Doty Ravine Preserve
2009 Upland Survey Report

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Introduction

Doty Ravine Preserve (Preserve) is located west of Gladding Road, north of Wise Road, south of Manzanita Road, and north of the City of Lincoln, in Placer County, California. The Preserve comprises approximately 427 acres. The Preserve includes vernal pool and swale complexes and associated vernal pool grassland, fallow irrigated pasture, and Doty Ravine. The Preserve corresponds to portions of Sections 27, 28, 33, and 34, Township 13 North, Range 6 East of the Lincoln, California 7.5-quadrangle. The site corresponds to Assessor Parcel Numbers (APN) 020-162-006 and 020-150-027.

The purpose of the Doty Ravine Upland sampling program is to assess the condition of grasslands on the Preserve and elucidate trends in system health to inform resource management and to support the Doty Ravine Management Plan. The goal of the plan is to ensure that the preserved upland habitats are maintained in good condition such that they will promote the flora and fauna that the Preserve was established to protect, as well as to promote the survival of the federally threatened and endangered species that occur or have the potential to occur in the Preserve.

Upland surveys commenced in 2008. Nine control plots were established in fall 2007 by erecting triangular fencing (2.4 m per side) to exclude large herbivores. Cattle (30 cow/calf pairs) were then introduced to the Preserve and managed by contractor Dan Macon. In April 2008 each control plot and three associated grazed variable plots were sampled following the methods described below. Due to budget considerations the 2009 survey was reduced to four control plots each with two associated variable plots.

For the current year, 24 cow/calf pairs and 12 heifers were on the northern portion of the Preserve; stocking rate was staged starting in November 2008 and increasing through January 2009. The animals were rotated in a clockwise direction, starting on the west and north side of the canal, then south of the canal and east. The section north of the canal was grazed twice before the animals were removed in July. Approximately 100 ewes were on the southern portion of the Preserve starting in October 2008. They were moved off after about one month and were brought back from January to early April 2009. They were rotated across approximately the eastern two-thirds of the Preserve (D. Macon, personal communication, October 2009).

Methods

Two control plots from both the north and south portions of the Preserve were selected for sampling. For each of these, two of the three variable plots were further selected. Plots occurred on soils described by the National Resource Conservation Service as Redding and Corning gravelly loams, Alamo variant clay, and Ramona sandy loam (**Attachment A: Figure 1**; NRCS 2008). Sampling timing aimed to mimic the conditions of the 2008 survey. Justin Wages and Mehrey Vaghti sampled plots 7, 7a, 7b, 9, 9a and 9b on May 12, 2009, and plots 1, 1a, 1b, 5, 5a and 5b on May 20, 2009. We recorded all species present and occularly estimated their absolute cover; plant nomenclature followed Hickman (1993). We recorded GPS coordinates for each plot. The triangular fencing (2.4 m per side) provided the bounds of the control plots. For each variable plot, we located the t-bar center post and laid two 10 m ropes through the center, one aligned north to south and the other east to west.
The data were entered and manipulated in Microsoft Excel (Microsoft Corporation 2002). No statistical analyses were performed due to the limited time-series (1 year); the power of the analysis would be low and it would be difficult to separate true effects from stochasticity.

Results

We recorded 36 species across all plots; 31% of these were native species. Of the introduced species, 2 were considered invasive: *Taeniatherum caput-medusae* (medusahead) and *Centaurea solstitialis* (yellow star-thistle). Of the 23 remaining exotic species 43% were forbs and 57% were grasses. *T. caput-medusae*, *Vulpia bromoides* (annual fescue), *Bromus hordeaceus* (soft chess), *Trifolium hirtum* (rose clover), and *Lolium multiflorum* (Italian ryegrass) occurred in every plot. *T. caput-medusae* and *V. bromoides* contributed the vast majority of cover with 44% and 36% average cover across all plots, respectively (**Attachment A: Figure 2**).

T. caput-medusae and *V. bromoides* maintained their dominance in the variable plots as well as the control plots (**Attachment A: Figure 3)**; however, their cover was reduced in the variable plots. This resulted in greater cover of several other species, especially forbs such as *T. hirtum*, *Holocarpha virgata* (yellowflower tarweed) and *Hypochaeris glabra* (smooth cat's ear).

T. caput-medusae cover was especially reduced in the variable plots. This result was reflected in comparisons of average relative cover in the control plots verses the variable plots (**Attachment A: Figure 4**). While invasive cover decreased in the variable plots, exotic cover increased. This was largely due to *T. caput-medusae* being replaced by exotic species such as *V. bromoides*, *T. hirtum*, *H. glabra*, *B. hordeaceus*, and *Hordeum murinum* (barley).

Native species cover and diversity were greater in the variable plots than the control plots (**Attachment A: Figure 4 & Figure 5**). The increase in native cover was largely driven by *H. virgata* which had 0.3% and 7.8% cover in the control plots and variable plots, respectively. The following four native species occurred only in variable plots: *Castilleja attenuata* (attenuate Indian paintbrush), *Trifolium glomeratum* (clustered clover), *Croton setigerus* (turkey mullein), and *Epilobium torreyi* (willow herb).

Given the different grazing regimes for the northern and southern portions of the Preserve, variable plot species cover was compared for North Doty verses South Doty (**Attachment A: Figure 6**). The southern portion of the Preserve supported greater *V. bromoides* cover but

had less *T. caput-medusae*. The northern portion supported greater average relative cover of native forb species.

Discussion

Overall, the results suggest that grazing has reduced the cover of *T. caput-medusae*, an undesirable invasive species which accumulates heavy thatch and tends to reduce plant species diversity (Cal-IPC 2009). The cause of the difference in *T. caput-medusae* cover for North Doty verses South Doty is undocumented at this time. The results were affected by historic species cover, precise grazing regime, weather, combinations of the above and sample size. Results from the 2008 upland survey showed greater *T. caput-medusae* cover for South Doty (**Attachment B**). Cal-IPC (2009) recommends heavy sheep grazing in spring to assist in controlling *T. caput-medusae*.

Comparisons between the control and variable plots suggest that grazing has increased the diversity and average cover of native forb species. Further, the survey timing may have missed additional native species whose lifecycles were complete by late spring.

The results showed a decrease in thatch cover and a slight increase in bare soil in plots exposed to grazing; the degree of difference was slightly greater on North Doty than South Doty. These conditions are preferred by foraging Swainson's hawks (Bechard 1982).

The results continue to be confounded by the difference in control plot size (2.97 m^2) verses variable plot size (100 m^2). Further, there were twice as many variable plots as control plots. The increased occurrence of native species in the variable plots could be at least partly a function of detection probability.

If feasible, it is recommended that the control plot size and shape be modified to match the variable plots. It is further recommended to increase grazing pressure during the most palatable stages of *T. caput-medusae* growth.

References

Bechard, M. J. 1982. Effect of vegetative cover on foraging site selection by Swainson's hawk. Condor **84**:153-159.

California Invasive Plant Council (Cal-IPC). 2009. Invasive Plants of California's Wildland: Taeniatherum caput-medusae. http://www.cal-ipc.org/ip/management/ipcw/pages/detailreport.cfm@usernumber=80&surveynumber=182.php?print=y

Hickman, J. C., ed. 1993. *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley.

Natural Resources Conservation Service (NRCS). 2008. Official Soil Series Descriptions [Online]. http://soils.usda.gov/technical/classification/osd/index.html. United States Department of Agriculture, Lincoln, NE.

ATTACHMENT A

Figure 1: Doty Ravine Preserve Upland Surveys: Control and Variable Plot Locations vs. Soils

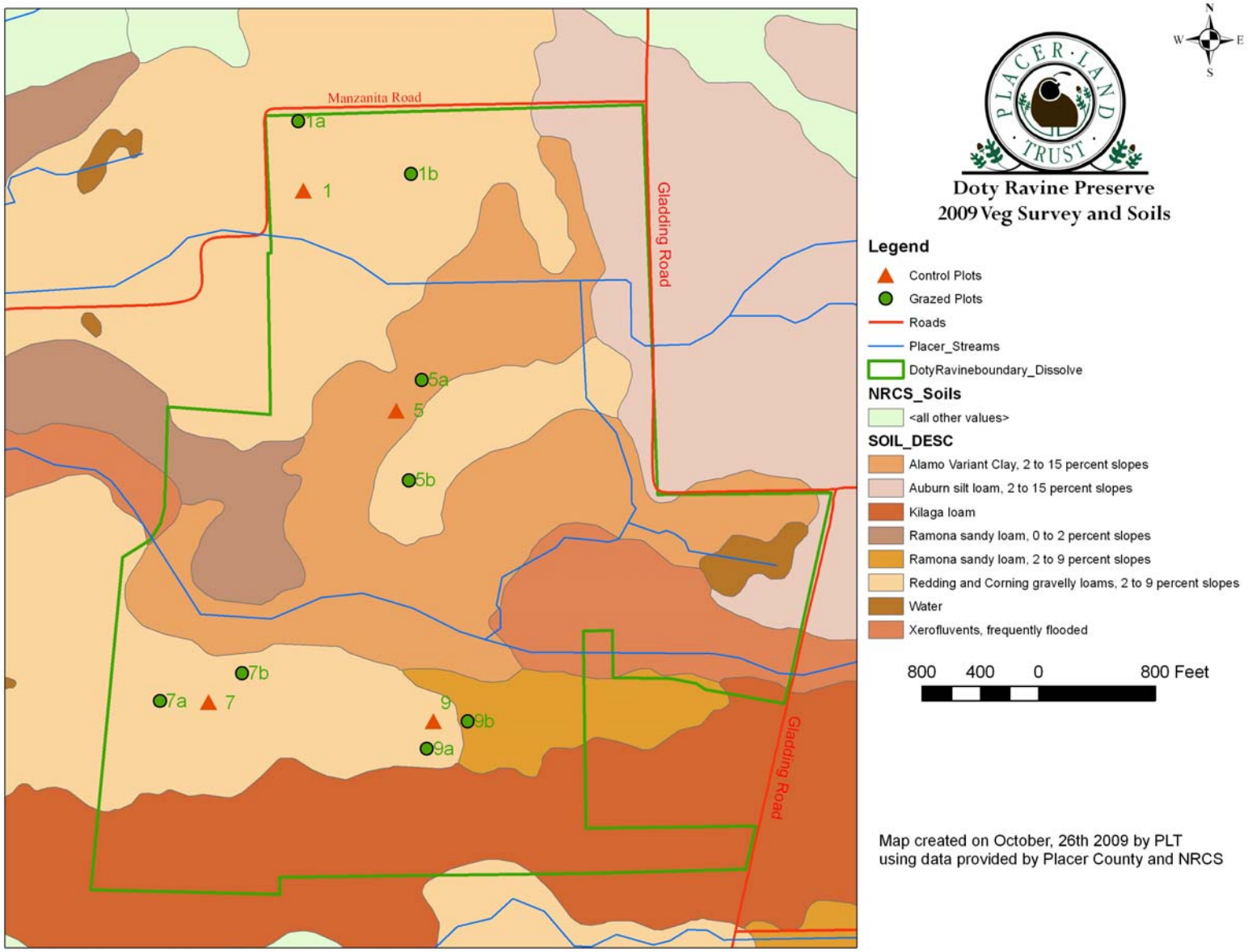
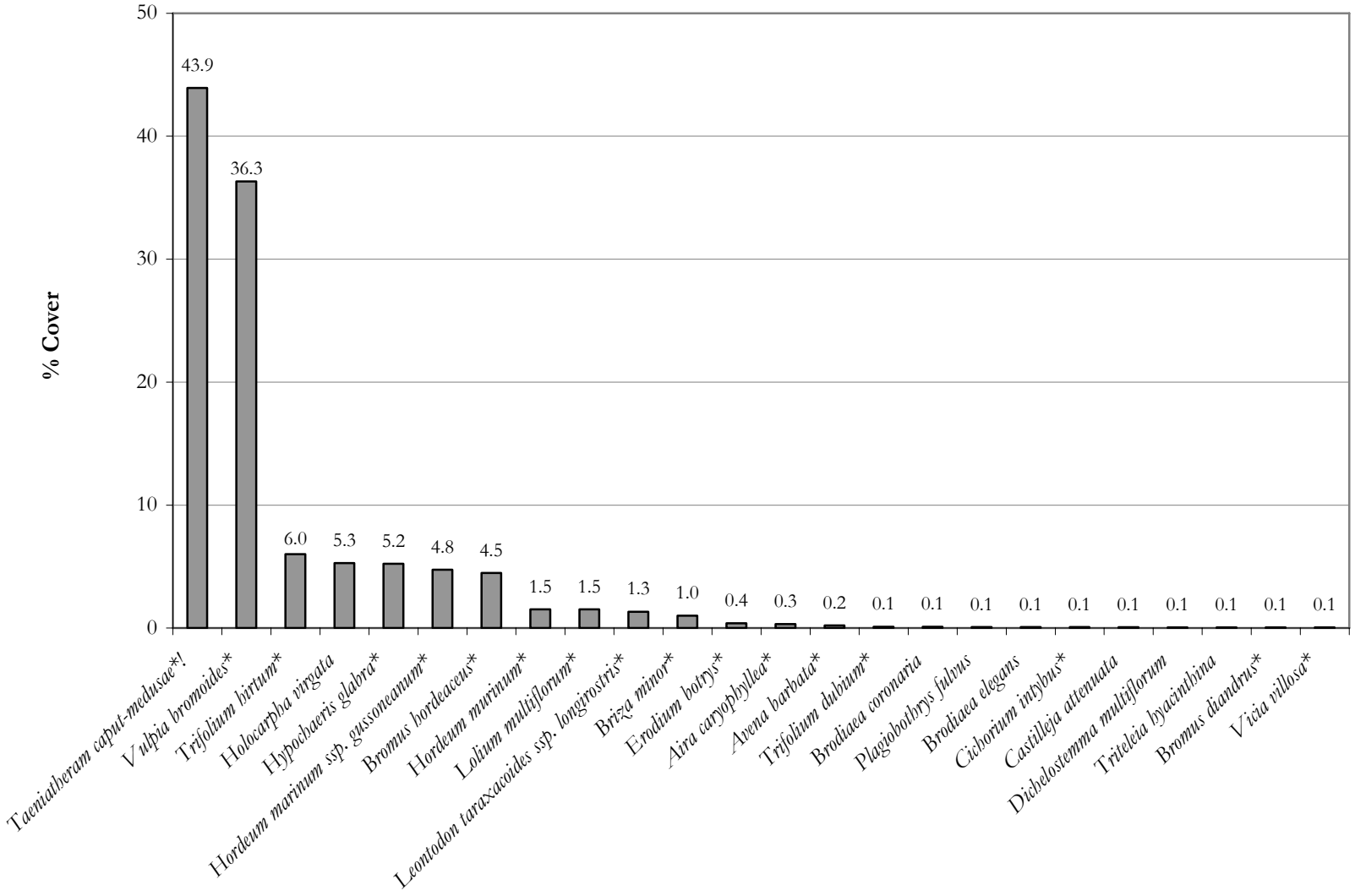
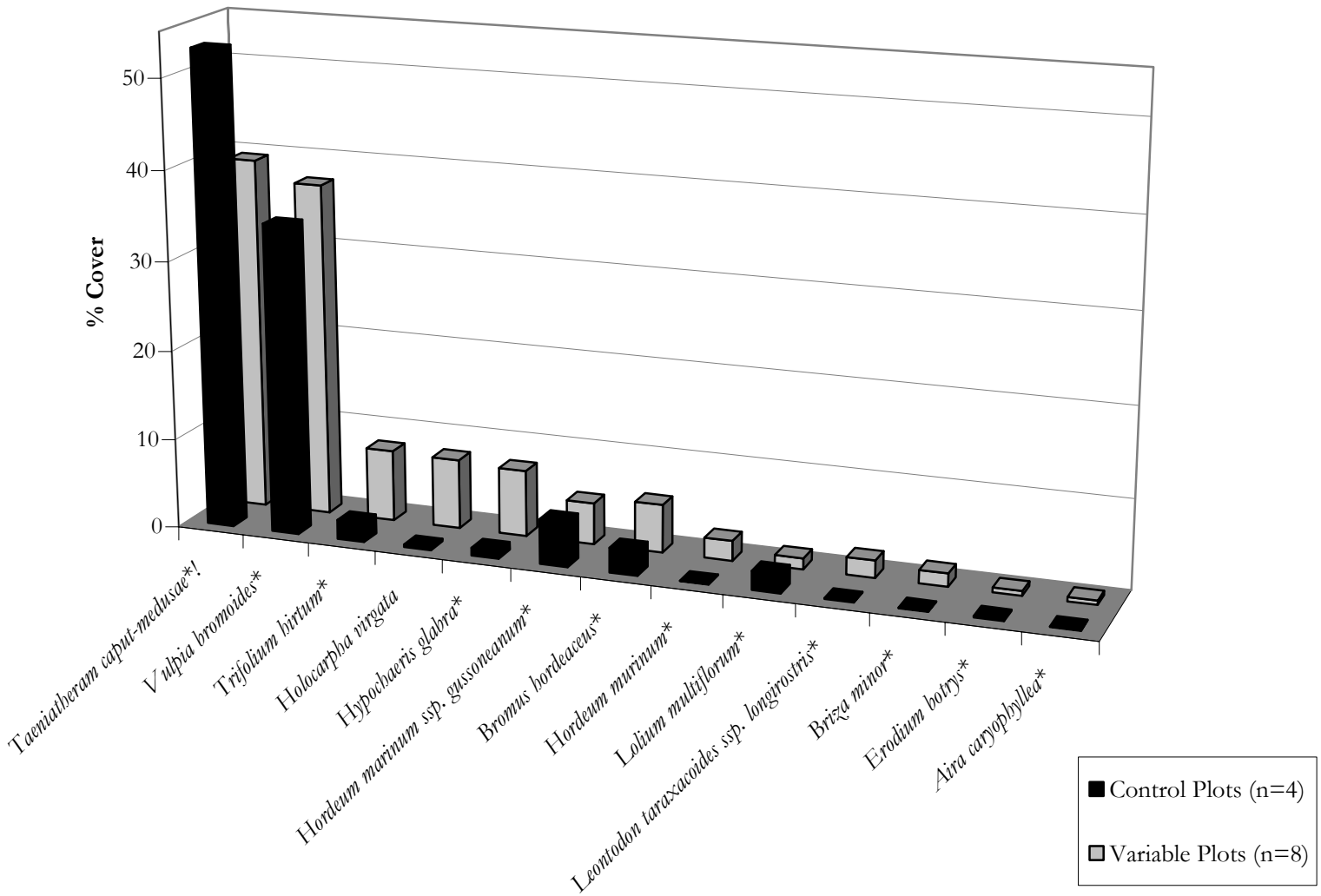


Figure 2 - Average Cover Across All Plots for Species ≥0.1% Cover (n=12)



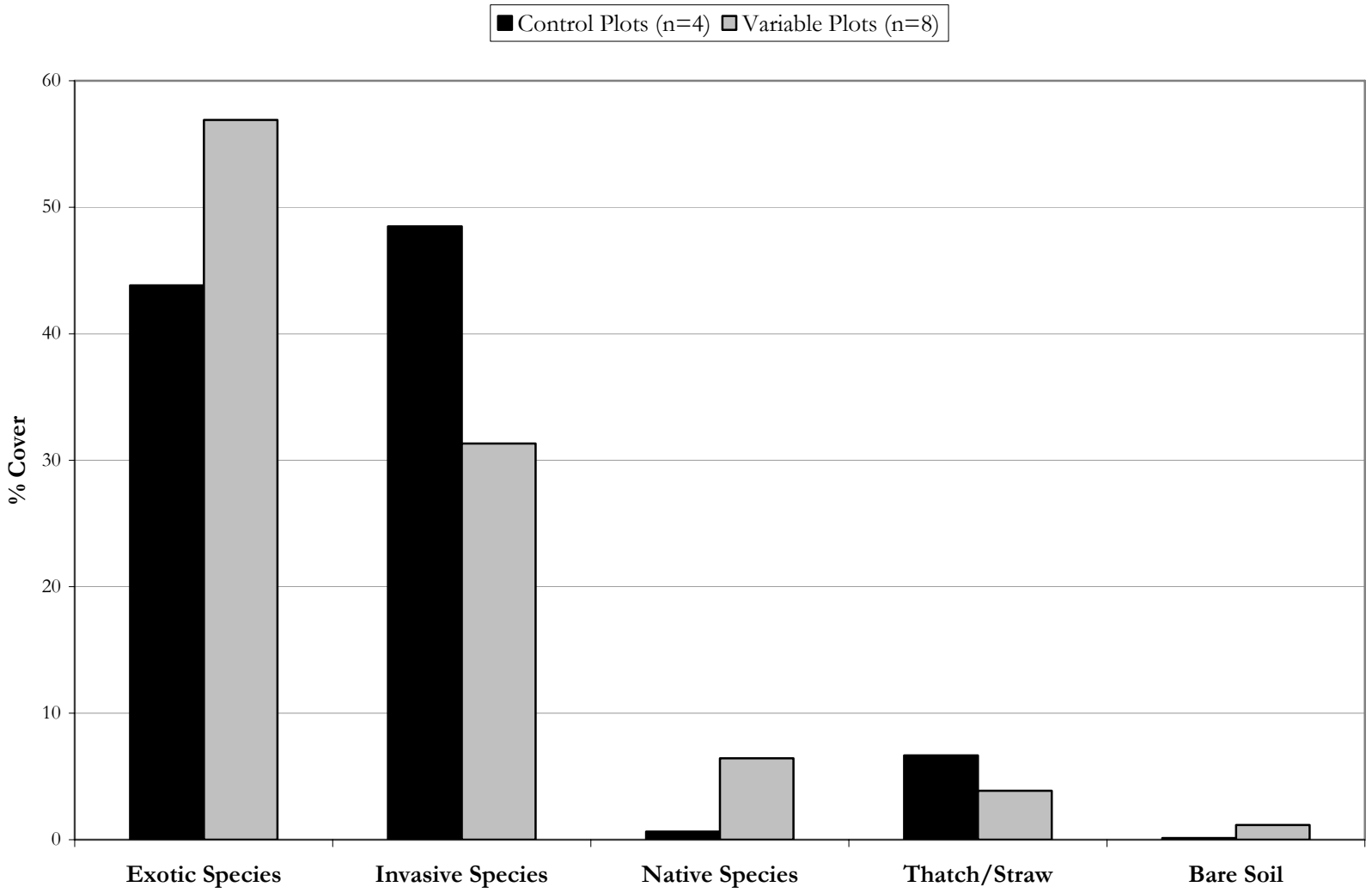
* = exotic species; ! = invasive species

Figure 3 - Average Cover Control Plots vs. Variable Plots for Species ≥0.4% Cover



* = exotic species; ! = invasive species

Figure 4 - Average Relative Land Cover



Note: The following excluded categories had cover ≥0.2%: Animal droppings; Bryophytes/Lichens; Rocks/Cobbles.

Figure 5 - Average Plant Species Diversity

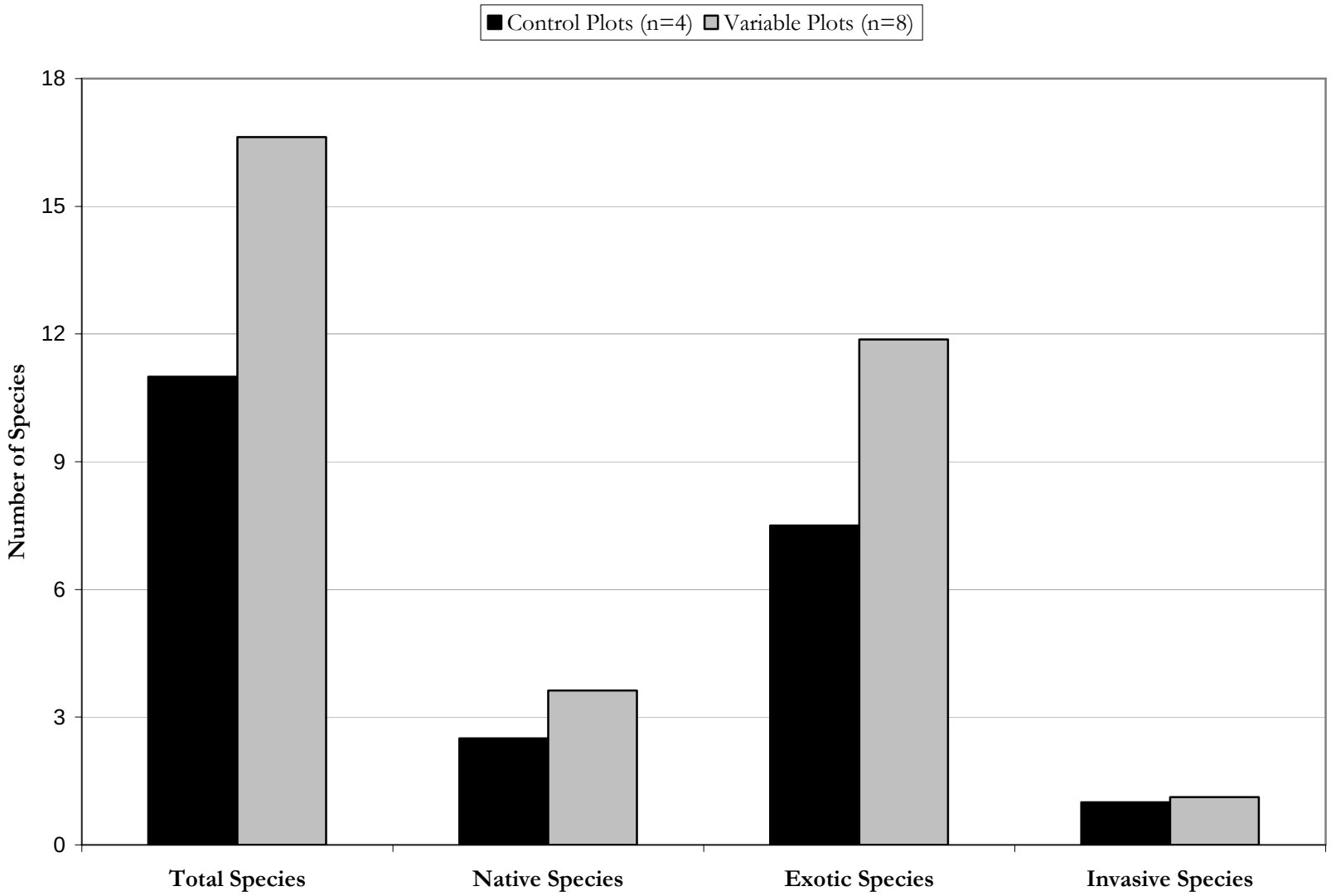
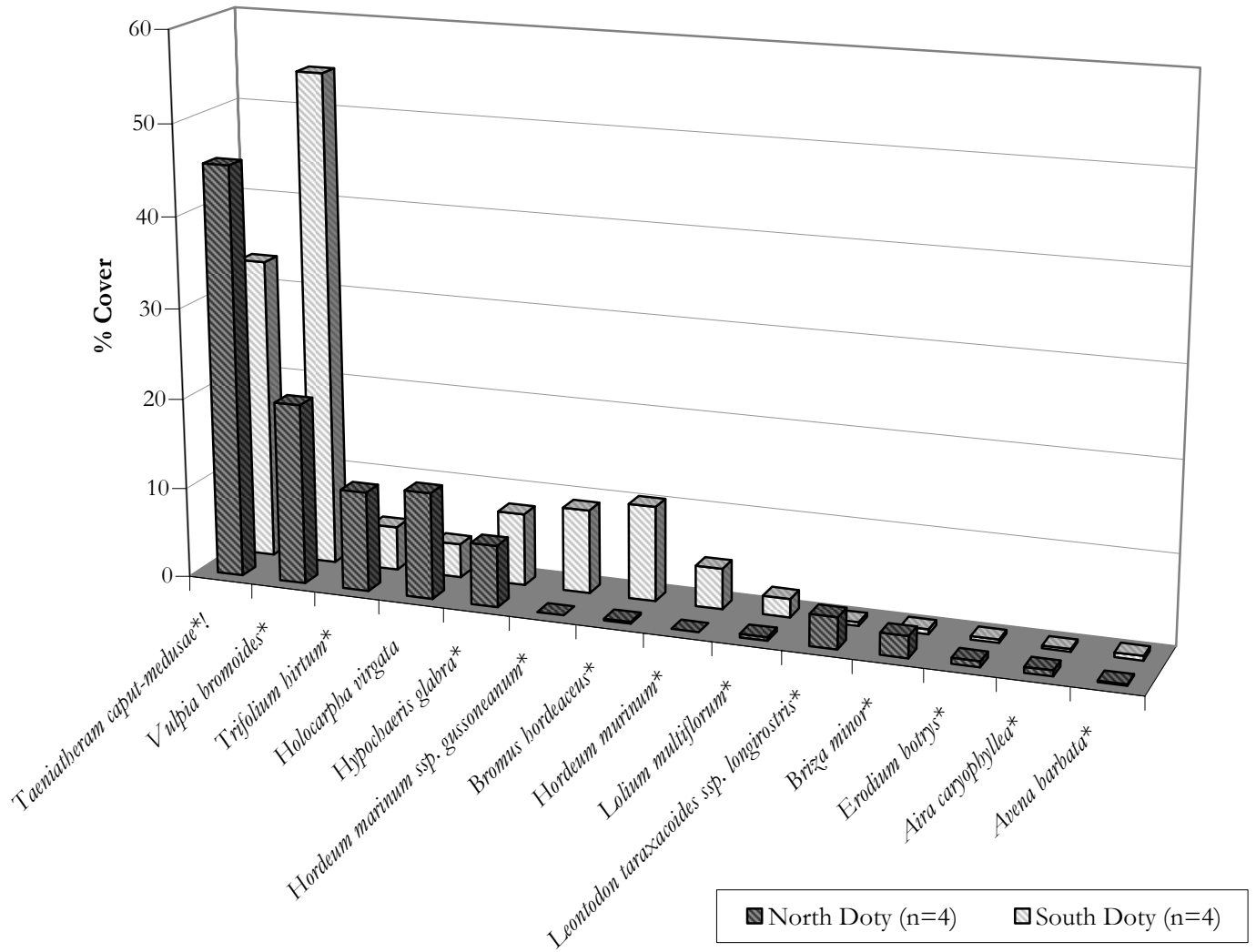


Figure 6 - Average Cover Variable Plots North Doty vs. South Doty for Species ≥0.4% Cover



ATTACHMENT B

Doty Ravine Preserve

Flora Survey Report 2008 by Justin Wages

Introduction

Doty Ravine Preserve is composed of grasslands, riparian habitat, vernal pool complexes, some oak woodland habitat, and seasonal wetlands, of these grasslands dominate the 427 acre property. Plant species diversity is generally low in the upland grassland portions of the Property. This could be due to heavy infestation of medusahead (*Taeniatherum caput-medusae*) as this invasive species crowds out native species and prevents other species from germinating due to a high percentage of RDM (residual dry matter) and the highly competitive nature of this species (USDA National Agricultural Library). In late 2007, Placer Land Trust (PLT) began using cattle and sheep grazing as an adaptive management tool to impact the medusahead and other non-native species in the upland grassland area of Doty Ravine Preserve.

Purpose

To create a long term study on the grassland species on Doty Ravine Preserve and use the information gained to create and modify PLT's adaptive management plans. The main goal of adaptive management at Doty Ravine Preserve is to reduce the number and quantity of non-native species, increase the number and quantity of native species and to improve overall ecosystem health, biodiversity, and resiliency.

Methods

On April 27-28, 2008 PLT conducted an upland flora survey with the aid of volunteers, biologists, ecologists, and college professors. The survey methods were as follows:

- Setting up 10m x 10m quadrats in 27 random upland locations across the property.
- Teams of 3-4 volunteers lead by a qualified botanical scientist worked to identify all plant species (using Jepson guide for difficult species) within each of the 27 quadrats and note species coverage, bare ground, rocks, thatch, and animal droppings. Teams performed the same tasks on the 9 Control Plots that had been set up the previous fall prior to cattle grazing. This gave us a total of 36 sample sites spread over 427 acres. 12 of 36 sample sites were located on the "South" side of Doty Ravine (Doty Ravine Creek divides the north and south sides of the property). The remaining 24 sample plots were located on the "North" side of Doty Ravine Preserve.
- Sample plots were identified as either Control Plots (9) or Variable Plots (27) and each plot's GPS coordinates were recorded to aid in future surveys.

In the late Fall of 2007 Lessee Dan Macon introduced cattle (30 cow/calf units) on the north side of Doty Ravine and throughout the grazing season (approx. Nov-May) he moved the cattle through a series of paddocks, approx. every 6-10 days, created with electric fencing. The purpose of moving the cattle frequently was to avoid overgrazing a particular paddock yet expose that area to high grazing intensity and mechanical impact then move the cattle before any lasting damage was done and give the grasses time to recover. The cattle were only moved back to a paddock once the grasses have recovered and were in Phase II (high growth and high protein content) of their growth period. *see below for more information on Plant Growth After Grazing*

The south side of Doty Ravine Preserve was also subject to grazing by 30 cow/calf units but the cattle were left to an open grazing regime and no paddocks were used. This was done for two reasons. 1. To reduce the amount of work for the rancher and allow him/her to focus on managing the cattle on the north side of the property. 2. To create a control situation where the managed grazing techniques used on the north side of the property could be compared to typical non-managed grazing practices in an effort to determine if the managed grazing techniques were beneficial to reducing invasive grass species, specifically medusahead, and increasing the percentage of native grass species.

Conclusion

While it is much too early to come to any solid scientific conclusions, we are excited to see the possible positive effects of grazing, especially managed grazing, on Doty Ravine grasses. According to the data collected, grazing reduced the amount of medusahead on both sides of the Preserve (see Figure 1.0) but were reduced most on the north side of the Preserve where managed grazing techniques were used (see figure 2.0).

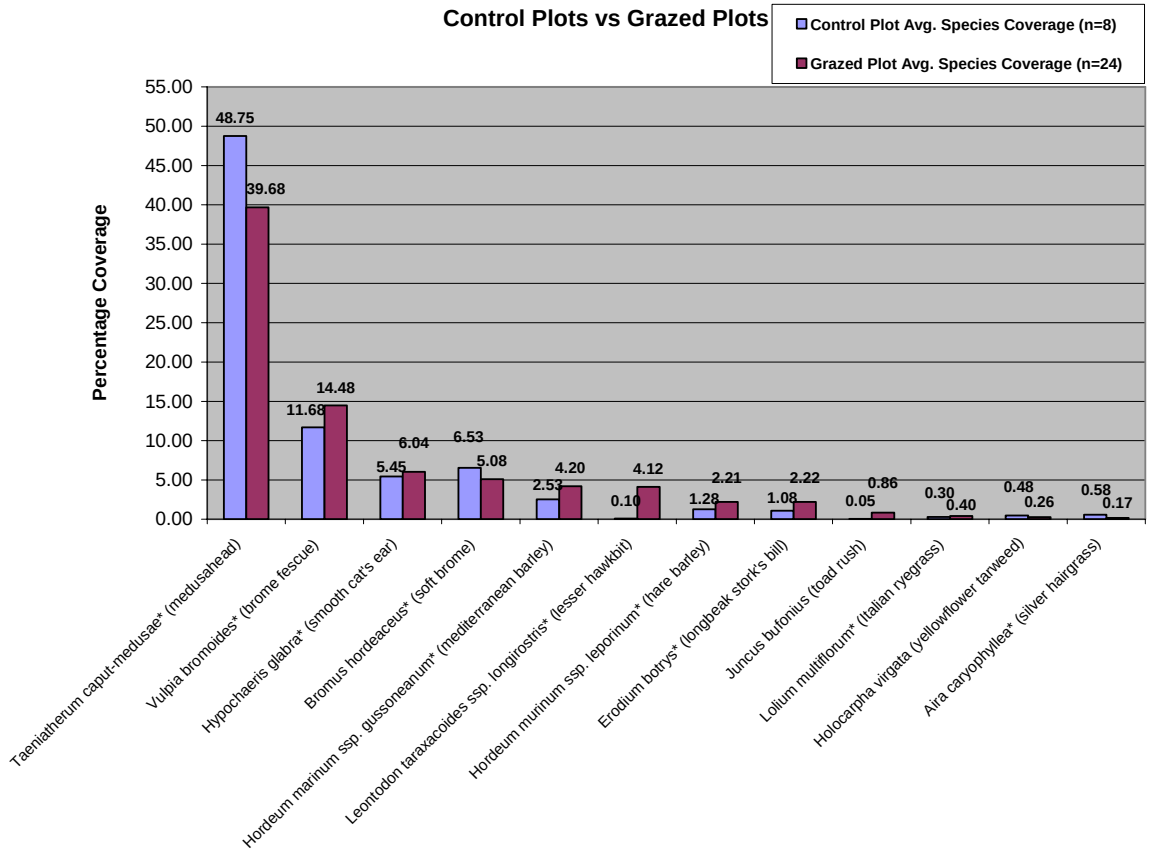


Figure 1.0 Comparisons between Control Plots (no grazing occurred) and Variable Plots (grazing occurred). This includes both managed and unmanaged grazing.

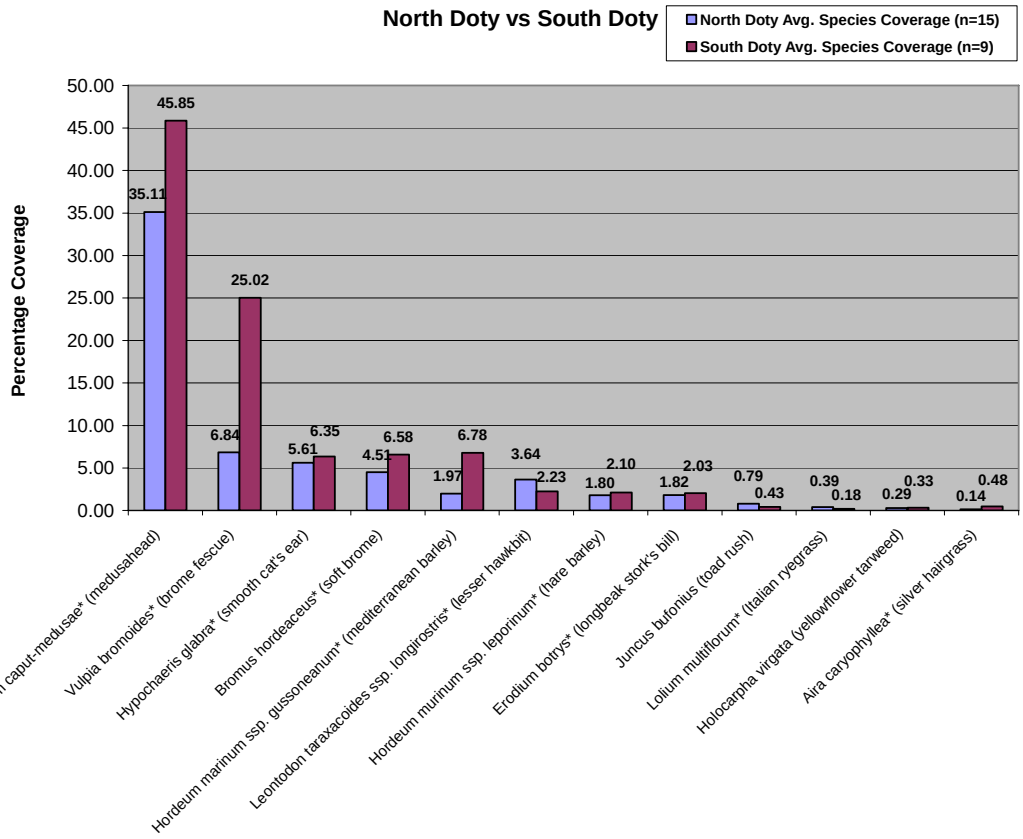
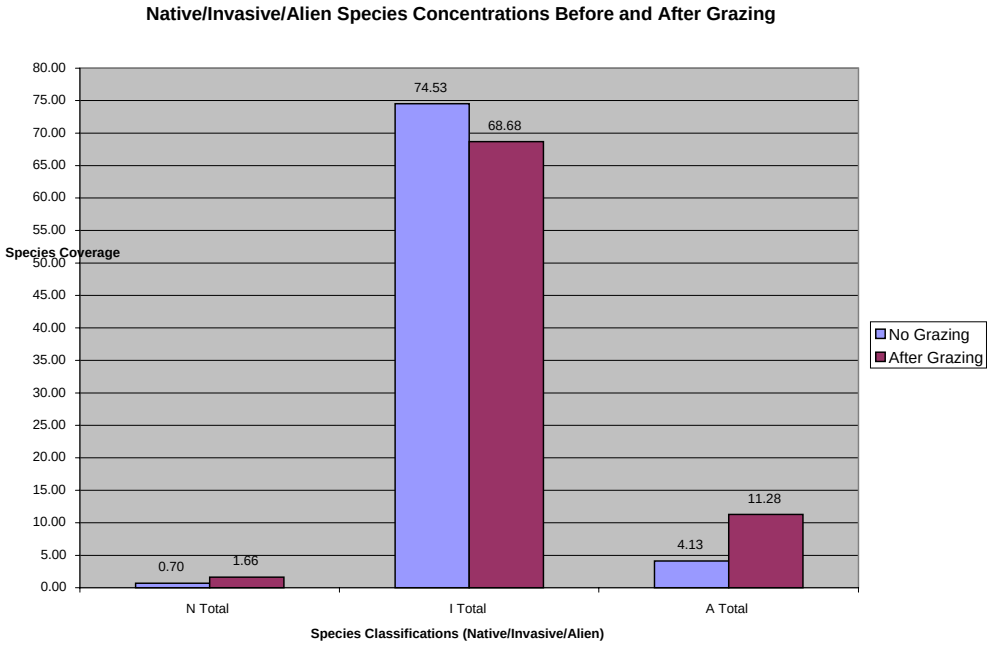


Figure 2.0 Comparisons between North and South Doty Preserve using only grazed plot data

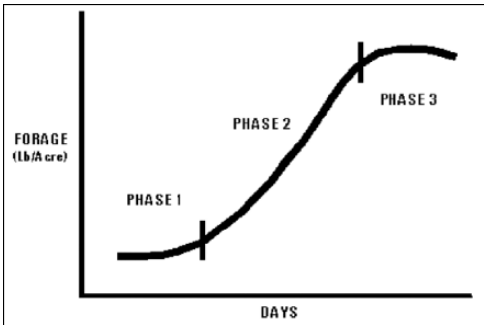
Furthermore, some studies indicate that careful grazing techniques in vernal pool habitat can decrease non-native species and increase native species (Marty 2005). Again, while it is too soon to reach a conclusion in regards to grazing impact on non-native vs. native species density, we do find that our data reflects similar effects to the study by Jaymee Marty (2005), at least in terms of invasive species vs. native



and alien species.

Plant Growth After Grazing (Pratt, D. 1993)

FIGURE 1. PLANT GROWTH AFTER GRAZING (THE 'S' SHAPED CURVE)



THE "S" SHAPED CURVE

The efficiency with which plants convert the sun's energy into green leaves and the ability of animals to harvest and use energy from those leaves depends on the phase of growth of the plants.

After grazing, plants go through three phases of growth that form an "S" shaped curve (figure 1). ***Phase I*** *occurs after plants have been severely grazed. After grazing, fewer leaves are left to intercept sunlight and plants require more energy for growth than they are able to produce through photosynthesis. So, to compensate, energy is mobilized from the roots. The roots become smaller and weaker as energy is used to grow new leaves.*

Plant growth during phase I is very slow but the leaves are extremely palatable and nutritious.

Remember phase I - high quality but low quantity.

When regrowth reaches one fourth to one third of the plant's mature size, enough energy is captured through photosynthesis to support growth and begin replenishing the roots. This is ***phase II.*** *It is the period of most rapid growth. During phase II, leaves contain sufficient protein and energy to meet the nutritional needs of most livestock.*

Remember phase II - high quality and high quantity.

As plants continue to grow, leaves become more and more shaded. Lower leaves die and decompose. Leaves use more energy for respiration than they can produce through photosynthesis. This is ***phase III.*** *Phase III material is stemmy and fibrous. Nutrient content, palatability, and digestibility of leaves in phase III material is poor.*

Remember phase III - low quality but high quantity.

Principle:Adjust grazing and rest periods to keep plants in Phase II,the most rapid period of growth.

Do not graze plants so short that they enter phase I. Phase I regrowth is very slow and will reduce total productivity. Do not allow plants to enter phase III. In phase III, shading and senescence begin to detract from efficiency of photosynthesis. ***The harvest of energy from your pastures will be maximized by keeping plants in phase II.***

Sources:

1. Marty, J. 2005. Effects of cattle grazing on diversity in ephemeral wetlands. Conservation Biology **19**:1626-1632
2. Pratt, D. 1993. Principles of Controlled Grazing. Livestock & Range Report No. 932 Spring 1993