IMPACTS TO GROUND VEGETATION BY FERAL SHEEP ON MT. MAXWELL, SALT SPRING ISLAND

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SUMMARY

This pilot study investigated the impacts feral sheep had on ground vegetation on the ecological reserve of Mt. Maxwell, Salt Spring Island.

Grazing and trampling done by these feral sheep have changed the composition of vegetation. In all experimental plots, the lightly impacted areas had a greater diversity of species. The average heights of all grass species decreased on the heavily impacted areas while increasing the percentage of barren ground.

ACKNOWLEDGEMENTS

I would like to acknowledge Don Guthrie and Sue Fahey for their help and Andy Jackoy for his assistance in plant identification. Very special thanks goes out to Sue Simonsen, for without her the field work would not have been a classic example of the blond leading the blind. Thanks Sue.

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1.0 INTRODUCTION

1.1 HISTORY

In 1972 a 65 ha. plot of land on Mt. Maxwell on Salt Spring Island was declared an ecological reserve to protect a stand of Garry oak (Quercus garryana). According to residents, domestic sheep have been allowed to roam freely on this mountain since the 1930s and still do. In 1984, 16 ha. of the reserve was fenced off in an attempt to keep sheep out. However, fresh feces and evidence of recent grazing indicate that some sheep are getting into the fenced area.

Presently residents of Mt. Maxwell have observed approximately 20 sheep in two separate flocks. These people have also reported seeing at least two domestic goats loose in the area.

1.2 PURPOSE

The purpose of this report was to determine if the feral sheep of Mt. Maxwell on Salt Spring Island, B.C. are having an impact on ground level vegetation or changing its composition in the area of the Garry oak (Quercus garryana) ecological reserve.

Past studies have found that feral sheep and other domestic animals have impacts on soil (Thurlow et al. 1986, Climo and Richardson 1984, Pluhar et al. 1987, Weltz et al. 1986, Warren et al. 1986, and Ahmed et al. 1987) and wildlife (Loope and Sanchez 1987, Van Duren and Coblentz 1987, and Eastman 1972).

Due to the time constraints for this study, impacts to soil and wildlife was not included.

2.0 STUDY AREA

The study area is located on Mt. Maxwell on Salt Spring Island on the British Columbia coast. This south facing property overlooks Sansum Narrows on the central west coast of Salt Spring Island (Figure 1).

The ecological reserve located here was the hub of the study area. Five plots were laid on the inside of the fence, which is located two thirds the way up the reserve from the beach (Figure 2). All these plots were located near the north perimeter of the fence line because of the relative ease of finding a matched plot on the outside of the fence. Five plots were also made on the outside of the fence. Because the fence on the north perimeter of the reserve doubled as the reserve boundary, all these outside plots were located outside the reserve's boundary. All ten plots ranged in elevation from 150m. to 350m. above sea level.

The area was studied between March 10th and March 18th, 1990.

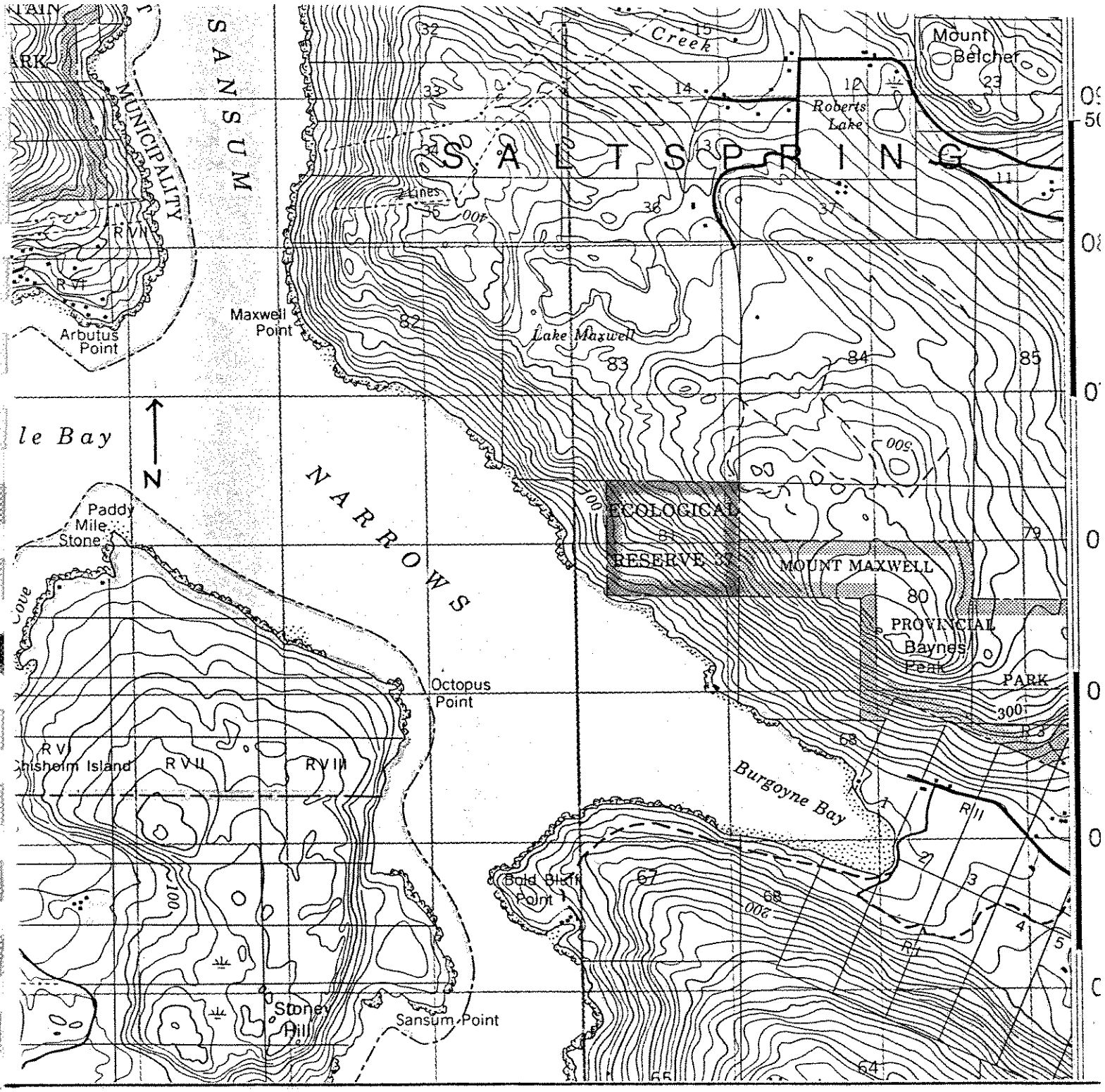

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Figure 1. Location of Study Area. (Source: Dept. of Energy, Mines and Resources. 1981).

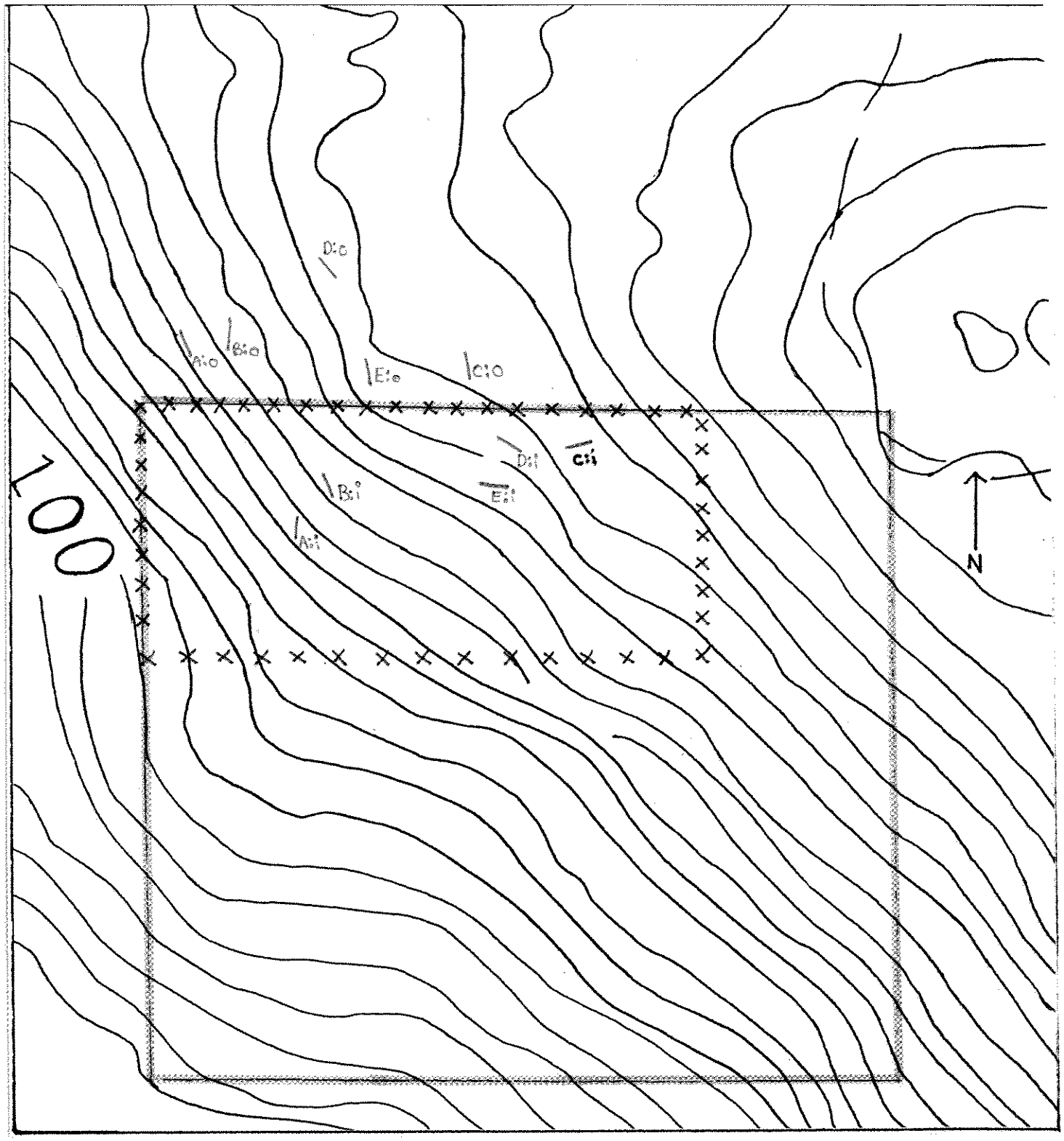

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Figure 2. Study area and plots. (Source: Dept. of Energy, Mines and Resources. 1981).

3.0 MATERIALS AND METHODS

3.1 MATERIALS

To complete this study, a 50m. surveyor's tape, 20 wooden stakes and twine were used to establish the plots and a clinometer was used to determine the slope of each plot. The surveyor's tape was also used to determine heights of grasses.

3.2 METHODS

The grasses were identified from dead grasses of the previous year. The new shoots were then compared to the mature dead species. This method is subject to error and greater accuracy would be possible if the study were done in the summer months. The herb species were identified by family, and in one case no identification could be made.

Ten plots were established. Each was a transect line exactly ten meters long. These sites were randomly selected within the chosen area as explained on the following page. As previously mentioned, five plots were made inside the fence (Figure 2). Here comparatively fewer sheep have grazed since 1984 (lightly impacted) than on the outside (heavily impacted). When the inside plots were completed, matched plots were made outside the fence (Figure 2). When determining the location of the matched plots, vegetation types, slope, aspect and shelter were considered and were duplicated as closely as possible to that of the plot inside the fence.

Difficulties were experienced here because through casual observation the ground vegetation outside the fence appeared to be very different from that inside the fence (Figures 3 and 4). For this reason, the assumption was made that if all other factors were similar to that of the matched plot, the ground vegetation would also be similar, without the influence of sheep. This assumption was based on a like study done by D.V. Van Duren and B.E. Coblentz on Santa Cruz Island, California (1987) which concluded that grazing by feral sheep can change the composition of ground level vegetation.

The five matched plots were located in areas where vegetation type and shelter differed. All plots had a south aspect. Plots A:i (inside) and A:o (outside) were located in an open Garry oak parkland with slopes of 22% and 23% respectively. These plots were not well sheltered. Plots B:i and B:o were located on an exposed treeless rock outcrop with slopes of 15% and 22% . Plots C:i and C:o were placed in a sheltered mixed stand of Garry oak and Douglas-fir (Pseudotsuga menziesii) and had slopes of 10% and 12%. Plots D:i and D:o were located in a sheltered Douglas-fir stand with slopes of 11% and 14%. Plots E:i and E:o were made in a open Garry-oak stand similar to plots A:i and A:o but with fewer trees and less slope (0% and 10%).

Figure 3. Photograph of hillside approximately 50 m. inside fence.

Figure 4. Photograph of the same hillside as above approximately 50 m. outside fence.

For each plot, the percentage of each specie of grass and herb was determined as well as the percent of humus. This was done by measuring the amount of each species along the 10m. tape then multiplying this number by 10, thus determining the amount per 100m., or percent. The percentage of litter was visually estimated for each plot. The grasses present were then measured and an average height was determined for each species.

The matched plots were compared to one another with respect to species presence or absence, percentage of present species per plot, percentage of humus or bare rock, height of grass species (taken from dead grass from the previous season), and percent litter. An overall comparison between the lightly impacted and heavily impacted areas was then made.

4.0 RESULTS

The percent of each plant specie present was calculated per plot. The results are shown in Tables 1 through 10.

Table 1. Results of Plot A:i. Garry-oak parkland.

SPECIES	PERCENT	AVE. HEIGHT	
Dactylis sp.	50%	0.5 m.	
Agropyron repens	3%	0.77 m.	
Poa sp.	1%	0.5 m.	
Rhytidiadelphus triogratus	5%		
Saxifragaceae	3%		
Brassicaceae	2%		
Humus	33%		
Rock	3%		LITTER = 70% oak
			SLOPE = 22%

Table 2. Results of Plot A:o. Garry-oak parkland.

SPECIES	PERCENT	AVE.HEIGHT	
Dactylis sp.	79%	0.16 m.	
Aira praecox	1%	0.14 m.	
Rhytidiadelphus triogratus	4%		
Brassicaceae	1%		
Humus	9%		
Rock	6%		LITTER = 60% oak
			SLOPE = 23%

Table 3. Results of Plot B:i. Treeless rock outcrop.

SPECIES	PERCENT	AVE.HEIGHT
Dactylis sp.	34%	0.2 m.
Aira praecox	1%	0.14 m.
Rhytidiadelphus triogratus	51%	
Polytrichum sp.	8%	
Rock	6%	LITTER = 5% oak
		SLOPE = 15%

Table 4. Results of Plot B:o. Treeless rock outcrop.

SPECIES	PERCENT	AVE.HEIGHT
Aira praecox	25%	0.13
Rhytidiadelphus triogratus	58%	
Unidentified herb (3)	5%	
Rock	12%	LITTER = 0%
		SLOPE = 22%

Table 5. Results of Plot C:i. Mixed Garry-oak/ Douglas-fir stand.

SPECIES	PERCENT	AVE.HEIGHT
Agropyron repens	13%	1.2 m.
Festuca sp.	3%	0.5 m.
Dieranum sp.	1%	
Polytrichum sp.	5%	
Galium boreale	1%	
Humus	77%	

LITTER = 90% oak/ 10% D-fir

SLOPE = 10%

Table 6. Results of Plot C:o. Mixed Garry-oak/ Douglas-fir stand.

SPECIES	PERCENT	AVE.HEIGHT
Agropyron repens	17%	0.78 m.
Festuca sp.	1%	0. 3 m.
Saxifragaceae	4%	
Galium boreale	6%	
Humus	72%	

LITTER = 70% oak /5% D-fir

SLOPE = 12%

Table 7. Results of Plot D:i. Douglas-fir stand.

SPECIES	PERCENT	AVE.HEIGHT
Agrpyron repens	13%	1.0 m.
Festuca sp.	19%	0.6 m.
Rhytidiadelphus triogtatus	2%	
Kindbergia oregana	7%	
Unidentified moss (4)	1%	
Humus	58%	

LITTER = 20% oak / 60% D-fir

SLOPE = 11%

Table 8. Results of Plot D:o. Douglas-fir stand.

SPECIES	PERCENT	AVE.HEIGHT
Agropyron repens	2%	0.7 m.
Kindbergia oregana	33%	
Dieranum sp.	3%	
Galium boreale	1%	
Humus	59%	
Rock	2%	

LITTER = 10% oak / 70% D-fir

SLOPE = 14%

Table 9. Results of Plot E:i. Garry-oak stand.

SPECIES	PERCENT	AVE.HEIGHT
Dactylis sp.	20%	0.43 m.
Agropyron repens	60%	1.01 m.
Saxifragaceae	5%	
Galium boreale	10%	
Yarrow	5%	

LITTER = 90% oak

SLOPE = 0%

Table 10. Results of Plot E:o. Garry-oak stand.

SPECIES	PERCENT	AVE.HEIGHT
Dactylis sp.	47%	0.23 m.
Dieranum sp.	20%	
Humus	28%	
Rock	5%	

LITTER = 90% oak

SLOPE = 10%

5.0 DISCUSSION

Some problems were associated with this pilot study. The time of year (March) of the study was not appropriate to identify vascular plants.

5.1 PLOTS A:i AND A:o (Tables 1 and 2)

With these plots, the grass Dactylis sp. increased in the area outside the fence. The average height of Dactylis sp. decreased by 32% in the heavily grazed area which correlates with the findings of D.V. Van Duren and B.E. Coblentz (1987). Agropyron repens and Poa sp. heights could not be compared because these species were not present in plot A:o. Agropyron repens and Poa sp. were absent outside the fence, in the highly grazed area, as was the herb in the Saxifragaceae family. These results relate to the findings of Bowns and Bagley in 1986 which indicate that grazing will result in an increase in unpalatable vegetation and a decrease in palatable vegetation.

This would indicate that the sheep found the Dactylis sp. less palatable and the Agropyron repens and Poa sp. more palatable. This also may be the case with the Saxifragaceae, or its absence in the heavily grazed area may be the result of trampling. The presence of Aira praecox in the heavily grazed area is believed not to be significant due to the low percentage.

5.2 PLOTS B:i AND B:o (Tables 3 and 4)

It was interesting to note that Dactylis sp. contributed to 34% of the vegetation in the lightly grazed area but was completely absent in the heavily grazed area when, as mentioned above, it was believed to be unpalatable. It appears that Aira praecox is even less palatable that Dactylis sp. which would explain it being the only grass species present in the plot outside the fence. Another explanation could be the fact that sheep tend to change their diet both daily (Arnold and Dudzinski 1978) and seasonally (Bullock 1885) or the sheep simply had eaten up all of the more palatable grasses and began to consume the less palatable.

The absence of Polytrichum sp. and the presence of the unidentified herb in the heavily grazed area could be the result of trampling which results in a changed soil structure which these species may prefer. It could also indicate problems in identifying very young species.

The average height of Aira praecox decreased in the heavily grazed area but only by a very small percent. This may be a result of the sheep not using this species.

5.3 PLOTS C:i AND C:o (Tables 5 and 6)

The slight differences between these two plots indicate that sheep do not use this area for grazing as heavily as other areas.

This is appropriate since the plots were mostly bare ground. However, because these sites were both sheltered and supplied shade, the sheep may have used these areas as a bedding or resting areas which would account for the absence of moss at plot C:o. It was noted that a large amount of sheep feces was present in the area of plot C:o which would support this.

The average grass height decreased for both grass species present in the area outside the fence (Figure 6).

5.4 PLOTS D:i AND D:o (Tables 7 and 8)

Like plots C:i and C:o, this appeared to be an area that sheep did not graze heavily for the same reasons as plot C:i and C:o. However, the changes in vegetation type and percents could be explained by the presence of a water source in proximity to plot D:o. Arnold and Dudzinski (1978) found that sheep will grab at vegetation while on the move to and from water. Trampling also could have played a role in the differences between these two plots due to probable sheep traffic to and from the water.

The average height of Agropyron repens decreased in the area outside the fence which again correlates with the findings of Van Duren and Cobletz.

5.5 PLOTS E:i AND E:o (Tables 9 and 10)

This pair of plots had many of the same qualities as plots A:i and A:o. The only real difference was slope, with plots A:i and A:o having slopes of 22% and 23% and plots E:i and E:o having slopes of 0% and 10% respectively. As in plots A:i and A:o, Dactylis sp. increased while Agropyron repens was absent in the heavily grazed area. This supports the theory that the more palatable Agropyron repens was consumed by the sheep while the Dactylis sp. flourished. The presence of Dieranum sp. and the absence of Saxifragaceae and Galium boreale in the heavily grazed area again may be explained by the fact that vegetation composition may change due to grazing. The presence of bare ground increased in the heavily grazed area probably due to trampling.

The average height of Dactylis sp. decreased by 50% on the heavily grazed area.

5.6 OVERALL COMPARISON

In all cases, the outside plots showed a greater species diversity than the inner more heavily grazed matched plots (Figure 5). This agrees with the findings of Bowns and Bagley (1986) who encountered the same results with their study in the mountains of Utah. It also appeared that the grass species apparently most favored by sheep decreased as the less favored species increased, thus changing the composition of the

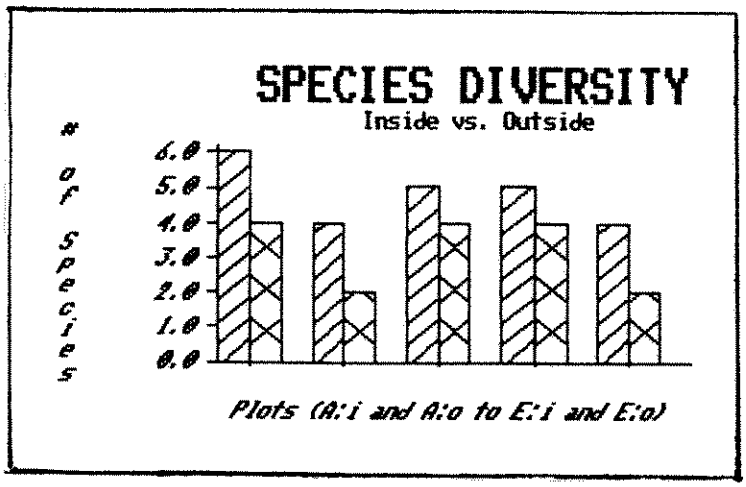
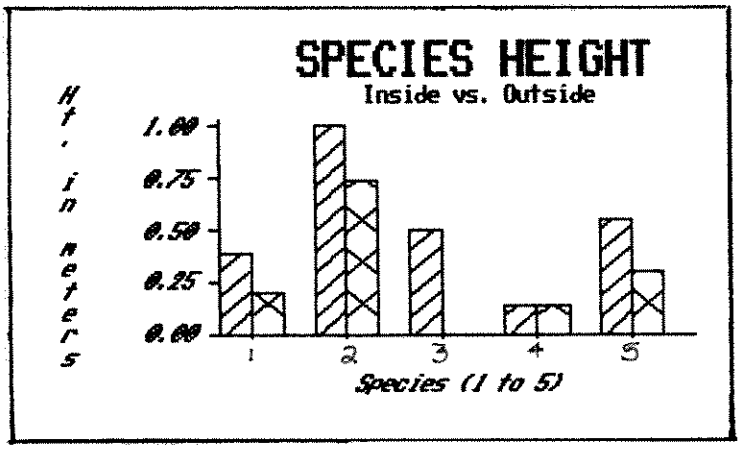


Figure 5. Comparison of number of species inside and outside the fence. Slanted bars represent areas inside the fence, cross-hatched bars represent areas outside the fence.



1. Dactylis sp.
2. Agropyron repens
3. Poa sp.
4. Aira praecox
5. Festuca sp.

Figure 6. Comparison of average heights for each grass species inside and outside the fence. Slanted bars represent areas inside the fence, crosshatched bars represent areas outside the fence.

vegetation outside the fence. In every case, the average height of the grasses decreased in the heavily grazed areas even if they were thought to be undesirable by sheep (Figure 6). In three of the five matched plots, an increase of bare ground resulted with the presence of sheep.

6.0 CONCLUSION

Since only five matched plots of varied vegetation types were studied and vascular plants were difficult to identify during the study period, the results must be deemed incomplete. However, these data would lead to some tentative conclusions.

The feral sheep of Mt. Maxwell are changing the vegetation by grazing and trampling. They are altering the vegetative composition and decreasing the height of grasses. On treeless outcrops, in Douglas-fir stands, and in Garry oak stands, the percent of bare ground appears to be the result of grazing and trampling by sheep.

7.0 RECOMMENDATIONS

The following recommendations will ensure more conclusive results.

- An extensive study of the same nature be undertaken in the summer months.
- A minimum of three matched plots should be made for each vegetation type.
- Since sheep are getting into the fenced area, the fence should be repaired and maintained.
- Effects to soil and wildlife should be considered in an extensive study.

8.0 REFERENCES

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