g., Quercus agrifolia* forest. An alliance is based on the dominant or diagnostic species of the stand, and is usually of 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.

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. If this is the case, also make sure to state that it is not in the MCV under the explanation for "Confidence in alliance identification."

Field-assessed association name (optional): Name of the species in the alliance and additional dominant/diagnostic species from any strata, as according to CNPS classification. 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).*

Please note: 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 away in meters from the GPS waypoint and the direction in degrees aspect that the adjacent alliance is found (e.g., *Amsinckia tessellata* / 50m, 360° N *Eriogonum fasciculatum* /100m, 110°).

Confidence in 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 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.

Other identification problems or mapping issues: 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. If it does, how much of the likely mapping unit would be comprised of this type. For example: "this sample represents the top of kangaroo rat precincts in this general area, which are surrounded by vegetation represented by CARR000x; this type makes up 10% of the mapping unit."

Is polygon >1 type: Yes / No (circle one): *In areas that have been delineated as polygons on aerial photographs/imagery for a vegetation-mapping project*, assess if the polygon is mapped as a single stand. "Yes" is noted when the polygon delineated contains the field-assessed alliance and other vegetation type(s), as based on species composition and structure. "No" is noted when the polygon is primarily representative of the field-assessed alliance.

If yes, explain: If "Yes" above, explain the other vegetation alliances that are included within the polygon, and explain the amount and location that they cover in the polygon.

Appendix B

Field Data Collection Forms

CNPS and CDFG Combined Vegetation Rapid Assessment and Relevé Field Form

Relevé or Rapid Assessment (circle one) (Revised May 13, 2011)

For Office Use:	**Final database #:**	**Final vegetation type name:**	**Alliance**_____ **Association**

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #:	**Air photo:**	**Date:**	**Name(s) of surveyors (circle recorder):**

GPS wypt #: _____ **GPS name:** _____ **Datum:** _____ **or NAD83. Bearing, left axis at SW pt**_____ **(degrees) of** **Long / Short** **side**

UTME ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ **Zone: 10 / 11** (circle one) **Error: ±**_____ **ft / m / pdop**

GPS within stand? Yes / No If No, cite from waypoint to stand, distance _____**(meters) & bearing** _____**(degrees)**

Elevation: **ft / m Camera Name/Photograph #'s**:

Stand Size (acres): <1, 1-5, >5 | Plot Size (m^2): 10 / 100 / 400 / 1000 | Plot Shape ___ **x**___ **ft / m or Circle Radius**____**ft / m**

Exposure, Actual °: _____ **NE NW SE SW Flat Variable All | 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)

H20:____ **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 AND VEGETATION 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.) **Desert Riparian Tree/Shrub:** **1** (<2ft. stem ht.), **2** (2-10ft. ht.), **3** (10-20ft. ht.), **4** (>20ft. ht.)

Desert Palm/Joshua Tree: **1** (<1.5" base diameter), **2** (1.5-6" diam.), **3** (>6" diam.) **% NonVasc cover:**____ **% Vasc Veg cover:**_____

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

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

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species, Stratum, and % cover. Stratum categories: T=Tree, S = Shrub, H= Herb, E = SEedling, A = SApling, N= Non-vascular.
% cover intervals for reference: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, 75%.

Strata	Species	% cover	C	Strata	Species	% cover	C

Unusual species: _____

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:**

Is poly >1 type: Yes / No If yes, explain:

CNPS and CDFG Combined Vegetation Rapid Assessment and Relevé Field Form

RELEVE SPECIES SHEET (Revised 5/13/2011)

Page _____ of Polygon/Stand #: _____

Stratum categories: T = Tree, S = Shrub, H = Herb, E = SEedling, A = SApling, and N=Non-vascular
% Cover Intervals for reference: r = trace, + = <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

Strata	Vascular plant name or lichen/bryophyte	% Cover	Collection	Final species determination (or DBH)

RECON FIELD FORM (Sept. 6, 2011)

Surveyors: **Date:**

Waypoint ID:

UID:

Poly represents stand: **Y N**

GPSname: **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Distance / bearing: _____(meters) / _____(degrees)

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Size of stand: <0.5 0.5-1 1-5 >5 Camera/Photos:

Field alliance name:

Comments:

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

Surveyors: **Date:**

Waypoint ID:

UID:

Poly represents stand: **Y N**

GPSname: **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Distance / bearing: _____(meters) / _____(degrees)

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Size of stand: <0.5 0.5-1 1-5 >5 Camera/Photos:

Field alliance name:

Comments:

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

Surveyors: **Date:**

Waypoint ID:

UID:

Poly represents stand: **Y N**

GPSname: **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Distance / bearing: _____(meters) / _____(degrees)

Base UTMs / projected UTMs (circle one)

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Size of stand: <0.5 0.5-1 1-5 >5 Camera/Photos:

Field alliance name:

Comments:

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

Field Verification Form: Fish Slough Vegetation Mapping (6/19/2013)

Surveyors (circle recorder)**:**	**Date:**
Waypoint ID: **Polygon UID:**	**GPSname:** **Projected? Yes / No / Base / Digitized** If projected or digitized, enter base Waypoint ID: **Bearing: _____(degrees) Distance: _____ (meters)** Base UTMs / projected UTMs (circle one) UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ PDOP: +/-

Strata	Species	% cover		Strata	Species	% cover	

Notes: (including recommendations for line-work revision, state of veg. "discernability" based on season and topography, classification interpretation, homogeneity and unusual sightings of plants or animals)	
Association	
Map Unit	
Camera/Photos	
Total Tree Cover	None >0-1% >1-5% >5-15% >15-25% >25-50% >50-75% >75-100% NA
Shrub Cover	None >0-1% >1-5% >5-15% >15-25% >25-50% >50-75% >75-100% NA
Herb Cover	0-1% >1-5% >5-25% >25-50% >50-75% >75-100% NA
Exotics	None or not visible 1 (Patches, but not significant RC<33%) 2 (Sig. cover, may exceed dom. strata RC <66%) 3 (Stand characterized by exotics RC>66%) NA
Estimated area of identifiable vegetation viewed	Rough % of polygon viewed _____
Is this a "multiple" point assessment?	NO YES if yes: _____ of ____ points for this polygon

Appendix C

Hierarchical Field and Mapping Key

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

Example Terms and Concepts Used Throughout the Key:

Dominance by layer: Tree, shrub, and herbaceous layers are considered physiognomically distinct. A vegetation type is considered to belong to a certain physiognomic group if it is dominated by one layer. Layers are prioritized in order of height when naming the type.

Dominant: 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 Douglas-fir"), or it may refer to dominance by a physiognomic group, as in "dominated by shrubs." Dominance refers to the relative cover of one species or physiognomic group as compared to another species or physiognomic group.

Co-dominant: Co-dominance refers to two or more species in a stand that share dominance and have between 30 and 60 percent relative cover each.

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 vegetation classification and 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 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.

Relative cover: Refers to the amount of the surface of the plot or stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the amount of surface of the plot or stand covered by all species (in that group). Thus, 50 percent relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Relative cover values are proportional numbers and, if added, total 100 percent for each stand (sample).

Absolute cover: Refers to the actual percentage of the ground (surface of the plot or stand) that is covered by a species or group of species. For example, *Pinus sabiniana* covers between 5 percent and 10 percent of the stand. Absolute cover of all species or groups if added in a stand or plot may total greater or less than 100 percent because it is not a proportional number.

Characteristic/Diagnostic species: Must be present in at least 80 percent of the samples, with no restriction on cover.

Often/Usually occurring species: Must be present in at least 50 percent of the samples, with no restriction on cover.

Sparse: Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is less than 8 percent absolute cover.

Trace: Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is less than 5 percent absolute cover.

Open: Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is generally less than 33 percent absolute cover.

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

a. It has *compositional* integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernible boundary that may be abrupt or gradual.

b. It has *structural* integrity. It has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest formerly dominated by the same species but has burned on the upper part of the slope and not the lower is divided into two stands. Likewise, a sparse woodland occupying a slope with shallow rocky soils is considered a different stand from an adjacent slope of a denser woodland/forest with deep, moister soil and the same species.

Tree: Is a one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multiple stemmed following ramifying after fire or other disturbance, but the size of mature plants is typically greater than 5 meters. Undisturbed individuals of these species are usually single stemmed.

Shrub: Is normally a multi-stemmed woody plant that is usually between 0.2 meters and 5 meters tall. Definitions are blurred at the low and high ends of the height scales. At the tall end, shrubs may approach trees based on disturbance frequencies (e.g., old-growth resprouting chaparral species such as *Cercocarpus betuloides, Fraxinus dipetala, Heteromeles arbutifolia, Prunus ilicifolia,* and so forth, may frequently attain "tree size"). At the short end, woody perennial herbs or subshrubs of various species are often difficult to categorize into a consistent life-form.

Herbaceous plant: Is any species of plant that has no main woody stem development and includes grasses, forbs, and dieback perennial species.

Key to Vegetation (and Other Landscape Units) at Fish Slough

1. Landscape unit not vegetated - either heavily modified by human activity or consisting of flowing or contained water bodies (2 choices below)…

Landscape has been physically denuded of vegetation by humans for agriculture or development…
=Built-up and Urban Disturbance

Water either naturally occurring (streams, ponds) or contained by anthropogenic means (canals, reservoirs or aqueducts)…
=Water

1’. Natural and semi-natural settings with vegetation largely absent and no species evenly distributed. Vegetation not uniformly distributed across a landscape surface, generally less than 5% cover, not composed of evenly spaced trees or shrubs, or not characterized by herbaceous species most of the time. In good precipitation years, there may be ephemeral blooms of annual plants. Substrates vary from hills, mountains, playas to riverbeds (2 choices below)…

This mapping unit is defined by extensive solid blocks of resistant rock of any type. In Fish Slough, these may be volcanic extrusives such as basalt or rhyolite; large unfractured bedrock or boulders are typical, with narrow crevices in different densities. Overall shrub and herb cover tends to be under 5%, making it difficult to distinguish any particularly dominant species…
=Massive sparsely vegetated rock outcrop Mapping Unit (n=0)

This mapping unit defines silty or clay scalds/playas, often with salt crust surfaces and usually with <2% vegetative cover. Annuals may occur in good El Niño years in relatively high cover at the edges of scalds or with patchy distribution. Characteristics include flat or cracked substrate and no obvious slope. Reflectance may be gray to white to light brown...
=Unvegetated alkali scald (n=0)

1". Vegetation easily visible and usually with ≥5% total cover (though sometimes as low as 2% if evenly distributed) and characterized by trees, shrubs and/or herbs that have homogeneous distribution across the stand…

2. Vegetation is dominated by woody broad-leaved trees or tall shrubs…

3. Vegetation includes woody moisture loving species (such as willows, cottonwoods, or *Tamarix*). Not in uplands or dry washes, but in areas where moisture is present at least under the surface in the warmer months (near permanent surface or subsurface moisture)...

4. Stands are dominated or characterized by riparian winter deciduous, broad-leaved trees or tall shrubs, including *Populus fremontii,* and/or a species of *Salix.* If the tree canopy is between 5 and 10 percent absolute cover, the shrub canopy should not be more than double the tree canopy (otherwise, see 15'). Note that all diagnostics in this Macrogroup and Group are considered as such even as saplings when similar in size to mature individuals of shrubby *Salix,* (*e.g., S. exigua*). Thus, if the stand has greater than threshold cover for indicators of this Group as saplings, even if there is similar or greater cover of shrub willow species, the stand would key to the tree type…

5. Populus fremontii is dominant or co-dominant with >5% absolute cover and/or 50% relative cover in the tree canopy. Stands occur in areas with a subsurface water supply, and may be mapped to small clumps less than 1 acre in size. At Fish Slough, only two stands were encountered, both with *Ericameria nauseosa* and *Distichlis spicata* in the understory…
***=Populus fremontii* (Fremont cottonwood forest) Alliance (n=2)**

5'. *Salix exigua* is characteristically present as a dominant or co-dominant shrub with ≥5% absolute cover and/or >50% relative cover in shrub layer. It forms an open to continuous canopy along riparian corridors. It often forms narrow strips along major creeks and at edges of springs. Other willow species may be present as sub-dominants with low cover. At Fish Slough, stands have been observed with individuals intermixing with other non-riparian shrubs in atypical settings. In such instances, key to the non-riparian shrub type…
***=Salix exigua* (Sandbar willow thickets) Alliance (n=0)**

4'. Vegetation strongly dominated (>60% relative cover) by tall shrubby invasive *Tamarix* spp. (either *T. ramosissima, T. chinensis*, or other similar species) compared to other tall shrubs and/or low trees. [Stands have not been seen at Fish Slough, but individuals have been seen at the southern end of the mapping area]…

***=Tamarix* spp. (Tamarisk thickets) Semi-natural Stands (n=0)**

3'. Woody vegetation not strictly of wetland or riparian settings…

6. Stands include shrubs of alkaline to moist settings in lowlands. Often shrubs may be adjacent to wetlands and have some subsurface root connections with them - many of these species such as *Ericameria albidus, Sarcobatus vermiculatus, or Allenrolfea occidentalis* are halophytic or alkali-tolerant species growing at or near the edges of well-developed wetlands in the Fish Slough region. Stands often growing where salt deposits or alkali deposits are present. Part of the **Southwestern North American salt basin and high marsh Group**…

7. Stands are dominated by succulent-stemmed herbs or shrubs in the Chenopod family. Leaves are usually scale-like and inconspicuous. Restricted to salty basins that may be seasonally inundated or saturated…

Allenrolfea occidentalis ≥2% absolute cover in the shrub canopy and no other shrub species evenly distributed with greater or equal cover. *Sporobolus airoides* is characteristically present, sometimes with more than five times the cover of *A. occidentalis*. At Fish Slough, stands do not occur so much in saline playas and margins of salt pans, but often in open, widely-spaced stands, with species such as *Distichlis spicata* and *Glycyrrhiza lepidota*…
***=Allenrolfea occidentalis/Sporobolus airoides* Association of the *Allenrolfea occidentalis* (Iodine bush scrub) Alliance (n=19)**

7'. Stands are dominated by shrubby species, without succulent stems (including non-succulent members of the Chenopod family). Stands are rarely inundated or, if so, briefly, and often do not have well developed alkali or salt crusts…

8. Stands dominated or characterized by shrubby members of the Chenopodiaceae (three choices below)…

9. Stands are dominated by the small- to mid-sized shrub *Atriplex parryi* OR rarely include *Ericameria albida* as a co-dominant. *Sarcobatus vermiculatus* is characteristically sub-dominant. *A. parryi* stands are often the result of recent disturbance…
***=Atriplex parryi* Provisional Association of the *Atriplex parryi* (Parry's saltbush) Provisional Alliance (n=5)**

9'. *Suaeda moquinii* is ≥2% cover, dominant and evenly distributed. Stands typically occupy strongly alkaline places, usually with distinct salt deposits on the soil surface, but may occur in upland areas adjacent to wetlands. If *Suaeda moquinii* and either *Atriplex confertifolia* or *Sarcobatus vermiculatus* co-dominate, the alliance is *A. confertifolia* or *Sarcobatus,* respectively…
***=Suaeda moquinii* Association of the *Suaeda moquinii* (Bush seepweed) Alliance (n=1)**

9''. *Sarcobatus vermiculatus* is either dominant OR co-dominant with *Suaeda moquinii*, *Atriplex confertifolia, Ericameria nauseosa, Psorothamnus* spp., or *Tetradymia glabrata. Sarcobatus* seems to prefer sandy and salty soil just above the more abrupt transition to more alkaline/saline and fine textured wetlands…
***=Sarcobatus vermiculatus* (Greasewood scrub) Alliance (n=13)**

10. Stands are dominated by *Sarcobatus*, without any significant cover of *Atriplex confertifolia*; usually adjacent to wetlands and containing some wetland herbaceous species…
=***Sarcobatus vermiculatus*** **Association (n=2)**

10'. Stands contain some *A. confertifolia* and are usually higher on the slope, not immediately adjacent to wetland vegetation. *Suaeda moquinii, Psorothamnus* spp., and *Tetradymia glabrata* may intermix…
=Sarcobatus vermiculatus-Atriplex confertifolia **Association (n=11)**

8'. Stands dominated or co-dominated by *Rosa woodsii* or *Ericameria albida* in the shrub layer. Stands are adjacent to edges of the true wetlands and may or may not have alkali crusts associated with them…

11. *Rosa woodsii* dominates stands. *Phragmites australis, Anemopsis californica, Distichlis spicata, Schoenoplectus* spp. and other species may intermix…
=*Rosa woodsii* Provisional Alliance (n=2)

11'. Stands dominated or co-dominated by *Ericameria albida* in the shrub overstory. White flowered rabbitbrush is evenly spaced, sometimes with equal or higher cover of *Distichlis, Sporobolus*, *Elymus* or other graminoid herbs in the understory. Stands are generally seasonally dry and on higher ground than the true wetlands in Fish Slough…
=*Ericameria albida* (White flowered rabbitbrush) Alliance and Association (n=25)

6'. Stands of shrubs in upland settings, not associated with depressions, or moist sites…

12. Stands are in uplands and include *Atriplex canescens, A. confertifolia, Psorothamnus* spp., *Grayia spinosa, Ericameria teretifolia* and/or *Ephedra nevadensis* among the highest cover shrub species. *Krascheninnikovia lanata,* may be present, but not as a dominant in these stands…

13. *Atriplex canescens*, *A. confertifolia, Menodora spinescens, Psorothamnus polydenius* and/or *P. arborescens* characterize the shrub canopy (three choices below)…

14. *Psorothamnus arborescens* and/or *P. polydenius* characterize stands. Either *P. arborescens* or *P. polydenius* is present with at least twice the cover of *Atriplex canescens* and/or *A. confertifolia*, though both species of *Psorothamnus* are often present…
Psorothamnus (arborescens, polydenius) **Association of the *Psorothamnus (arborescens, polydenius)* (Mojave indigobush, Nevada indigobush scrub) Provisional Alliance (n=10)**

14'. *Atriplex canescens, A. confertifolia* or *Menodora spinescens* characterize stands, with *Psorothamnus arborescens* and *P. polydenius* being absent to co-dominant (three choices below)…

15. *Atriplex canescens* is evenly distributed across the stand, with *Psorothamnus arborescens* or *P. polydenius* being the only shrub that may meet or slightly exceed it in cover (if *Psorothamnus* has at least twice the cover, key to the *Psorothamnus* Alliance described above). Stands usually occupy sandy substrates, but may occur on hillslopes and ridges if sand is present due to wind…

=Atriplex canescens-Psorothamnus (arborescens, polydenius) **Provisional Association of the *Atriplex canescens* (Fourwing saltbush scrub) Alliance (n=7)**

15'. *Atriplex confertifolia* is dominant or co-dominant in the shrub layer. A species of *Psorothamnus* is often present, sometimes with equal or just under twice the cover of *A. confertifolia. Tetradymia glabrata* occasionally has the highest cover, but there is no alliance defined for this species. Stands often occur in alkaline valleys or playas and in the upper mid-elevation Mojave Desert, on rolling hills and slopes. They are particularly common in portions of the mapping area with rhyolite, or other upland volcanic soils…
=Atriplex confertifolia **(Shadscale scrub) Alliance (n=15)**

16. *Krascheninnikovia lanata* is present as a sub-dominant shrub...
=Atriplex confertifolia-Krascheninnikovia lanata **Association (n=9)**

16'. *Krascheninnikovia lanata* is absent, with *Psorothamnus arborescens* and/or *P. polydenius* being characteristically present…
=Atriplex confertifolia-Psorothamnus (arborescens, polydenius) **Provisional Association (n=6)**

13'. *Grayia spinosa* or *Ericameria teretifolia* characterize the shrub canopy…

17. *Ericameria teretifolia has ≥2% absolute cover and typically has the highest cover, but may share dominance with other shrubs such as Ericameria cooperi. Found in disturbed uplands or in longer-persistent stands on shallow granitic pediments and rock outcrops. Other associated shrubs may include Tetradymia spp., Grayia spinosa* and *Krascheninnikovia lanata.*
=*Ericameria teretifolia* (Needleleaf rabbitbrush scrub) Alliance (n=1)

17'. *Grayia spinosa* is evenly distributed and among one of the highest cover shrub species present. Co-dominance is the rule with *G. spinosa* stands; they rarely are strongly monospecifically dominant and may sometimes have slightly higher cover of *Ephedra nevadensis* or *Tetradymia glabrata* and similar cover of *Tetradymia axillaris* or *Atriplex confertifolia*. Thus, careful assessment of shrub dispersion is important for proper identification. In many cases stands have been affected by fire, clearing, grazing, or other disturbances and seral shrubs or increasers are present. Stands tend to occupy the transition between warm desert and cool desert vegetation…
=Grayia spinosa **(Spiny hop sage scrub) Alliance (n=10)**

12'. Stands characterized by *Ericameria cooperi, E. nauseosa,* or *Artemisia tridentata*. Stands have received recent disturbance from fluvial action, fire, or clearing and are usually in rocky uplands, cobbly washes, or other areas. Dominant plants are relatively small, short-lived plants that colonize uplands following natural or unnatural disturbance such as clearing or fire…

18. Stands characterized by either *Ericameria cooperi* or *E. nauseosa…*

19. *Ericameria nauseosa* has ≥2% cover and is the dominant shrub. Found in mid and upper elevations, usually in areas with fire, flood, agricultural or grazing history…
=Ericameria nauseosa **(Rubber rabbitbrush scrub) Alliance (n=10)**

20. *Sporobolus airoides* intermixes in the herbaceous understory with *Ericameria nauseosa. Distichlis spicata* is often present…
***=Ericameria nauseosa/Sporobolus airoides* Association (n=9)**
20'. Stands not as above, with *E. nauseosa* being the most characteristic species in a stand…
***=Ericameria nauseosa* Association (n=1)**

19'. *Ericameria cooperi* is evenly distributed and dominant across the stand. Stands show evidence of recent disturbance (typically fire) and are usually adjacent to stands with larger and longer-lived shrubs that are more easily keyed to *Grayia spinosa* or *Ericameria teretifolia.*

This type is highly provisional based on *E. cooperi* having a significant presence (generally >40% relative cover) in a stand. This alliance is unusual and most stands with co-dominant *E. cooperi* can be better placed in other alliances. Stands co-dominated by *E. nauseosa* or *E. teretifolia* usually key to those alliances, respectively. The species occurs commonly in the West Mojave in all sub-regions. It is spring-flowering and shorter-lived species that is more of a disturbance responder than *Ericameria teretifolia…*
***=Ericameria cooperi* (Cooper's goldenbush) Provisional Alliance (n=1)**

18'. *Artemisia tridentata* is dominant or co-dominant in the shrub canopy with ≥2% absolute cover in the shrub canopy. *Ephedra nevadensis* is often present. [Note: classification of vegetation using *Artemisia tridentata* has proceeded using different subspecies to indicate alliances due to the ecological stereotypy of many of the races]…
***=Artemisia tridentata-Ephedra nevadensis* Association of the *Artemisia tridentata* (Big sagebrush) Alliance (n=7)**

2'. Stands characterized by herbaceous species (although shrubs may be present with non-uniform distribution, or low total percent cover)…

21. Stands dominated or characterized by mostly annual grasses or forbs of uplands, not of wetlands…

22. Stands strongly dominated by non-natives, lacking evenly distributed diagnostic native plants (usually <5% relative cover). Annual *Bromus, Schismus, Avena, Brassica* and other non-native herbaceous species are strongly dominant, with low cover and/or heterogeneous distribution of native herb species...
=Mediterranean California naturalized annual and perennial grassland Group (n=0)

22'. Stands characterized by native species of dry upland and sandy settings…

Achnatherum hymenoides has >30% relative cover in the herbaceous layer, usually occurring with non-natives…
***=Achnatherum hymenoides* (Indian rice grass grassland) Alliance (n=0)**

21'. Stands dominated by tall to short herbs and graminoids in wet to moist meadows, seasonal ponds, vernal pools, or in regularly to episodically flooded bottomlands or depressions (including saline and alkaline depressions such as playas). Due to the proximity of fresh and saline or alkaline water sources in the study area, it is possible for freshwater and salt or alkaline stands to be immediately adjacent to one another. This may make mapping of wetland complexes near large playas and rivers problematic…

23. Stands are dominated by moderately tall, emergent perennial herbs such as Schoenoplectus, Typha, and Phragmites. Water chemistry may vary from brackish to fresh. Part of the **Western North American Freshwater Wet Meadow & Marsh Macrogroup…**

24. *Phragmit*es australis or Typha domingensis dominates…

25. *Phragmites australis*, the tall, stoloniferous, wetland grass, dominates the stand. Most stands are small, narrow and occur adjacent to permanent water sources such as springs, flowing streams and rivers. Most are below mappable size for this project, with the exception of a few stands along the southern portion of the map area . Most stands in isolated wetlands appear to be native…
***=Phragmites australis* (Common reed marshes) Alliance (n=4)**

25'. One or more species of *Typha* dominate(s) in the herbaceous layer (most stands growing within water with slightly alkaline or saline chemistry are *T. domingensis)*. If a species of *Schoenoplectus* co-dominates, key to the *Schoenoplectus* type…
***=Typha (angustifolia, domingensis, latifolia)* (Cattail marshes) Alliance (n=1)…**

Typha domingensis is dominant…
***=Typha domingensis* Association (n=1)**

24'. Tall bulrush (*Schoenoplectus* spp.) dominates in the herbaceous layer. Small, but often mappable stands occur in all areas of the study area, where ponds and sluggish, permanently flowing water exist…

26. *Schoenoplectus americanus,* a vivid, green, triangular-stemmed bulrush, forms open to dense stands in moist to flooded borders of saline or alkaline marshes and may be co-dominant with *S. acutus*…
***=Schoenoplectus americanus* (American bulrush marsh) Alliance (n=11)**

27. *Schoenoplectus americanus* dominates the tall herb layer. *Muhlenbergia asperifolia* is often present in the understory, sometimes with twice as much cover as *S. americanus…*
***=Schoenoplectus americanus* Association (n=5)**

27'. *Schoenoplectus acutus* is sub- to co-dominant with *S. americanus…*
***=Schoenoplectus americanus-Schoenoplectus acutus* (n=6)**

26'. *Schoenoplectus acutus* characterizes the herbaceous layer in fresh or brackish water. [*S. californicus* appears more regularly at edges of open water; and *Bolboschoenus maritimus* (formerly *Scirpus m*., and not represented by a specific map code in this project), the alkali bulrush, occurs in brackish to salty or alkaline water]…
***=Schoenoplectus acutus* (Hardstem bulrush marsh) Alliance (n=3)**

28. *Schoenoplectus acutus* strongly dominates in the herb layer…
***=Schoenoplectus acutus* Association (n=2)**

28'. *Typha domingensis* co-dominates with *S. acutus* in the tall herb layer…
***=Schoenoplectus acutus-Typha domingensis* Association (n=1)**

23’. Stands composed of mid-sized grasses, rushes (and possibly other graminoids, like *Carex*) and/or broad-leaf perennial herbs and characteristic of moist to wet meadows and marsh edges with fresh to alkaline or saline water chemistry...

29. Stands of rushes (*Juncus*), Yerba mansa (*Anemopsis*), King’s mousetail (*Ivesia kingii)* and/or *Eleocharis* that do not contain higher cover of true grasses such as *Distichlis, Sporobolus, or Spartina*. Usually not saturated or flooded through much of the growing season…

30. Stands of either *Juncus* or *Eleocharis* that are not distinguished by the presence of evenly distributed, broad-leaf perennial herbs*…*

31. Stands dominated by *Eleocharis rostellata* or *E. macrostachya. Juncus arcticus* may be co-dominant…

32. *Eleocharis rostellata* is dominant to co-dominant with other wetland herbs such as *Juncus arcticus* (*E. rostellata* is usually identifiable by somewhat narrow stems and recurving fruiting stems)…
=*Eleocharis rostellata* Association of the *Eleocharis rostellata* (Beaked spike rush marshes) Alliance (n=10)

32’. *Eleocharis macrostachya* is dominant or co-dominant with >30% relative cover in the herbaceous layer…
=***Eleocharis macrostachya* Association of the *Eleocharis macrostachya* (Pale spike rush marshes) Alliance (n=4)**

31’. *Juncus arcticus* (usually termed var. *mexicanus* or var. *balticus*) the dark brownish-green, rhizomatous rush with spiral stems, is dominant or characteristic…
***=Juncus arcticus* Association of the *Juncus arcticus (*var. *balticus, mexicanus)* (Baltic and Mexican rush marshes) Alliance (n=6)…**

30’. Stands not dominated by *Juncus* or *Eleocharis*, but instead distinguished by the presence and even distribution of broad-leaf perennial herbs (three choices below)…

33. Vegetation dominated or characterized by the distinctive, native herb *Anemopsis californica*. Stands may contain *Juncus* or *Schoenoplectus* species, but are not dominated by them. *Distichlis spicata* may be similar in cover to *A. californica.* Stands occur in moist meadows and flats, often associated with alkaline water and stands of *Distichlis spicata, Schoenoplectus americanus*, or *Juncus arcticus*. Individual stands occur in the northern portion of Fish Slough, near or on grazed irrigated meadows…
***=Anemopsis californica-Juncus arcticus* Association of the *Anemopsis californica* (Yerba mansa meadows) Alliance (n=6)**

33’. Stands dominated by the noxious perennial herb *Lepidium latifolium. If L. latifolium* is co-dominant with other natives, stand will key to the most diagnostic native species…
=*Lepidium latifolium* (Perennial pepper weed patches) Semi-Natural Stands (n=0)

33’’. *Ivesia kingii* characterizes open stands in alkaline settings, usually having the highest cover in the herbaceous layer and intermixing with other species such as *Juncus arcticus,*

Pyrrocoma racemosa, Spartina gracilis, Poa secunda and others. If *Muhlenbergia asperifolia* is co-dominant, key to this alliance…
=*Ivesia kingii* Association of the *Ivesia kingii* Provisional (King's mousetail) Alliance (n=17)

29'. Stands are dominated by grasses while other graminoids, such as *Juncus* or *Eleocharis* may be present, but are not abundant…

34. Stands dominated or characterized by tufted or bunch grasses (three choices below)…

35. *Muhlenbergia asperifolia,* the small, very cute, fluffy-tufted grass, with filamentous panicle branches, is strongly dominant in the herbaceous layer. If *M. asperifolia* is co-dominant with another herb species that has its own alliance, key to the other alliance. *M. asperifolia* is usually a disturbance responder, following fire or grazing; often in areas typically dominated by *Juncus arcticus* or *Eleocharis. Carex* and *Solidago spectabilis* are among some of the other taxa that may be present (Note: may be below MMU. Look for the possible dominance of a *Puccinellia*, which may look like *M. asperifolia* and is another possible disturbance follower in similar habitats)...
=*Muhlenbergia asperifolia* Provisional (Alkali muhly) Alliance (n=2)

35'. Vegetation characterized and/or dominated by the perennial tufted grass *Sporobolus airoides* (Alkali sacaton). *Distichlis spicata* and/or *Glycyrrhiza lepidota* may have similar or higher cover. Shrubs such as *Ericameria albida*, *E. nauseosa, Allenrolfea occidentalis*, or *Sarcobatus vermiculatus* can have scattered cover, but these woody species are not evenly distributed and generally have lower cover than *Sporobolus*…
=*Sporobolus airoides* Association of the *Sporobolus airoides* (Alkali sacaton grassland) Alliance (n=17)

35''. *Poa secunda* ssp. *juncifolia* has the highest cover in the herbaceous layer and co-occurs with a variety of species, such as *Distichlis spicata* and *Juncus arcticus,* on alkaline soils…
=*Poa secunda* (Curly or one-sided blue grass grassland) Alliance (n=2)

34'. Stands dominated or characterized by rhizomatous grasses as opposed to tufted bunch grasses…

36. *Spartina gracilis* is co-dominant to dominant, without a strong presence by *Juncus arcticus*, *Distichlis spicata* or *Sporobolus airoides…*
=*Spartina gracilis* (Alkali cordgrass marsh) Alliance (n=4)

36'. *Distichlis spicata* is dominant OR co-dominant with *Juncus arcticus* or *Muhlenbergia asperifolia. Eleocharis rostellata* and other wetland herbs may have similar cover to *D. spicata*, but they are not evenly distributed. Soils are often deep, alkaline or saline, and poorly drained. A variety of native and nonnative forbs and grasses may be present…
=*Distichlis spicata* (Salt grass flats) Alliance (n=20)

37. *Juncus arcticus* intermixes and may have similar cover to *Distichlis spicata. Muhlenbergia asperifolia* may be similar in cover to *D. spicata…*
=*Distichlis spicata-Juncus arcticus* Association (n=17)

37’. *Distichlis spicata* is the only characteristic species in the herbaceous layer…
=*Distichlis spicata* Association (n=4)

Appendix D

Plant Species in Fish Slough Mapping Area

This is a list of all plant species recorded during field data collection. We use the USDA PLANTS database nomenclature; names in parentheses are from the Jepson Manual, 2nd Edition (Baldwin et al. 2012).

Species Name	Stratum
Achnatherum (=Stipa) hymenoides	Herb
Achnatherum speciosum (=Stipa speciosa)	Herb
Agrostis exarata	Herb
Allenrolfea occidentalis	Shrub
Amsinckia sp.	Herb
Amsinckia tessellata	Herb
Anemopsis californica	Herb
Apocynum cannabinum	Herb
Artemisia tridentata	Shrub
Asclepias sp.	Herb
Asclepias speciosa	Herb
Aster lanceolatus ssp. hesperius (=Symphyotrichum lanceolatum var. hesperium)	Herb
Astragalus sp.	Herb
Atriplex canescens	Shrub
Atriplex confertifolia	Shrub
Atriplex lentiformis	Shrub
Atriplex parryi	Shrub
Atriplex phyllostegia (=A. covillei)	Herb
Bassia hyssopifolia	Herb
Bassia sp.	Herb
Brassica sp.	Herb
Brassica tournefortii	Herb
Brickellia microphylla	Shrub
Brickellia sp.	Shrub
Bromus diandrus	Herb
Bromus madritensis	Herb
Bromus madritensis ssp. rubens	Herb
Bromus tectorum	Herb
Camissonia sp.	Herb
Carex simulata	Herb
Carex sp.	Herb
Castilleja minor	Herb
Centaurium namophilum (=Zeltnera namophila)	Herb
Centaurium namophilum var. nevadense (=Zeltnera exaltata)	Herb
Centaurium sp. (=Zeltnera)	Herb
Centrostegia thurberi	Herb
Chaenactis fremontii	Herb
Chaenactis sp.	Herb
Chrysothamnus viscidiflorus	Shrub
Cicuta douglasii	Herb

Species Name	Stratum
Cirsium mohavense	Herb
Cirsium vulgare	Herb
Cleomella brevipes	Herb
Cleomella obtusifolia	Herb
Cleomella parviflora	Herb
Cleomella plocasperma	Herb
Cleomella sp.	Herb
Cordylanthus (=Chloropyron) maritimus	Herb
Cordylanthus maritimus ssp. canescens (=Chloropyron maritimum ssp. c.)	Herb
Crepis runcinata	Herb
Cryptantha sp.	Herb
Cuscuta sp.	Herb
Distichlis spicata	Herb
Dodecatheon pulchellum	Herb
Eleocharis macrostachya	Herb
Eleocharis rostellata	Herb
Eleocharis sp.	Herb
Elymus cinereus	Herb
Elymus elymoides	Herb
Elymus triticoides	Herb
Ephedra nevadensis	Shrub
Epilobium adenocaulon (=E. ciliatum)	Herb
Epilobium palustre	Herb
Epilobium sp.	Herb
Equisetum laevigatum	Herb
Eriastrum sp.	Herb
Eriastrum wilcoxii	Herb
Ericameria albida	Shrub
Ericameria cooperi	Shrub
Ericameria nauseosa	Shrub
Ericameria sp.	Shrub
Ericameria teretifolia	Shrub
Eriogonum deflexum	Herb
Eriogonum inflatum	Herb
Eriogonum sp.	Herb
Eriogonum umbellatum	Shrub
Euthamia occidentalis	Herb
Frankenia salina	Herb
Galium sp.	Herb
Glycyrrhiza lepidota	Herb
Gnaphalium (=Pseudognaphalium) stramineum	Herb
Grayia spinosa	Shrub
Helianthus annuus	Herb

Species Name	Stratum
Helianthus nuttallii	Herb
Helianthus sp.	Herb
Heliotropium curassavicum	Herb
Hirschfeldia incana	Herb
Hordeum jubatum	Herb
Hordeum sp.	Herb
Iris missouriensis	Herb
Iris sp.	Herb
Iva axillaris	Herb
Ivesia kingii	Herb
Juncus arcticus (=J. balticus)	Herb
Juncus balticus	Herb
Juncus mexicanus	Herb
Koeleria sp.	Herb
Krascheninnikovia lanata	Shrub
Lactuca serriola	Herb
Lepidium fremontii	Shrub
Lepidium latifolium	Herb
Lepidium sp.	Shrub
Leptodactylon (=Linanthus) pungens	Herb
Lessingia lemmonii	Herb
Leymus (=Elymus) triticoides	Herb
Loeseliastrum schottii	Herb
Lycium andersonii	Shrub
Lycopus asper	Herb
Machaeranthera (=Arida) carnosa	Shrub
Malva parviflora	Herb
Melilotus albus	Herb
Menodora spinescens	Shrub
Mentha arvensis	Herb
Mentha canadensis	Herb
Mirabilis bigelovii (= M. laevis var. villosa)	Herb
Muhlenbergia asperifolia	Herb
Nitrophila occidentalis	Herb
Nitrophila sp.	Herb
Panicum capillare	Herb
Phragmites australis	Herb
Phragmites sp.	Herb
Poa fendleriana	Herb
Poa pratensis	Herb
Poa secunda	Herb
Poa secunda ssp. juncifolia	Herb
Poa sp.	Herb

Species Name	Stratum
Polypogon monspeliensis	Herb
Populus fremontii	Tree
Potentilla sp.	Herb
Psathyrotes annua	Herb
Psorothamnus arborescens	Shrub
Psorothamnus arborescens var. minutifolius	Shrub
Psorothamnus polydenius	Shrub
Psorothamnus sp.	Shrub
Puccinellia nuttalliana	Herb
Puccinellia sp.	Herb
Purshia tridentata	Shrub
Pyrrocoma racemosa	Herb
Pyrrocoma racemosa var. paniculata	Herb
Pyrrocoma sp.	Herb
Robinia pseudoacacia	Tree
Robinia sp.	Tree
Rosa woodsii	Shrub
Rumex crispus	Herb
Salix exigua	Shrub
Salix laevigata	Tree
Salix lasiolepis	Shrub
Salsola sp.	Herb
Salsola tragus	Herb
Sarcobatus vermiculatus	Shrub
Sarcobatus vermiculatus var. baileyi (=S. baileyi)[1]	Shrub
Schismus sp.	Herb
Schoenoplectus acutus	Herb
Schoenoplectus americanus	Herb
Scirpus (=Amphiscirpus) nevadensis	Herb
Sida (=Malvella) leprosa	Herb
Sisyrinchium halophilum	Herb
Sisyrinchium sp.	Herb
Solidago sp.	Herb
Solidago spectabilis	Herb
Spartina gracilis	Herb
Sphaeralcea ambigua	Herb
Sporobolus airoides	Herb
Stanleya elata	Herb
Stanleya pinnata	Herb

[1] Sarcobatus baileyi is a rare plant that has a CNPS Rare Plant Rank of 2B.3, It was previously known from less than five locations in California but is more common in Nevada. Plants were found at the reconnaissance point FIR1306251738, in a sandy depression approximately ½ mile straight line distance ENE of the NE Spring near the dirt road to Ronda Lane in Chalfant. A voucher was deposited at UCD.

Species Name	Stratum
Stephanomeria exigua	Shrub
Stephanomeria pauciflora	Shrub
Stephanomeria sp.	Herb
Stipa speciosa	Herb
Suaeda moquinii (=S. nigra)	Shrub
Symphyotrichum frondosum	Herb
Tetradymia axillaris	Shrub
Tetradymia canescens	Shrub
Tetradymia glabrata	Shrub
Tetradymia sp.	Shrub
Tetradymia stenolepis	Shrub
Triglochin concinnum (=T. concinna)	Herb
Triglochin concinnum var. debile (=T. concinna var. debilis)	Herb
Triglochin maritimum (=T. maritima)	Herb
Triglochin sp.	Herb
Typha angustifolia	Herb
Typha domingensis	Herb
Typha sp.	Herb
Urtica holosericea (=U. dioica ssp. h.)	Herb
Xylorhiza tortifolia	Shrub

Appendix E

Crosswalk

This table is a crosswalk between the mapped vegetation types and the California Wildlife Habitat Relationships Classification.

Map Unit	Alliance / Association	CWHR Type	CWHR Code
1411	*Populus fremontii* Alliance	Desert Riparian	DRI
	Populus fremontii Association	Desert Riparian	DRI
1521	*Rosa woodsii* Provisional Alliance	Montane Riparian	MRI
	Rosa woodsii Provisional Alliance (Unable to map to association level)	Montane Riparian	MRI
3122	*Poa secunda* Alliance	Perennial Grassland	PGS
	Poa secunda ssp. *juncifolia* Association	Perennial Grassland	PGS
3411	*Phragmites australis* Alliance	Fresh Emergent Wetland	FEW
	Phragmites australis Association	Fresh Emergent Wetland	FEW
3413	*Schoenoplectus acutus* Alliance	Fresh Emergent Wetland	FEW
	Schoenoplectus acutus Association	Fresh Emergent Wetland	FEW
	Schoenoplectus acutus-Typha domingensis Association	Fresh Emergent Wetland	FEW
3415	*Typha (angustifolia, domingensis, latifolia*) Alliance	Fresh Emergent Wetland	FEW
	Typha (*angustifolia, domingensis, latifolia*) Alliance (Unable to map to association level)	Fresh Emergent Wetland	FEW
	Typha domingensis Association	Fresh Emergent Wetland	FEW
3512	*Eleocharis macrostachya* Alliance	Wet Meadow	WTM
	Eleocharis macrostachya Association	Wet Meadow	WTM
3611	*Juncus arcticus* (var. *balticus, mexicanus)* Alliance	Alkali Desert Scrub	ASC
	Juncus arcticus (var. *balticus, mexicanus*) Alliance (Unable to map to association)	Alkali Desert Scrub	ASC
	Juncus arcticus Association	Alkali Desert Scrub	ASC
3661	*Distichlis spicata* Alliance	Alkali Desert Scrub	ASC
	Distichlis spicata Association	Alkali Desert Scrub	ASC
	Distichlis spicata-Juncus arcticus Association	Alkali Desert Scrub	ASC
3712	*Sporobolus airoides* Alliance	Wet Meadow	WTM
	Sporobolus airoides Association	Wet Meadow	WTM
3713	*Anemopsis californica* Alliance	Alkali Desert Scrub	ASC
	Anemopsis californica-Juncus arcticus Association	Alkali Desert Scrub	ASC
3715	*Schoenoplectus americanus* Alliance	Fresh Emergent Wetland	FEW
	Schoenoplectus americanus Alliance (Unable to map to association level)	Fresh Emergent Wetland	FEW
	Schoenoplectus americanus Association	Fresh Emergent Wetland	FEW
	Schoenoplectus americanus-Schoenoplectus acutus Association	Fresh Emergent Wetland	FEW
3716	*Eleocharis rostellata* Alliance	Alkali Desert Scrub	ASC
	Eleocharis rostellata Association	Alkali Desert Scrub	ASC
3717	*Muhlenbergia asperifolia* Provisional Alliance	Alkali Desert Scrub	ASC
	Muhlenbergia asperifolia Provisional Alliance (Unable to map to association level)	Alkali Desert Scrub	ASC
3718	*Ivesia kingii* Provisional Alliance	Perennial Grassland	PGS
	Ivesia kingii Provisional Alliance (Unable to map to association level)	Perennial Grassland	PGS
	Ivesia kingii Provisional Association	Perennial Grassland	PGS

Map Unit	Alliance / Association	CWHR Type	CWHR Code
3719	*Spartina gracilis* Alliance	Alkali Desert Scrub	ASC
	Spartina gracilis Association	Alkali Desert Scrub	ASC
3721	*Allenrolfea occidentalis* Alliance	Alkali Desert Scrub	ASC
	Allenrolfea occidentalis/Sporobolus airoides Association	Alkali Desert Scrub	ASC
3725	*Suaeda moquinii* Alliance	Alkali Desert Scrub	ASC
	Suaeda moquinii Association	Alkali Desert Scrub	ASC
3729	*Atriplex parryi* Provisional Alliance	Alkali Desert Scrub	ASC
	Atriplex parryi Provisional Association	Alkali Desert Scrub	ASC
4111	*Menodora spinescens* Alliance	Desert Scrub	DSC
	Menodora spinescens-Atriplex confertifolia Association	Desert Scrub	DSC
5111	*Atriplex canescens* Alliance	Alkali Desert Scrub	ASC
	Atriplex canescens-Psorothamnus (arborescens, polydenius) Provisional Association	Alkali Desert Scrub	ASC
5112	*Atriplex confertifolia* Alliance	Alkali Desert Scrub	ASC
	Atriplex confertifolia Alliance (Unable to map to association level)	Alkali Desert Scrub	ASC
	Atriplex confertifolia Association	Alkali Desert Scrub	ASC
	Atriplex confertifolia-Krascheninnikovia lanata Association	Alkali Desert Scrub	ASC
	Atriplex confertifolia-Psorothamnus (arborescens, polydenius) Provisional Association	Alkali Desert Scrub	ASC
5212	*Ericameria nauseosa* Alliance	Sagebrush	SGB
	Ericameria nauseosa Alliance (Unable to map to association level)	Sagebrush	SGB
	Ericameria nauseosa Association	Sagebrush	SGB
	Ericameria nauseosa/Sporobolus airoides Association	Sagebrush	SGB
5215	*Ericameria cooperi* Provisional Alliance	Desert Scrub	DSC
	Ericameria cooperi Provisional Alliance (Unable to map to association level)	Desert Scrub	DSC
5217	*Ericameria teretifolia* Alliance	Sagebrush	SGB
	Ericameria teretifolia Association	Sagebrush	SGB
5311	*Artemisia tridentata* Alliance	Sagebrush	SGB
	Artemisia tridentata-Ephedra nevadensis Association	Sagebrush	SGB
5411	*Grayia spinosa* Alliance	Desert Scrub	DSC
	Grayia spinosa-Atriplex confertifolia Association	Desert Scrub	DSC
5413	*Ephedra nevadensis* Alliance	Desert Scrub	DSC
	Ephedra nevadensis Alliance (Unable to map to association level)	Desert Scrub	DSC
5427	*Psorothamnus* (*arborescens, polydenius*) Alliance	Desert Scrub	DSC
	Psorothamnus (*arborescens, polydenius*) Alliance (Unable to map to association level)	Desert Scrub	DSC
5511	*Sarcobatus vermiculatus* Alliance	Alkali Desert Scrub	ASC
	Sarcobatus vermiculatus Alliance (Unable to map to association level)	Alkali Desert Scrub	ASC
	Sarcobatus vermiculatus Association	Alkali Desert Scrub	ASC
	Sarcobatus vermiculatus-Atriplex confertifolia Association	Alkali Desert Scrub	ASC
5512	*Ericameria albida* Alliance	Alkali Desert Scrub	ASC
	Ericameria albida Association	Alkali Desert Scrub	ASC

Map Unit	Alliance / Association	CWHR Type	CWHR Code
6115	Massive sparsely vegetated rock outcrop	Barren	BAR
	Massive sparsely vegetated rock outcrop (Unable to map to association level)	Barren	BAR
6116	Unvegetated alkali scald	Barren	BAR
	Unvegetated alkali scald (Unable to map to association level)	Barren	BAR
9300	Built-up and Urban Disturbance	Urban	URB
	Built-up and Urban Disturbance (Unable to map to association level)	Urban	URB
9800	Water	Riverine	RIV
	Water (Unable to map to association level)	Riverine	RIV