

Affect of Goat Grazing on Plant Reproductive Success and Biodiversity

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Abstract

My study was intended to investigate the effect of moderate goat grazing on plant species composition. To do this I compared the number of flowers produced by every species of plant in my test site in Hayward to the total number of plants of that species, in grazed and ungrazed plots. What I found was that in the grazed plot, fewer flowers were produced per plant than in the ungrazed plot. My results suggest that goat grazing, like cow grazing, can affect species composition and biodiversity. More research is needed to establish the extent of these effects, and their consequences.

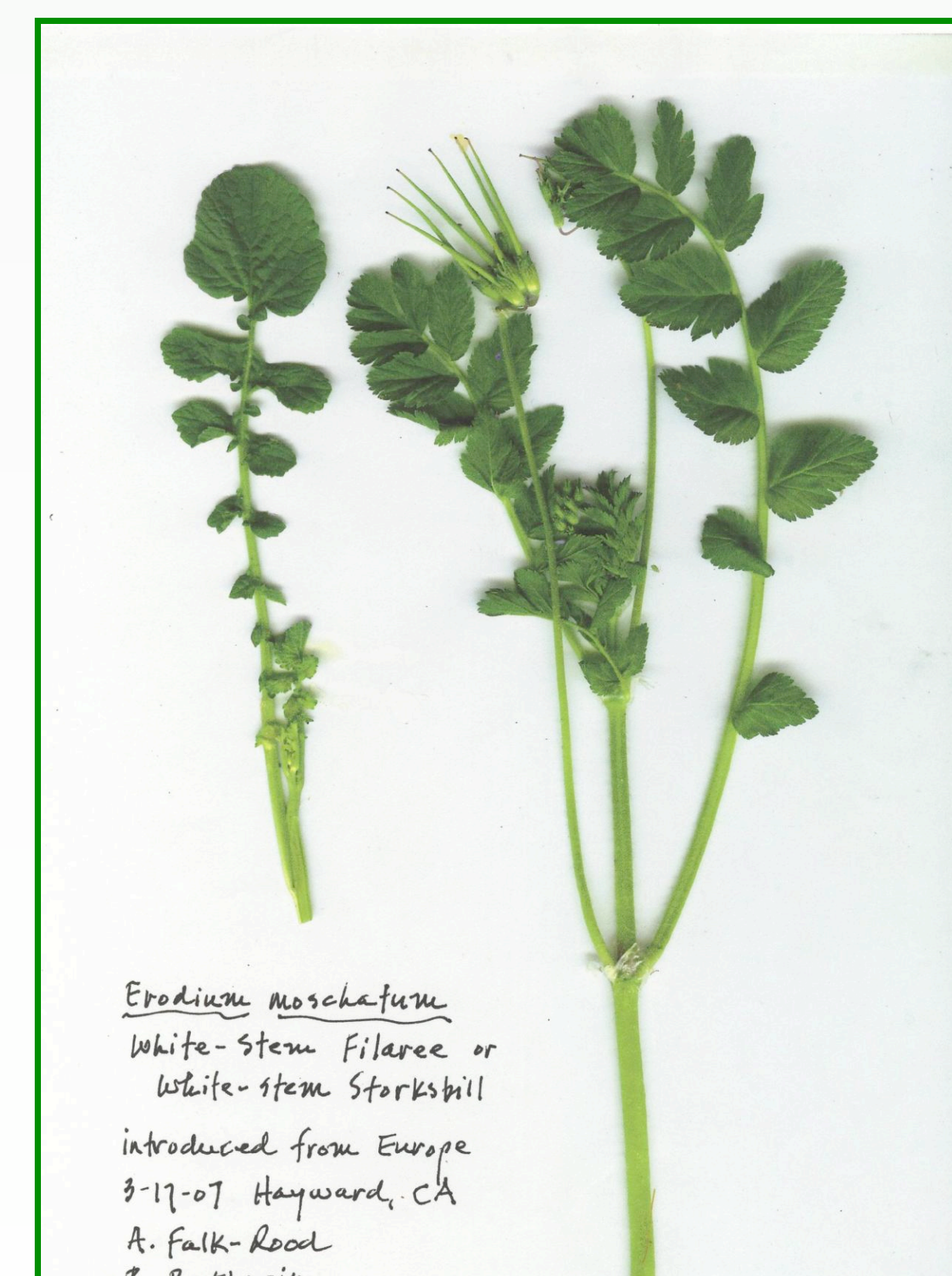
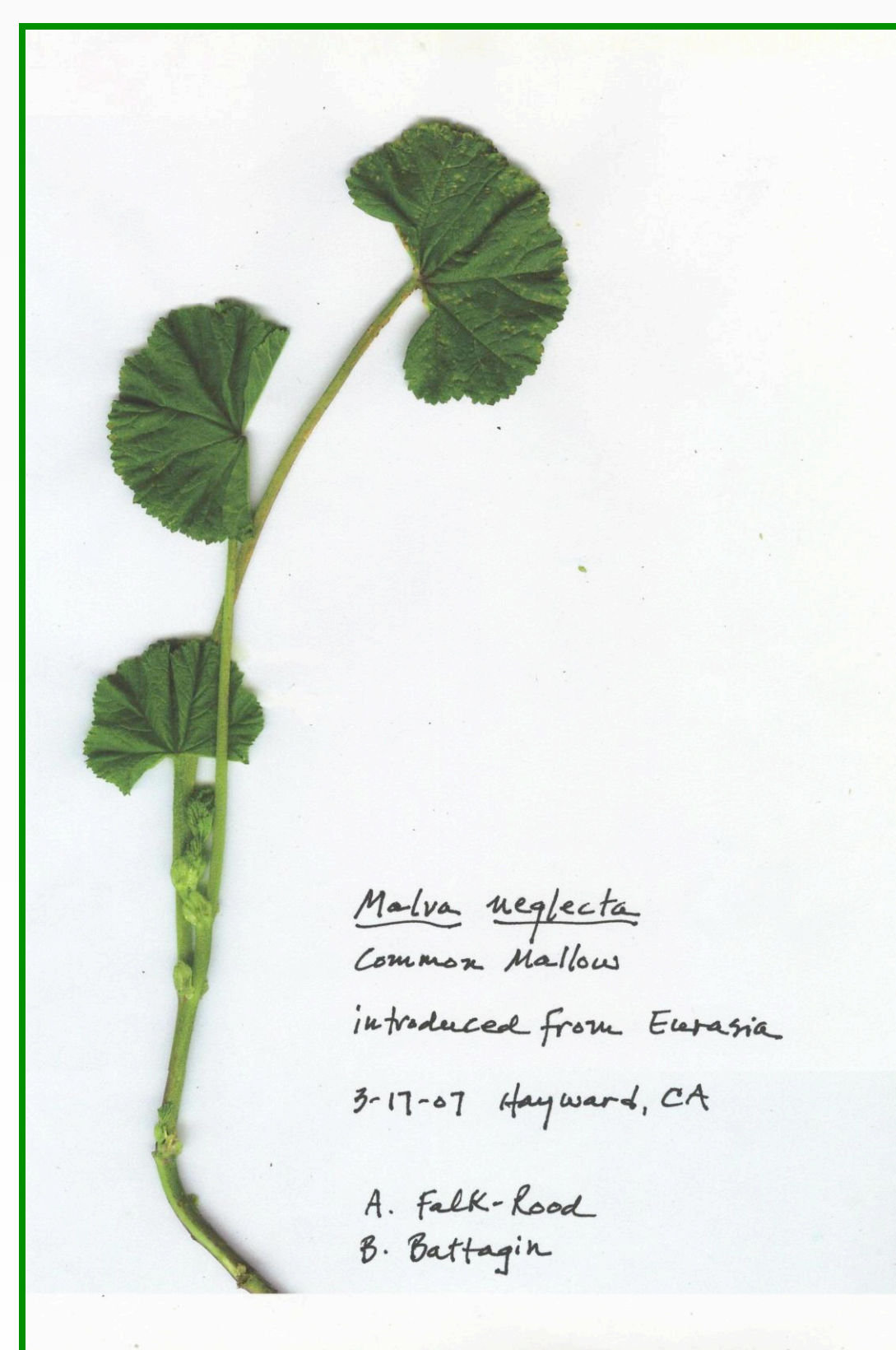
Introduction

The Bay Area's landscape is especially prone to fire because of our bi-seasonal Mediterranean climate in which no rain falls for half a year. Recently, land managers such as the East Bay Municipal Utilities District and the East Bay Regional Park District have successfully used grazing to create fuel breaks for fire prevention (Kluger, 2002). It is well known that overgrazing by cows can lead to soil erosion and compaction, can cause watershed contamination from feces, can threaten to native species, can cause a loss of biodiversity, and can create a host of other environmental problems (Berlow et al. 1999). Much less is known about the effects of goat grazing.

I theorized that goats might create a disturbance more similar to the natural disturbance of our area's former native grazers. If this were true, goats would even be beneficial to the ecosystem. Goat grazing might act as an intermediate disturbance, and thus promote biodiversity (Connell, 1978). If these inclinations proved true, my results would suggest that goats would be an excellent, environmentally sound tool for controlling fires.

I found the land at my study site in Hayward to be highly disturbed and entirely lacking native species. My plan was to study how introducing a goat might change the existing make-up of the vegetation. My null hypothesis was that no statistically significant change in the species composition of the grazed area would be observed.

The plants
There were a total of ten species on the land, all of which were introduced.
Three were grass species (annual bluegrass—*Poa annua*, raintail fescue—*Vulpia myuros*, and hare barley—*Hordeum murinum* ssp. *leporinum*), a dock species (*Rumex* sp.), a geranium (*Geranium dissectum*), white stem storksbill (*Erodium moschatum*), horehound (*Marrubium vulgare*), common mallow (*Malva neglecta*), a clover species (*Trifolium* sp.), and a mustard species (*Brassica* sp.). The dock and horehound did not occur in large enough numbers to be statistically significant.



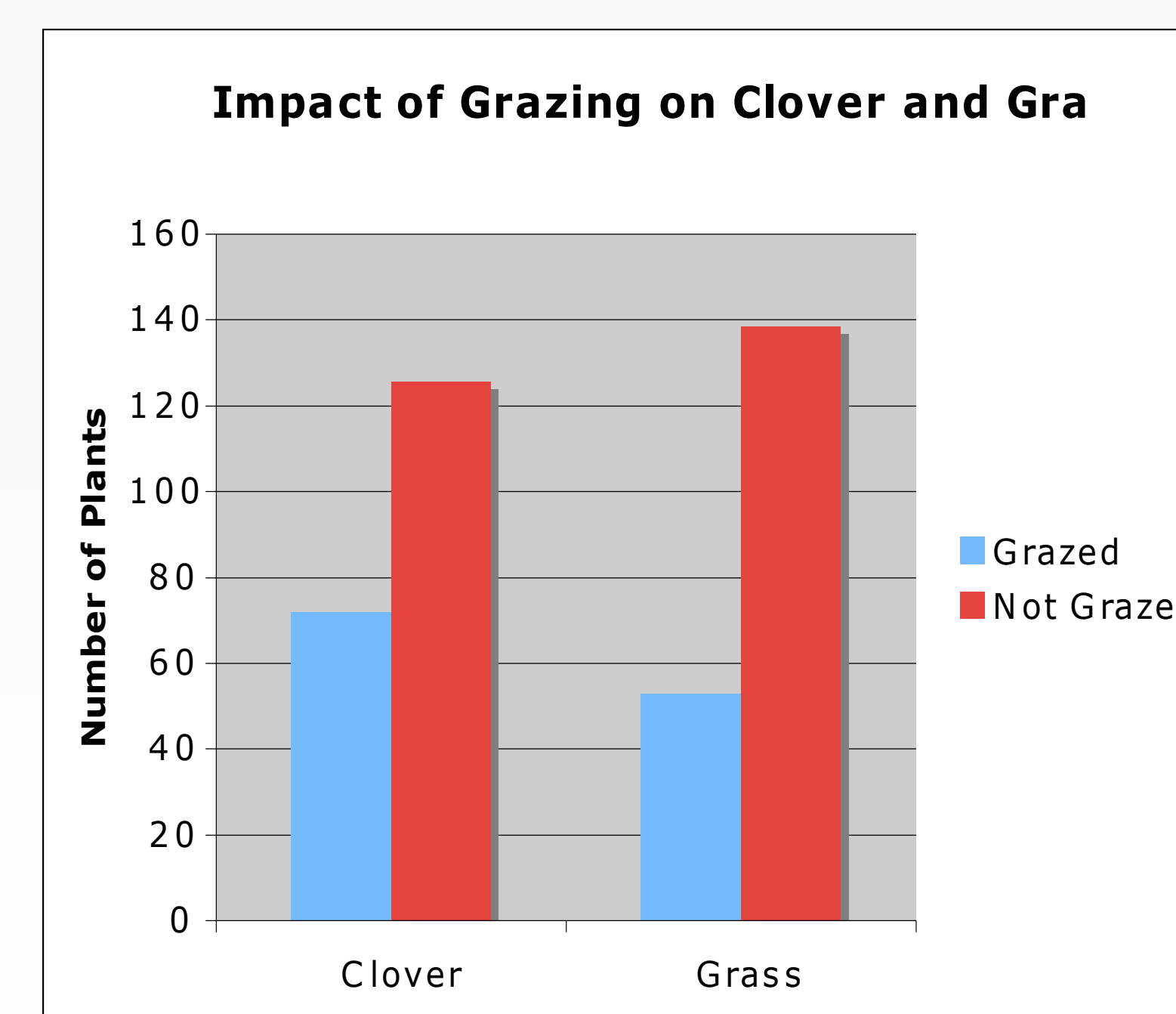
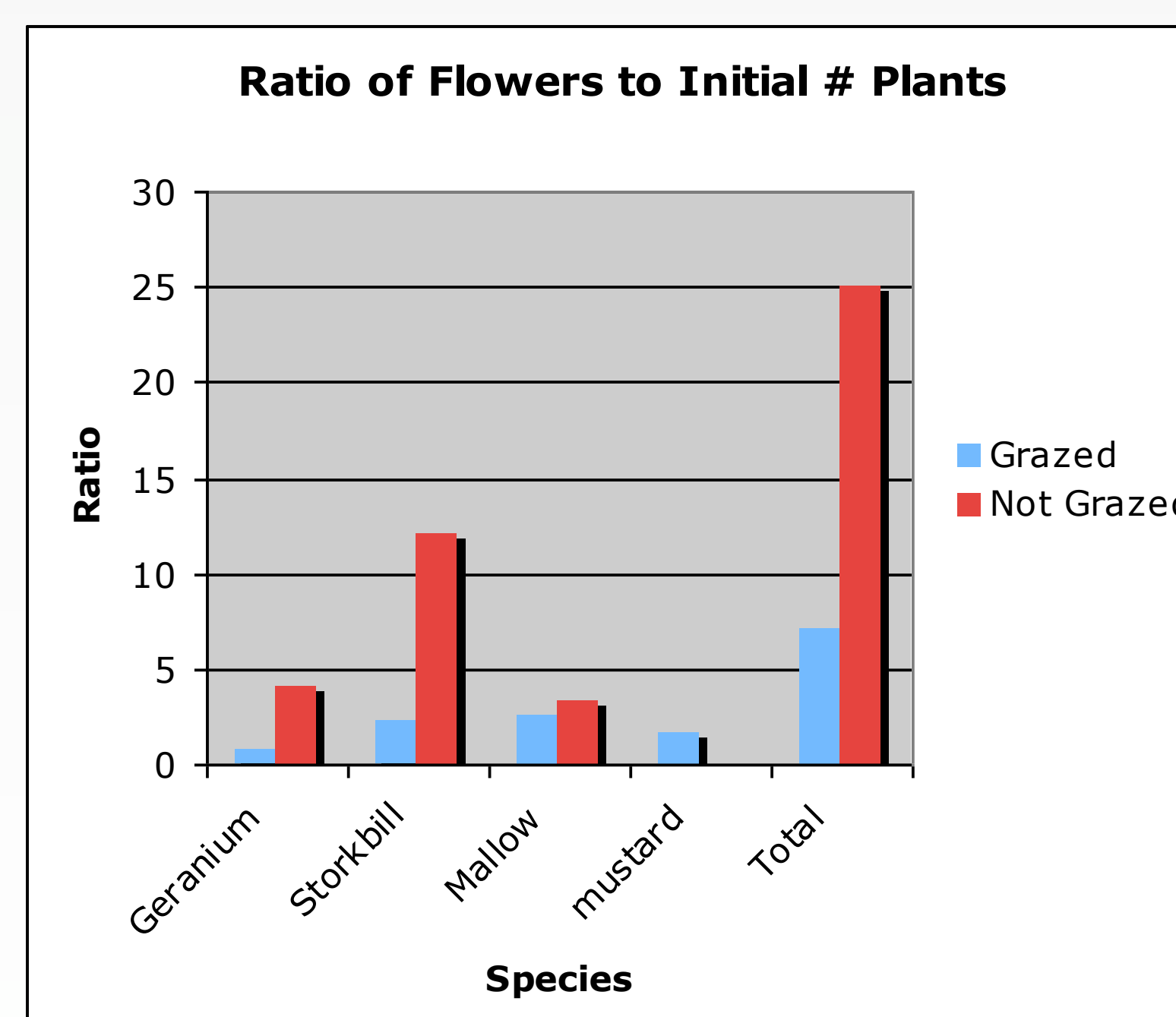
Methods

My goal was to measure how goat grazing might affect the ability of each of the ten local plants to produce seeds. I first had to construct a control area and an area to be grazed. To do this, I built a fence around a rectangle of land about 20 feet by 24 feet. Inside this rectangle, I built an inner circle of fence of about 10 feet in diameter—my control area. In late April I took initial pre-grazing data on the species make-up of the area. I recorded the number of each of the ten species of plants growing within a 1 foot by 1 foot quadrat ten times in random locations in the ungrazed area, and ten times in random locations in the grazed area, marking each spot with a stake. In late May, once all the plants were in flower, I returned to take my second round of data. Returning to the same twenty locations, I this time counted the total number of flowers produced by each species.



Results

There was a statistically significant difference between the grazed and ungrazed plots in the number of total surviving flowers per plant: my hypothesis proved wrong. Specifically, geranium, storksbill, mustard, clover, and all the grasses produced fewer flowers under goat grazing. The first graph compares the ratio of flowers counted in May to plants originally counted in April between the grazed and ungrazed plots. Statistical differences were present for all species except mallow. The second graph shows a similar pattern for grasses and clover flowers, with the ungrazed section producing many more flowers. However, data for clover and grasses relied solely on flower count, as these plants had not grown enough to take initial plant counts in April.



Bibliography

"Effects of goat-grazing on composition and structure of fire-prone vegetation." Kluger, Barbara, 2002.
"Diversity in Tropical Rain Forests and Coral Reefs." Connell, Joseph H., 1978.



Conclusion

The low intensity goat grazing caused many plants to be decapitated, but few, if any, were entirely removed. Mallow and geranium, being low-lying plants that produce flowers lower on the plant, were less affected than storksbill and mustard, whose long flower stems were vulnerable. The results suggest that if this level of goat grazing were to be used extensively, low-lying plants might be favored. It is unknown whether this pressure would favor native species or biodiversity, but both are possible. One factor that might mitigate these changes, however, is weather, which might carry seeds into the area from great distances. Another factor that might make changes in annual seed production caused by grazers less important is the vast quantity of seeds stored in the topsoil: it would take years before this reservoir was depleted. Furthermore, it seems unlikely that even widespread grazing could limit grass growth, because grasses produce so many seeds and are so successful at distributing them, even over miles. Yet other factors that my study was unable to consider were soil compaction and erosion caused by goats, processes that might favor the growth of certain species. Further studies should investigate goat grazing on larger plots of land over several successive years.

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