**Greater Sage-grouse habitat and demographic response to grazing by non-native ungulates

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 **Abstract:**Within the Great Basin of the Western United States, management discussions regarding the impacts of grazing by livestock and feral horses on Greater Sage-grouse often focus on the negative habitat impacts, and how the sage-grouse populations will respond in turn. While the linkage between sage-grouse demographics and habitat is well documented, quantifying the direct impacts of non-native grazing on sage-grouse has been fraught with difficulties. These struggles include the logistical constraints and cost associated with monitoring multiple sage grouse populations across large landscapes, an adequate temporal span to detect responses, and grazing manipulations at a large enough spatial scale to affect grouse populations. We investigated the response of sage-grouse demographics, movements, and habitat to grazing of non-native ungulates in Northern Nevada and Southern Oregon. We failed to detect a difference in these metrics when grazing was analyzed at discrete treatment levels, however, we did find evidence for an effect when grazing was treated as a continuous measure of intensity. Grazing intensity during the breeding season of sage-grouse was estimated by integrating records of duration and number of livestock permitted on grazing allotments, and on the ground transect data targeting feces of both horses and livestock. Using Bayesian Hierarchal modeling to account for uncertainty in each component of our data, we found little evidence that sage-grouse are avoiding areas with high intensities of grazing by either horses or livestock. Likewise, there was little support for an effect of grazing on nest survival. We observed lower chick survival rates in areas that had higher grazing intensities of horses, livestock, and combinations both. We also found evidence for a negative effect of grazing on the habitat chicks were using during this time. These results suggest that high intensities of grazing during the breeding season of sage-grouse are negatively impacting populations, and may inform recommendations for issuing grazing permits and managing feral horses within the breeding range of sage-grouse.