Final Report on the Digitization of Historic, 1930's Wieslander Vegetation Type Maps for Pinnacles National Monument

Oct 13, 2010 James H. Thorne, PhD., University of California, Davis, Ca. 95616

Need for mapping & overview

Resource management at Pinnacles National Monument has recognized the utility of assembling information about the vegetation of the lands it serves. Such information can be used to inform decision making for a wide range of management activities. One source of historic data that covers the National Monument is the 1930s era Wieslander Vegetation Type Map survey. The University of California, Davis, has completed a project for PINN to digitize these maps. This report provides a brief summary of the information developed. The digital materials have all been submitted to PINN.

Historic Wieslander Vegetation Map Background and Production

The Wieslander Vegetation Type Map (VTM) Project was a United States Forest Service (USFS) effort to record California's vegetation between 1928 and 1940 (Wieslander 1935a, 1935b, 1985; Griffin and Critchfield 1972). Headed by Albert Wieslander, the group took over 3,000 photographs of vegetation, surveyed over 17,000 vegetation plots, recorded field notes, and mapped patterns of vegetation across 35% of the state, about 155,000 km² (Colwell 1977). Lands mapped were predominantly USFS lands, but extensive tracks of private land, and three national parks (Lassen, Yosemite, and Sequoia/Kings Canyon), were also included (Wieslander 1985; Griffin and Critchfield 1972). The VTM survey covered California's coast ranges from San Francisco to the Mexican border. The project also collected 25,000 plant voucher specimens, which are housed at the Jepson Herbarium, University of California, Berkeley. These data collections are an important vegetation legacy; and all components except the vegetation maps have been digitized for preservation and are available for state-wide analyses (Ertter 2000; Kelly et al. 2005; the vegetation plot data have been digitized and are available at http://vtm.berkeley.edu; the photographs are also available at http://www.lib.berkeley.edu/BIOS/vtm/). The vegetation maps for the central and northern Sierra Nevada have been digitized (Thorne et al. 2006; http://cain.nbii.org/plants animals/plants/wieslander). VTM data are the most authoritative source of information on the extent of dominant vegetation species available in California for the 1930s.

The VTM project data provides the foundation for much of the current knowledge of vegetation in California. Already published biogeographic works include elevational transect maps of vegetation (Critchfield 1971), the distribution of California's trees (Griffin and Critchfield 1972), and the distribution of range brushlands and shrubs (Sampson and Jespersen 1963). The vegetation plot data have been used in numerous

studies, including community classifications (Jensen 1947; Allen et al. 1991; Allen-Diaz and Holzman 1991), and vegetation change (Bradbury 1974; Minnich 1978; Minnich et al. 1995; Minnich and Dezzani 1998; Bouldin 1999; Taylor 2000; Taylor 2004a, b; Franklin et al. 2004). Since 80 years have elapsed since the VTM survey, the data also provide us with a way to examine both human-induced and natural change on the landscape, such as assessing the extent to which different habitats have already been lost, which can be used to inform priorities for resource management in the National Monument, as has been done for a single quadrangle in the Sierra Nevada (Thorne et al. 2008).

UC Davis developed a systematic approach to rendering the old maps. This report details the result of digitizing the maps for Pinnacles National Monument, located in the central coast ranges of California (Figure 1).

The steps to process the historic maps are outlined in detail in the attached methods manual (Morgan et al. 2007; <u>http://cain.nbii.org/plants_animals/plants/wieslander</u>), but generally run as follows for each quadrangle listed above:

- 1) Scan the original VTM maps at 300 Dots per inch- because each VTM map was cut in pieces, all pieces are scanned;
- 2) Scan identical editions of the United States Geological Survey topographic maps that the VTM vegetation maps were drawn on;
- 3) Geo-rectify the USGS topographic maps (Figure 2a);
- 4) Register the VTM vegetation map pieces onto the USGS topographic (Figure 2b).
- Once a VTM vegetation map is geo-referenced, it can then be;
- 5) Traced using an on-screen digitizing technique that combines ArcInfo GIS software (ESRI 2005) with a WaCom tablet and digital pen (WaCom 2004) (Figure 3d). When the polygons are completed, they are;
- 6) Attributed with the species codes written on the original VTM vegetation maps for each polygon. These species codes are used to;
- 7) Assign species names (from over 1700 species recorded in the VTM project statewide, using the Jepson Manual (Hickman 1993) naming conventions. Each polygon can then be;
- 8) Represented by an aggregate string of dominant plant species that each occupied at least 20% of the polygon's area. Finally, we;
- 9) Assign the species aggregations to California Wildlife Habitat Relationship (WHR) Models (California Department of Fish and Game 2004) and California Manual of Vegetation classes (Sawyer and Keeler-wolf 2009), which are habitat descriptors, using a combination of species and seral information (Figure 4).

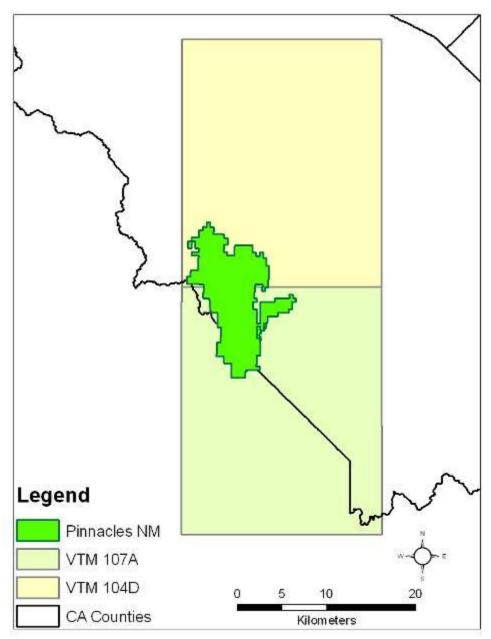


Figure 1. The extent of Wieslander VTM vegetation map proposed for Pinnacles National Monument. The two quadrangles that the maps occur on were fully digitized for this report.

PINN is located on two 15 minute quadrangles. The topographic maps used in the mapping by Wieslander Vegetation crews are: San Benito, 1931, VTM 104D and Metz, 1921, VTM 107A (Figure 2a). We obtained scans of these quadrangles from UCSB Alexandria Digital Library. We registered the quads using 16 tic marks per quad. The VTM maps were cut by the original surveyors into 'tiles' which were glued to canvas backing. Each quad has 4 tiles (Figure 2b). Both original scans and georeferenced versions of the tiles are provided. The Pinnacles National Monument covers 92.94 km² and is found on both of these quadrangles (Figure 1 and Figure 3a-d).

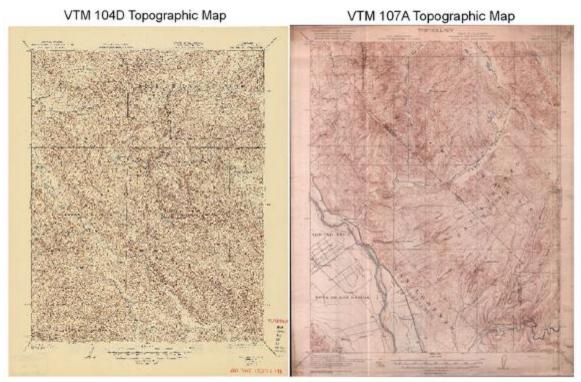


Figure 2a. The USGS Topographic maps used by the Wieslander Vegetation crew: San Benito, 1931, VTM 104D (left) and Metz, 1921, VTM 107A (right). Digital scans of these maps are included in the deliverables.

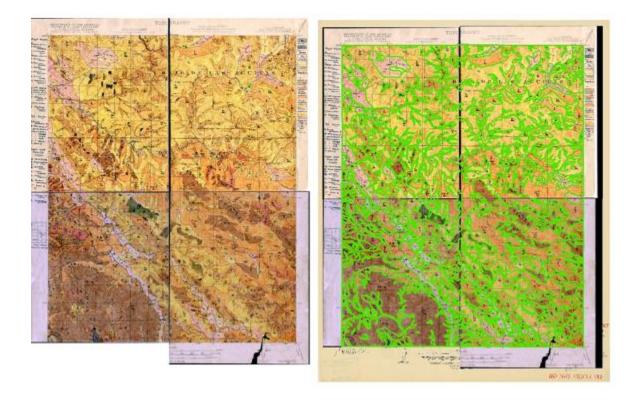


Figure 2b. The unclipped borders of VTM vegetation map tiles are shown for quad 104D with notes often written by the surveying crew (left). Once they are registered onto the USGS topographic maps, the polygons can be traced (right).

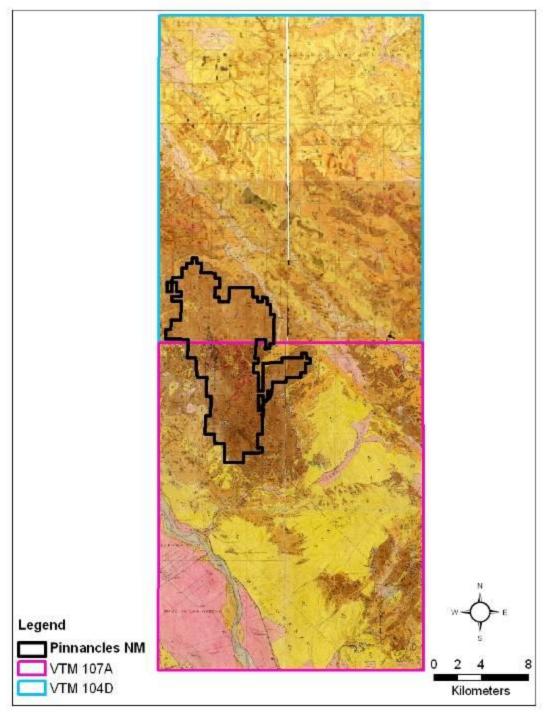


Figure 3a. This image shows the clipped borders of georeferenced Wieslander VTM vegetation map tiles for both quadrangles and the Pinnacles National Monument.

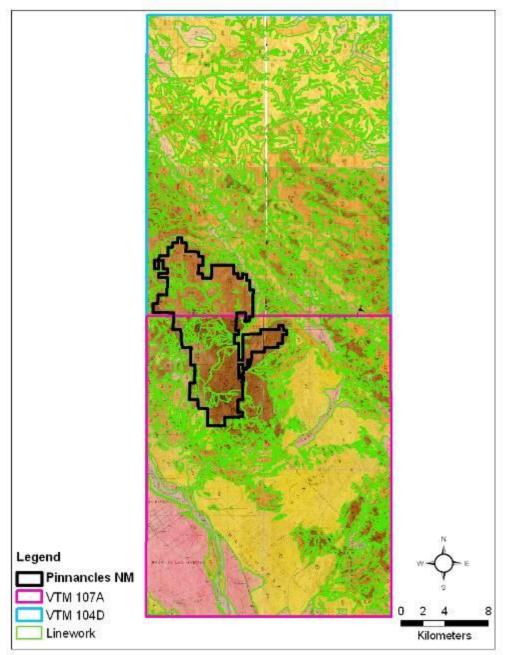


Figure 3b. This image shows the clipped borders of georeferenced Wieslander VTM vegetation map tiles for both quadrangles and the Pinnacles National Monument with the digitized line work.

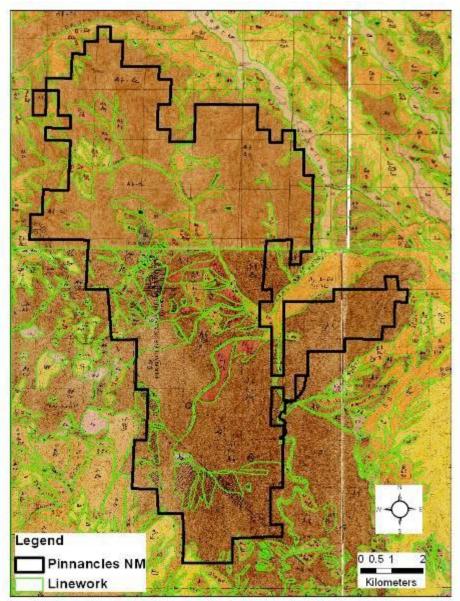


Figure 3c. This image shows the extent of the Pinnacles National Monument and Wieslander VTM tiles.

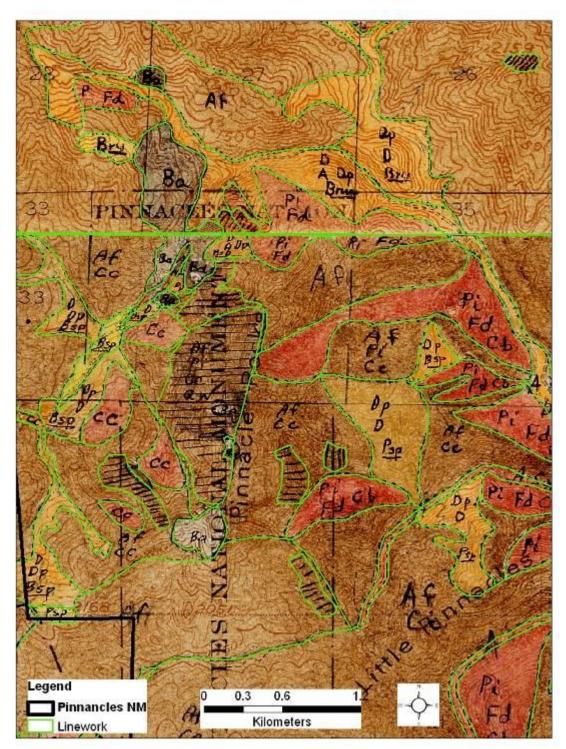


Figure 3d. Above is a more detailed image of the written codes and the Wieslander VTM line work within the Pinnacles National Monument.

THE ID SP4	SPH BANK	572	ST2 HAME	573	SPO BAME	574	washing	NCVI NAME	WHEN	Ares
26 Dp	Pinus sobhlene	D'	Suprous douglast				Pinus sobinterveGeretoste deuglastito	Querous dougles APtrus sebitrions Woodland Allance	DOP	345237.022210
07 But	Brodises coulor ters	Av42	Aven as hardwards				Brochers constanter aliver as instantial	Californio di unali Grazistorei Albance	405	ARTIN SACING.
98 Mt	ndenistone tencio.letally	1000					Admissional Neccouldram	Challula Chippenie Allance	LHI:	222484307652
99 Ac	Artenicia californica	Set	Selvis melliters				Artemicia californicaCelvia melinare0	Artenisis californica Galvia malifera Shrubland Allence	CSC	221454.059873
100 At	Addressione Rescioulations						Addresslove toxiculatur0	Chowing Chaptered Alloney	0.40	108503.438753
30.93	Propulses Incompany Investigation	364	Rahe	A	How mail age from		Appalan Demonda Invessoria/SalarCherrolaux, appCalatil	Papalan beronita harrel Alamon	VH	K/05/ 2042
102 -44	Advantions fascipulature						Adenational Nacioustum)	Chanice Crapane Allance	CRC	72005-81306
103 A1	Adamentions fescioulatum	Cr.	Controlhus currenties				Adenestione fescioulatur/Connethus currentus@	Chomise Wedgeleof Allence	CRC	215731.105853
104 000	Ma Doka	1.1.1	200 (100 C C C C C C C C C C C C C C C C C C			_	Mathedat	No Data	UKW	24597 \$10345
25.00	Prost sebriere	<i>U</i> *	Charge disagents				Anal JohnaneOsecus disglesiti	Is wood angless Pitus september fronderic riterice	HIP	100/01F R Solo
106 (At	Adenactions feacibulatum						Adenantiona fasciculaturi0	Charrise Chepierrei Allence	CRC	408020.354809
907 Bru2	Browup much lightly rabeing	34	Addressform Resciould			-	Bronus reachtoraty ratio a Advantance Application 0	Bromos hondescence-Branau modelencia Sent-Natural M	405	413265.071541
10.00 (A1	Astronomications frances defineds			-			Automational Instantial I	Distance Cooperal Medice	1301	00,000 1608/7
109-101	Guerous dougiată	Dø	Pinut sabiniana	(ind)	Vuble event Nation	11/22	Guerous douglasiPinus patriana/Jupia mysros histuta/Urana barbatal	Querous douglasti-Pitus sapiniana Woodland Alliance	DOP.	1151727 82900
110 At	Admentone foscioulatum						Aderections topcloulstum0	Chamize Chapterni Allence	CRC	717634.038765
111,801	Fradam costienes	4,47	Aver a harbalo	_		_	Brochers count as an advers as inset satural	Californio Januari Drambord Alliance	ACC	148780 204008
112 AG	Artestina caleortica	508	Salva nettera	-			Artestada calebraticadarva raenterad	Artestina californica Sarvia mettera involtana Aliance	1.50.	12010108-0
113 Eci	Drodun douterien	Ave2	Avena barbeta	Pz2	Fox secunds secunds		Brodian dicaterian/wene barbetePos secunda secundad	California Annual Grazoland Allance	AGS	58030.91379
914.541	Arter endorse tractoutstam			-			Administration to a characterial and	Chowing Origonical Allorety	CRC	343044 482228
115.349	Fradam continues	0.47	formalization of	-			Hardwar on all a service task shall	Takine no. Accord Househaut Alwane	ARK	CODE/10 HORABAY
116 01	Adenantiona fescioulature	Cz.	Cessionus puneeus				Adenantiona fescioulatur/Geanotikus curseaturii	Chamize Wedgeleyr Allence	CRC	9/3013.22/78
917 Ac	Artenialo colitornico	21	Disperant faceloulds:				Artenisis colitonicoDiosonum teaciculatum0	Artenisis californica-Briogonum facelesiotum Shutsland A	CSC	122945.440123
118 40	As breaksing could as along	Fai	Falva relieva	BI .	Pringingen fange als de		As breaks a codd, waar of Salvin coeffit or offer opprises a lower to deliver (T	Arbentos cultor a a Salva cultor a Orable el Alexan	1202	1942/KID MODIA
118.17	(Sumplet Bolgies)	LW	Rout cabrierie	10	Annualus cartornice	12	Guercus poglikuPitus kapinana/vercusus cationical woncarpus petu	Number anogine Paul Assistant Mondane Mance	HIP .	1296181-0481
120 At	Adenautorea fescioulatura	Ag.	Antostechvics deuce				Adenautional fescioulaturi Arctestaphylas sieuca0	Chamips - Dichemy Manzantis Chapanal Allance	CRC	012945.005308
121.01	Querous doughty#	HQ.	Accesso califerrica				Querous dosalay/Acyculary californica0	Querous douglest Accession colliprates Woodbird Allone	BOW	350156,737182
7.0° bos	Froducts constantiation	447	forme land rate	-		-	tradisch analyzera bertelati	Data me Arrivet Household Allence	AGK	101000-020000
122 Ac	Artenicia californica						Artenicia californica()	Artenisia californica Struband Aliance	CSC	94701.082704
124 D'	Quercus dosoles!	HC	Account califernics				Querous dosolartiAgroular californica0	Querous doughtall Acadalus californics Woodland Allione	DOW	107055.125506
128.441	Andre an de rese le pre tra abal ante	12		-		-	Acts to do you have to data will	Draine Coperal Linear	1201	71327 4446
126 340	Final second	v	DAVIDE DOGINA				Final cabrierie Contract (contract)	Itumout polytexi Pitus septrate theoderic ritence	MP.	29101.201010
127 Ac	Artenisis californica						Artenisia californica0	Artenisis californics Strublend Allence	CSC	01255.21830
128 De	Pinary potenting	D/	Querous dosident	-		-	Procy solarian arQueteuro da unicetto	Querous dougleos/Place calificities Months of Allerect	BOD	140405 17635
T/R EQ	Huden coldenario	1.42	Inversion land rates	-		-	Production of a manifestory function of the	Dational Across Heavier Library	MIK	ITHER PLOT
130 De	Finus sabiniana	D.	GLAVOUS GOLGINS				Rinus asbnieneGuercus douglabil)	Querous pouglasti-Pitus sacitivase Woodland Allance	DOP	814573.534718
131 Cu	Cultivated						Cutivator®	Agiculture	ACR	17683.852708
DO UNI	As beyond a could be sized			_		-	As investors and it as a cold	Arbenetics california a Washing at Alicence	1992	KENER HENE?
102.645	Singen ocuteren	1082	overa tarbeta	813	FOR DADUDGE DADUDGE		Erodun ocuterantivene berbeteine becunde secundel	Calcume Annue Resulted Aberice	AWK .	21106.0 984.010
124 Ac	Artenicis californica	100	-De-242244	1000			Artenisis celifornica0	Artenisis californics Shublend Allience	CSC-	05210.033606
158 Cu	Cultivated	1.0	and the second s			-	Cultivator®	Argiculture	ACR	1031453 2255
2.06 /01	Automations for a detail.	70	Pathonika Sylon species			-	Automatives for a deletation and a second and a second at the	Discourse - Hughenry Montanaia Discoursed Albanaire	1341:	2180907 200 00/1
177 44	Adapteriona carelis latur.	100	No. of the second				Antanantina Asar in datum)	(Institute Transmit Alliente	che	1000030-0183

Figure 4. The table shows a Wieslander VTM vegetation map attribute table of assigned species codes and names for each polygon. Along with assigned species aggregations to California Wildlife Habitat Relationship and California Manual of Vegetation classes.

The resulting maps (Figures 5a & b) contain 1650 polygons on the two quads, and 131 polygons in the Monument, with the following range of sizes (Table 1).

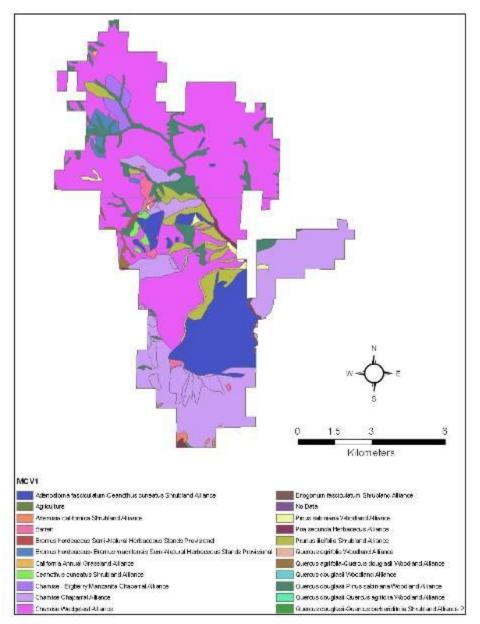


Figure 5a. Map of assigned species aggregations to California Manual of Vegetation classes (Sawyer and Keeler-wolf 2009).

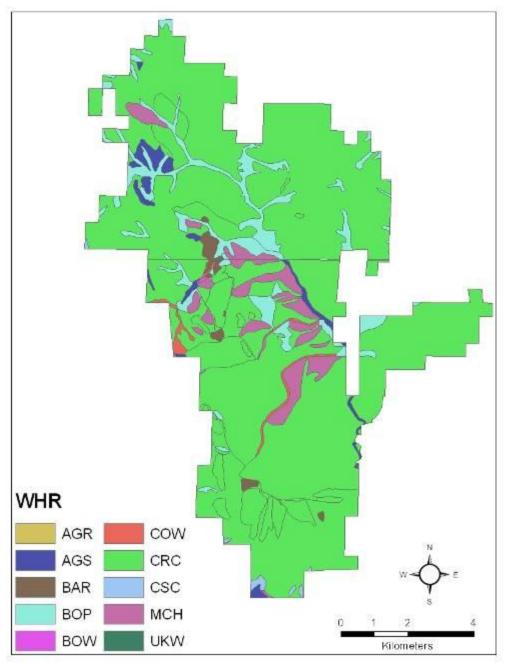


Figure 5b. Map of assigned species aggregations to California Wildlife Habitat Relationship (WHR) Models (California Department of Fish and Game 2004).

Table 1. The size class distribution of vegetation mapping units surveyed in the 1930s by the Wieslander VTM mapping crews. The values shown are for the entire extent of both quads. Of the six largest polygons, three are grasslands, one is agriculture, one a blue oak woodland (*Quercus* douglasii) and one a chamise chaparral (*Adenostoma fasiculatum*). The two polygons over 100 km² are grasslands. Note that the size distribution between polygons found in the Monument and those on the entire quads is similar. Also note that use of these maps for resource management analysis will likely be most effective when considering polygons from 2-128 ha in size.

	# Polygons in Quads 104D &	# Polygons in
Size Class	107A	PINN
0-1 ha	14	1
1-2 ha	62	7
2-4 ha	220	15
4-8 ha	317	17
8-16 ha	312	19
16-32 ha	284	20
32-64 ha	190	17
64-128 ha	120	12
128-256 ha	63	4
256-512 ha	40	1
512-1024 ha	16	6
1024-2048		
ha	5	5
2048-4096		
ha	2	6
4096-8192	2	0
ha	2	0
> 8192 ha	2	1

The extent of different Manual of California Vegetation Types (MCV; Sawyer and Keeler Wolf 1995) and California Wildlife Habitat Relationship (WHR; California Department of Fish and Game 2004) vegetation types is presented for Pinnacles National Monument (Table 2) and for the extent of the two quadrangles digitized for this contract (Appendix 1). Note that a second Manual of California Vegetation (Sawyer and Keeler Wolf 2009) was published while our work was ongoing. We also provide the vegetation extents according to that manual.

The accompanying digital data include a GIS of the vegetation polygons pulled from the original maps. This GIS contains all the species recorded by the VTM crews, and the final vegetation types according to the three classifications listed above. The GIS can be used to examine what the vegetation type of any given polygon is, or what species comprised the dominant species in that polygon (**Figure 4**). Details of the dominance ranking within polygons are given in Thorne et al. (2008) and in the methods manual.

The basic information for interpretation goes as follows: 1) a single species in a polygon must cover at least 80% of the area; 2) two or more species in a polygon, each species occupies at least 20% of the area; 3) species in different strata, such as shrubs and grasses, represent a mosaic polygon in which the species from each strata are listed in rank order for that polygon, within their respective strata. Polygons with cross hatching indicate areas of early seral condition due to fire or logging, depending on the angle of the cross hatching. We also are including a pdf of the field manual provided to the VTM crews who conducted the original maps and also a transcription of an interview with Albert Wieslander, who ran the mapping project. This interview was conducted towards the end of his life, and some sections provide insight into how he perceived the VTM data might be used over time.

Table 2. This table presents the extent of different vegetation types found within the borders of Pinnacles National Monument. The top table contains the extents according to the 1995 Manual of California Vegetation, the middle table contains the extents according to the 2009 Manual of California, and the bottom table contains the extents according to the California Wildlife Habitat Relationship landcover classes. Rows in yellow reflect vegetation types that were either added or lost between classifications. Rows in pink represent types that were identified as secondary vegetation types within mosaic polygons. For Pinnacles this was only identified for Salix dominated vegetation.

MCV1 1995 Edition PINN	Total area MCV1 1995 Edition PINN ha	Total area MCV1 1995 Edition PINN km2	Number of polygons	Mean polygon size ha	Mean polygon size km2
Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance	1,071.67	10.72	11	97.42	0.97
Agriculture	0.02	0.0002	1	0.02	0.0002
Artemisia californica Shrubland Alliance	22.52	0.23	5	4.50	0.05
Barren	80.48	0.80	8	10.06	0.10
Bromus hordeaceus- Bromus madritensis Semi-Natural Herbaceous Stands Provisional	91.56	0.92	6	15.26	0.15
Bromus hordeaceus Semi-Natural Herbaceous Stands Provisional	13.88	0.14	2	6.94	0.07
California Annual Grassland Alliance	2.93	0.03	1	2.93	0.03
Ceanothus cuneatus Shrubland Alliance	45.54	0.46	5	9.11	0.09
Chamise - Bigberry Manzanita Chaparral Alliance	125.29	1.25	3	41.76	0.42
Chamise Chaparral Alliance	2,159.21	21.59	19	113.64	1.14
Chamise Wedgeleaf Alliance	4,465.28	44.65	12	372.11	3.72
Eriogonum fasciculatum Shrubland Alliance	2.54	0.03	1	2.54	0.03
No Data	0.27	0.00	1	0.27	0.00
Pinus sabiniana Woodland Alliance	52.38	0.52	6	8.73	0.09
Poa secunda Herbaceous Alliance	59.82	0.60	3	19.94	0.20

Prunus ilicifolia Shrubland Alliance	403.58	4.04	13	31.04	0.31
Quercus agrifolia					
Woodland Alliance	40.49	0.40	3	13.50	0.13
Quercus agrifolia-					
Quercus douglasii	24.75	0.00		24.75	0.00
Woodland Alliance Quercus douglasii	31.75	0.32	1	31.75	0.32
Woodland Alliance	4.27	0.04	4	1.07	0.01
Quercus douglasii-					
Pinus sabiniana					
Woodland Alliance	617.25	6.17	19	32.49	0.32
Quercus douglasii- Quercus agrifolia					
Woodland Alliance	0.24	0.0024	1	0.24	0.0024
Quercus douglasii-					
Quercus					
berberidifolia	2.00	0.02		2.00	0.00
Shrubland Alliance P	2.86	0.03 Total area	1	2.86	0.03
	Total area	MCV2			Mean
	MCV2 1995	1995	Number	Mean	polygon
MCV2 1995 Edition	Edition PINN ha	Edition PINN km2	of	polygon size ha	size km2
			polygons	Size IId	KIIIZ
Coline Allianan D		0.00	1	0 22	0.00
Salix Alliance P	8.22	0.08	1	8.22	0.08
Salix Alliance P	8.22	0.08 Total area	1	8.22	0.08
Salix Alliance P	8.22 Total area		1	8.22	0.08 Mean
	Total area MCV1 2009	Total area MCV1 2009	Number	Mean	Mean polygon
MCV1 2009 Edition	Total area MCV1 2009 Edition	Total area MCV1 2009 Edition	Number	Mean polygon	Mean polygon size
MCV1 2009 Edition PINN	Total area MCV1 2009	Total area MCV1 2009	Number	Mean	Mean polygon
MCV1 2009 Edition	Total area MCV1 2009 Edition	Total area MCV1 2009 Edition	Number	Mean polygon	Mean polygon size
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus	Total area MCV1 2009 Edition PINN ha	Total area MCV1 2009 Edition PINN km2	Number of polygons	Mean polygon size ha	Mean polygon size km2
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance	Total area MCV1 2009 Edition PINN ha 1,071.67	Total area MCV1 2009 Edition PINN km2 10.72	Number	Mean polygon size ha 97.42	Mean polygon size km2
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture	Total area MCV1 2009 Edition PINN ha	Total area MCV1 2009 Edition PINN km2	Number of polygons	Mean polygon size ha	Mean polygon size km2
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02	Total area MCV1 2009 Edition PINN km2 10.72 0.0002	Number of polygons 11	Mean polygon size ha 97.42 0.02	Mean polygon size km2 0.97 0.0002
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23	Number of polygons 11 1 5	Mean polygon size ha 97.42 0.02 4.50	Mean polygon size km2 0.97 0.0002 0.05
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02	Total area MCV1 2009 Edition PINN km2 10.72 0.0002	Number of polygons 11	Mean polygon size ha 97.42 0.02	Mean polygon size km2 0.97 0.0002
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren Bromus hordeaceus-	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23	Number of polygons 11 1 5	Mean polygon size ha 97.42 0.02 4.50	Mean polygon size km2 0.97 0.0002 0.05
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23	Number of polygons 11 1 5	Mean polygon size ha 97.42 0.02 4.50	Mean polygon size km2 0.97 0.0002 0.05
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren Bromus hordeaceus- Bromus madritensis Semi-Natural Herbaceous Stands	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52 80.48	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23 0.80	Number of polygons	Mean polygon size ha 97.42 0.02 4.50 10.06	Mean polygon size km2 0.97 0.0002 0.05 0.10
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren Bromus hordeaceus- Bromus madritensis Semi-Natural Herbaceous Stands Provisional	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23	Number of polygons 11 1 5	Mean polygon size ha 97.42 0.02 4.50	Mean polygon size km2 0.97 0.0002 0.05
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren Bromus hordeaceus- Bromus madritensis Semi-Natural Herbaceous Stands Provisional Bromus hordeaceus	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52 80.48	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23 0.80	Number of polygons	Mean polygon size ha 97.42 0.02 4.50 10.06	Mean polygon size km2 0.97 0.0002 0.05 0.10
MCV1 2009 Edition PINN Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance Agriculture Artemisia californica Shrubland Alliance Barren Bromus hordeaceus- Bromus madritensis Semi-Natural Herbaceous Stands Provisional	Total area MCV1 2009 Edition PINN ha 1,071.67 0.02 22.52 80.48	Total area MCV1 2009 Edition PINN km2 10.72 0.0002 0.23 0.80	Number of polygons	Mean polygon size ha 97.42 0.02 4.50 10.06	Mean polygon size km2 0.97 0.0002 0.05 0.10

California Annual Grassland Alliance	2.93	0.03	1	2.93	0.03
Ceanothus cuneatus Shrubland Alliance	45.54	0.46	5	9.11	0.09
Arctostaphylos					
glauca Shrubland					
Alliance	4,590.57	45.91	15	306.04	3.06
Chamise Chaparral					
Alliance	2,159.21	21.59	19	113.64	1.14
Eriogonum					
fasciculatum					
Shrubland Alliance	2.54	0.03	1	2.54	0.03
No Data	0.27	0.0027	1	0.27	0.0027
Pinus sabiniana Woodland Alliance	52.38	0.52	6	8.73	0.09
Poa secunda					
Herbaceous Alliance	59.82	0.60	3	19.94	0.20
Prunus ilicifolia	102 50		10	24.04	0.24
Shrubland Alliance	403.58	4.04	13	31.04	0.31
Quercus agrifolia Woodland Alliance	72.24	0.72	4	18.06	0.18
Quercus douglasii	72.24	0.72	4	18.00	0.10
Woodland Alliance	624.63	6.25	25	24.99	0.25
		Total area			
MCV2 1995 Edition PINN	Total area MCV2 1995 Edition PINN ha	MCV2 1995 Edition PINN km2	Number of polygons	Mean polygon size ha	Mean polygon size km2
	MCV2 1995 Edition	1995 Edition	of	polygon	polygon size
PINN	MCV2 1995 Edition PINN ha	1995 Edition PINN km2	of polygons	polygon size ha	polygon size km2
PINN	MCV2 1995 Edition PINN ha	1995 Edition PINN km2	of polygons	polygon size ha	polygon size km2
PINN	MCV2 1995 Edition PINN ha	1995 Edition PINN km2	of polygons	polygon size ha	polygon size km2
PINN Salix Alliance P	MCV2 1995 Edition PINN ha 8.22	1995 Edition PINN km2 0.08 Total area WHR 1995 Edition	of polygons 1 Number of	polygon size ha 8.22 Mean polygon	polygon size km2 0.08 Mean polygon size
PINN Salix Alliance P WHR1 1995 Edition PINN	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha	1995 Edition PINN km2 0.08 0.08 Total area WHR 1995 Edition km2	of polygons 1 Number of polygons	polygon size ha 8.22 Mean polygon size ha	polygon size km2 0.08 Mean polygon size km2
PINN Salix Alliance P WHR1 1995 Edition PINN Agriculture	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha 0.02	1995 Edition PINN km2 0.08 0.08 7 0.08 0.08 0.08 0.0002	of polygons 1 Number of polygons 1	polygon size ha 8.22 Mean polygon size ha 0.02	polygon size km2 0.08 Mean polygon size km2 0.0002
PINN Salix Alliance P WHR1 1995 Edition PINN Agriculture Annual Grasslands	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha 0.02 168.20	1995 Edition PINN km2 0.08 0.08 Total area WHR 1995 Edition km2 0.0002 1.68	of polygons 1 Number of polygons 1 12	polygon size ha 8.22 Mean polygon size ha 0.02 14.02	polygon size km2 0.08 Mean polygon size km2 0.0002 0.14
PINN Salix Alliance P WHR1 1995 Edition PINN Agriculture Annual Grasslands Barren Blue Oak Foothill	MCV2 1995 Edition PINN ha 8.22 7 7 7 7 7 7 7 7 7 7 7 7 8 7 8 7 8 7 8	1995 Edition PINN km2 0.08 7008 7008 7008 8008 8008 8008 80002 1.68 0.800	of polygons 1 Number of polygons 1 12 8	polygon size ha 8.22 Mean polygon size ha 0.02 14.02 10.06	polygon size km2 0.08 Mean polygon size km2 0.0002 0.14 0.10
PINN Salix Alliance P WHR1 1995 Edition PINN Agriculture Annual Grasslands Barren Blue Oak Foothill Pine	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha 0.02 168.20 80.48	1995 Edition PINN km2 0.08 Total area WHR 1995 Edition km2 0.0002 1.68 0.80	of polygons 1 Number of polygons 1 1 2 8 8	polygon size ha 8.22 Mean polygon size ha 0.02 14.02 10.06 25.76	polygon size km2 0.08 Mean polygon size km2 0.0002 0.14 0.10 0.26
PINN Salix Alliance P Salix Alliance P WHR1 1995 Edition PINN Agriculture Annual Grasslands Barren Blue Oak Foothill Pine Blue Oak Woodland Coastal Oak Woodland Chamise-Redshank	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha 0.02 168.20 80.48 669.87 4.27 72.24	1995 Edition PINN km2 0.08 Total area WHR 1995 Edition km2 0.0002 1.68 0.80 0.80 6.70 0.04	of polygons 1 Number of polygons 1 1 2 8 26 4 4	polygon size ha 8.22 Mean polygon size ha 0.02 14.02 10.06 25.76 1.07 18.06	polygon size km2 0.08 Mean polygon size km2 0.0002 0.14 0.10 0.26 0.01 0.26
PINN Salix Alliance P Salix Alliance P WHR1 1995 Edition PINN Agriculture Agriculture Barren Blue Oak Foothill Pine Blue Oak Woodland Coastal Oak Woodland Coastal Oak Woodland Chamise-Redshank Chaparral	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha 0.02 168.20 80.48 669.87 4.27 72.24	1995 Edition PINN km2 0.08 Total area WHR 1995 Edition km2 0.0002 1.68 0.80 0.80 0.80 0.80 0.004 0.04	of polygons 1 Number of polygons 1 1 2 8 2 6 4 4	polygon size ha 8.22 Mean polygon size ha 0.02 14.02 10.06 25.76 1.07 18.06	polygon size km2 0.08 Mean polygon size km2 0.0002 0.14 0.10 0.26 0.01
PINN Salix Alliance P Salix Alliance P WHR1 1995 Edition PINN Agriculture Annual Grasslands Barren Blue Oak Foothill Pine Blue Oak Woodland Coastal Oak Woodland Chamise-Redshank	MCV2 1995 Edition PINN ha 8.22 Total area WHR 1995 Edition ha 0.02 168.20 80.48 669.87 4.27 72.24	1995 Edition PINN km2 0.08 Total area WHR 1995 Edition km2 0.0002 1.68 0.80 0.80 6.70 0.04	of polygons 1 Number of polygons 1 1 2 8 26 4 4	polygon size ha 8.22 Mean polygon size ha 0.02 14.02 10.06 25.76 1.07 18.06	polygon size km2 0.08 Mean polygon size km2 0.0002 0.14 0.10 0.26 0.01 0.26

Unknown	0.27	0.0027	1	0.27	0.0027
WHR2 1995 Edition PINN	Total area WHR 1995 Edition ha	Total area WHR 1995 Edition km2	Number of polygons	Mean polygon size ha	Mean polygon size km2
Valley Foothill Riparian	8.22	0.08	1	8.22	0.08

6) References

- Allen, B.H.; Holzman B.A.; Evett R.R. 1991. A classification system for California's hardwood rangelands. Hilgardia 59:1-45.
- Allen-Diaz, B.H.; Holzman B.A. 1991. Blue oak communities in California. Madroño 38: 80-95.
- Bouldin, J.R. 1999. Twentieth-century changes in forests of the Sierra Nevada, California. Davis, CA: University of California; 222 p. Ph.D. dissertation.
- Bradbury, D.E. 1974. Vegetation history of Ramona Quadrangle San Diego County, California (1931-1972). Los Angeles, CA; University of California, 200 p. Ph.D. dissertation.
- California Department of Fish and Game. 2004. **The California wildlife habitat relationships system.** Sacramento, CA: California Department of Fish and Game. http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html
- Colwell, W.L. 1977. **The status of vegetation mapping in California today**. In: Barbour, M.G.; Majors, J. editors, Terrestrial vegetation of California. John Wiley & Sons, New York, NY; 195-220.
- Critchfield, W. B. 1971. **Profiles of California vegetation**. Research Paper PSW-76. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, USDA Forest Service.
- Ertter, B. 2000. Our undiscovered heritage: past and future projects for species-level botanical inventory. Madroño 47: 237-252.
- ESRI, 9.3. 2008. ArcMap version 9.3. Redlands, CA: Environmental Systems Research Institute.
- Franklin, J.; Coulter, C.L.; Rey, S. J. 2004. Change over 70 years in a southern California chaparral community related to fire. Journal of Vegetation Science 15: 701-710.
- Griffin, J.R.; Critchfield, W.B. 1972. **The distribution of forest trees in California.** Research Paper PSW-82. Berkeley, CA.: Pacific Southwest Forest and Range Experiment Station, USDA Forest Service.
- Hickman, J. C. 1993. The Jepson Manual: the higher plants of California. Berkeley, CA.: University of California Press. 1400 p.
- Kelly, M.; Allen Diaz, B.; Kobzina, N. 2005. Digitization of a historic dataset: the Wieslander California Vegetation Type Mapping Project. Madroño 52: 191-201.
- Jensen, H.A. 1947. A system for classifying vegetation in California. California Fish

and Game 33: 199-266.

- Minnich, R.A.; Barbour, M.G.; Burke, J.H.; Fernau, R.F. 1995. Sixty years of change in Californian conifer forests of the San Bernardino Mountains. Conservation Biology 9: 902-914.
- Minnich, R. A., and R. J. Dezzani. 1998. Historical decline of coastal sage scrub in the Riverside-Perris Plain, California. Western Birds 29:366-391.
- Morgan,B.; Thorne, J.H.; Kelsey, R.; Kennedy, J.; Bjorkman, J.; Thrasher, S. 2007 Wieslander Vegetation Type Maps. A Digitizing Process Manual. University of California, Davis, CA.
- Sampson, A. W.; Jespersen, B. S. 1963. California range brushlands and browse plants. Oakland, CA: University of California, Division of Agriculture and Natural Resources.
- Sawyer, T and T. Keeler Wolf. 2009. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA.
- Sawyer, T and T. Keeler Wolf. 1995. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA.
- Taylor, R. S. 2004a. A Natural History of Coastal Sage Scrub in Southern California: Regional Floristic Patterns and Relations to Physical Geography, How It Changes Over Time, and How Well Reserves Represent Its Biodiversity. Santa Barbara, CA: University of California, 223 p. PhD dissertation.
- Taylor, R. S. 2004b. Changes in coastal sage scrub composition and structure over 70 years in an urbanizing landscape. In: Proceedings of the 2004 Ecological Society of America 89th annual meeting, "Lessons of Lewis & Clark: Ecological Exploration of Inhabited Landscapes", Portland OR.
- Thorne, J. H., B. J. Morgan, and J. A, Kennedy. 2008. Vegetation Change over 60 Years in the Central Sierra Nevada. *Madroño* 55:223-237.
- Thorne, J. H.; Honig J.; Thrasher, S.; Kelsey R.; Morgan, B. 2006. Assessing landscape change over 70 years in the Sierra Nevada. California Energy Commission, PIER. Publication. 104 p.
- Thorne, J.H., J. A. Kennedy, T. Keeler-Wolf J. F. Quinn, M. McCoy, J. Menke. 2004. A new vegetation map of Napa County using the Manual of California Vegetation Classification and its comparison to other digital vegetation maps. *Madroño* 51(4) 343-363.
- WaCom. 2004. **WaCom digitizer tablet.** Vancouver, WA: WaCom Technology Corporation.
- Wieslander, A.E. 1985. A.E. Wieslander, California forester: mapper of wildland vegetation and soils (an oral history conducted in 1985 by Ann Lange).
 Berkeley, CA: Regional Oral History Office, Bancroft Library, University of California; 316 p.
- Wieslander, A.E. 1935a. A vegetation type map for California. Madroño 3: 140-144.
- Wieslander, A.E. 1935b. First steps of the forest survey in California. Journal of Forestry 33: 877-884.

Appendix 1. These tables show the extent of vegetation on the two quadrangles containing Pinnacles National Monument. The top table contains the extents according to the 1995 Manual of California Vegetation, the middle table contains the extents according to the 2009 Manual of California, and the bottom table contains the extents according to the California Wildlife Habitat Relationship landcover classes. Rows in yellow reflect vegetation types that were either added or lost between classifications. Rows in pink represent types that were identified as secondary vegetation types within mosaic polygons.

MCV1 1995 Edition	Total Area by MCV1 1995 Edition Quads	Total Area by MCV1 1995 Edition Quads	Number	Mean	Mean Polygon
Quads 104D and 107A	104D and 107A ha	104D and 107A km2	of polygons	Polygon size ha	size km2
Adenostoma fasciculatum- Ceanothus cuneatus					
Shrubland Alliance Adenostoma fasciculatum-Salvia mellifera Shrubland	1,420.10	14.20	14	101.44	1.01
Alliance Aesculus californica	4.21	0.04	2	2.10	0.02
Woodland Alliance	28.20	0.28	3	9.40	0.09
Agriculture	14,475.20	144.75	98	147.71	1.48
Artemisia californica Shrubland Alliance	3,304.70	33.05	181	18.26	0.18
Artemisia californica- Eriogonum fasciculatum Shrubland Alliance	2,184.39	21.84	61	35.81	0.36
Artemisia californica- Salvia mellifera Shrubland Alliance	3,849.25	38.49	70	54.99	0.55
Baccharis salicifolia Shrubland Alliance	1,042.19	10.42	13	80.17	0.80
Barren	332.65	3.33	41	8.11	0.08
Bromus hordeaceus- Bromus madritensis Semi-Natural Herbaceous Stands Provisional	290.31	2.90	11	26.39	0.26
Bromus hordeaceus Semi-Natural Herbaceous Stands Provisional	163.61	1.64	12	13.63	0.14
California Annual Grassland Alliance	22,268.48	222.68	127	175.34	1.75
Ceanothus cuneatus Shrubland Alliance	45.53	0.46	5	9.11	0.09

Chamise - Bigberry					
Manzanita Chaparral					
Alliance	657.14	6.57	8	82.14	0.82
Chamise Chaparral					
Alliance	10,666.54	106.67	202	52.54	0.53
Chamise Wedgeleaf					
Alliance	8,502.84	85.03	29	293.20	2.93
Common Rush					
Riparian Grassland	78.53	0.79	5	15.71	0.16
Distichlis spicata	20.42	0.00		20.42	0.20
Herbaceous Alliance	38.43	0.38	1	38.43	0.38
Dry Wash Habitat P	1,230.83	12.31	1	1,230.83	12.31
Eriodictyon californicum					
Shrubland Alliance	14.03	0.14	1	14.03	0.14
Eriogonum	14.03	0.14	I	14.05	0.14
fasciculatum					
Shrubland Alliance	606.08	6.06	20	30.30	0.30
Juniperus californica		0.00			0.00
Woodland Alliance	189.26	1.89	12	15.77	0.16
Lepidospartum					
squamatum					
Shrubland Alliance	7.12	0.07	1	7.12	0.07
Lotus scoparius					
Shrubland Alliance	34.51	0.35	3	11.50	0.12
No Data	6.11	0.06	4	1.53	0.02
Pinus coulteri					
Woodland Alliance	3.40	0.03	1	3.40	0.03
Pinus lambertiana					
Forest Alliance	0.71	0.01	1	0.71	0.01
Pinus sabiniana		2.66		10.00	0.47
Woodland Alliance	365.63	3.66	22	16.62	0.17
Poa secunda Herbaceous Alliance	22 675 02	236.75	110	215.23	2.15
Populus fremontii	23,675.03	250.75	110	215.25	2.15
Forest Alliance	196.02	1.96	6	32.67	0.33
Prunus ilicifolia	190.02	1.50		52.07	0.55
Shrubland Alliance	544.11	5.44	18	30.23	0.30
Quercus agrifolia	011122			00120	0.00
Woodland Alliance	83.30	0.83	6	13.88	0.14
Quercus agrifolia-					
Quercus douglasii					
Woodland Alliance	194.44	1.94	8	24.31	0.24
Quercus					
berberidifolia					
Shrubland Alliance	422.59	4.23	49	8.62	0.09
Quercus					
berberidifolia-					
Adenostoma	20.04	0.24	4	20.04	0.24
fasciculatum	20.91	0.21	1	20.91	0.21

Shrubland Alliance					
Quercus berberidifolia-					
Ceanothus cuneatus Shrubland Alliance	156.66	1.57	4	39.17	0.39
Quercus douglasii Aesculus californica					
Woodland Alliance Quercus douglasii	705.02	7.05	11	64.09	0.64
Woodland Alliance	6,965.02	69.65	239	29.02	0.29
Quercus douglasii- Juniperus californica Woodland Alliance P	83.66	0.84	4	20.91	0.21
Quercus douglasii- Pinus sabiniana					
Woodland Alliance	15,087.86	150.88	115	131.20	1.31
Quercus douglasii- Pinus sabiniana/Ceanothus cuneatus Woodland					
Alliance	338.53	3.39	1	338.53	3.39
Quercus douglasii- Quercus agrifolia Woodland Alliance	1,033.27	10.33	11	93.93	0.94
Quercus douglasii-	1,033.27	10.55		55.55	0.54
Quercus berberidifolia					
Shrubland Alliance P Quercus douglasii-	926.93	9.27	26	35.65	0.36
Quercus					
berberidifolia Woodland Alliance P	691.18	6.91	19	36.38	0.36
Quercus douglasii-	051.10	0.51	15	50.50	0.50
Quercus lobata	52.20	0.53		52.20	0.50
Woodland Alliance Quercus	52.20	0.52	1	52.20	0.52
douglasiiQuercus					
wislizeni Woodland	00 FF	0.00		40.07	0.10
Alliance Quercus wislizeni	38.55	0.39	2	19.27	0.19
Shrubland Alliance	695.21	6.95	26	26.74	0.27
Salix Alliance	5.26	0.05	1	5.26	0.05
Salvia mellifera		4.70	20	12.10	0.42
Shrubland Alliance Valley Oak Alliance	471.76 113.31	4.72 1.13	39 2	12.10 56.66	0.12 0.57
valley Ouk Alliance	110.01	1.15	2	50.00	0.57

MCV2 1995 Edition Quads 104D and 107A	Total Area by MCV2 1995 Edition Quads 104D and 107A ha	Total Area by MCV2 1995 Edition Quads 104D and 107A km2	Number of polygons	Mean Polygon size ha	Mean Polygon size km2
Artemisia californica-					
Eriogonum					
fasciculatum	55.60	0.50	2	10 50	0.10
Shrubland Alliance	55.68	0.56	3	18.56	0.19
Quercus					
berberidifolia					
Shrubland Alliance	127.79	1.28	8	15.97	0.16
Salix Alliance P	8.22	0.08	1	8.22	0.08
				•	

MCV1 2009 Edition Quads 104D and 107A	Total Area by MCV1 2009 Edition Quads 104D and 107A ha	Total Area by MCV1 2009 Edition Quads 104D and 107A km2	Number of polygons	Mean Polygon size ha	Mean Polygon size km2
Adenostoma fasciculatum- Ceanothus cuneatus Shrubland Alliance	1,420.10	14.20	14	101.44	1.01
Adenostoma fasciculatum-Salvia mellifera Shrubland Alliance	4.21	0.04	2	2.10	0.02
Adenostoma fasiculatum Shrubland Alliance	19,169.38	191.69	231	82.63	0.83
Aesculus californica Woodland Alliance Agriculture	28.20	0.28 144.75	3	9.40 147.71	0.09
Arctostaphylos glauca Shrubland Alliance	657.14	6.57	8	82.14	0.82
Artemisia californica Shrubland Alliance	3,304.70	33.05	181	18.26	0.18
Artemisia californica- Eriogonum fasciculatum Shrubland Alliance	2,184.39	21.84	61	35.81	0.36
Artemisia californica- Salvia mellifera Shrubland Alliance	3,849.25	38.49	70	54.99	0.55

Avena barbata Semi-					
Natural Herbacious Stands	145 50	1.46	8	18.20	0.18
	145.58	1.40	0	18.20	0.18
Baccharis salicifolia Shrubland Alliance	1 0 1 2 1 0	10.42	13	00.17	0.80
	1,042.19	10.42	-	80.17	
Barren	332.65	3.33	41	8.11	0.08
Bromus hordeaceus-					
Bromus madritensis					
Semi-Natural					
Herbaceous Stands	290.31	2.90	11	26.39	0.26
Provisional	290.31	2.90	11	20.39	0.20
Bromus hordeaceus					
Semi-Natural Herbaceous Stands					
Provisional	163.61	1.64	12	13.63	0.14
California Annual	105.01	1.04	12	15.05	0.14
Grassland Alliance	22,122.90	221.23	119	185.91	1.86
Ceanothus cuneatus	22,122.30			105.51	1.00
Shrubland Alliance	45.53	0.46	5	9.11	0.09
Common Rush	43.55	0.40		5.11	0.05
Riparian Grassland	78.53	0.79	5	15.71	0.16
Distichlis spicata					
Herbaceous Alliance	38.43	0.38	1	38.43	0.38
Dry Wash Habitat P	1,230.83	12.31	1	1,230.83	12.31
Eriodictyon					
californicum					
Shrubland Alliance	14.03	0.14	1	14.03	0.14
Eriogonum					
fasciculatum					
Shrubland Alliance	606.08	6.06	20	30.30	0.30
Juniperus californica					
Woodland Alliance	189.26	1.89	12	15.77	0.16
Lepidospartum					
squamatum					
Shrubland Alliance	7.12	0.07	1	7.12	0.07
Lotus scoparius					
Shrubland Alliance	34.51	0.35	3	11.50	0.12
No Data	6.11	0.06	4	1.53	0.02
Pinus coulteri					
Woodland Alliance	3.40	0.03	1	3.40	0.03
Pinus lambertiana					
Forest Alliance	0.71	0.01	1	0.71	0.01
Pinus sabiniana					
Woodland Alliance	365.63	3.66	22	16.62	0.17
Poa secunda					
Herbaceous Alliance	23,675.03	236.75	110	215.23	2.15
Populus fremontii					
Forest Alliance	196.02	1.96	6	32.67	0.33

Prunus ilicifolia Shrubland Alliance	544.11	5.44	18	30.23	0.30
Quercus agrifolia Woodland Alliance	277.74	2.78	14	19.84	0.20
Quercus berberidifolia Shrubland Alliance	579.25	5.79	53	10.93	0.11
Quercus berberidifolia- Adenostoma fasciculatum	579.25	5.73		10.95	0.11
Shrubland Alliance	20.91	0.21	1	20.91	0.21
Quercus douglasii Woodland Alliance	25,922.21	259.22	429	60.28	0.60
Quercus lobata Woodland Alliance	113.31	1.13	2	56.66	0.57
Quercus wislizeni Shrubland Alliance	695.21	6.95	26	26.74	0.27
Salix Alliance	5.26	0.05	1	5.26	0.05
Salvia mellifera Shrubland Alliance	471.76	4.72	39	12.10	0.12

WHR1 2009 Edition Quads 104D and 107A	Total Area by WHR1 2009 Edition Quads 104D and 107A ha	Total Area by WHR1 2009 Edition Quads 104D and 107A km2	Number of polygons	Mean Polygon size ha	Mean Polygon size km2
Agriculture	14,475.20	144.75	98	147.71	1.48
Annual Grasslands	46,397.43	463.97	260	178.45	1.78
Barren	1,563.49	15.63	42	37.23	0.37
Blue Oak Foothill Pine	16,094.22	160.94	147	109.48	1.09
Blue Oak Woodland	9,203.00	92.03	276	33.22	0.33
Coastal Oak Woodland	277.74	2.78	14	19.84	0.20
Chamise-Redshank Chaparral	21,250.83	212.51	255	83.01	0.83
Coastal Scrub	10,457.81	104.58	375	27.89	0.28
Fresh Emergent Wetland	1,309.99	13.10	30	43.67	0.44
Mixed Chaparral	2,825.97	28.26	130	21.74	0.22
Montane Hardwood Conifer	3.40	0.03	1	3.40	0.03
Montane Hardwood	28.20	0.28	3	9.40	0.09
Saline Emergent					
Wetland	38.43	0.38	1	38.43	0.38
Sierran Mixed Conifer	0.71	0.01	1	0.71	0.01
Unknown	69.80	0.70	6	11.63	0.12

Valley Oak Woodland	113.31	1.13	2	56.66	0.57
Valley Foothill					
Riparian	201.28	2.01	7	28.75	0.29
		Total			
	Total Area by WHR2 2009	Area by WHR2 2009 Edition			Mean
WHR2 2009 Edition	Edition Quads	Quads	Number	Mean	Polygon
Quads 104D and	104D and	104D and	of	Polygon	size
107A	107A ha	107A km2	polygons	size ha	km2
Coastal Scrub	55.68	0.56	3	18.56	0.19
Mixed Chaparral	127.79	1.28	8	15.97	0.16
Valley Foothill					
Riparian	8.22	0.08	1	8.22	0.08