

Vegetation Mapping for Wildlife Habitat, Conservation Planning and Land Management Analysis in the Central Coast Region and including the Ciervo-Panoche Natural Area

**California Native Plant Society (CNPS)
Vegetation Program -- May 2015**

Introduction

CNPS has initiated a project with partners at the Bureau of Land Management (BLM) and The Nature Conservancy (TNC); Phase 1 of the project includes detailed vegetation mapping in the north-western portion of the Ciervo-Panoche Natural Area (CPNA). The resulting datasets are expected to be evaluated within a larger state-wide climate change monitoring effort, since this project provides baseline vegetation monitoring data for evaluating vegetation change with respect to projected climate change. The project objectives during Phase 1 have included vegetation field sampling and vegetation mapping (photo-interpretation, delineation, and attribution) in the north-western CPNA (see Figure 1).

Methods

CNPS conducted vegetation sampling in the northern CPNA in the spring of 2013 and 2014 to establish a floristic vegetation classification. A combined vegetation rapid assessment and relevé protocol, developed by CNPS and the California Department of Fish and Wildlife (CDFW), was used to conduct field surveys. The rapid assessment method is stand-based while the relevé method is plot-based; both methods are used to categorize and map vegetation at a fine-scale. Relevé plots were conducted mainly in herbaceous vegetation and rapid assessment surveys were used for woody types.

The vegetation data were entered into a custom MS Access database along with existing data from the region, and both a vegetation classification and key were developed. The classification is fully compatible with the National Vegetation Classification System (NVCS) (FGDC 2008) and the Manual of California Vegetation (Sawyer et al. 2009), which CNPS and CDFW jointly maintain. For a more detailed description of the sampling and classification protocols used in this project, refer to the "Carrizo Plain National Monument Vegetation Classification and Mapping Project" report (Buck-Diaz & Evens 2011).

CNPS compiled numerous layers of existing GIS data, including aerial imagery, geology, soils, and land ownership boundaries. Staff also modified a customized ESRI geodatabase to conduct fine-scale vegetation mapping. Staff translated the vegetation key into mapping units that comply with the NVCS (using in-kind CNPS contributions). We developed a mapping cheat sheet that includes the map classes and alliances as well as higher level groups and macrogroups to standardize the attribution of all vegetation types (see attached).

Using ArcGIS, CNPS delineated vegetation units or polygons using 'heads-up digitizing' techniques. Heads-up digitizing is a GIS process of interpreting imagery on-screen and of manually using a mouse to digitize polygons. The vegetation map was based upon one-meter resolution NAIP imagery taken in the summer of 2012. The minimum mapping unit (MMU) was 1 acre, with exceptions for wetland and other special types (0.5 acre MMU). While the primary map attribute was vegetation type, additional map attributes include structural information (e.g., herbaceous, shrub and tree cover),

and disturbance and site quality information. Previously collected field data (through in-kind CNPS, CDFW and TNC contributions) provided the mappers with information on signatures for the different vegetation types. Mapping staff conducted quality control on their work before initiating a field validation effort. For more detailed methodology on mapping techniques see the “Vegetation Mapping and Accuracy Assessment Report for Carrizo Plain National Monument” (Stout, et al. 2013).



Figure 1. Extent of Phase 1 mapping within the Carrizo Plain National Monument

The following steps summarize the vegetation mapping tasks completed in Phase 1:
1) Translated a vegetation classification key of the northern CPNA into a map key, where the map classes are compliant with NVCS;

- 2) Delineated vegetation polygons and attributed with vegetation type, cover, and other characteristics such as disturbance type present, across the north-western CPNA (85,000 acres);
- 3) Conducted field verification in the map area.

Results

CNPS has conducted 131 rapid assessment and relevé field samples during six weeks of field sampling in the northern Ciervo-Panoche region. These samples were added to existing CNPS and CDFW data from the region and a total of 233 samples were classified. The analysis resulted in a floristically based vegetation key, which was then translated into mapping types. We also established 10 permanent long-term monitoring plots to detect vegetation change over time across different plant community types; the monitoring plots include a 400 m² relevé plot with one 100 m² and eight 1 m² plots nested within the larger plot (Buck-Diaz and Evens 2011). The permanent plots will contribute to a larger study of the impacts of climate change within the Central Coast ecoregion.

Initial mapping of approximately 85,000 acres was completed utilizing both in-kind CNPS contributions and BLM funding. The map includes over 4,000 polygons within 45 mapping unit types mainly at the alliance level with two association level map units and other land cover types. The *Eriogonum fasciculatum* - *Hesperoyucca whipplei* Association was mapped at a finer scale to highlight potential habitat for the desert night lizard (*Xantusia vigilis*), and the *Eriogonum nudum* var. *indictum* Association was mapped because it is included on the CNPS Inventory of Rare and Endangered Plants (list 4.2). Nine land cover or exotic vegetation codes were used (e.g., cliffs and rock outcrops, developed, agriculture, exotic trees and shrubs).

The majority of the map area, approximately 62,000 acres, is identified as California Annual & Perennial Grassland Macrogroup, while grasslands with field surveys were classified at a finer level. Four shrub types dominate the majority of the remaining area: *Ephedra californica* Alliance (which provides critical habitat for the endangered blunt-nosed leopard lizard, *Gambelia sila*) and *Eriogonum fasciculatum* Alliance—each cover about 6,000 acres; and *Ericameria linearifolia* and *Atriplex polycarpa* Alliances—each cover about 4,000 acres each. Of the finer scale types, 83 acres of the CNPS listed *Eriogonum nudum* var. *indictum* Association and 374 acres of *Eriogonum fasciculatum* – *Hesperoyucca whipplei* Association were mapped. Additional acres of these important types occur to the east of the Phase 1 mapping area. The final map was quality controlled and a dissolve geo-processing tool was used to review and modify adjacent polygons with identical attributes.

CNPS conducted a map field validation effort to ensure that the map adheres to the state and national standards of 80% accuracy. Staff reviewed and modified an existing accuracy assessment field data form. Polygons were allocated by CNPS and were stratified by vegetation type and distance from roads/trails to ensure efficiency in the field. Any polygon with a pre-existing classification or reconnaissance survey associated with it was excluded from the allocation. Allocated polygons of the same map unit were located at least 1km away from other allocated polygons of the same map unit. In March 2015, CNPS staff conducted 189 field validation surveys across 192 pre-selected polygons. Surveys were performed across the mapping area over a two week period and covered an array of vegetation types.

Two forms of accuracy, users' and producers', can be estimated from the data (Story and Congalton 1986). Users' accuracy (field verification) is defined as the probability that a location mapped as class 'i' is shown in the field to be class 'i'. This provides an estimate of how well spatial mapping data represents what is found on the ground. Producers' accuracy (map user), on the other

hand, is conditional on the true vegetation class in the field. The producers' accuracy for class 'j' is the probability that a location of vegetation class 'j' in the field is mapped as class 'j'. Producers' accuracy informs the producers of remotely sensed data how readily a mapping class may be detected when it occurs on the ground (Story and Congalton 1986, Lea and Curtis 2010).

Producer's accuracy across all types with a sample size of 3 or more was 81%, while the user's accuracy of types with a sample size of 3 or more was 86%, meeting state standards for accuracy. Producer and user accuracy was slightly lower across all types regardless of sample size (i.e., 77% and 81% respectively), though several types had only one sample. Field validation data were used to correct the map based on individual samples and trends of inaccuracy.

Next steps

Future work could include additional quality control on attributes such as degree of roaded-ness and the presence/absence of *Hesperoyucca whipplei*, and the distinction of alkali versus freshwater wetland types. Additional review and/or lumping of lower scoring alliance types to the group level can improve the map accuracy (e.g. placing both *Schoenoplectus* and *Typha* alliances in Arid West Interior Freshwater Emergent Marsh Group). New sampling and/or ground truth of inaccessible private lands in the southeast portion of the Phase 1 map would assist in the identification of shrub patterns difficult to interpret via remote sensing.

Given additional funds, a finer delineation of grassland polygons could be achieved based on the attributes of overall cover and disturbance. The presence of burrowing rodents was noted in areas with distinct patterns, which were visible via aerial imagery, and was recorded in a "Notes" field, and large grassland polygons were split if they differed in presence versus absence of burrows. Polygons could be selected using the "Notes" field and a yes/no attribute could be created to highlight visible burrows for other research needs.

One third of the Ciervo-Panoche Natural Area has been mapped during this Phase 1. With additional funding support, we hope to map the remaining two-thirds by 2019. A fine-scale vegetation map and supporting field survey data will provide baseline information for long-term land management, conservation, and wildlife habitat protection in this region.

Literature cited:

Buck-Diaz, J. and J. Evens. 2011. Carrizo Plain National Monument Vegetation Classification and Mapping Project. A report submitted to the Bureau of Land Management. California Native Plant Society, Sacramento, CA. http://cnps.org/cnps/vegetation/pdf/carrizo-vegetation_rpt2011.pdf

Federal Geographic Data Committee (FGDC). 2008. National Vegetation Classification Standard, Version 2 FGDC-STD-005-2008 (version 2). Vegetation Subcommittee, Federal Geographic Data Committee, FGDC Secretariat, U.S. Geological Survey. Reston, VA. 55 pp. + Appendices. http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/NVCS_V2_FINAL_2008-02.pdf

Lea, C. and A. C. Curtis. 2010. Thematic accuracy assessment procedures: National Park Service Vegetation Inventory, version 2.0. Natural Resource Report NPS/2010/NRR—2010/204. National Park Service, Fort Collins, Colorado.

Sawyer, J.O., T. Keeler-Wolf, and J. Evens. 2009. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA. <http://vegetation.cnps.org/>

Story, M., and R. G. Congalton. 1986. Accuracy assessment: a users' perspective. *Photogrammetric Engineering and Remote Sensing* 52:397–399.

Stout, D., J. Buck-Diaz, S. Taylor, and J. M. Evens. 2013. Vegetation Mapping and Accuracy Assessment Report for Carrizo Plain National Monument. A report submitted to the Bureau of Land Management. California Native Plant Society, Sacramento, CA. http://cnps.org/cnps/vegetation/pdf/carrizo-mapping_rpt2013.pdf

Ciervo-Panoche Natural Area Hierarchical Classification – updated 2018

M009 California Forest & Woodland Macrogroup **M009 California Forest & Woodland Macrogroup**

Californian Broadleaf Forest & Woodland Group

- 1131 Quercus douglasii Alliance (G4:S4)
Quercus douglasii / Ericameria linearifolia (N)
- 1132 Quercus lobata Alliance (G3:S3)

Californian Conifer Forest & Woodland Group

- 1121 Juniperus californica Alliance (G4:S4)
Juniperus californica - Ericameria linearifolia / Herbaceous (Y)
Juniperus californica / Herbaceous (Y)

M036 Warm Southwest Riparian Forest Macrogroup

Sonoran-Chihuahuan Warm Desert Riparian Woodland Group (1210)

- 1211 Populus fremontii Alliance (G4:S3)
Populus fremontii / Baccharis salicifolia (Y)
Populus fremontii Great Valley (Y)
- 4113 Salix laevigata Alliance (G3:S3)
Salix laevigata / Atriplex spp. Provisional (Y)

M298 Warm Southwest Semi-natural Flooded & Swamp Forest

Southwestern North American Semi-natural Riparian Forest & Scrub

- 9141 Tamarix spp. Semi-natural Stands

M044 Californian Coastal Scrub Macrogroup

Central & Southern California Coastal Sage Scrub Group (2310)

- 2312 Artemisia californica Alliance (G5:S5)
Artemisia californica (N)
- 2314 Artemisia californica - Eriogonum fasciculatum Alliance (G4:S4)
Artemisia californica - Eriogonum fasciculatum (N)
- 2317 Eriogonum fasciculatum Alliance (G5:S5)
Eriogonum fasciculatum (N)
Eriogonum fasciculatum - Ephedra californica (Y)
Eriogonum fasciculatum - Hesperoyucca whipplei (Y)
- 2335 Ericameria linearifolia - Cleome isomeris Alliance (G4:S4)
Ericameria linearifolia (Y)
Isomeris arborea (Y)
- 2321 Gutierrezia californica Alliance (G3?:S3?)
Gutierrezia californica / Poa secunda (Y)
- 2323 Isocoma acradenia Alliance (G3:S3)
Isocoma acradenia (Y)
- 2324 Lupinus albifrons Alliance (G4:S4)
Lupinus albifrons (N)

M093 Great Basin Saltbush Scrub Macrogroup

Intermountain Shadscale – Saltbush Scrub Group

- 2411 Atriplex polycarpa Alliance (G4:S4)
Atriplex polycarpa / Annual Herbaceous (N)

M076 Warm Desert Freshwater Shrubland, Meadow & Marsh Macrogroup

North American Warm Desert Riparian Low Bosque & Shrubland Group (4110)

- 4111 Baccharis salicifolia Alliance (G4:S4)
Baccharis salicifolia (N)
- 4221 Pluchea sericea Alliance (G4:S3)
Pluchea sericea (Y)
- 4116 Salix lasiolepis Alliance (G4:S4)
Salix lasiolepis (Y)

M092 North American Warm-Desert Xero-Riparian Scrub Macrogroup

Warm Semi-Desert Shrub & Herb Dry Wash Group

- 4211 Ephedra californica Alliance (G3:S3)
Ephedra californica / Annual-perennial herb (G3:S3)
Ephedra californica - Gutierrezia californica / Eriastrum pluriflorum (Y)

M082 Cool Semi-Desert Alkaline-Saline Wetland Macrogroup

North American Desert & Semi-Desert Alkaline-Saline Shrub Wetland Group (4310)

- 4311 Allenrolfea occidentalis Alliance (G4:S3)
Allenrolfea occidentalis (Y)
Allenrolfea occidentalis / Distichlis spicata (Y)
- 4312 Atriplex spinifera Alliance (G4:S4)
Atriplex spinifera / Herbaceous (Y)
- 4317 Frankenia salina Alliance (G4:S3)
Frankenia salina (Y)
Frankenia salina - Distichlis spicata (Y)
- 4314 Suaeda nigra Alliance (G4:S3)
Suaeda nigra / Lepidium dictyotum (Y)

M073 Western North American Temperate Lowland Wet Shrubland, Wet Meadow & Marsh Macrogroup

Arid West Interior Freshwater Emergent Marsh Group (6110)

- 6111 Schoenoplectus americanus Alliance (G5:S3)
Schoenoplectus americanus (Y)
Schoenoplectus pungens Provisional
- 6113 Typha (angustifolia, domingensis, latifolia) Alliance (G5:S5)

Ciervo-Panoche Natural Area Hierarchical Classification – updated 2018

Vancouverian Freshwater Wet Meadow and Marsh Group (6210)

- 6312 Eleocharis macrostachya Alliance (G4:S4)
Eleocharis macrostachya (N)
- 6211 Juncus arcticus (var. balticus, mexicanus) Alliance (G5:S4)
Juncus arcticus var. balticus (N)

M074 Western North American Vernal Pool Macrogroup

California Vernal Pool Group (G2:S2)

- 6313 Lasthenia fremontii - Distichlis spicata Alliance (G2:S2)

M081 North American Pacific Coastal Salt Marsh Macrogroup

Temperate Pacific Tidal Salt & Brackish Marsh Group

- 6411 Distichlis spicata Alliance (G5:S4)
Distichlis spicata - Juncus arcticus var. balticus (J. arcticus
var. mexicanus) (N)

M045 California Annual & Perennial Grassland Macrogroup (5100)

California Annual Grassland Group (5110)

- 5111 Amsinckia (menziesii, tessellata) – Phacelia spp. Alliance
(G4:S4)
Amsinckia tessellata - Erodium cicutarium (N)
Phacelia tanacetifolia Provisional (Y)
- 5114 Lasthenia californica - Plantago erecta - Vulpia microstachys
Alliance (G4:S4)
Lasthenia (californica, gracilis) (Y)
Lepidium nitidum - Trifolium gracilentum-Vulpia
microstachys (Y)
- 5115 Monolopia (lanceolata) - Coreopsis (calliopsidea) Alliance
(G3:S3)
Monolopia lanceolata (Y)

California Native Perennial Grassland Group (5120)

- 5132 Corethrogyne filaginifolia - Eriogonum (elongatum, nudum)
Alliance (G4:S4)
5136 Eriogonum nudum var. indictum - Eriogonum
vestitum (Y)

California Semi-natural Grassland & Forb Meadow Group (5200)

- 5212 Avena (barbata, fatua)
Avena fatua
- 5213 Bromus (diandrus, hordeaceus) - Brachypodium distachyon
Bromus diandrus
- 5211 Bromus rubens - Schismus (arabicus, barbatus)
Bromus rubens

M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland

Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

- 5122 Poa secunda Alliance (G4:S3?)
Poa secunda - Bromus rubens (Y)

M171 Great Basin & Intermountain Dry Shrubland & Grassland

Intermountain Semi-Desert Grassland

- 5140 Achnatherum hymenoides Alliance (G4:S1)

Other

Unvegetated (9110)

- 9111 Developed
- 9112 Road
- 9113 Cliffs & Rock Outcrops
- 9114 River & Lacustrine Flats & Streambeds

Agriculture (9120)

Water (9130)

- 9131 Perennial Stream Channel
- 9132 Reservoirs & Ponds

Exotic trees & shrubs (9140)

Unknown (9999)

All vegetation types with a rank of S3 or lower are considered sensitive natural communities. Associations without a full ranking analysis are marked with a Y or N to indicate rarity. Semi-Natural stands are not ranked.