2017

SJNHP Cattle Point Vegetation Monitoring

San Juan National Historic Park

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SJNHP Cattle Point Vegetation Monitoring

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Table of Contents

Cover photo: view of the Regrade and Road Cut study areas looking west. Inset: miniature lupine (*Lupinus bicolor* ssp. *bicolor*), Road Cut transect # 27, crown brodiaea (*Brodiaea coronaria*). All photos in the report by Nelson Salisbury © EarthCorps, 2017.

Special thanks to Paula Curran, Morgan Jackson, Minwook Park, and Hannah Supplee of EarthCorps for their assistance in data collection, data entry, and project coordination.

Cattle Point Road Reroute Vegetation Monitoring Protocols

The purpose of this monitoring effort is to assess the current vegetation structure on approximately 53,308 square meters (13 acres) of herbaceous-dominated habitat affected by the realignment of Cattle Point Road. The study area includes the regraded portion of the old road and the road-cut above and below the new road created during the realignment. These areas have been the focus of active revegetation efforts over the last several years.

The following protocols aim to determine the current proportion of native vs. exotic vegetation (as well as a general measure of species composition) and to provide a method to track changes to these metrics over time. Existing and established protocols (Natural Resource Report NPS/NCCN/NRR—2012/538) have been implemented in the larger surrounding area that aim to provide similar information in a broader context. The established protocols described in the 2012 report noted above have been adapted and modified for use in this current effort to track changes directly related to the Cattle Point Road realignment.

Sample Approach

In order to determine the average cover and abundance of native and non-native species across all affected areas, transects were stratified throughout the entire 13 acre study area. The study area was divided into three units consisting of the two areas above and below the new road cut and the larger area consisting of the dismantled old road. These units are referred to in this report as "Upper" describing the area above the new road, "Lower" describing the area below the new road, and "Regrade" for the area where the old road was removed and regraded. For the purpose of analysis the Upper and Lower units associated with the new road were considered as one multi-part unit referred to as the Road Cut zone while.

Transect Spacing

Baseline transects were established along the entire length of all three study units. Beginning at one end of each unit, a baseline transect was established running the length of the unit. Sample transects were stratified at 50 meter intervals beginning at a random distance between zero a 50 meters from the beginning of one end of each unit. For the Upper and Lower units, the starting points for sample transects were demarcated with either a piece of rebar with an orange cap or a wooden stake with orange flagging every 50 meters along the baseline transects. For the Regrade unit, sample transects were only demarcated by capped rebar used for marking quadrats (see below). Baseline transects for the "Upper" and "Regrade" units began at the west end of each unit progressing at 50m intervals to the east. The baseline for the "Lower" unit began at the east end of the unit progressing at 50m intervals towards the west (See Map in Appendix A). The baseline transects were measured adjacent to the road for the Upper units and along the approximate centerline of the lower revegetated roadbed in the Regrade unit. Following this sample design, a total of 77 sample transects can be established at 50 m intervals across all three study units.

Quadrat Sampling

A sample transect was laid in a north-south orientation at each 50m interval. The sample transect consists of stratified 1meter by 1meter quadrats being sampled proportional to the width of the unit at that location. Quadrats will be spaced a minimum of 5 meters apart and

should not be placed within one meter of the edge of a unit. No more than a total of three quadrats will be sampled per transect. Spacing of quadrats will be determined as follows:

1. Measure the entire width of the study unit at the location of the sample transect and determine the center of the unit. Quadrats will be centered along the sample transect.
2. If the unit is 15m wide or wider, sample **three** quadrats as follows:
    a. Place one quadrat at the center of the unit and one additional quadrat on both sides and five meters away from the edge of the center quadrat.
3. If the unit is between 9m and 14m wide, sample **two** quadrats as follows:
    a. Place each quadrat five meters apart from the center of the unit (one edge of each quadrat will be 2.5m from the center of the unit).
4. If the unit is between 3m and 9m wide, sample **one** transect centered in the unit.
5. If the unit is less 3m wide, no quadrats are sampled

Quadrat samples were intended to be permanent for this effort and were therefore marked with a piece of rebar. If three quadrats are monitored along a sample transect, a rebar stake is installed at the center of the middle quadrat and at the outer edge of each subsequent quadrat (rebar would be spaced at 6.5 m intervals). If two quadrats are monitored, rebar is installed at the outer edge of each quadrat (7 m apart). If only one quadrat is monitored, a single rebar stake is installed at the center of the quadrat. Note: it is recommended that future efforts consider placing the rebar at the center of all quadrats.

Data Collection

Within each quadrat, the following information will be collected:

- Ocular estimation of overall cover of native and non-native vegetation. Estimates are made for each of the following classes by evaluating absolute cover for each class and ignoring overlap between different species:
    - Total Native Vascular Vegetation
    - Total Non-Native Vascular Vegetation
    - Total Non-Vascular Vegetation
    - Unvegetated Surfaces (rocks, bare surfaces, litter, etc.)
- Ocular estimation of each individual species (absolute cover ignoring overlap within a species)

The presence of each vegetation species will be recorded in one of the following cover classes: >0-5%, >5-25%, >25-50%, >50-75%, >75-95%, and >95-100%. Each recorded species should be recorded and assigned a minimum of >0-5% cover. The sum of the cover of all vegetation species can add to more than 100% if the vegetation is layered in the vertical dimension.

Photo Monitoring

One photo was taken at each sample transect. If three quadrats were sampled on a transect, the center quadrat was photographed. If two quadrats were sampled, the southernmost quadrat was photographed. In future sampling efforts, photographs could be taken for each quadrat if deemed useful. Quadrat photographs taken in 2017 are included in Appendix B.

2017 Data Summary

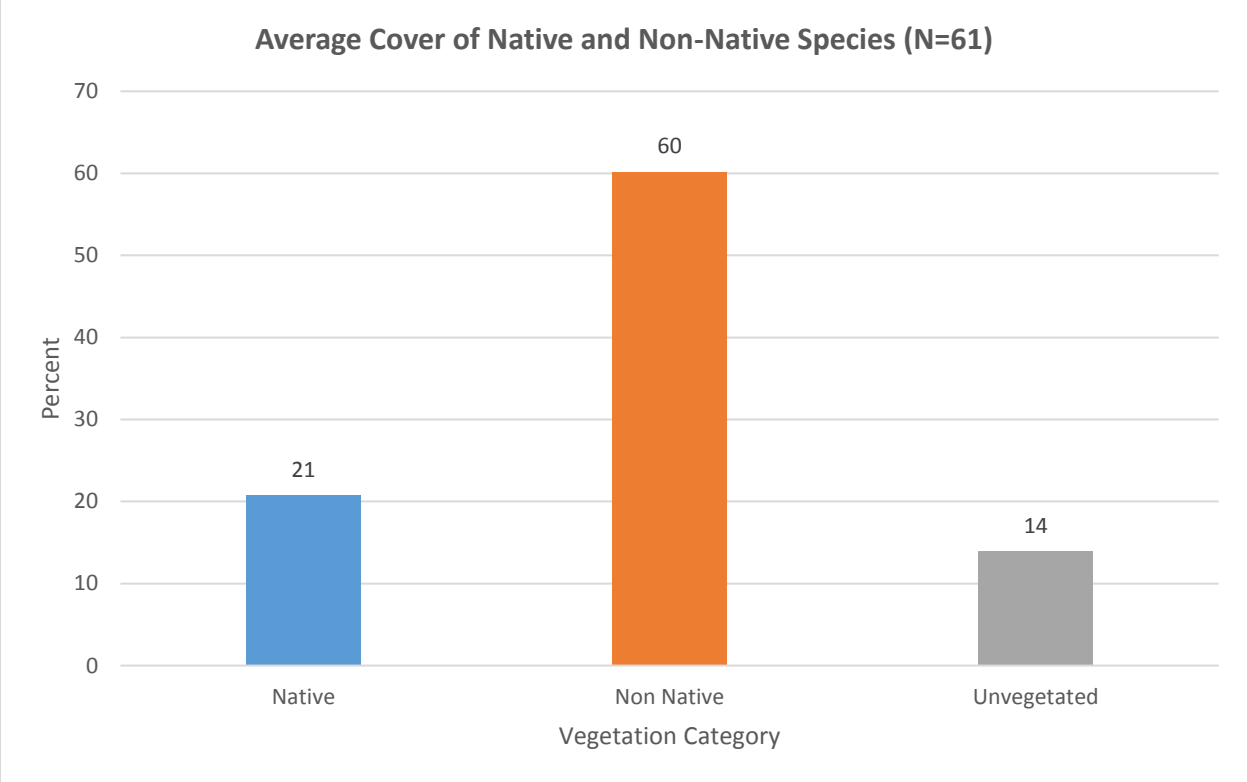
Year One 2017 Pilot Monitoring

During the 2017 year-one pilot sampling effort, approximately one third of all sample transects were monitored. Beginning at the fist random location along the baseline, every third sample transect (every 150 meters) was monitored. Three additional transects (at intervals between 150 meters) were also sampled in 2017: two in the eastern portion of the Regrade unit in the area that has received the most active management, and one transect at the western edge of the Lower unit. In total, 27 sample transects were monitored with 61 individual quadrats sampled. Eleven transects were established in the lower Regrade zone (32 quadrats) and a total of 16 transects were established in the Upper and Lower units of the Road Cut zone (29 quadrats). Preliminary results for these data are presented below. Monitoring took place over the course of two days on May 31 and June 01, 2017. For summary purposes, cover class values were converted to the midpoint of the percentage range represented by that class.

Native and Non-Native Cover

Data collected included estimates for overall cover of native species, non-native species, and bare ground. Overall estimates at the quadrat level suggest that in general, the majority of the area (both the road cut and regrade zones) are dominated by non-native plant species. On average across all quadrats (N=61), 21% of cover is native compared to 60% non-native and 14% unvegetated (Figure 1).

Figure 1. Average cover from all quadrats derived from overall quadrat level estimates, sampled May 31-June1, 2017.



These data show that the upper road cut zone has less cover of native species and more cover of non-native species compared to the lower regrade zone (Figure 2). This trend is also visible when looking at average cover from each transect (Figure 3).

Figure 2. Average cover from all quadrats derived from overall quadrat level estimates by zone, sampled May 31-June1, 2017.

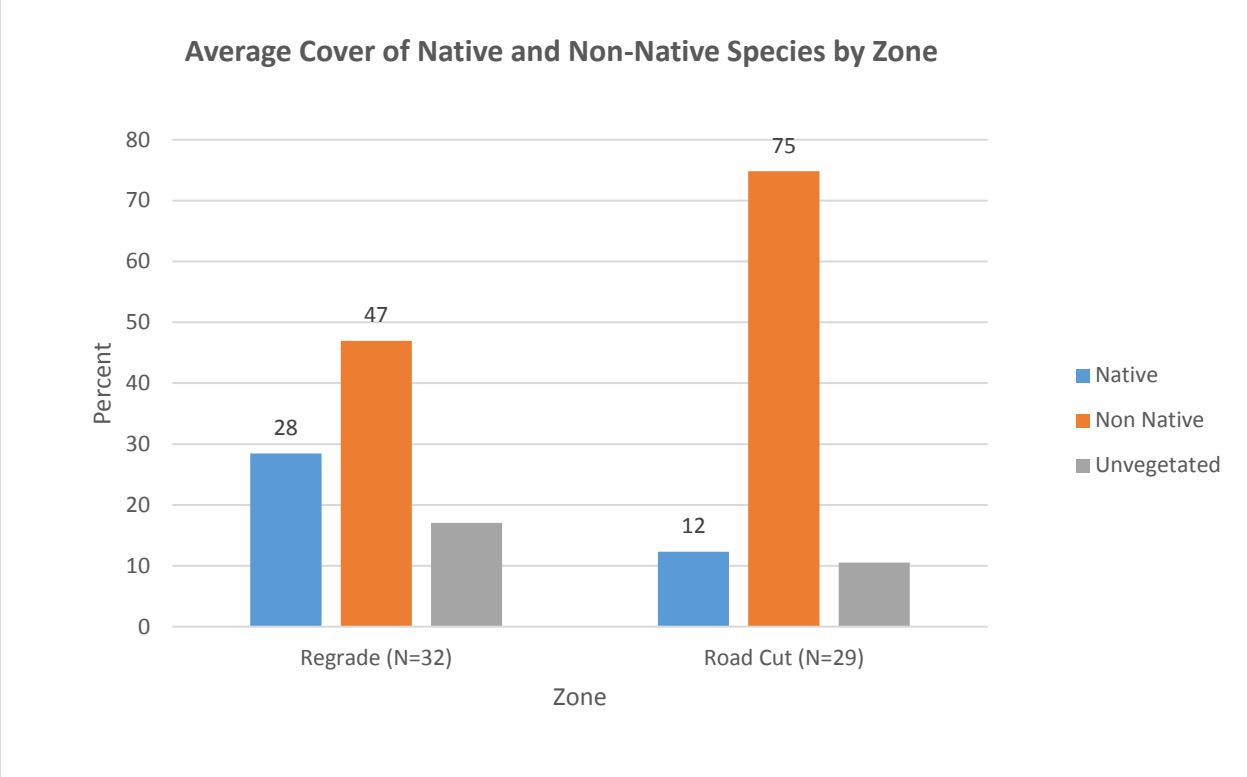
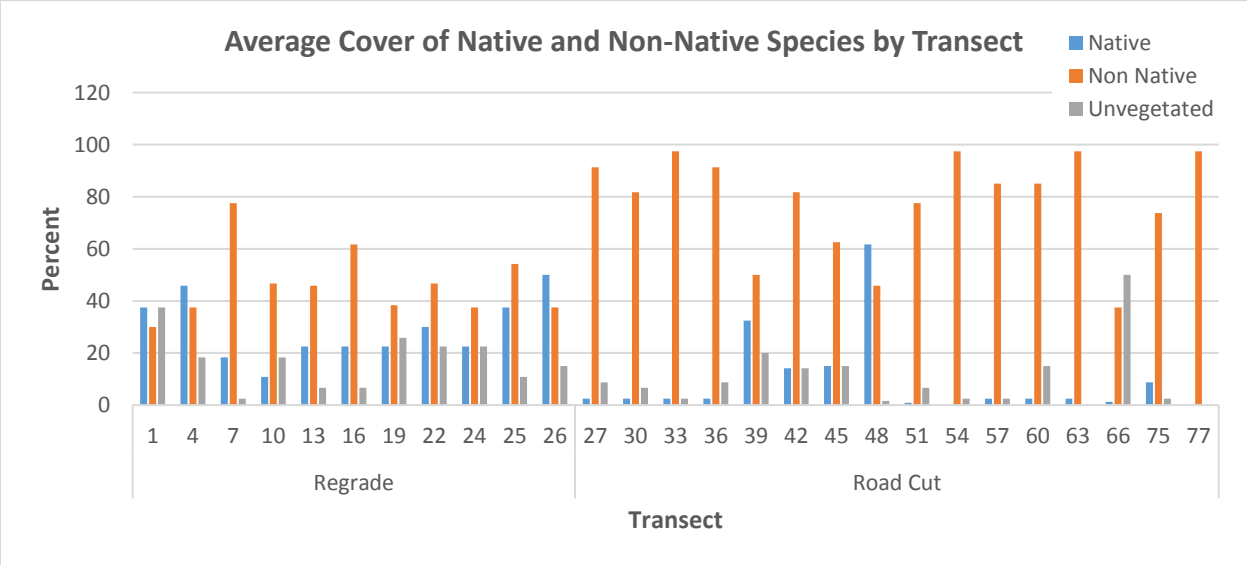
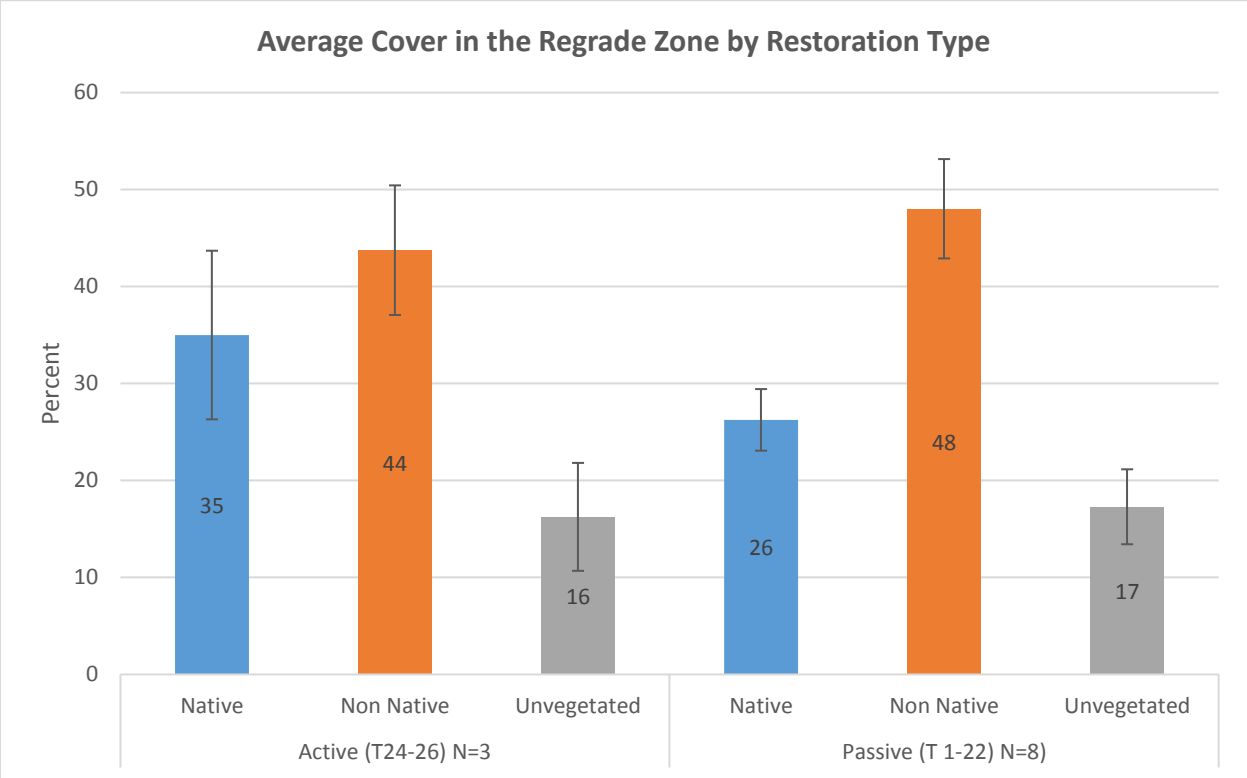


Figure 3. Average cover by transect derived from overall quadrat level estimates, sampled May 31-June1, 2017. Note: see page 15 for an expanded version of this figure.



More active restoration has occurred in the western-most portion of the regrade zone (transects 23 through 26). Data from the 2017 sample effort show only a minor difference in cover from quadrats sampled in this area compared to quadrats sampled in the rest of the zone (Figure 4).

Figure 4. Average cover by transect derived from overall quadrat level estimates comparing transects in "active" restoration compared to the rest of the Regrade zone, sampled May 31-June1, 2017. Bars represent standard error.



Species Composition

A total of 43 vascular plant species were identified during the 2017 pilot sampling effort; 12 native species and 31 non-native species (Table 1). The most commonly encountered species found in more than 90% of all quadrats were all non-native and include sheep sorrel (98%), silver hairgrass (92%), hairy cat's-ear (90%), and hairy vetch (90%) (Table 1). The most common native species by both cover and frequency were blue wild rye and red fescue at an average percent cover of 7% across all quadrats.

The species with the highest average cover across all quadrats were sheep sorrel, ripgut brome, blue wild rye, and red fescue respectively (Figure 5). Average cover for all native species across all quadrats is shown in Figure 6. Species composition differed substantially by zone with non-native species being more prevalent in the Road Cut zone vs. the Regrade zone. In particular, ripgut brome is much more prevalent in the Road Cut zone (Figures 7 and 8)

Table 1. Average cover and frequency (N=61) for all species identified in 2017 (May 31-June 01). Bold species are non-native.

Scientific Name	Common Name	Nativeness	Average Cover (Percent)	Where Present	Frequency (Percent)
Agrostis capillaris	colonial bent	Non-native	2.54	4.19	61
Aira caryophyllea	silver hairgrass	Non-native	2.5	2.72	92
Amsinckia menziesii	Menzies' fiddleneck	Native	0.08	2.5	3
Anagallis arvensis	pimpernel	Non-native	0.08	2.5	3
Brodiaea coronaria	crown brodiaea	Native	0.66	2.5	26
Bromus hordeaceus ssp. hordeaceus	downy brome	Non-native	3.32	4.4	75
Bromus rigidus	ripgut brome	Non-native	11.43	15.5	74
Bromus sitchensis var. sitchensis	Sitka brome	Native	1.72	3.28	52
Cerastium arvense	field chickweed	Native	0.04	2.5	2
Cirsium arvense	Canada thistle	Non-native	0.04	2.5	2
Cirsium vulgare	bull thistle	Non-native	3.61	8.46	43
Crepis capillaris	smooth hawksbeard	Non-native	0.12	2.5	5
Dactylis glomerata	orchard grass	Non-native	0.41	5	8
Daucus carota	Queen Anne's lace	Non-native	0.53	2.5	21
Dianthus armeria	Deptford pink	Non-native	0.16	2.5	7
Elymus glaucus ssp. jepsonii	Jepson's blue wildrye	Native	6.76	9.82	69
Elymus repens	quackgrass	Non-native	0.04	2.5	2
Erodium cicutarium	crane's bill	Non-native	1.6	3.36	48
Eschscholzia californica	California poppy	Non-native	1.15	7.78	15
Festuca roemeri	Roemer's fescue	Native	0.94	3.19	30
Festuca rubra ssp. rubra	red fescue	Native	6.72	10.79	62
Holcus lanatus	common velvetgrass	Non-native	4.75	6.3	75
Hypericum perforatum	Klammath weed	Non-native	0.41	2.5	16
Hypochaeris radicata	hairy cat's-ear	Non-native	5.08	5.64	90
Lolium arundinaceum	tall fescue	Non-native	0.53	4.06	13
Lupinus bicolor ssp. bicolor	miniature lupine	Native	3.77	7.67	49
Lupinus littoralis	seashore lupine	Native	1.6	6.5	25
Medicago lupulina	black medic	Non-native	0.25	15	2
Plantago lanceolata	English plantain	Non-native	1.48	4.29	34
Poa annua	annual blue grass	Non-native	0.04	2.5	2
Rubus discolor	Himalaya blackberry	Non-native	1.07	32.5	3
Rumex acetosella	common sheep sorrel	Non-native	12.42	12.62	98
Teesdalia nudicaulis	barestem teesdalia	Non-native	1.52	2.89	52
Trifolium arvense	hare's foot clover	Non-native	1.93	3.67	52
Trifolium dubium	hop clover	Non-native	5.37	7.44	72
Trifolium microcephalum	littlehead clover	Native	0.25	2.5	10
Trifolium repens	Dutch clover	Non-native	0.98	6.67	15
Trifolium subterraneum	burrowing clover	Native	0.7	6.07	11
Trifolium willdenowii	suckling clover	Native	0.41	2.5	16
UknF5	Unknown forb	Non-native	0.29	2.5	11
Vicia hirsuta	hairy vetch	Non-native	2.13	2.77	77
Vicia sativa ssp. sativa	garden vetch	Non-native	3.28	3.64	90
Vulpia bromoides	brome fescue	Non-native	1.07	4.06	26

Figure 5. Average cover of the 15 most prevalent species (by cover) for all quadrats (N=61) sampled May 31-June1, 2017.

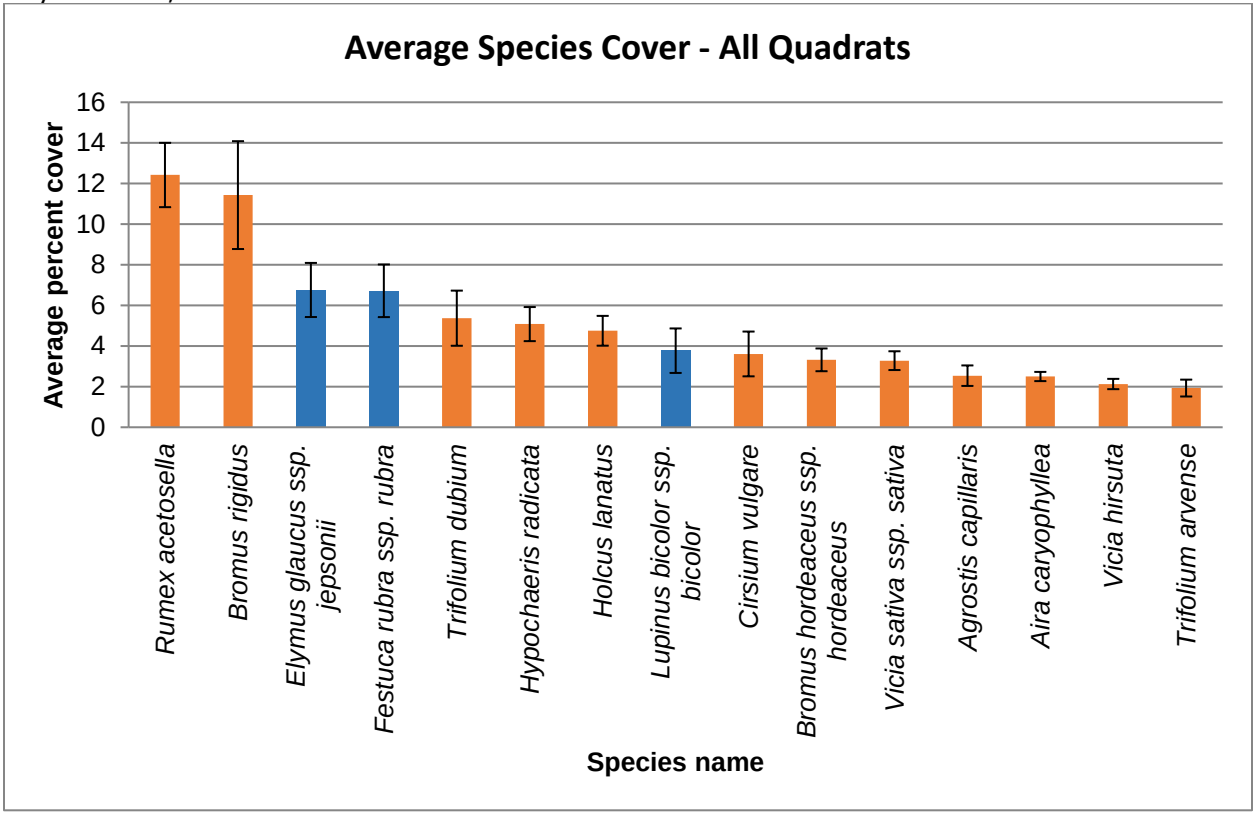


Figure 6. Average cover of all native species for all quadrats (N=61) sampled May 31-June1, 2017.

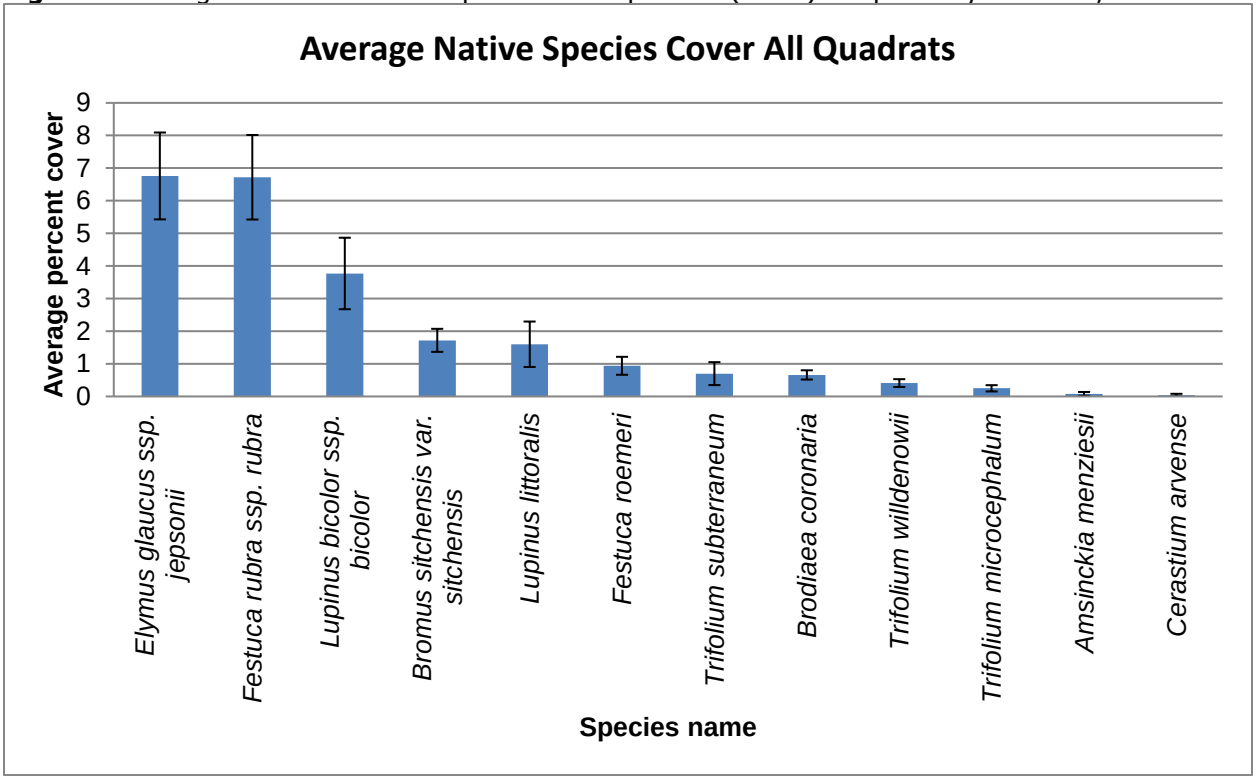


Figure 7. Average cover of the 15 most prevalent species (by cover) for quadrats sampled in the Regrade zone (N=32) sampled May 31-June1, 2017.

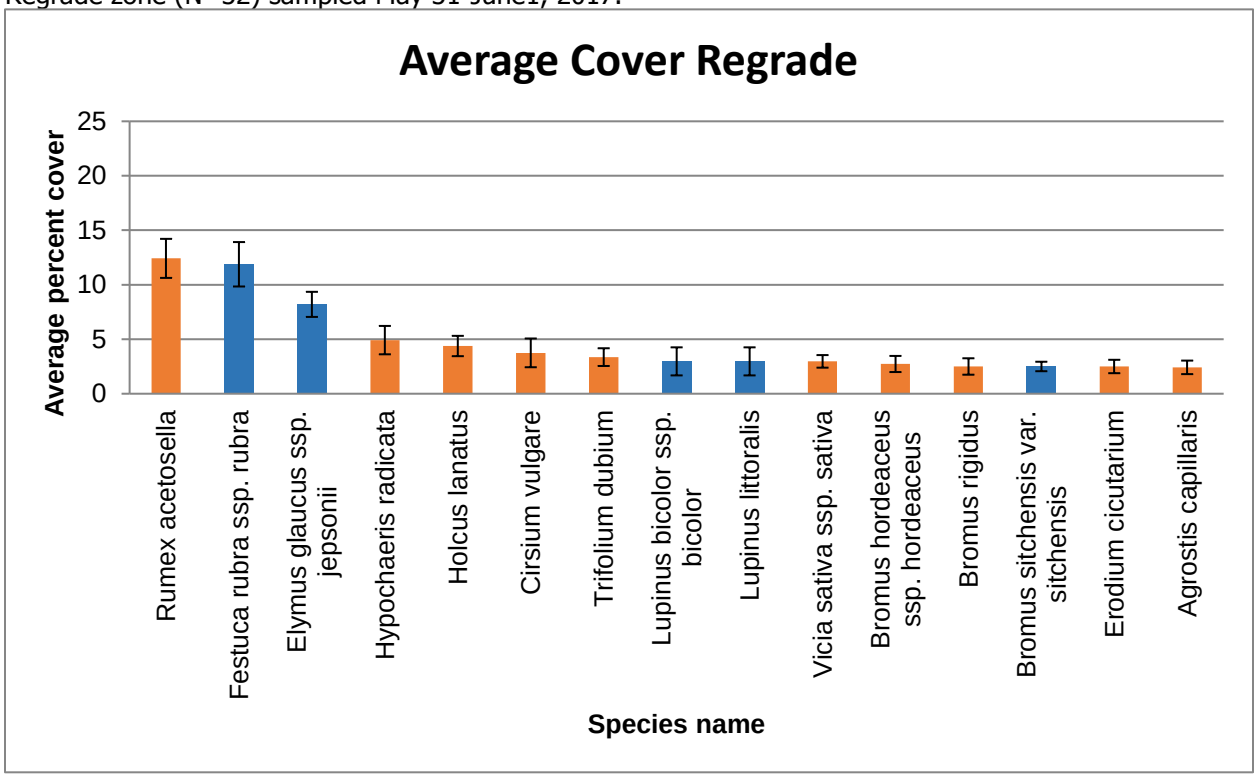
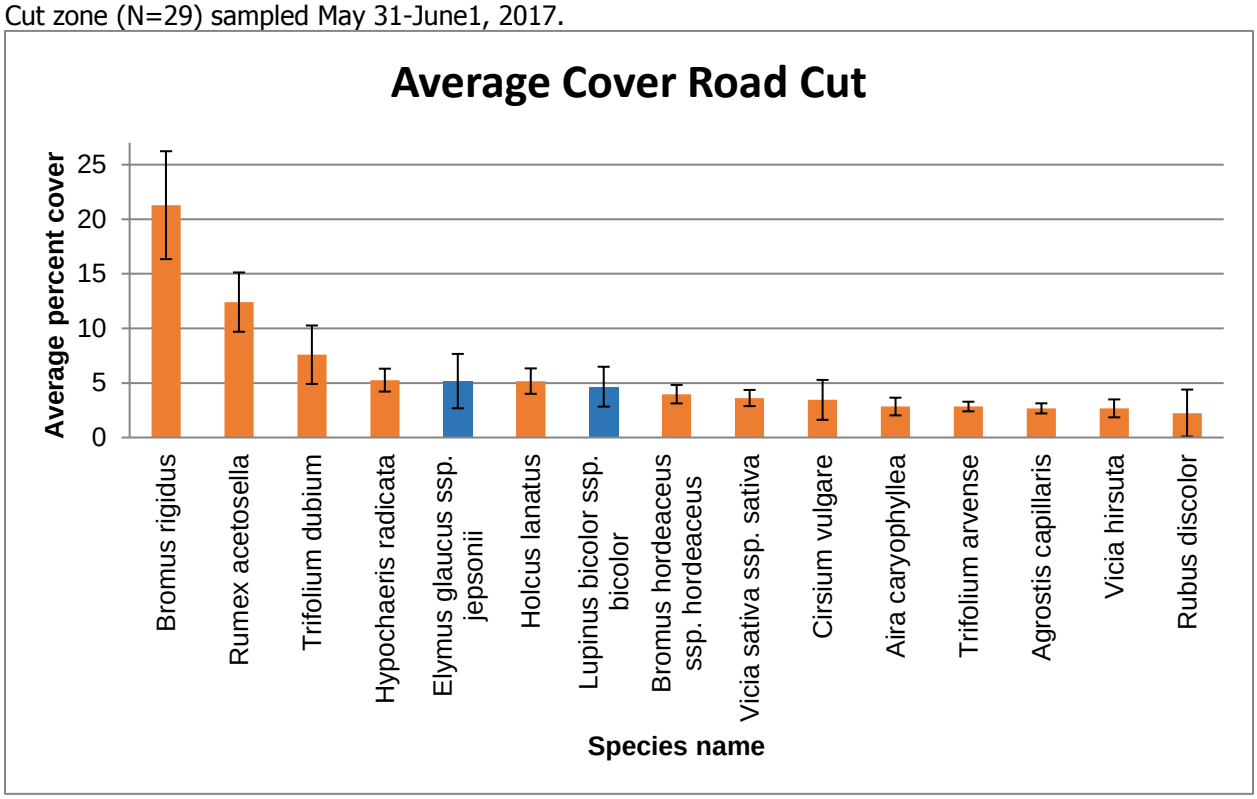


Figure 8. Average cover of the 15 most prevalent species (by cover) for quadrats sampled in the Road Cut zone (N=29) sampled May 31-June1, 2017.



Species identification and survey notes:

- The native *Trifolium microcephalum* (littlehead clover) was likely misidentified with the non-native *Trifolium arvense* (rabbits foot clover) in an unknown number of plots.
- It is possible that the native *Trifolium subterraneum* (burrowing clover) was occasionally misidentified with the non-native *Trifolium repens* (Dutch clover), especially when not in flower.
- It is possible that the non-native *Trifolium dubium* (small hop clover) may have occasionally been misidentified with the non-native *Medicago lupulina* (black medick).
- An unknown forb species was encountered along five transects that was not identified. This species resembled a broadleaved aster and was not seen in flower. This species is indicated as UnkF5 in the database and was assumed to be non-native for the purpose of analysis.
- Transect markers may have been placed incorrectly between transect 66 and 75 in the Lower road cut unit. Transect 72 was not sampled in 2017 and the location of this and adjacent transects should be verified.
- All large Lupine plants (easily differentiated from *Lupinus bicolor* ssp. *bicolor*) were recorded as *Lupinus littoralis*, although some plants had characteristics suggestive of or (intermediary between) *Lupinus rivularis*. It is suggested that more analysis be conducted regarding the classification of this species (see below for more info)

Lupine species found in study area appear to be *Lupinus littoralis.* Some plants in the general vicinity (although not noted directly in study plots) exhibit characteristics indicative of *Lupinus rivularis*. No definitive identification was made during the time of this survey, although voucher specimens collected generally support the classification descriptions of *L. littoralis*. It is recommended that further identification be carried out if a conclusive identification is warranted.

Distinguishing characteristics:

- Stems often long strigose to villous (see below).
- Leaflets never greater than 3 cm (as opposed to 2.5-4 cm as in *L. rivularis*)
- Keel turns up abruptly (as opposed to more gradually arcuate as in *L. rivularis* – see photos in extended Hitchcock and Cronquist).
- Flowers generally less than 12 mm (should be as opposed to 12-16 mm as in *L. rivularis*)
- Decumbent, sprawling stems
-

Confounding characteristics…

- Inflorescence occasionally longer than 1.5 dm.
- No indication of rust colored hairs on stem and petioles (this characteristic was not generally present in online resource photos…)
- Several fruits had more than 8 seeds (should be 5-8, not many dissected, fruits generally not ripe at time of collection)
- Many stems not as densely villous as expected.

San Juan Island National Historic Park

Cattle Point Road Realignment - Vegetation Monitoring

Legend

- Sample Transects (2017)
- Study Area (53,308 m²)

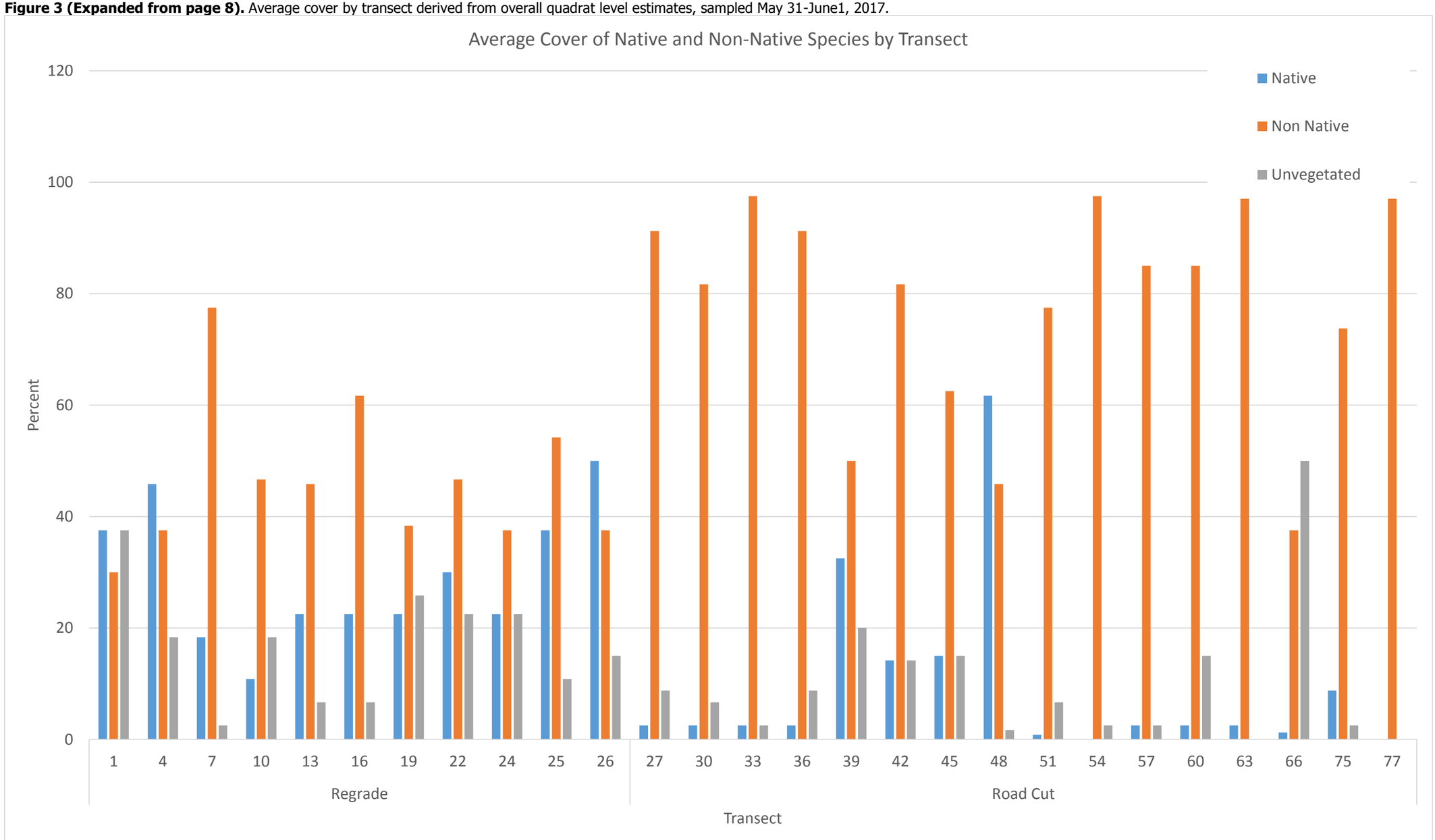
N

Feet

0 200 400 800

1 inch = 340 feet

Figure 3 (Expanded from page 8). Average cover by transect derived from overall quadrat level estimates, sampled May 31-June1, 2017.



APPENDIX B: PHOTO MONITORING 2017

Transect 1:

Transect 4:

Transect 7:

Transect 10:

Transect 13:

Transect 16:

Transect 19:

Transect 22:

Transect 24:

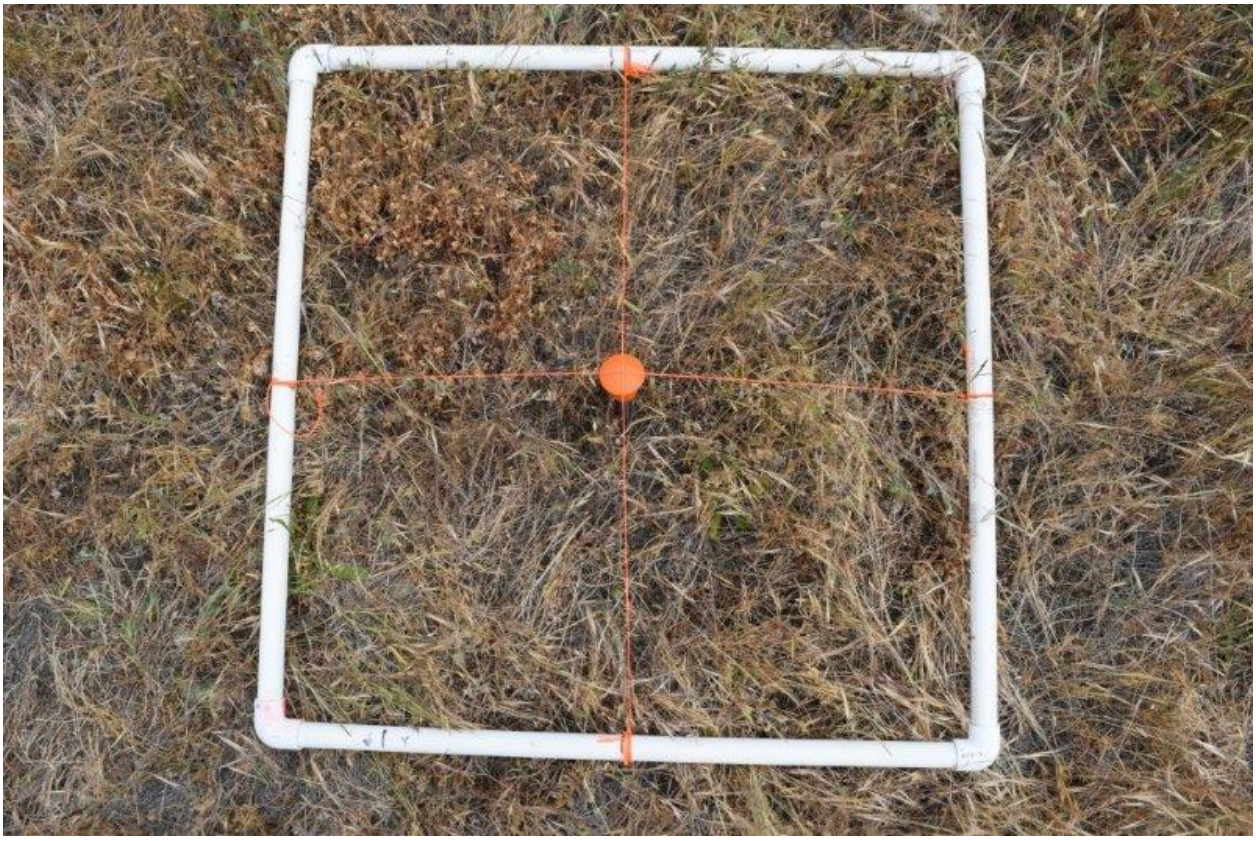
Transect 25:

Transect 26:

Transect 27:

Transect 30:

Transect 33:

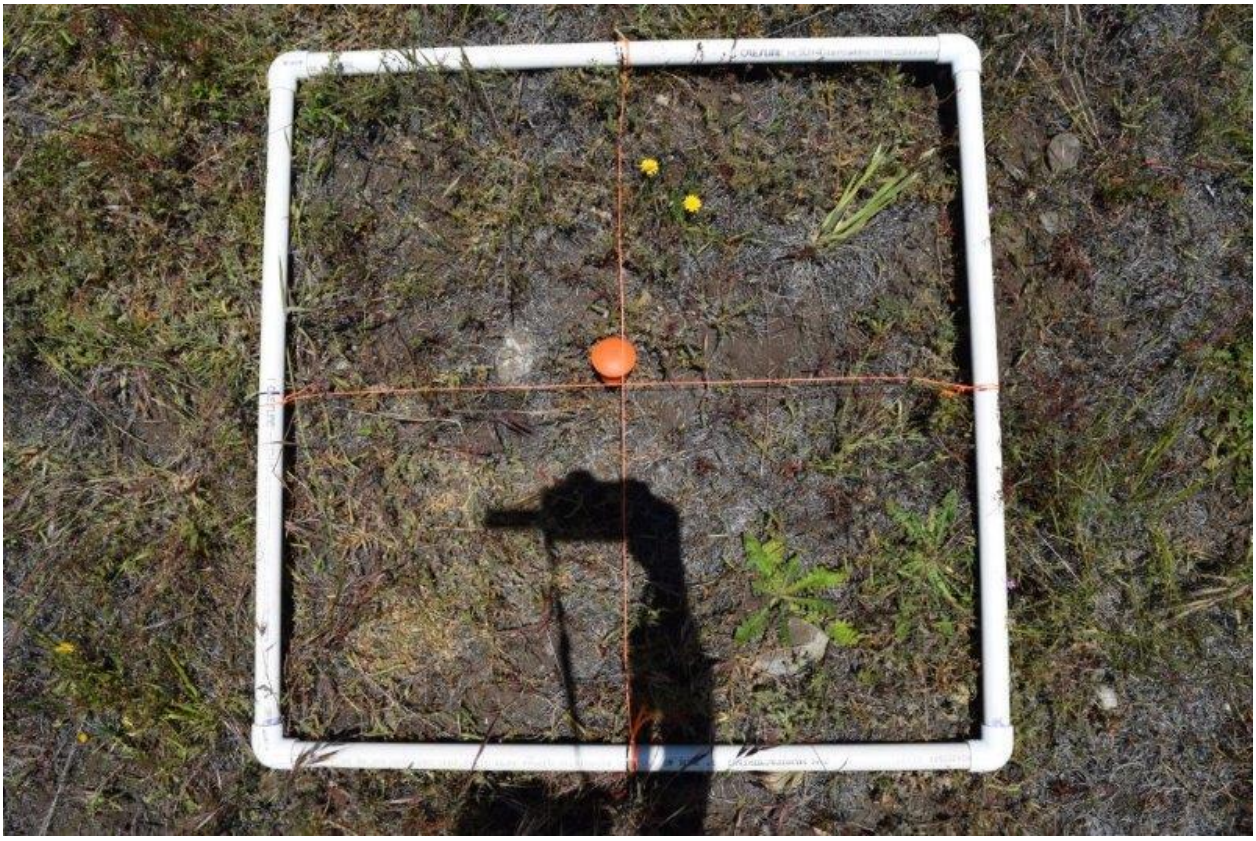


Transect 36:

Transect 39:

Transect 42:

Transect 45:



Transect 48:

Transect 51:

Transect 54:

Transect 57:

Transect 60:

Transect 63:

Transect 66:

Transect 75: