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Estimating Forage Loss from California Ground Squirrels in Central California Rangelands (Abstract)

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ABSTRACT: California ground squirrels (*Otospermophilus* spp.) cause more economic damage to California rangelands than any other rodent (Baldwin et al. 2022). Burrow systems can undermine stock pond dams, ranch roads, and even hillslopes. However, forage loss is generally the primary concern. When asked, ranchers offer detailed qualitative descriptions of the damage ground squirrels cause and how it impacts the economic viability of their operations. Damage by ground squirrels can be particularly concerning because ranching operations are often on the margins of profitability. Unfortunately, few studies have quantified economic losses from ground squirrels. Additionally, ranchers commonly lease grazing land from public agencies. In many cases, agency employees have a limited understanding of ranching operations and generally do not allow for control of ground squirrels.

Quantitative data on ground squirrel impacts to rangelands and ranching operations may help land management agencies better understand the challenges faced by their lessees and justify targeted management actions in the future. Therefore, we tested the amount of standing crop removed by ground squirrels across 16 sites on the Central Coast and interior central California 2019 and 2020. Sampling was conducted during a 4 to 6-week period in May and early-June. This timeframe coincided with the period after juvenile squirrels emerged from natal dens, which allowed us to quantify the collective impact that the entire ground squirrel population had on the landscape. We included four different ground squirrel density categories per site: minimal (0-1 squirrel), low (2-6 squirrels), medium (7-15 squirrels), and high (more than 15 squirrels). To quantify ground squirrels, we counted individuals in 0.4-ha plots using binoculars from an observation point outside the plots. We conducted five ground squirrel counts, repeated twice a day over three days for a total of 30 counts per plot, and used the highest number observed in analyses. We estimated standing crop (biomass of herbaceous vegetation) using the comparative yield method. We also evaluated precipitation and livestock grazing intensity in relation to forage production.

We found that each ground squirrel reduced standing crop by 27.2 kg per ha. Precipitation also influenced forage production: each cm of precipitation yielded 16.6 kg per ha of additional available forage. In our model, identified effects of livestock grazing intensity; interaction between livestock grazing intensity and ground squirrel abundance; and interaction between precipitation and ground squirrel abundance on residual standing crop were not statistically significant. Although grazing intensity does influence vegetation biomass, we did not identify a significant relationship between the two, likely because we were limited to collecting grazing intensity data at the scale of the field, not at the scale of our survey plots.

Despite their economic impacts, ground squirrels are critically important to California rangeland ecosystems. Ground squirrel burrows are documented to provide habitat for native wildlife including burrowing owls (*Athene cunicularia*) and California tiger salamanders (*Ambystoma californiense*). Ground squirrel colonies are also known to be associated with increased native bird species richness, diversity, and abundance (Lenihan 2007). Because of these potential benefits to supporting native wildlife, active ground squirrel management should only be conducted on rangelands when ground squirrel damage exceeds levels considered tolerable by ranch managers. The level of damage considered intolerable will likely vary among managers of different sites. Results from this study could help ranchers and other land managers identify when such a threshold is exceeded.

KEY WORDS: California ground squirrel, forage loss, forage removal, *Otospermophilus beecheyi*, rangeland management, standing crop biomass

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