



Plant Community Monitoring for Northern Coastal Scrub in the San Francisco Bay Area Network

2015 Annual Report

Natural Resource Data Series NPS/SFAN/NRDS—2019/1226



ON THE COVER

View from northern coastal scrub monitoring plot at Tomales Point, Point Reyes National Seashore, 2015.
(NPS/Sierra Spooner)

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Abstract

This report summarizes monitoring data collected in northern coastal scrub vegetation in 2015 by the San Francisco Bay Area Inventory and Monitoring Network (SFAN), under its Plant Community Monitoring Protocol (Steers et al. 2016a), which tracks changes in vegetation structure and composition over time in select plant communities. SFAN established and monitored 16 permanent plots in northern coastal scrub vegetation at Golden Gate National Recreation Area and Point Reyes National Seashore in 2015, the first year of protocol implementation in a four-year sampling cycle.

The monitoring plots were each located in a separate stand of northern coastal scrub vegetation, randomly selected from the park vegetation map. Each plot was established at the center point of the stand, and was delimited by a 17.95m radius circle. The plots contain a 7.32m radius subplot, with three 15m transects radiating from the plot center, each with a 1m² quadrat placed equidistant from the plot center. Field observers measured vegetation structure and composition metrics in the plots using several sub-protocols.

We summarize data at the square meter scale for vascular plant cover by taxa, total live and dead vegetation cover, total live and dead herbaceous cover, total native and non-native herbaceous cover, litter, bare ground, total foliar cover, and taxonomic richness. We summarize percent cover data from the 12m transects for woody plant and vine taxa, herbaceous plants, litter, and bare ground. At the 168m² scale we report mean taxonomic richness, frequency of taxa, and number of taxa by life form and nativeness. We report on occurrences of special-status and invasive plants, provide qualitative field notes, and present and appendix listing all vascular plants observed among all the plots.

Acknowledgments

This work could not have been accomplished without insights and guidance from the lead vegetation managers at San Francisco Area National Parks: Alison Forrestel, Lorraine Parsons, Brent Johnson, and Fernando Villalba. We are also indebted to the San Francisco Area Network Inventory and Monitoring Program's data manager Sarah Wakamiya and the program manager, Daniel George. Finally, we wish to thank our dedicated and brilliant 2015 vegetation ecology interns, Raphaela Floreani Buzbee and Kristofer Daum, who were integral to the field work, data collection, and data quality for this report.

Introduction

This report presents data collected by the San Francisco Bay Area Network of National Parks (SFAN) Inventory and Monitoring Program under its Plant Community Monitoring Protocol (Steers et al. 2016a). The program seeks to track changes over time in *structure and species composition* in 21 selected plant communities in SFAN parks. One of these communities is northern coastal scrub, which occurs in the coastal park units at Point Reyes National Seashore (PORE) and Golden Gate National Recreation Area (GOGA). 2015 was the first year of long-term monitoring for northern coastal scrub under the Steers et al. (2016a) protocol.

Northern Coastal Scrub Community Description

Northern coastal scrub (Holland and Kiel 1995) is dominated by evergreen shrubs one to two meters tall. Coyote brush (*Baccharis pilularis*) is dominant in the shrub layer or co-dominant with other shrubs such as *Artemisia californica*, *Ceanothus thyrsiflorus*, *Frangula californica*, or *Toxicodendron diversilobum*. The coyote brush alliance is endemic to California and is found primarily in the outer Coast Ranges from Humboldt to San Diego County, but is best represented in central coastal California. The shrub layer may be continuous to open and the herbaceous layer is typically well developed. On exposed coastal bluffs the shrub layer is generally open and exhibits prostrate growth as low as 25cm. In sheltered locations the shrub canopy is more continuous and shrubs can reach 2m in height. Plant taxonomic richness varies widely along environmental gradients; however it tends to be higher where the shrub canopy is more open and the herbaceous layer more continuous.

Northern coastal scrub is a dynamic, disturbance-driven vegetation community. Disturbance factors include fire, drought, salt spray, grazing, and anthropogenic clearing. In the absence of disturbance, stands may be colonized by tree species such as *Pseudotsuga menziesii*, *Quercus agrifolia*, and *Umbellularia californica*. Small-scale gap dynamics affect species composition and community structure at local scales, with herbaceous species colonizing gaps created by shrub dieback (Baxter and Parker 1999). Small mammal density is high under more continuous shrub canopies and herbivory by species such as brush rabbit (*Sylvilagus bachmani*) strongly regulates vegetation structure in coastal scrub (McBride 1964, Bartholomew 1970). Small mammal herbivory suppresses the growth of understory herbaceous species, and promotes invasion resistance in coastal scrubs with continuous canopies (Lambrinos 2002).

Northern coastal scrub provides important habitat for special status plant and animal species and is important breeding habitat for many songbirds. Coastal scrub habitats in California are threatened by habitat loss, fragmentation, degradation, and successional change. Local declines in white-crowned sparrow (*Zonotrichia leucophrys*) have been linked to loss of northern coastal scrub habitat through forest succession at PORE (Chase et al. 2005).

Northern coastal scrub is one of the most abundant vegetation types in northern SFAN lands. Extensive stands occur throughout PORE and GOGA in almost all settings. It is the predominant vegetation type of southwestern coastal slopes in Marin County from Drakes Estero to the Marin headlands. It also predominates on GNNRA lands in San Mateo County, at Milagra Ridge, Sweeney

Ridge, and Rancho Corral de Tierra. Figure 1 shows the extent of northern coastal scrub at PORE and GOGA.

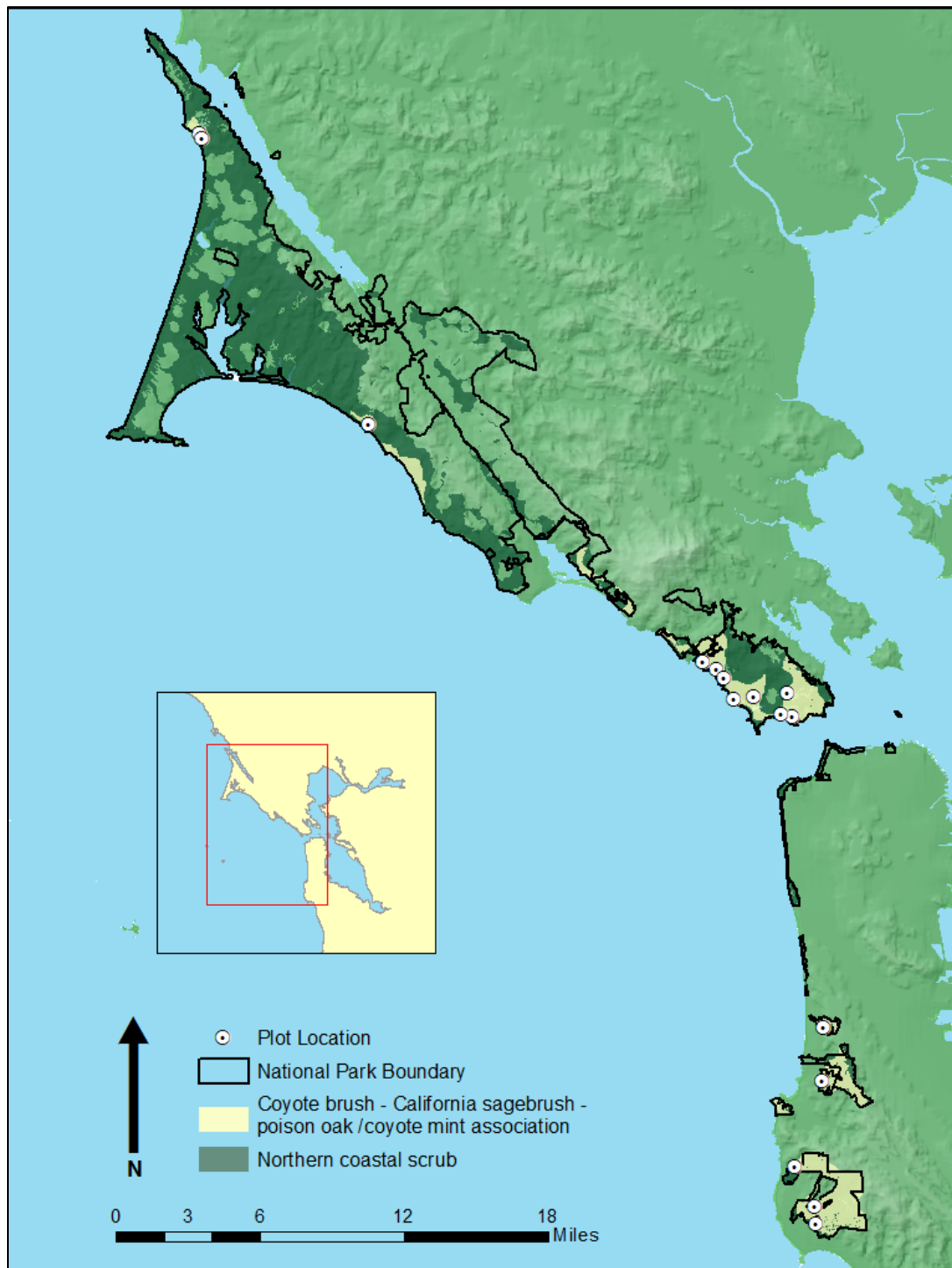


Figure 1. Extent of northern coastal scrub in PORE and GOGA, the fine-scale coyote brush – California sagebrush – poison oak /coyote mint association chosen for sampling, and the plot locations.

Methods

In 2015 biologists with the SFAN Inventory and Monitoring Program established 16 permanent monitoring plots in Northern Coastal Scrub at PORE and GOGA to track changes in vegetation structure and community composition over time. The full methodology for site selection and plot establishment is described in the document *Plant Community Monitoring Protocol for the San Francisco Bay Area Network of National Parks, Standard Operating Procedures* (Steers et al. 2016b). Below is a synopsis of the approach for plot establishment and data collection.

General monitoring design

In order to identify northern coastal scrub community locations in SFAN parks, SFAN ecologists crosswalked the broad definition of *northern coastal scrub* (Holland and Kiel 1995) to the coarse-scale *coastal scrub supercluster* mapping units from the Plant Community Classification and Mapping Project for PORE and GOGA (Schirokauer et al. 2003). From this coarse scale vegetation type, the fine-scale *coyote brush – California sagebrush – poison oak /coyote mint association* was selected for sampling (Steers et al. 2016a, Appendix A and B). From the Schirokauer et al. (2003) vegetation map GIS, SFAN staff randomly selected a set of spatially-distributed polygons (or “stands”) within this fine-scale vegetation type to represent the northern coastal scrub community. SFAN staff filtered out potential sites located on slopes greater than 30 degrees due to safety concerns and to reduce sampling disturbance. A power analysis of pilot data determined the number of stands needed to meet program objectives (Steers et al. 2016b SOP 5). Figure 1 shows the general extent of the broad northern coastal scrub supercluster, the fine-scale association, and the plot locations.

We established one sampling plot within each of 18 selected stands (e.g., Figure 2) randomly using the following procedure: within each of the selected stands staff identified the central-most point in the polygon through GIS analysis. In the field, we navigated to the first randomly identified coordinates, and evaluated the location. We accepted plot locations if they met the following criteria: location represents the target vegetation, location does not pose immitigable risks to field crews, location is on a less than 30 degree slope, and the plot does not intersect a road or trail. If we rejected the first plot location we then navigated to the nearest location within the plot that met the criteria and established the plot at that site.



Figure 2. A stand selected for sampling outlined in white. Also, shown with black lines are the divisions of the discrete portion where sampling plots are placed (also in black).

SFAN staff visited the 18 selected stands in 2015. We rejected six of the initial stands because they did not key to the correct alliance (Schirokauer et al. 2003). We rejected two of the plots because the plots were on slopes greater than 30 degrees and we were not able to visit alternate plot locations in 2015; in 2019 the program will add two additional plots in order to meet calculated sample size goals. The 16 plots established in 2015 are primarily located on southwestern to southeastern exposures (Table 1). The average plot slope is 24 degrees (16 degrees minimum, 29 degrees maximum).

Table 1. Slope and aspect of the northern coastal scrub plots. Note, plots 3 and 17 were not established in 2015.

Plot	Slope (°)	Aspect (°)	Ordinal Direction
1	25	199	S
2	23	204	SW
4	23	209	SW
5	27	138	SE
6	22	174	S
7	24	215	SW

Table 1 (continued). Slope and aspect of the northern coastal scrub plots. Note, plots 3 and 17 were not established in 2015.

Plot	Slope (°)	Aspect (°)	Ordinal Direction
8	29	220	SW
9	23	170	S
10	28	194	S
11	16	254	W
12	23	240	SW
13	29	268	W
14	19	156	SE
15	27	169	S
16	27	236	SW
18	18	138	SE

Within stands that met criteria for plot establishment, we created a 17.95m radius circular plot. We monumented each center point with a length of rebar topped with an aluminum cap. We also monumented the ends of each of three 15m transects radiating from the center point at 30°, 150°, and 270° as measured by a compass (Figure 3). Within this plot, field observers measured vegetation structure and community composition metrics using several sub-protocols. These are described briefly in section “Methodologies for measurement of vegetation structure and species composition” below, and in more detail in Steers et al. 2016b sections SOP 7 through SOP 12.

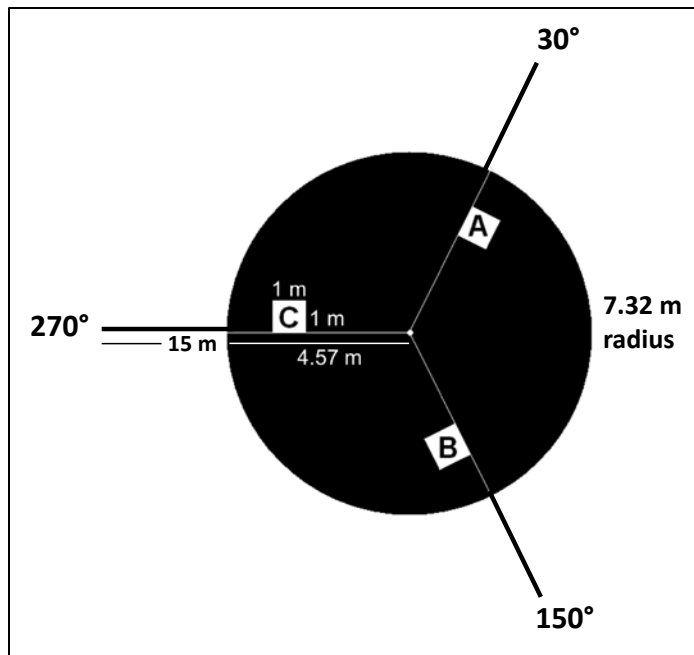


Figure 3. Graphical representation of the plot. Plot components shown include three 15m transects radiating from the plot center, three 1m² quadrats placed along the transects, and the 7.32m radius subplot. Not shown is the 17.95m macroplot.

Methodologies for measurement of vegetation structure and species composition

SFAN staff identified all vascular plants using nomenclature in the Jepson Manual, 2nd edition (Baldwin et al. 2012). Plants were identified to the minimum taxonomic rank (species, subspecies, or varieties), the smallest taxonomic units recognized by the Jepson Manual; however in rare cases we were unable to determine minimum taxonomic rank due to a lack of identifiable characters resulting from unsuitable phenology or disturbances such as herbivory. Prior to data summarization, the SFAN botanist resolved taxonomic ambiguities to the lowest common taxonomic rank possible for each plot, and for the entire dataset, through review of the data and examination of collected plant specimens.

Plant cover in 1 square meter quadrats

Detailed methodology for data collection is found in Steers et al. 2016b SOP 8.

In each of the plots visited in 2015, we measured vascular plant cover in three 1m² quadrats (Figure 3). Although we collected data for all plants less than 3m in height in the quadrats, the primary purpose of this methodology is to evaluate changes in herbaceous plant cover over time. Within each quadrat we evaluated plant presence at 50 regularly dispersed points, by dropping a small-diameter pin flag vertically at each point.

We recorded the name for each plant less than 3m in height that was “hit” by the pin. When we encountered plant material that was dead but still standing as if it were in a live position, we noted the species and recorded it as dead. For woody plants, if we hit both dead and live tissue on the same plant, we recorded both states if the dead tissue was hit above the live tissue, in order to quantify

dieback from stem tips. If we hit live tissue above and dead tissue below, we only recorded the live state, because healthy woody plants tend to grow upward and shade out their lower stems, which naturally senesce. At points where no plants were observed, we recorded ground variables at the point, such as “litter” and “bare ground”.

We estimated cover of each plant taxon encountered by first averaging the cover among the three 1m² quadrats measured in each plot, then averaging cover for each taxon among all plots. We calculated cover metrics for “litter” and “bare ground” similarly. We then summarized the plant data broadly, creating metrics for live vegetation cover, dead vegetation cover, live herbaceous cover, native live herbaceous cover, and non-native live herbaceous cover. We excluded from this analysis any plants with uncertain nativeness (e.g., plants identified to genus only with both native and non-native species within the genus). We then summarized cover data for plants with greater than 1% cover in the quadrats, excluding dead plants from this summary. For all these metrics we created bootstrapped 90% confidence intervals around the estimated mean (Orloff and Bloom 2014). Environmental metrics are presented in section “Ground cover and foliar cover metrics” below, while live and dead plant cover data are presented in section “Plant cover in 1 square meter quadrats.”

Woody plant and vine cover along 12 meter transects

Detailed methodology for data collection is found in Steers et al. 2016b SOP 10.

In each plot we measured woody plant and vine cover on three 12m long transects (Figure 4), by dropping a small-diameter pin flag vertically along the transect at 25cm intervals along the transect. Observers tracked all plants less than 3m in height.

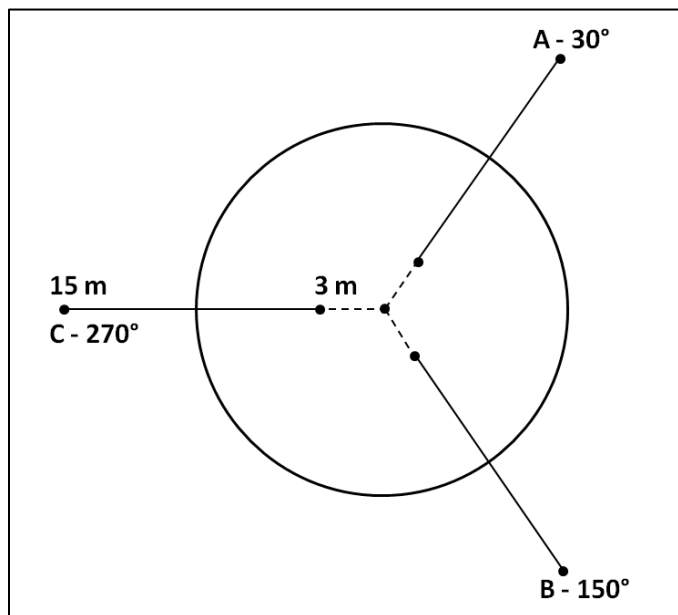


Figure 4. Graphical representation of the 12m transects.

We recorded the name of each woody plant or vine observed in the direct path of the pin. When we encountered plant material that was dead but still standing as if it were in a live position, we noted

the species and recorded it as dead. If we hit both live and dead tissue on the same plant, we recorded both live and dead states if the dead tissue was hit above the live tissue, but only recorded the live state if dead tissue was hit below the live tissue, as described above in section “Plant cover in 1 square meter quadrats.” At points where no plants were observed, we recorded alternate variables at the point such as “herbaceous”, “litter” and “bare ground”. Cover of woody vegetation taller than 3m in height observed within the plot was recorded via observation with an upward-pointing device - a GRS densitometer - at 25cm intervals along the transect. We recorded these observations as “tree canopy” hits.

We estimated cover of each plant taxon encountered by first averaging the cover among the three 12m transects measured in each plot, then averaging cover for each plant among all plots. We calculated cover metrics for “litter” and “bare ground” similarly. We then summarized the plant data by *live woody plant or vine*, *dead woody plant or vine*, *live native shrub or subshrub*, *live non-native shrub or subshrub*, *dead shrub or subshrub*, *live vine*, *herbaceous plants*, and *tree canopy*. We excluded from this analysis any plant taxa with uncertain nativeness (e.g., plants identified to genus only with both native and non-native species within the genus). We then summarized cover data for plants with greater than 1% cover along the transects, excluding dead plants from this summary. For all these metrics we created bootstrapped 90% confidence intervals around the estimated mean (Orloff and Bloom 2014). Environmental metrics are presented in section “Ground cover and foliar cover metrics” below, while live and dead plant cover data are presented in section “Woody plant and vine cover along cover along 12m transects.”

Taxonomic richness in 1 square meter quadrats and 7.32 meter radius circular plots

Detailed methodology for data collection is found in Steers et al. 2016b SOP 8.

We recorded the presence of all vascular plant taxa rooted in or overhanging each 1m² quadrat at less than 3m in height, then broadened the search area to a circle of radius 7.32m from the plot center point. These observations included both live plants and dead but identifiable plants. We tallied the number of unique (live or dead) plants observed in the three quadrats in each plot, and averaged this number by plot to derive the metric Taxonomic Richness per Square Meter, and tallied the number of plants observed in the 7.32m circular plots to derive the metric Taxonomic Richness per 168.3 Square Meters, the areal extent of the plot.

Occasionally, a taxon was only identifiable to the genus level due to unsuitable phenology or disturbance. If we didn’t identify any other plants in that genus to species in the plot or quadrat, we tallied the genus as one taxon for richness calculations. For example, where observers only recorded *Marah* sp. in the plot or quadrat we tallied it as one taxon. If we identified a plant to genus only and also identified congeneric taxa in the plot or quadrat to a lower taxonomic rank, the genus-only record was not tallied as a unique taxon. For example, where observers recorded *Galium* sp. and also recorded *Galium porrigens* in the plot or quadrat, we tallied these two records as one taxon for richness calculations.

Taxonomic richness metrics are presented in section “Vegetation Composition Metrics” below.

Results

Ground cover and foliar cover metrics

Estimated cover of litter was 6.0% in the 1m² quadrats, and 5.6% on the 12m transects (Table 2). Estimated cover of bare ground was 2.5% in the 1m² quadrats, and 3.0% on the 12m transects. The foliar cover observed in the 1m² quadrats (that is, all area covered by at least one layer of vegetation at less than 3m in height) was 91.5%.

Table 2. Ground and foliar cover measured in the 1m² quadrats. Showing the mean percent cover estimate and 90% confidence interval (CI) around the mean.

Metric	1m ² quadrats		12m transects	
	Estimated Cover	90% CI	Estimated Cover	90% CI
Litter	6.0	4.3 - 7.5	5.6	4.4 - 6.8
Bare Ground	2.5	1.6 - 3.3	3.0	2.1 - 3.9
Total Foliar Cover	91.5	–	–	–

Plant cover in 1 square meter quadrats

The estimated absolute foliar cover of all live vascular plant taxa calculated across all 1m² quadrats was 110.5% (Table 3). Absolute cover of all taxa may include overlapping canopies; therefore it may exceed total foliar cover, which is presented above in Table 2. The absolute cover of dead vascular plants was 47.1%.

The estimated absolute cover of live herbaceous plants was 30.6%, with 24.0% of that representing native species and 5.5% representing non-native species.

Table 3. Herbaceous plant cover and other metrics evaluated with point intercept in 1m² quadrats. Showing the mean percent cover estimate and 90% confidence interval (CI) around the mean.

Metric	Estimated Cover	90% CI
Total Live Vegetation	110.5	99.8 - 120.6
Total Dead Vegetation	47.1	42.2 - 52.2
Total Live Herbaceous	30.6	19.3 - 40.9
Native Live Herbaceous	24.0	16.2 - 31.3
Non-native Live Herbaceous	5.5	2.2 - 8.6

Plants with 1% or greater cover within the 1m² quadrats are shown in Table 4 and Figure 5 below. All plants with 1% or greater cover in these plots are native (Jepson Herbarium 2017). Other plants observed in the quadrats exhibited less than 1% cover. These are included in the complete 2015 species list for northern coastal scrub in Appendix A.

Table 4. Live plant taxa with 1% or greater cover found in 1m² quadrats. Showing the mean percent cover estimate and 90% confidence interval (CI) around the mean.

Taxon	Estimated Cover	90% CI
<i>Baccharis pilularis</i> subsp. <i>consanguinea</i>	33.8	30.3 - 37.2
<i>Artemisia californica</i>	26.8	22.8 - 30.8
<i>Stipa lepida</i>	11.9	7.5 - 16.2
<i>Toxicodendron diversilobum</i>	7.8	3.5 - 11.5
<i>Mimulus aurantiacus</i> var. <i>aurantiacus</i>	4.9	2.9 - 6.8
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	4.2	1.0 - 7.1
<i>Anagallis arvensis</i>	1.8	1.1 - 2.5
<i>Agrostis hallii</i>	1.5	0.0 - 2.9
<i>Baccharis pilularis</i> subsp. <i>pilularis</i>	1.5	0.0 - 3.0
<i>Lathyrus vestitus</i>	1.5	0.0 - 3.1
<i>Phalaris aquatica</i>	1.5	0.0 - 3.1

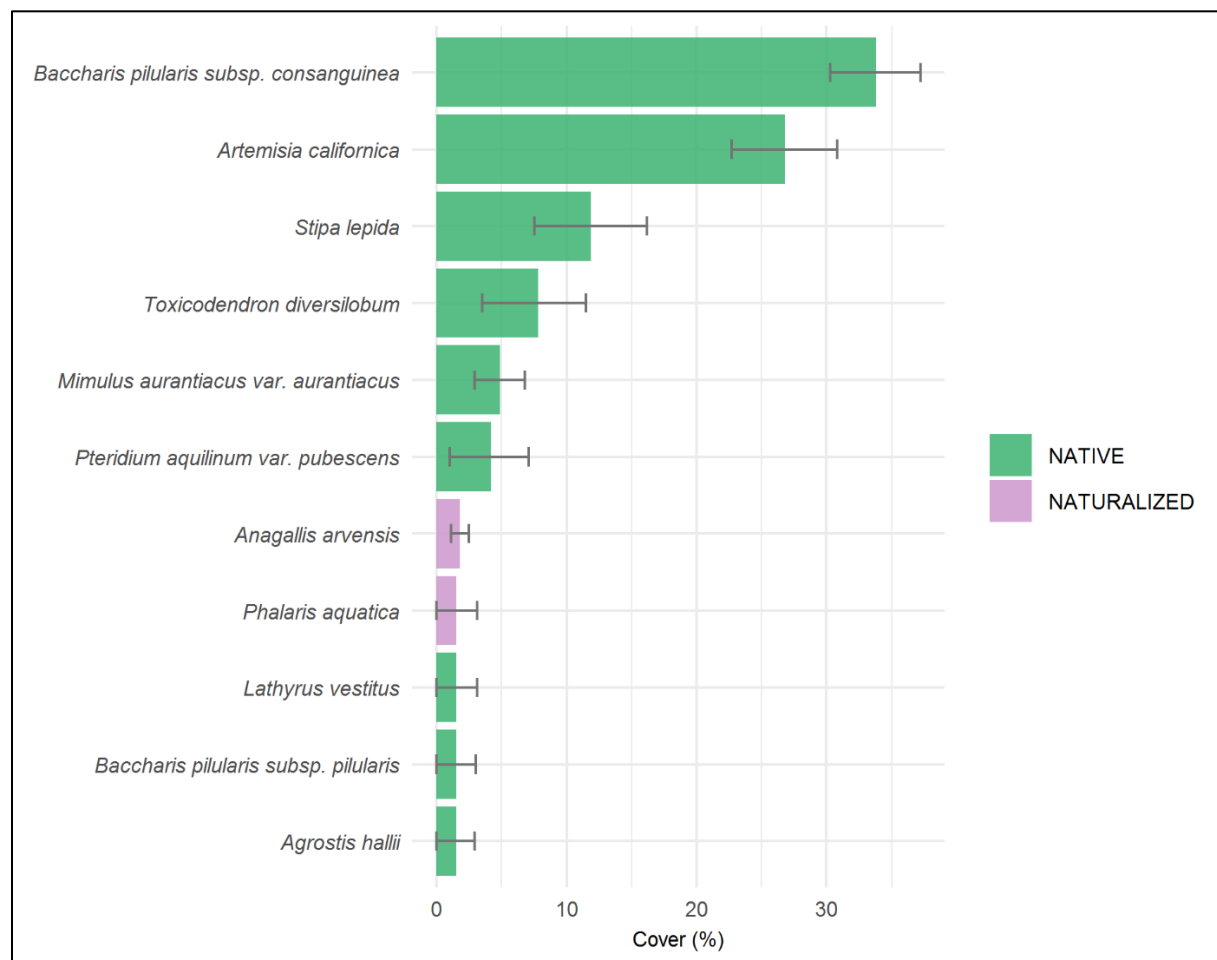


Figure 5. Live plant taxa with 1% or greater cover found in 1m² quadrats. Error bars show 90% confidence intervals around the estimated means.

Woody plant and vine cover along cover along 12m transects

Estimated cover of live woody plant or vine taxa calculated across all plots was 85.4% (Table 5). Estimated cover of dead woody plants or vines was 43.0%. Live native tree, shrub or subshrub species comprised 83.4% cover and dead tree, shrub or subshrub cover comprised 42.3% cover. No live non-native trees, shrubs or subshrubs were observed in 2015. Live vines comprised negligible cover (0.7%). Other variables observed on the 12m transects include herbaceous plants (5.6% cover) and tree canopy (no observations for this metric).

Table 5. Woody plant cover and other metrics evaluated with point intercept on 12m transects. Showing the mean percent cover estimate and 90% confidence interval (CI) around the mean.

Life Form	Estimated Cover	90% CI
Live Woody Plant or Vine	85.4	80.9 - 89.8
Dead Woody Plant or Vine	43.0	39.3 - 46.7
Live Native Shrub or Subshrub	83.4	79.3 - 87.4
Live Non-native Shrub or Subshrub	—	—
Dead Shrub or Subshrub	42.3	38.3 - 46.4
Live Vine	0.7	0 - 1.5
Herbaceous	5.6	3.0 - 8.0
Tree Canopy	—	—

Woody species and vines “hit” along transects are shown in Table 6 and Figure 6; all of these were California natives in 2015 (Jepson Herbarium 2017).

Table 6. Live woody plants and vines observed along 12m transects. Showing the mean percent cover estimate and 90% confidence interval (CI) around the mean.

Taxon	Estimated Cover	90% CI
<i>Baccharis pilularis</i> subsp. <i>consanguinea</i>	37.9	33.7 - 42.2
<i>Artemisia californica</i>	27.8	23.2 - 32.3
<i>Toxicodendron diversilobum</i>	9.6	6.9 - 12.3
<i>Mimulus aurantiacus</i> var. <i>aurantiacus</i>	5.6	4.1 - 6.9
<i>Rubus ursinus</i>	1.3	0.5 - 2.0
<i>Eriophyllum staechadifolium</i>	1.0	0.1 - 1.8
<i>Frangula californica</i> subsp. <i>californica</i>	0.9	0.2 - 1.5
<i>Lathyrus vestitus</i> var. <i>vestitus</i>	0.5	0 - 1.0
<i>Monardella villosa</i>	0.3	0 - 0.5
<i>Calystegia purpurata</i> subsp. <i>saxicola</i>	0.2	0 - 0.3
<i>Symphoricarpos albus</i> var. <i>laevigatus</i>	0.1	0 - 0.3
<i>Holodiscus discolor</i>	0.1	0 - 0.2
<i>Baccharis pilularis</i> subsp. <i>pilularis</i>	0.1	0 - 0.2
<i>Marah</i> sp.	negligible	0 - 0.1

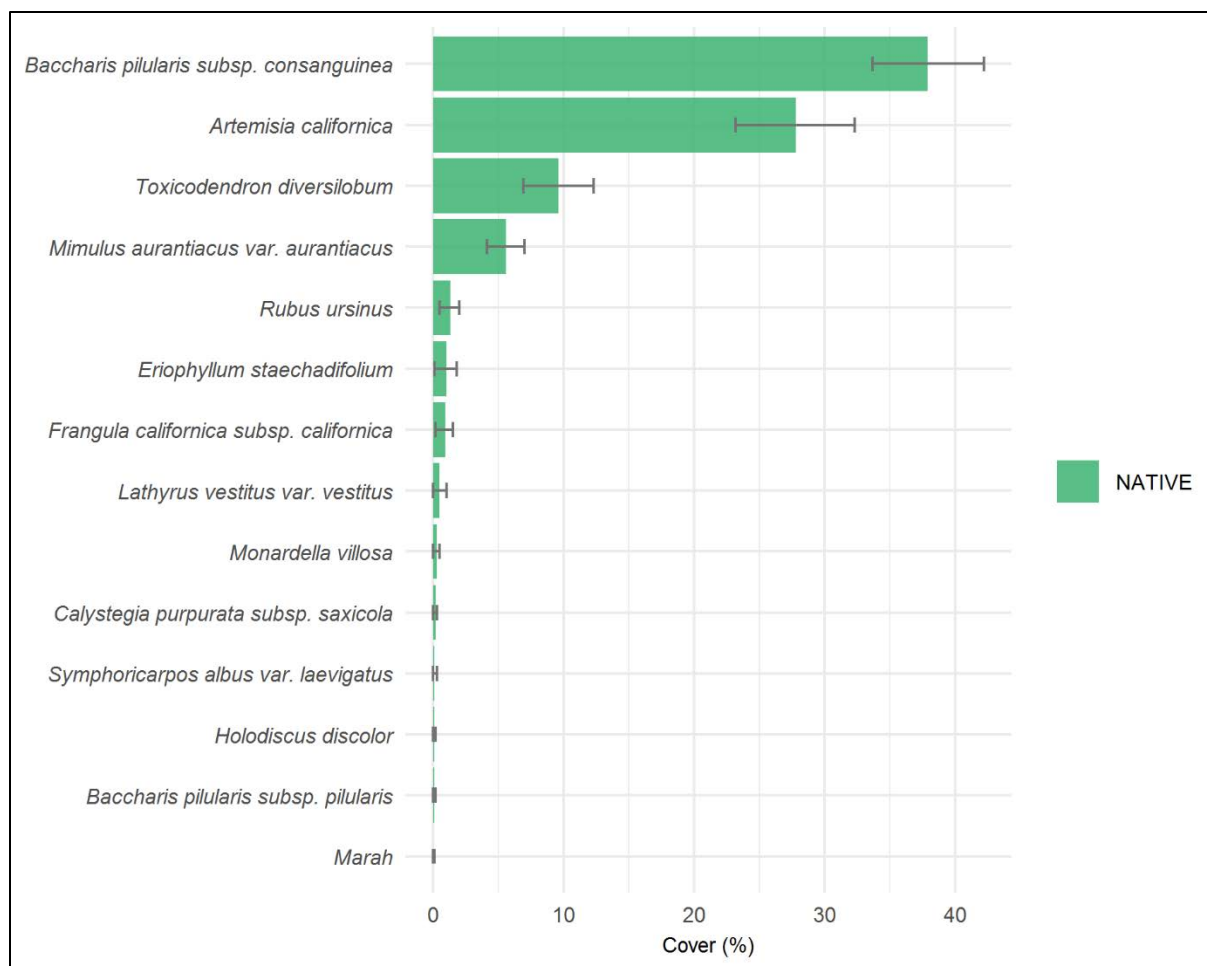


Figure 6. Live woody plants and vines observed on 12m transects. Error bars show 90% confidence intervals around the estimated means.

Vegetation Composition Metrics

SFAN staff observed 81 unique vascular plant taxa in the 7.32m radius subplots, which included 1 tree taxon, 20 shrub and subshrub taxa, 3 vine taxa, and 58 herbaceous taxa (Table 7). Of all taxa observed 78% were native to California, 21% were non-native herbaceous plants. Life form and nativeness follow Baldwin et al. (2012). See Appendix A for a list of all vascular plant taxa.

Table 7. Number of species observed by Life Form, Nativeness, and Special Status.

Life Form	Nativeness	Number of Species	Percentage of All Species Observed
Tree	Native	0	–
	Non-native	1	1%
Shrub and Subshrub	Native	19	23%
	Non-native	0	–
Vine	Native	3	4%
	Non-native	0	–
Herbaceous	Native	41	51%
	Non-native	17	21%
Total	–	81	–

The average number of taxa in the 1m² quadrats was 10.9, and the average number of taxa 7.32m radius (168.3m²) plots was 15.5 (Table 8).

Table 8. Plant taxonomic richness by 1m² quadrats and 168.3m² circular plots. Showing the mean richness estimate and 90% confidence interval (CI) around the mean.

Area	n	Mean taxonomic richness	90% CI
Taxonomic richness by 1m ² quadrat	48	10.9	9.4 - 12.4
Taxonomic richness by 168.3m ² circular plot	16	15.5	12.4 - 18.4

Of the 81 total taxa in the circular plots in 2015, 26 taxa occurred with greater than 15% frequency (Table 9). Of these taxa, 12 were shrubs or subshrubs, 2 were vines, and 12 were herbaceous plants.

Table 9. Frequency of taxa occurring in more than 15% of the 7.32m radius plots.

Stratum	Taxon Name	Number of Plots	Frequency (%)	Nativeness
Woody Plant or Vine	<i>Calystegia purpurata</i> subsp. <i>saxicola</i>	3	19	Native
	<i>Lathyrus vestitus</i>	3	19	Native
Shrub or Subshrub	<i>Artemisia californica</i>	16	100	Native
	<i>Baccharis pilularis</i> subsp. <i>consanguinea</i>	16	100	Native
	<i>Mimulus aurantiacus</i> var. <i>aurantiacus</i>	13	81	Native
	<i>Toxicodendron diversilobum</i>	13	81	Native
	<i>Rubus ursinus</i>	9	56	Native
	<i>Clinopodium douglasii</i>	9	56	Native
	<i>Frangula californica</i> subsp. <i>californica</i>	8	50	Native
	<i>Eriophyllum staechadifolium</i>	5	31	Native

Table 9 (continued). Frequency of taxa occurring in more than 15% of the 7.32m radius plots.

Stratum	Taxon Name	Number of Plots	Frequency (%)	Nativeness
Shrub or Subshrub (continued)	<i>Galium porrigens</i> var. <i>porrigens</i>	5	31	Native
	<i>Baccharis pilularis</i> subsp. <i>pilularis</i>	4	25	Native
	<i>Monardella villosa</i>	4	25	Native
	<i>Acmispon glaber</i> var. <i>glaber</i>	3	19	Native
Herbaceous	<i>Anagallis arvensis</i>	15	94	Naturalized
	<i>Stipa lepida</i>	12	75	Native
	<i>Pseudognaphalium californicum</i>	6	38	Native
	<i>Chlorogalum pomeridianum</i> var. <i>divaricatum</i>	5	31	Native
	<i>Fragaria vesca</i>	5	31	Native
	<i>Pteridium aquilinum</i> var. <i>pubescens</i>	5	31	Native
	<i>Plantago lanceolata</i>	4	25	Naturalized
	<i>Stachys rigida</i> var. <i>quercetorum</i>	4	25	Native
	<i>Agrostis hallii</i>	3	19	Native
	<i>Elymus glaucus</i>	3	19	Native
	<i>Horkelia californica</i> var. <i>californica</i>	3	19	Native
	<i>Solidago elongata</i>	3	19	Native

Special-status and invasive plants

Special status plants are defined here as taxa that are federally or state listed as rare, threatened or endangered; or candidates for federal or state listing; or included in the California Native Plant Society Inventory of Rare, Threatened, and Endangered Plants (CNPS 2017).

Invasive plants are defined here as taxa that are listed in the California Invasive Plant Council Inventory (Cal-IPC 2017); or listed by the SFAN Invasive Plants Early Detection Program (SFAN 2017). Invasive plants are taxa that are not native to an environment, and once introduced they quickly reproduce and spread, causing harm to the environment, economy, or human health.

Cal-IPC ranks invasive species from high to low by the statewide severity of their ecological impacts, spread rate, and distribution, using the ratings High, Moderate, and Limited. The SFAN early detection program ranks invasive plant species by their risk of invasiveness and distribution in SFAN parks. High priority species are present in isolated locations and pose a high risk of invasiveness; medium priority species are more widespread, and pose a moderate to high risk of invasiveness, or are under surveillance; and low priority species are widespread and abundant, with variable ecological impacts.

Special-status plants

One special-status plant, Bodega morning glory (*Calystegia purpurata* subsp. *saxicola*) was present in 3 plots (19% frequency). This subspecies is a CNPS Rank 1B.2 taxon, meaning it is rare threatened, or endangered in California and elsewhere. Bodega morning glory is endemic to the

North Coast of California, occurring from Mendocino County to Marin County, and is listed as “fairly endangered in California” due to trampling by foot traffic and competition from non-native species.

Invasive plants

Twelve invasive plant species were found within the plots (Table 10). One species had a Cal-IPC rating of High, seven had a Cal-IPC rating of Moderate, and four had a Cal-IPC rating of Limited. Five of these species were also on priority lists for the SFAN Invasive Plants Early Detection Program at GOGA and PORE. One was a high priority for early detection, one was medium priority, and three were low priority.

Table 10. Invasive plant taxa frequency in 7.32m radius plots, Cal-IPC ratings, and early detection priority levels.

Taxon	Cal-IPC rating	SFAN Early Detection Priority	Frequency (%)
<i>Plantago lanceolata</i>	Limited	–	25
<i>Bromus hordeaceus</i>	Limited	–	6
<i>Carduus pycnocephalus</i> subsp. <i>pycnocephalus</i>	Moderate	–	6
<i>Cirsium vulgare</i>	Moderate	–	6
<i>Cortaderia jubata</i>	High	Low	6
<i>Eucalyptus globulus</i>	Limited	Medium	6
<i>Geranium dissectum</i>	Moderate	–	6
<i>Hirschfeldia incana</i>	Moderate	Low	6
<i>Holcus lanatus</i>	Moderate	–	6
<i>Hypericum perforatum</i> subsp. <i>perforatum</i>	Limited	High	6
<i>Phalaris aquatica</i>	Moderate	Low	6
<i>Rumex acetosella</i>	Moderate	–	6

Photo monitoring

During each monitoring event, we took photo points at eye-level from plot center along the three 15m transects (A, B, and C). A photographic scale pole marked in 0.5m increments was placed at the 7.32m mark along each transect. High resolution images of all plot photos are stored in NPGallery, and may be viewed at the link below.

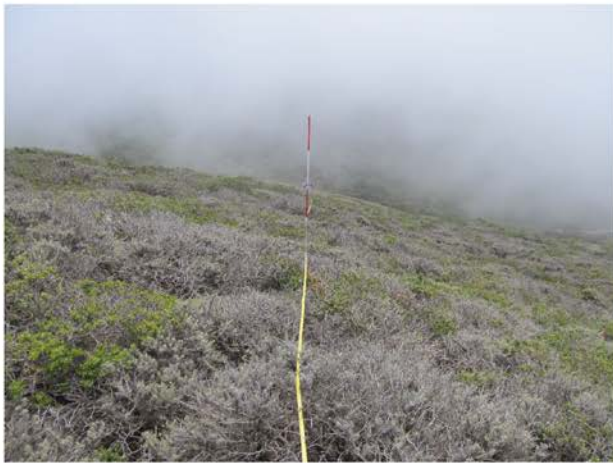
[NPGallery: 2015 Northern Coastal Scrub Plot Photos](#)

Note that there are no photos for plot numbers 3 and 17, because these sites were rejected, and not established in 2015. Additionally, there are no photos for plot number 5, which was established and sampled, but not photographed.

Figure 7 shows an example of three photo monitoring points taken along transects A, B, and C in a northern coastal scrub sample plot.



SCR B04A_20150630



SCR B04B_20150630



SCR B04C_20150630

Figure 7. Photo monitoring points taken from a plot center along the three 15m transects A, B, and C. The photo labels indicate the community type (SCR B), plot number (4), transect (A, B, C), and date.

Field Notes

The shrub canopy was fairly continuous in most northern coastal scrub plots, with mean foliar cover of 91.5% (Table 2). Coyote brush and California sagebrush (*Artemisia californica*) are consistently codominant, with a relatively sparse herbaceous understory.

Signs of contemporary disturbance noted in the plots included large game trails, understory herbivory, and ground slumping. Game trails ostensibly created by deer and elk were noted to cause minimal to significant canopy gaps in 88% of the plots. Signs of herbivory in the herbaceous layer (chewed leaves, small mammal scat) were ubiquitous under closed shrub canopies. Herbaceous cover was higher where shrub canopies were more open, and lower under continuous canopy. Two sites were located on or near slumps, a common erosion feature of hillsides the San Francisco Bay Area.

Invasive plant taxa were not present at high levels of cover, and were generally infrequent in the northern coastal scrub plots. Notable exceptions included sites with more intensive histories of anthropogenic disturbance at Rancho Corral de Tierra, and Muir Beach. Roads and trails at Rancho are heavily impacted by invasive jubata grass (*Cortaderia jubata*) and klamathweed, which have colonized areas disturbed by historic off-road vehicle and ranching activities. The Muir Beach site, located near a historic dairy, was grazed intensively for decades and is now heavily invaded by Harding grass (*Phalaris aquatica*).

We observed significant recent die-back in many woody species of northern coastal scrub, reflected in the mean estimated cover of 42.3% dead shrubs, presumably due to drought conditions. The period from 2012 to 2015 marked one of the major drought events in California's recorded history, including the driest water year on record in 2014 (NASA 2014, USGS 2017). California sagebrush exhibited greater dieback and death than coyote brush.

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Appendix A: All Vascular Plants Observed in Northern Coastal Scrub Plots in 2015

Table A-1. All vascular plants observed in northern coastal scrub plots in 2015.

Life Form	Species	Nativeness*	Status*
Trees	<i>Eucalyptus globulus</i>	Naturalized	Weed listed by Cal-IPC
Vines	<i>Calystegia purpurata</i> subsp. <i>saxicola</i>	Native	CNPS Rare/Endangered
	<i>Lathyrus vestitus</i>	Native	—
	<i>Lathyrus vestitus</i> var. <i>vestitus</i>	Native	—
Shrubs and Subshrubs	<i>Acmispon glaber</i> var. <i>glaber</i>	Native	—
	<i>Artemisia californica</i>	Native	—
	<i>Baccharis pilularis</i> subsp. <i>consanguinea</i>	Native	—
	<i>Baccharis pilularis</i> subsp. <i>pilularis</i>	Native	—
	<i>Ceanothus thyrsiflorus</i> var. <i>thyrsiflorus</i>	Native	—
	<i>Clinopodium douglasii</i>	Native	—
	<i>Erigeron glaucus</i>	Native	—
	<i>Eriogonum latifolium</i>	Native	—
	<i>Eriophyllum confertiflorum</i> var. <i>confertiflorum</i>	Native	—
	<i>Eriophyllum staechadifolium</i>	Native	—
	<i>Frangula californica</i> subsp. <i>californica</i>	Native	—
	<i>Galium porrigens</i> var. <i>porrigens</i>	Native	—
	<i>Lupinus arboreus</i>	Native	—
	<i>Lupinus variicolor</i>	Native	—
	<i>Mimulus aurantiacus</i> var. <i>aurantiacus</i>	Native	—
	<i>Monardella villosa</i>	Native	—
	<i>Rubus ursinus</i>	Native	—
	<i>Symphoricarpos albus</i> var. <i>laevigatus</i>	Native	—
	<i>Toxicodendron diversilobum</i>	Native	—
Herbaceous Plants	<i>Acaena pinnatifida</i> var. <i>californica</i>	Native	—
	<i>Achillea millefolium</i>	Native	—
	<i>Agoseris apargioides</i> var. <i>apargioides</i>	Native	—
	<i>Agrostis pallens</i>	Native	—
	<i>Aira caryophyllea</i>	Naturalized	—
	<i>Anagallis arvensis</i>	Naturalized	—
	<i>Angelica hendersonii</i>	Native	—
	<i>Artemisia douglasiana</i>	Native	—
	<i>Bromus carinatus</i> var. <i>carinatus</i>	Native	—
	<i>Bromus hordeaceus</i>	Naturalized	—
	<i>Bromus maritimus</i>	Native	—

*Nativeness and Status from Jepson Herbarium eflora <http://ucjeps.berkeley.edu/eflora/>

Table A-1 (continued). All vascular plants observed in northern coastal scrub plots in 2015.

Life Form	Species	Nativeness*	Status*
Herbaceous Plants (continued)	<i>Carduus pycnocephalus</i> subsp. <i>pycnocephalus</i>	Naturalized	Weed listed by Cal-IPC
	<i>Carex brevicaulis</i>	Native	–
	<i>Carex tumulicola</i>	Native	–
	<i>Castilleja wightii</i>	Native	–
	<i>Cerastium arvense</i> subsp. <i>strictum</i>	Native	–
	<i>Chlorogalum pomeridianum</i> var. <i>divaricatum</i>	Native	–
	<i>Cirsium vulgare</i>	Naturalized	Weed listed by Cal-IPC
	<i>Cortaderia jubata</i>	Naturalized	Weed listed by Cal-IPC
	<i>Danthonia californica</i>	Native	–
	<i>Dryopteris arguta</i>	Native	–
	<i>Dudleya farinosa</i>	Native	–
	<i>Elymus glaucus</i>	Native	–
	<i>Eriogonum nudum</i> var. <i>nudum</i>	Native	–
	<i>Eschscholzia californica</i>	Native	–
	<i>Festuca bromoides</i>	Naturalized	–
	<i>Festuca perennis</i>	Naturalized	Weed listed by Cal-IPC
	<i>Fragaria vesca</i>	Native	–
	<i>Galium aparine</i>	Native	–
	<i>Geranium dissectum</i>	Naturalized	Weed listed by Cal-IPC
	<i>Hirschfeldia incana</i>	Naturalized	Weed listed by Cal-IPC
	<i>Holcus lanatus</i>	Naturalized	Weed listed by Cal-IPC
	<i>Horkelia californica</i> var. <i>californica</i>	Native	–
	<i>Hypericum perforatum</i> subsp. <i>perforatum</i>	Naturalized	Weed listed by Cal-IPC
	<i>Iris douglasiana</i>	Native	–
	<i>Iris macrosiphon</i>	Native	–
	<i>Juncus patens</i>	Native	–
	<i>Lomatium dasycarpum</i>	Native	–
	<i>Luzula comosa</i>	Native	–
	<i>Madia sativa</i>	Native	–
	<i>Melica torreyana</i>	Native	–
	<i>Pentagramma triangularis</i> subsp. <i>triangularis</i>	Native	–
	<i>Phalaris aquatica</i>	Naturalized	Weed listed by Cal-IPC
	<i>Plantago lanceolata</i>	Naturalized	Weed listed by Cal-IPC
	<i>Pseudognaphalium californicum</i>	Native	–
	<i>Pteridium aquilinum</i> var. <i>pubescens</i>	Native	–
	<i>Rumex acetosella</i>	Naturalized	Weed listed by Cal-IPC
	<i>Sanicula bipinnatifida</i>	Native	–

*Nativeness and Status from Jepson Herbarium eflora <http://ucjeps.berkeley.edu/eflora/>

Table A-1 (continued). All vascular plants observed in northern coastal scrub plots in 2015.

Life Form	Species	Nativeness*	Status*
Herbaceous Plants (continued)	<i>Sidalcea malviflora</i> subsp. <i>malviflora</i>	Native	–
	<i>Silene gallica</i>	Naturalized	–
	<i>Solidago elongata</i>	Native	–
	<i>Solidago velutina</i> subsp. <i>californica</i>	Native	–
	<i>Stachys rigida</i> var. <i>quercetorum</i>	Native	–
	<i>Stipa lepida</i>	Native	–
	<i>Stipa pulchra</i>	Native	–
	<i>Triteleia laxa</i>	Native	–
	<i>Vicia sativa</i>	Naturalized	–

*Nativeness and Status from Jepson Herbarium eflora <http://ucjeps.berkeley.edu/eflora/>

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