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Deer in the West

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Abstract: A historical review of mule deer and white-tailed deer population estimates is presented for both species. Problems involved in obtaining white-tailed deer population estimates for the western states and provinces are discussed with a recommendation for all agencies to separate the 2 species in their management programs. It is pointed out that when mule deer and white-tailed deer populations coexist; white-tailed deer generally are favored. The complex question of what is rangeland health relative to mule deer is explored through a review and synopsis of a recent paper on mule deer habitat in the Great Basin (Clements and Young 1997). It appears that a common factor in today's decline of mule deer as compared to historic populations in the Southwest is lowered fawn:doe ratios. The big question, yet unanswered is why are these fawn ratios lower? Blame is commonly placed on factors such as increased competition from elk, impacts of predators, loss of habitat, over harvest, or some combination of all. The role of "good food" and importance to deer nutritional well being is discussed. It is suggested that absence of standardized inventory and management methodologies complicate this problem. It is recommended that efforts be focused on measuring fawn survival rates and incorporating these data into improved population models. The opportunity to explore use of Adaptive Harvest Management on a regional (multi-state) basis is suggested as a way to stabilize the volatile and political arena of hunting season establishment. A call for greater unity and broader partnerships in deer management is highlighted.

INTRODUCTION

I have been asked to provide a general overview of population trends for the deer species in the West and discuss habitat and political challenges that affect deer management. I have been asked to assess what the future holds for managers of these populations and to provide anything else I feel important. I have a suspicion that the "anything else" category may dominate my presentation. But what the heck, I am giving a keynote address and I figure that should license me to free lance a bit! On the serious side, I will try to follow form of a keynote address and hit on topics or issues that I feel all of you are gathered at this meeting to discuss. I will not attempt to pursue any of them in too much depth as I am confident that others on the agenda will do an adequate job of that.

Key Issues

Let us begin with a quick overview of the key issues that are before us at this workshop. I will focus on issues labeled as "causes" of the apparent mule deer decline. At the top of the list I would put habitat quality and quantity. As I travel over the West, the impacts of man's activities are obvious everywhere. More often than not, these changes are occurring on deer ranges. This is especially true in the intermountain West. Today, questions of interspecies competition seem to be high on most everyone's list. This would include impacts of increasing elk populations on mule deer, and impacts of expanding white-tailed deer populations on mule deer.

We would be abrogating our responsibility if we did not add impacts of hunting to the list. The growing demand for

hunting of mature bucks is a common problem in almost every state. This demand has to be balanced with expectations of hunters to hunt every year, and with consequences to agency and local economies if hunter numbers are limited too severely. The low buck:doe ratios occurring in most states as a result of unlimited or very liberal hunter numbers are becoming an untenable problem in many states. We must find ways to better balance this equation.

From the beginning of time, any discussion on deer management would include a discussion on predation. That is true today. It appears that when populations are at their lowest, questions on impacts of predators become more intense. Whether this is cause and effect is not clearly understood. It does seem that effect of predators is greatest when populations are struggling or at lower levels. Effect of predators is also greater when habitat is in poor condition. One thing for sure, the changing social climate in today's world precludes any widespread predator control programs. The practice of single species management is over.

Another topic frequently mentioned in the decline of mule deer is disease. This is a difficult one. Our ability to assess presence or impact of diseases on free-ranging wildlife is very limited. Diseases do affect deer populations. In general, it seems that these impacts are limited to localized areas and under specialized environmental conditions. However, 1 emerging disease found in mule deer and elk in northern Colorado and southern Wyoming that is generating growing concern is chronic wasting disease (Spraker et al. 1997). This disease has similarities to scrapies and appears to be present in a larger segment of the deer and elk population than initially thought. This situation must be watched carefully.

The final issue on my radar screen is apathy. I believe part of the problem is that overall management of deer has been neglected over the past decade. In many states, managers, hunters, and agencies have become enamored with elk. Deer have been taken for granted. It is time that deer management and deer habitat conservation receives more attention.

Population Trends for Mule and White-tailed Deer

Details on population trends for the deer species in each of the western states and provinces will be presented elsewhere at this conference, consequently I will not attempt to detail population status for each state and province at this time. I will present historic range-wide population estimates for mule deer and white-tailed deer with comparisons to more recent estimates. I will not address black-tailed deer numbers separately.

I consulted several sources for my historic population estimates for the 2 species (Seton 1937, Rue 1978, Schmidt and Gilbert 1978, Wallmo 1981, Halls 1984). In addition, past reports from the western states deer workshops were reviewed and in some cases further interpretations of the estimates presented were made. Timely, range-wide estimates for deer species are not readily available.

Almost any biologist is familiar with estimates of populations of North American game animals in 1600 made by the famous naturalist Ernest Thompson Seton (Seton 1937). Seton made his projections by estimating the total land base that would have been habitat for a given species and combined this with an estimate of density per land unit and projected the totals. As one can imagine, considering the huge land bases available for deer to occupy in the 1600s, the estimates are large.

Seton's estimate for white-tailed deer populations in 1600 was 40 million. Almost

all experts have considered this estimate too high (Rue 1978, McCabe and McCabe 1984). A total of 30 million is frequently used. In 1800, Seton estimated 14 million white-tailed deer. For a more detailed presentation on historic white-tailed deer distribution and density, the reader is referred to the discussion on historical aspects of white-tailed deer presented by McCabe and McCabe (1984).

For mule deer, Seton estimated 10 million in North America at the arrival of Europeans (Rue 1978). The next key date when range-wide population estimates were generated was shortly after the turn of the century in 1908. This was a time of great natural resource concern following several decades of rapid depleting numbers of most all wild animals in North America. Interestingly, the estimate were similar and thought to be less than 500,000 white-tailed deer (McCabe and McCabe 1984) and 500,000 mule deer (Wallmo 1981).

The next range-wide estimates I could find for the 2 species were made for mule deer in 1950 at 2.3 million (Wallmo 1981), and for white-tailed deer in 1980, 14 million (McCabe and McCabe 1984). More recent estimates (early 1990s) total 35 million white-tailed deer (my extractions of several data sets) and approximately 3 million mule deer (Western States Summaries). Interestingly, total estimates for mule deer over their entire range have varied little for the past 25 years (Western States Summaries).

I totaled numbers for white-tailed deer for the 11 western states and provinces reporting white-tailed deer in the 1995 Western States Deer and Elk Workshop Report. In certain states or provinces, I had to interpret or calculate the number of white-tailed deer as these states or provinces did not separate white-tailed deer from mule deer in their data. The resulting total was approximately 5 million white-tailed deer in

the West. Of this total, Texas reported nearly 4 million.

Obviously, any of these estimates must be taken with a bit of caution, but they do illustrate the magnitudes of change and the large impacts (both good and bad) that man and man's activities have had on these populations and their habitats.

I urge representatives from the various states and provinces who still combine data for the 2 species to seriously consider separating the data bases. The need will only grow for more definitive estimates of these important species. For various reasons, there is a growing trend for states and provinces to not present population data in their biennial reports to the western deer workshop. This is regrettable as there is no other source for this information. I urge organizers of each workshop to request this information.

Mule Deer-White-Tailed Deer Interactions

For my discussion on deer in the West, I will highlight what we know about interactions of mule deer and white-tailed deer populations when they occupy the same habitats. Frequently where the 2 species occur together, managers express concern that white-tailed deer are increasing at the expense of mule deer. Why is this? The reason most often advanced is that agricultural changes to the habitat favor white-tailed deer over mule deer. White-tailed deer seem to adapt well to agricultural crops. Geist (1991) theorized that mule deer need a more complex habitat, either broken by topography or downed logs etc. to favor their "stotting" strategy for predator avoidance. It has also been theorized by Geist (1991) that white-tailed deer are more competitive breeders when the 2 species are together, with white-tailed bucks breeding mule deer does. Geist further suggests that resulting hybrids, unable to "stot," are

inefficient at predator avoidance making them more susceptible to predation.

Geist also suggests that hunting practices in most states today that place heavy pressure on bucks results in a greater reduction of mule deer bucks than for the more nocturnal and secretive white-tailed bucks (Geist 1991). Geist further proposes that use of heavier cover for escape by white-tailed bucks is an advantage over the tendency for mule deer bucks to flee in more open terrain. Like so many other topics concerning deer, however, the generality that white-tailed deer fare better than mule deer when they are together apparently does not hold true everywhere. deVos (pers. commun. 1997) reported that in Arizona mule deer seem to be holding their own in these situations.

From my perspective, over the broad range of deer in the West it seems that distribution of white-tailed deer is increasing substantially. I attribute this change largely to alteration of native habitats to agriculture and agriculture-related activities. It may become necessary for managers to consider more intensive habitat and/or hunting management if this trend is undesirable.

Rangeland Health and Mule Deer

The apparent decline in mule deer numbers raises the question of the health of the habitat. What is rangeland health relative to mule deer? Is it shrub density, yield, and vigor? Is it status of the under story forbs and grasses? Is it age structure of the shrubs or extent of tree canopy? Is it a diverse mixture of various habitat types? These questions and others have been debated for decades.

One thing for certain, the relationship between "health" of the land and mule deer population performance is complex. Numerous studies and a myriad of exclosures across the range of mule deer

demonstrate that grazing herbivores have definite impacts on the vegetation complex. It is tempting to compare deer habitats today to those present at the time of the mountain man making the assumption that the "undisturbed" vegetation complexes of that time were optimum for deer. This may not be true.

In a recent viewpoint paper, (Clements and Young 1997) point out that in the Great Basin area of western Nevada and eastern California, journals of the mountain man during the period 1820-1840 indicate few mule deer. These areas during the 1950s supported thousands of mule deer. What happened in 100 years? It is likely that many unrelated, but contributing events shaped this response. While I may not agree with all of the points in the paper by Clements and Young, I do think it provides a good framework for discussion on the topic of mule deer habitat.

Clements and Young (1997) restructure key events in the Great Basin from the 1880s to recent times and paint a picture of the types of habitat changes that may have occurred to produce the mule deer responses recorded over time. The story begins when livestock were introduced into the western Great Basin in 1860s. Livestock numbers increased rapidly in the 1870s. Dominant perennial bunch grasses could not tolerate the intense grazing and were greatly reduced (Clements and Young 1997). As grasses decreased they were replaced by sagebrush seedlings. In addition, the winter of 1889-90 was severe and resulted in large losses to both livestock and wildlife. Furthermore, the years 1889-1896 were extremely wet in the Great Basin (Upchurch and Brown 1951). Finally, records demonstrate that apparently this combination of events led to the large stands of bitterbrush characteristic of the Great Basin to establish in the period 1890-1910 (Hormay 1943).

The increase in shrub cover caused

shepherds to set fires to reduce the shrubs (Clements and Young 1997). Small mammals cache bitterbrush seeds resulting in the existence of seed banks for bitterbrush. This is not the case for sagebrush and sagebrush plants were reduced. Lack of competition for soil moisture would have further favored establishment of large stands of bitterbrush. Reduced numbers of deer and livestock following the hard winter also contributed to this vegetation response. Clements and Young (1997) speculated that these large stands of bitterbrush came into their productive best during the 1950s, resulting in the large deer populations recorded at that time.

The point of this discussion is that a series of events occurred approximately 60 years before the response was noted in the deer population. This long time lag makes cause and effect predictions almost impossible. Long-term and small vegetative changes may be occurring annually, but our ability to detect or measure the change is limited. As discussed in Clements and Young (1997), Sneva (1972) working in the sagebrush steppe of Oregon reported that for every 1% cover in sagebrush canopy between 10 and 20% canopy, there was a 10% decrease in herbaceous yield.

Sneva further pointed out that if at 10% canopy cover of sagebrush the herbaceous yield was 100 units per m², an increase in sagebrush cover to 15% would decrease herbaceous yield to 50 units, and if canopy cover increased to 20%, herbaceous yield would approach zero. These changes would be dramatic for a grazing mule deer. Furthermore, a 5 or 10% change in sagebrush canopy would not be detectable by casual observation.

Because of the long time lag and the difficulty in measuring rangeland health relative to mule deer, it is not worthy of investing huge amounts of fiscal or human

resources into the problem. These resources could best be spent monitoring responses of the mule deer population(s) in question.

Mule Deer Recruitment--A Change Over Time?

As identified earlier, there are a number of factors commonly referenced as causes of the apparent mule deer decline. These include habitat quality, habitat quantity, inter-species competition, hunting, predation, diseases, and apathy. Of these, what appears to be the more important? To answer this question, it is first important to try to better understand what population response is resulting in the lower numbers of mule deer. Is it adult or fawn survival? Is it a lower conception rate? Is it early fawn survival? Based on discussions with earlier mule deer workers, and on the literature, I propose that a key difference in mule deer parameters today, as compared to times when populations were expanding, is a lower measured fawn:doe ratio in early winter.

Robinette (1976), summarizing several study areas and many years of observation in Utah and Nevada during the 1930s, 40s and 50s, presented fawn:100 doe ratios that approached or exceeded 100. Average fawn doe ratios of >75 fawns per 100 does were common. Interestingly, Robinette (1976) reported that several herds he studied had fall composition counts with 100 fawns per 100 does, even when herds were approaching or at peak numbers. These peak numbers were the large mule deer populations in the Great Basin that are so commonly referred to today as "the good old days." These populations were huge.

Robinette conducted his Oak Creek, Utah, study from the late 1940s into the 1950s. His measured fawn:doe ratios averaged about 68 fawns:100 does which was about 1/3 less than ratios measured in the late 1930s and early 1940s. Robinette

(1976) observed that "the lower fawn crops prevailed despite a substantial reduction in deer numbers, cattle use, and even coyote numbers." Robinette further stated "*the decline continued despite the introduction of "1080" in 1947 which drastically reduced coyote numbers. The decline was almost certainly associated with an overstocked summer range.*"

Robinette's analyses continued with comparisons of vegetation enclosures that were established in the early 1950s. He remarked, "*failure of the preferred deer forbs to recover was evident from observations within a set of enclosures established in 1952.*" He concluded with the remark that "*observations at Oak Creek make it quite evident that merely reducing a herd is no assurance that damaged range will recover.*"

I conclude several things from these studies and observations. First, they demonstrate that in times of expanding deer populations, observed fawn:doe ratios are high, sometimes exceeding 100 fawns:per 100 does. Secondly, at times of decreasing populations, fawn:doe ratios are considerably less. Thirdly, Robinette associates this continued decline with condition of the summer range. I interpret this to be a nutritional-reproductive link. These observations do not tell us if the decrease in fawn ratios is a result of poor fawn production or poor fawn survival. Based on reproductive performance for mule deer reported in many studies across the West (Connolly 1981), it is probable that conception or fawn production *in utero* remained high. If this were the case, then loss of fawns primarily occurs from birth to the fall measurement time.

Evidence that this reduced fawn recruitment ratio is operating today is manifested in many western deer herds. As an example, in Wyoming over the time frame of the early 1970s to 1995, 2 mule

deer herds have shown decreases from more than 90 fawns:100 does to ratios of less than 60 fawns:100 does (Bohne 1997)

Conversations with, and reports from, many state mule deer biologists further document this trend. Cause of this loss is not clear.

I suggest, however, that efforts to monitor mule deer populations recognize this characteristic and focus on measurements that would elucidate fawn survival rates from birth through the first 6 months of life. It would be important to learn if the reduction in fawns is coming before birth, at birth, or shortly after birth.

Speculated Causes of the Decline

The most common listed causes of the apparent mule deer decline seems to be the following: competition from elk, predation, loss of habitat, over harvest, or some combination of the above. It is probable that no 1 cause is responsible across the range of mule deer. As discussed in the previous section, information as to the timing of fawn losses would shed more light on the ultimate cause for the problem. It is my professional judgement that the overall combination of listed causes are involved and all exacerbated by a continuing loss of habitat quality and quantity. A good portion of the loss of habitat (both quality and quantity) is resulting from vegetation succession. This is especially true with increases in pinyon-juniper (*Pinus edulis-Juniperus* spp.) forests across the Southwest. Natural plant succession is not generally conducive to deer habitat.

If we are to accept the idea that lowered fawn recruitment is the main problem, it follows that habitat quality (either summer or winter or both) is a major factor. Habitat quality could manifest its impact in several ways. If summer ranges are inadequate, mule deer would be unable to obtain sufficient nutrition to withstand upcoming

winter. Fawn nutrition as provided by the does' milk could be an issue. Poor fawn nutrition would lead to poor growth and result in fawns being small heading into winter. If habitat quality is poor in summer, this could also lead to lower reproductive rates of the doe. It is known that all mammalian females must reach some level of body fat before they are able to ovulate and conceive. Obtaining this level of body fat is especially a problem for yearling female deer that are also still growing.

Inadequate winter ranges could contribute to poor fawn recruitment as fawns would find inadequate forage to get them through the winter (Bartmann et al. 1992). Competition for "good food" (Hobbs and Swift 1989) between fawns and does may be a problem with inadequate winter ranges. Deer with a smaller rumen require higher quality food than do elk. Elk can feed on much lower quality forage and prosper. Obviously, poor winter ranges with small amounts of "good food" could result in lower nutrition of does. Growth and development of fawns suffer and this could result in lower fawn survival. Even though this relationship is unclear, observations by Robinette (1976), speculation on rangeland health by Clements and Young (1997), and hypotheses by many other workers over many different study areas and time periods suggest that the nutritional link between mule deer habitat and mule deer population performance is real.

Habitat quality as reflected by vegetative cover and structure, is an issue for predator avoidance (Geist 1991). Poor nutrition could render deer more susceptible to predators as well. More work needs to be done on interaction of habitat quality and predator avoidance for deer. The listed factor of elk competition would contribute to a decrease in overall habitat quality for mule deer.

What Should We Measure?

Given this background, what measurements should deer managers focus on to improve knowledge bases? The complexity of measuring vegetation and the long-term interactions of habitat with population performance suggest that measurements of population performance are the most promising.

Rising costs of inventory mandates that only the most efficient and most applicable measures be taken. Modeling processes have identified the "most sensitive parameters." These are measures that contribute most significantly to outcomes of the model. A characteristic of these parameters is that they tend to vary most over time. In other words they have a wide range of values from year-to-year. With mule deer, it appears that yearly fawn survival is 1 parameter that fits this description best (White and Bartmann 1998). Consequently, fawn survival should be the focus of monitoring efforts.

Radio telemetry has greatly facilitated this inventory, albeit it is expensive. It is necessary to mark adequate numbers of animals before data obtained are statistically reliable. In addition to cost of collars and applying them, there is the additional cost of monitoring animals on a frequent basis. However, data obtained are most useful to constructing useable population models. It is suggested that 1 approach may be the selection of "key" population units representing varying vegetative and climactic conditions. These "key" areas can then be used as indices to other unmeasured populations for modeling purposes.

It will also be necessary to have basic population structure information. It is probable that a combination of the fawn survival data and population composition measures would be most efficient (White and Bartmann 1997). Sampling studies to elucidate the best combination of inventory

efforts should be done. The goal of this work should be development of the most dependable and defensible population models to guide management. These data, gathered over a series of years with varying weather components, would significantly improve management models.

The increasing political arena affecting establishment of deer hunting seasons results in an unstable harvest future. These political decisions continue to erode application of the best biology and science into the process. Another result is a wide "hodge podge" of deer hunting seasons among the various states that are constantly varying with little opportunity to measure effects of the established seasons. This uncertainty across states necessitates that we take a more innovative approach to the process of setting hunting and harvest methodologies. This same problem was faced in waterfowl management in recent years (Williams and Johnson 1995). The approach taken was to apply concepts of adaptive management (Walters 1986). In waterfowl circles the term is adaptive harvest management.

I propose that adaptive harvest management concepts would work for deer management as well. First there would need to be a plan initiated that organized a regional (multiple state approach) that established agreed upon inventory approaches for census, herd composition, fawn survival, and harvests. Standardized data analyses procedures would also be implemented. To fund this effort I suggest administrative funding from Federal Aid. I also suggest that this program be headquartered and supervised from 1 location in the West. A cooperative fish and wildlife research unit might be the most logical place for coordination of this initiative. This centralized unit would be most important to the rigorous treatment of the data, especially with relation to

development of alternate models that best use the data. It would be important to recognize that many political, cultural, and environmental differences exist in the individual states and that these differences must be considered as this process was implemented.

Adaptive harvest management calls for development of goals for harvest management activities. Goals could be defined as desired buck:doe ratios, fawn:doe ratios, or as population density levels. The process also calls for selection of a limited number of regulation alternatives. The process would also necessitate identification and selection of alternative models that best explained deer population dynamics. For instance, model options of additive or compensatory mortality responses to hunting (Bartmann et al. 1992) could be selected. Using these goals and models, a set of regulation options would be chosen and evaluated.

Each year, or group of years, an optimal regulation package would be implemented that seemed to best fit the environmental and habitat conditions. After the regulatory decision was made, each alternative population model would be used to predict population size and attributes for the following year(s). Once monitoring data become available, models that more accurately predict observed population size or attributes gain credibility, while models that are poor predictors lose credibility. These new assessments of model credibility are used to start another iteration of the process.

Other Management Recommendations

Some states continue to combine data on white-tailed deer and mule deer. Efforts should be made to separate these databases. Issues and management of the 2 species are sufficiently different to warrant this effort. This is especially important for population

and harvest inventories.

Deer biologists should strive to standardize inventory procedures. This is especially important in model development. Similarly designed studies across several states would be valuable in increasing applicability of results.

It is also important that deer biologists and managers recognize that days of single species management are over. This will necessitate different approaches to plans for harvest and habitat management. Management frameworks encompassing ideas of landscape ecology and ecosystem management are in place and must be considered when single species outputs are desired.

Finally, apathy towards deer and deer management should be overcome with fresh and enthusiastic approaches to these species. They have been taken for granted for too long. It is the era of partnerships. Many of the problems cannot be solved by 1 agency or state alone. It will take everyone working together to make a difference in deer management as we near the new millennium.

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