V.6 Grazing Effects on Grasshopper Populations in Southern Idaho

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Many investigators have examined the impact grasshopper populations exert on the availability of forage for livestock. Fewer studies have been done on the reverse relationship: the effects of livestock grazing on grasshoppers. No previous studies have addressed this topic within the Intermountain region of Idaho.

In any discussion of the effects of livestock grazing on grasshoppers, the distinction between long-term and short-term effects of grazing must be maintained. Long-term changes due to grazing may include alterations in the composition of the plant community and changes in soil properties. Short-term changes include reduced forage, altered chemical and physical characteristics of plants, reduced plant height, and possibly a warmer and drier microclimate (see V.1). Only short-term grazing effects will be considered here.

Field Studies

We compared grasshopper densities and species composition between grazed and ungrazed plots from 1990 to 1993. The results have been consistent: we have seen either lower densities on heavily grazed plots or no differences at all. Over the 4-year period, the grazed plots had an average of half as many grasshoppers as the ungrazed plots (fig. V.6–1). One species, *Melanoplus sanguinipes,* accounted for most of the difference in density. The subfamilies Gomphocerinae (slantfaced) and Oedipodinae (bandwinged), as a group, were relatively indifferent to grazing. This does not mean that grazing did not affect certain species within these subfamilies, but densities were too low to evaluate individual species.

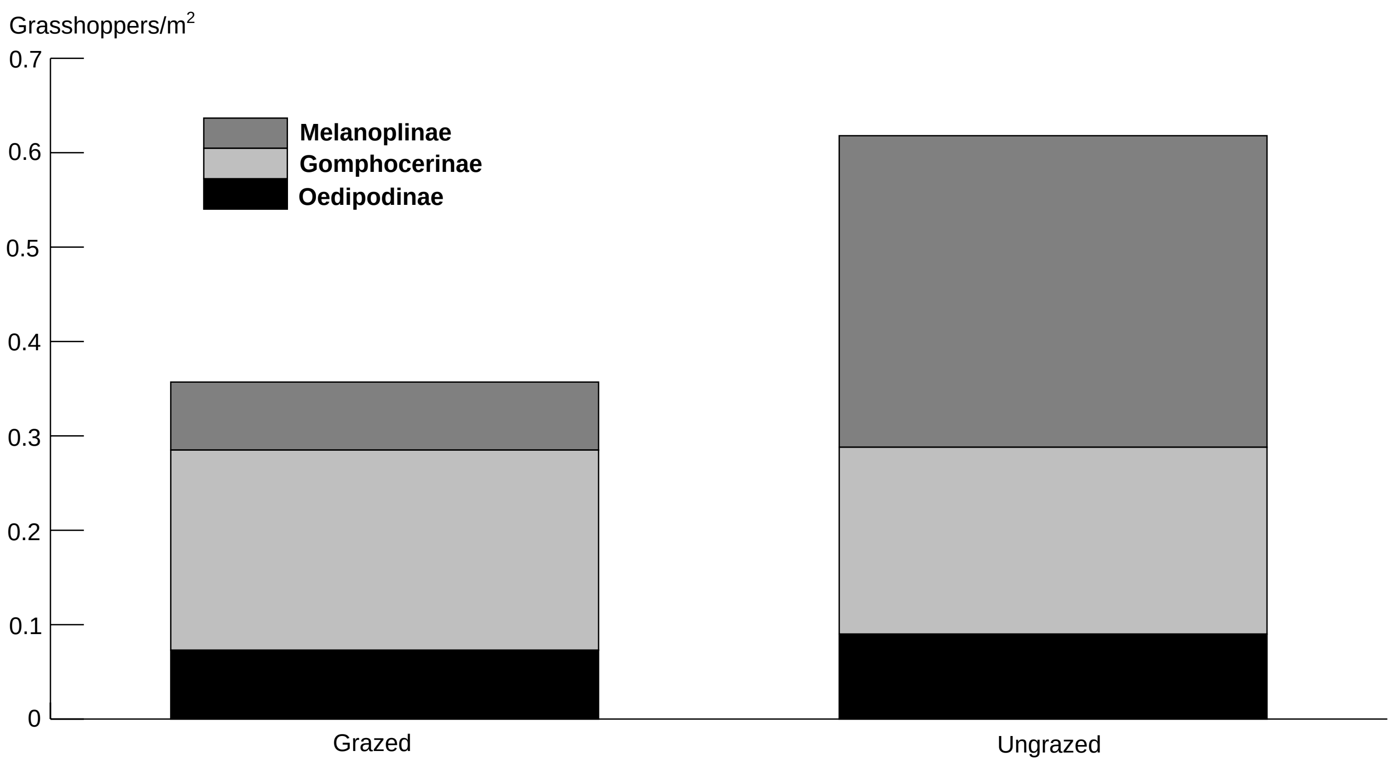

Figure V.6–1—Mean grasshopper densities from five pairs of grazed and ungrazed plots, 1990–93, within the Bureau of Land Management's Shoshone District (N = 3 samples per year × 4 years × 5 plots = 60).

In 1993, a year of above-average precipitation and unusually high rangeland productivity, grazing effects on grasshopper densities were not as pronounced as in other years. These results suggest that by reducing the amount of forage available to grasshoppers, livestock are competing with them and reducing the carrying capacity of the rangeland for grasshoppers. To test this hypothesis under more controlled conditions, we conducted cage studies during 1992 and 1993.

Cage Studies

Cages covering 1 m^2 were set out in an area dominated by cheatgrass *(Bromus tectorum)* and tumblemustard *(Sisymbrium altissimum)*, favored habitat of *M. sanguinipes.* We stocked the cages with 10 adult *M. sanguinipes* in July, shortly after adults were first observed in the field. Before we stocked the cages, we clipped half of the aboveground plant biomass (material) and weighed it to the nearest gram in half the cages. We counted grasshoppers within each cage weekly until no grasshoppers survived or until we finished the experiment in October. The remaining plants within the cages were clipped and weighed to the nearest gram after we terminated the experiment, and we sifted the soil to collect any grasshopper egg pods.

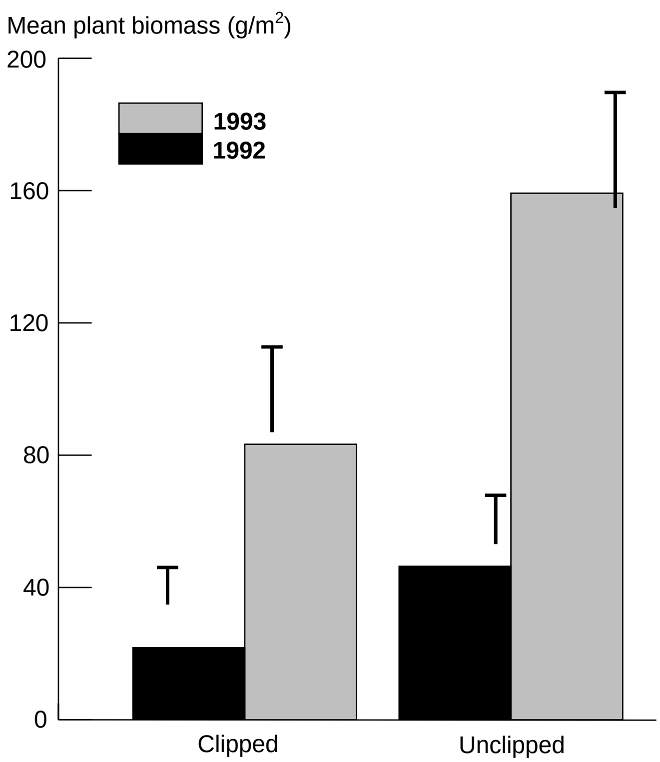

Figure V.6–2—Mean (N = 6 and 9, in 1992 and 1993, respectively) total dry weight of aboveground plant material in clipped and unclipped cages. Error bars indicate 1 standard error of mean. Plants consisted mainly of tumblemustard, cheatgrass, and Sandberg's bluegrass *(Poa sandbergii).*

Abundant precipitation generated much greater plant production in 1993 than the year before (fig. V.6–2). No differences in adult grasshopper survival (measured as total grasshopper-days) occurred between cages of clipped and unclipped plant biomass in either year (fig. V.6–3). However, dramatic differences in fecundity (reproductive capability—measured as eggs per female-day) occurred between the 2 years and between clipped and unclipped cages in 1993 (fig. V.6–4).

These field results suggest that fecundity of *M. sanguinipes* is strongly affected by host plant quality and/or quantity, although adult survival is not. Perhaps maintenance requirements for survival in adults of this species are quite low and can be met by low-quality food, such as dead plant litter. Egg production appears to be much more sensitive to diet.

As the previously cited chapter points out, other factors, besides forage availability, may also play a role in interactions between grazing and grasshoppers. Reduced plant height, increased bare ground, higher temperatures, and lower relative humidity are characteristic of grazed habitats. The behavioral responses of certain grasshopper species to these variables may affect population responses to grazed habitats. For instance, grasshoppers that take refuge in vegetation, such as many slantfaced grasshoppers, may actively seek habitats that provide a greater abundance of refuges, such as ungrazed habitats. Grasshoppers that escape predators by blending in with bare ground, such as many bandwinged species, may be indifferent to grazing-induced habitat changes. These sorts of habitat preferences could explain differing responses to grazing among species.

Concluding Statements

The effects of grazing on rangeland grasshoppers are dependent on so many factors (such as weather and plant community) that generalizations are difficult. Plant responses to grazing depend on the intensity and timing of grazing and the weather. For instance, younger plant tissue is generally more digestible and has higher protein levels than older tissue. In situations where plants can regrow following defoliation, the regrowth may provide higher quality forage for grasshoppers. In dry seasons or climates that do not allow for regrowth, defoliation results in less food, and probably food of lower quality, for grasshoppers. Similarly, the microclimate associated with grazed habitats (warmer and drier) may be beneficial to many grasshopper species during cool, wet spring weather but may be detrimental during summer droughts.

In summary, our observations suggest that livestock grazing often causes a short-term reduction in habitat quality for *M. sanguinipes* in southern Idaho. These observations suggest that grazing could be considered as a management tool for regulating grasshopper populations. However, we are skeptical of the practicality of using livestock grazing as a grasshopper management tool in southern Idaho. Rangeland productivity and the consequent carrying capacity for grasshoppers vary greatly from year to year within the Intermountain region. Livestock numbers are not flexible enough to permit land managers to respond to extreme fluctuations in carrying capacity of rangeland and grasshopper populations. During years of above-normal precipitation and high biomass productivity, grasshopper populations can increase tremendously. Grazing levels would have to be doubled or tripled to inhibit grasshopper reproduction appreciably.

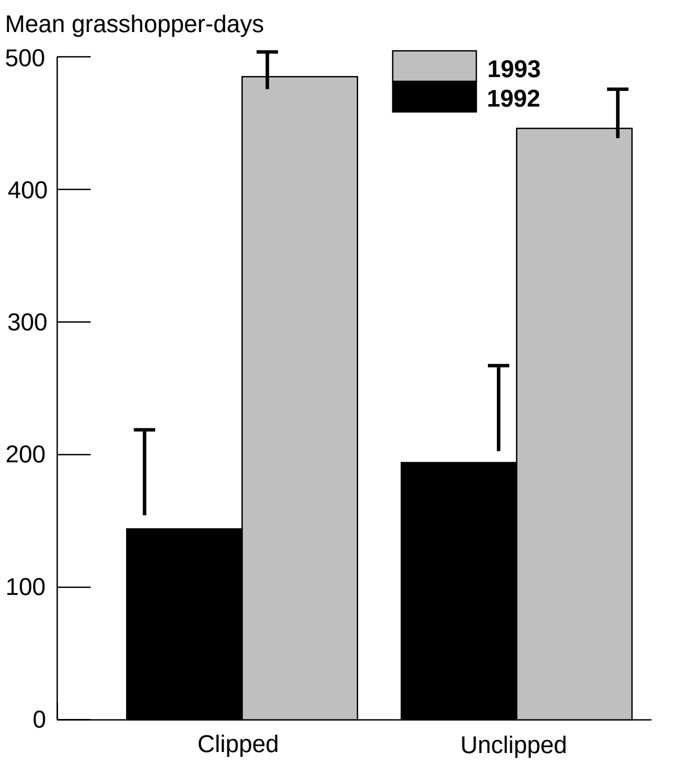

Figure V.6–3—Mean (N = 6 and 9, in 1992 and 1993, respectively) survival of adult grasshoppers *(Melanoplus sanguinipes)* within 1-m^2 cages. Error bars indicate 1 standard error of mean.

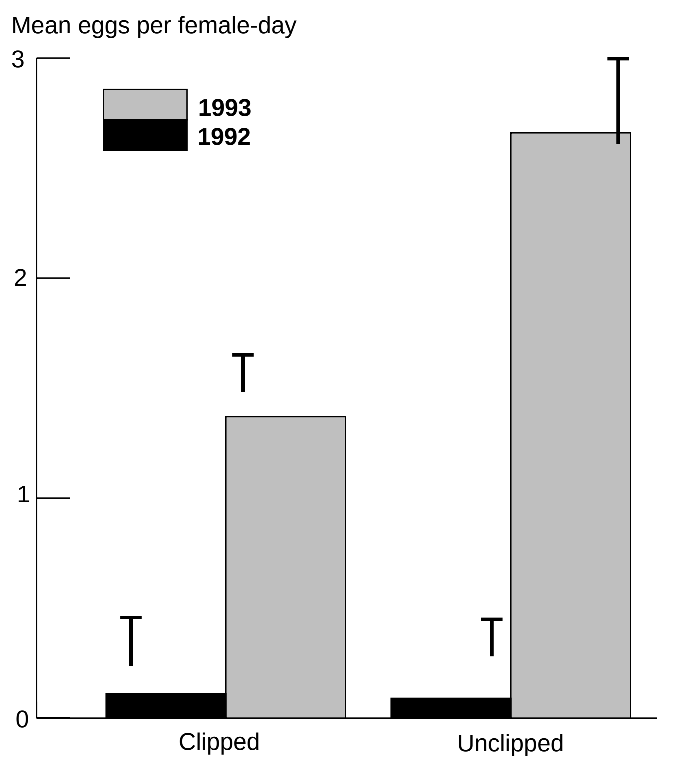

Figure V.6–4—Mean (N = 6 and 9, in 1992 and 1993, respectively) fecundity of female *Melanoplus sanquinipes* within 1-m^2 cages. Error bars indicate 1 standard error of mean.

Assuming that managers could increase livestock grazing to a point where it would reduce grasshopper populations, such levels of grazing could produce negative long-term effects. Chronic, heavy grazing could lead to long-term changes in vegetation toward more of the weedy annuals (fig. V.6–5) that promote high densities of pest grasshopper species (see V.3).

We expect grazing to have the greatest effect on grasshopper populations during drought episodes, when grasshopper populations are already low (see V.2). Under such conditions, grazing potentially could reduce already low grasshopper densities to the point of affecting creatures, such as nesting birds, that depend on grasshoppers for food. (For more information, see chapter I.9, "Birds and Wildlife as Grasshopper Predators.")

The sustainable level of livestock grazing on public rangelands is an issue that is receiving increased scrutiny. Managers need information regarding ecosystem responses to grazing to manage rangeland resources properly. Presently, knowledge about grazing effects on grasshoppers is fragmentary and incomplete. These issues involve economics, politics, sociology, ecology, and environmental ethics. The full integration and balancing of these considerations leave fertile ground for more holistic studies in the future.

Figure V.6–5—Grazing can produce negative effects on rangeland by removing understory grasses and creating an opportunity for weedy annuals.