Wildlife

POPULATION DYNAMICS AND HABITAT RELATIONSHIPS OF MULE DEER AND PRONGHORN

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THE STORY IN BRIEF: The mission of the Corona Range and Livestock Research Center (CRLRC) Big Game Program is to produce and maintain viable mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*) populations that economically contribute toward the support of the CRLRC. Mule deer and pronghorn are managed in a manner consistent with providing quality research, teaching, and demonstration opportunities for the faculty, staff and students of New Mexico State University. The results are used in Extension Programs designed to aid New Mexico citizens in managing their properties for multiple uses.

Declines in productivity of mule deer and pronghorn populations in New Mexico and throughout the West are usually related to suboptimal foraging habitats (Bender et al. 2007*a*,*b*; Lomas and Bender 2007). Further, wild and domestic herbivores are comanaged on both public and private lands, both can strongly affect the habitat of the other, and rangeland habitats are also strongly impacted by precipitation in the Southwest. Because habitat management, livestock grazing, and precipitation affect plant community composition, structure, and nutrient availability, each can influence habitat quality for wild ungulates and thus influence individual condition, habitat use, distribution, and performance of mule deer and pronghorn. Understanding these relationships is necessary to optimize returns from multiple-use public and private rangelands.

THE PROBLEM: Effects of most habitat management actions on individual and population performance of mule deer and pronghorn are poorly understood. Body (nutritional) condition of both wild and domestic ungulates strongly affects production and survival of young, survival of adults, susceptibility to predation, and growth of individuals (including antlers). In turn, condition is primarily a result of nutrition as mediated by security (disturbance) effects. Because individual performance is fundamental to population performance, measures of individual condition provide the most sensitive and least biased assessment of responses to habitat changes, and thus can identify any real effects of management. Studies of mule deer in northcentral New Mexico and the San Andres Mountains have shown that accrual of body reserves is related to a limited number of attributes of the habitat available to deer, and thus provides a powerful tool to identify critical habitats and effective management strategies (Bender et al. 2007*a*,*b*; Lomas and Bender 2007, Hoenes 2008). Similar relations likely exist for pronghorn, although our work at CRLRC will be the first project to ever assess these

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effects directly. Declines in mule deer and pronghorn population on CRLRC and throughout many areas of New Mexico highlight the need to identify causative factors and develop management programs to reverse declines to maintain or enhance recreation and revenues associated with wild ungulates. The role of CRLRC is to demonstrate proper and profitable management of all rangeland resources for both private and public managers; our program will fundamentally address the wild ungulate aspect of that equation in response to the varied livestock and habitat manipulations being conducted by all investigators at CRLRC.

OBJECTIVES:

1. Determine effects of current land management (i.e., pinyon-juniper control, deciduous shrub rehabilitation, etc) practices on condition, productivity, and distribution of wild ungulates.

2. Determine effects of environmental variables (precipitation, landscape phenology, plant community composition, etc.) on condition, productivity, and distribution of wild ungulates.

3. Determine effects of fine (hourly, daily) and coarse (seasonal, annual) scale livestock use patterns on distribution of wild ungulates at both fine and coarse temporal scales.

4. Evaluate current and alternative population management programs for wild ungulates to assess affects on population performance and economic returns.

5. Determine productivity, survival, and cause-specific mortality of wild ungulates and how these are affected by individual condition and animal distribution.

6. Determine population composition and population size of wild ungulates and relate these to individual animal performance.

7. Develop effective habitat and livestock management schemes for maximizing individual deer and pronghorn performance and consequently population production.

8. Continue administering the fee-hunting program and provide extension programs to livestock producers and natural resource management agencies.

EXPECTED OUTCOMES:

Develop habitat management guidelines for mule deer and pronghorn in New Mexico.

Develop predictive models of deer and pronghorn population productivity related to relevant environmental variables.

DURATION: December 2005 to June 2009

APPROACH:

1. Capture, radio-collar, and assess condition in late autumn (at the seasonal peak) and late winter (at the seasonal low) of male and female mule deer and pronghorn. Recapture individuals each subsequent autumn for condition (size, fat, muscle mass) assessments.

2. Model individual survival and productivity (pregnancy, lactation) as a function of condition and size indices, habitat use patterns, precipitation patterns, and spatial and temporal distribution of early phenology (green) forage across the CRLRC landscape.

Model annual and seasonal habitat use patterns as a function of distribution of livestock, precipitation, and spatial and temporal distribution of early phenology forage across CRLRC.

Assess population level productivity (fawn/adult female [F/D] or fawn/adult [F/A]) ratios and male/female ratios by helicopter composition counts in early-December and April annually.

Estimate population size of mule deer observed during April surveys by correcting for differential visibility of groups using group size and activity as correction factors. Determine minimum numbers of pronghorn during April surveys.

Use annual productivity, survival, population size, and population composition data to determine sustainable yield for permit allocation for the CRLRC fee hunt program.

PRELIMINARY RESULTS: The CRLRC deer population has declined from 539 in April 2005 to 191 by April 2008, an average decline of 29%/year. Declines in deer were driven by poor body condition of individuals resulting in low fawn recruitment (10–28 fawns/100 does) and low adult female annual survival rates (≤ 0.61). Malnutrition has been the primary cause of death of adult deer, comprising $> 66\%$ of observed mortalities.

Low precipitation from January–June (i.e., from conception to approximately parturition) resulted in low adult female survival (≤ 0.70) to June, whereas near normal precipitation resulted in high (0.96) survival. The effect of precipitation was related to composition of habitats on CRLRC and increasing energy needs of deer with advancing pregnancy during this time. CRLRC is dominated by perennial grasslands and pinyon-juniper woodlands, with little associated shrub cover. Because of this, deer are largely dependent on annual and perennial forbs, which in turn depend on properly timed precipitation for germination and growth. During 2 of the 4 years of our work, CRLRC received essentially no precipitation during January–May or June. Because deer depend on green feed in spring to meet the increased nutritional demands of late gestation as well as to recover body reserves lost over winter, low precipitation during this time results in extreme nutritional stress. On CRLRC, this stress is compounded by deer entering winter in poor condition ($\leq 6.2\%$ body fat for lactating does), and thus having few reserves entering spring. Low precipitation during January–June results in little forb growth, and consequently limited nutrition for deer to invest in fetal growth or recover reserves lost overwinter. Because of this, few viable fawns are born, and if dry conditions carry on

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through June, deer eventually exhaust their remaining reserves resulting in high adult mortality.

Similar research in northcentral New Mexico near Raton (Bender et al. 2007*a*,*b*; Lomas and Bender 2007) and in the San Andres Mountains (Hoenes 2008) found that mule deer showed similar responses to low precipitation during the January–June period in habitats lacking abundant browse stands. In areas where browse was relatively abundant, however, adult deer mortality did not increase nor did fawn recruitment decline to the lows seen in areas where mule deer depended almost exclusively on forb diets. Availability and use of browse appears to give a critical advantage during years of low precipitation through early summer.

Similar relationships between existing vegetation types and precipitation affect pronghorn, but because they have lower diet quality requirements than deer, effects have been less pronounced. Minimum numbers of pronghorn have decreased on CRLRC from 136 in April 2005 to 83 in April 2008, an average decline of 15%/year. Similar to deer, most mortality documented for pronghorn has been due to malnutrition, although entertoxemia and plant toxicities have also been implicated in pronghorn mortalities. Adult female survival has averaged 0.64 on CRLRC, much lower than average annual buck survival (0.83). Because of early parturition in pronghorn (May), low precipitation through May and June affects adult female pronghorn much more than males because of the high energy demands associated with late gestation and lactation.

Declines in deer and pronghorn numbers have had a strong economic impact on CRLRC. Revenues from deer and pronghorn hunting are used to subsidize research and management activities on CRLRC, and these revenues have dropped by 30% since 2004/5. This loss was driven by reductions in licenses offered from 30 to 20 for mule deer and 5 to 4 for pronghorn.

POTENTIAL APPLICATION: Preliminary data indicate the need to enhance browse availability to maintain a viable mule deer population on CRLRC. Current management strategies for pinyon-juniper communities, which emphasize conversion to perennial grassland, need to be altered to increase cover of palatable shrubs in these stands. Similarly, establishment of shrub stands in areas of CRLRC where browse and cover is lacking could increase both the quantity and quality of mule deer habitat. These actions can make the mule deer and pronghorn populations less susceptible to periodic drought, limiting the magnitude of adult mortality and consequently population declines associated with low precipitation.

EDUCATIONAL PLAN:

1. Develop Extension publication on Management of Mule Deer in New Mexico.

2. Actively work with public and private landowners in developing habitat and population management plans for large ungulates.

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