THE ROLE OF GENETICS IN DEER MANAGEMENT

PART III

A PRACTICAL LOOK AT HOW OUR MANAGEMENT ACTIONS AFFECT THE GENE POOL

BY JIM HEFFELFINGER

A lot of things are blamed on "poor genetics." Everyone seems to be interested in what they can do to "manage" the gene pool. Either they already have an old age structure and awesome habitat, or dealing with those things is just not as sexy.

A deer manager wants to improve the herd every way possible—the quicker the better. In many cases managers have, in fact, conducted extensive habitat improvements and established a conservative harvest to accomplish an old age structure. Now they want to work on the third component of the antler quality equation. This third part of the equation has been elusive and confusing with advice from the experts often contradictory.

More recent deer research has taken the old classic studies to new and exciting levels. The early studies laid the groundwork for what we know about basic deer genetics by studying deer herds in captivity so that researchers could control other factors such as nutrition, age and who was breeding whom.

Researchers are starting to take what was learned in captivity and test it in free-ranging populations. This change in scale brings with it a whole host of complications. Stuart Stedman warned about applying captive information to very large wild populations when he published a paper on the "Corral to County Continuum." Stedman said what you could do in a corral (pen) may not be reproducible at the county (or ranch) level.

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To manipulate a gene pool for something like antler quality you have to show that antler size is heritable, or passed on through the generations; secondly, you must be able to predict if an animal has "good" genes or "bad" genes before he does much breeding; and lastly, you have to be able to exert a selective pressure on the entire deer herd intensive enough to actually shift the proportion of good genes and bad genes in the population.

In the last issue (Part 2), I discussed heritability, predictability and some things that made selection difficult in free-ranging populations. All these are interrelated concepts that are central to the discussion of how successful different management strategies might be in shifting the gene pool to a higher proportion of bucks with large antlers. For the purposes of this discussion, I will address only the potential genetic changes and not other related social, financial and biological issues related to these management practices.

Anytime a hunter selects a deer for harvest in anything but a random way, that decision has the potential to affect the gene pool in a positive or negative way. By culling deer with undesirable traits from the herd we are attempting to improve the overall genetics of the population.

By the same token, does removing the biggest bucks from the herd cause a long-term decline in the genetic quality of the deer herd? This has been the battle cry of many individuals and organizations that would like to end hunting. "Evolution in reverse" they call it.

TROPHY MANAGEMENT

Trophy management is usually done on large blocks of private land where the owner(s) or manager chooses to limit harvest on that land (usually more than state regulations) to maximize the harvest of trophy bucks. These populations usually have many bucks in the older age classes and many more up-and-comers growing their way to old age.

If the deer population were a football team, we'd say it has a lot of depth in the important positions. One mature quarterback with a lot of points gets taken out with a shot to the ribs and we have many others of equal quality that can step in and do the job. Removing trophy bucks in this situation does not provide the intensive and consistent selective pressures needed to affect the diverse and constantly changing gene pool of the population.

The recent research on deer populations is showing us that white-tailed deer are one of the most genetically diverse mammals studied thus far. Other studies are teaching us more about the genetic structure and breeding strategies of deer populations. These differences are due to a complex web of many environmental and some random factors.

Thinking strictly about antler quality, no one has isolated an "antler gene." We know antler characteristics are hereditary, but probably through several genes working in concert so we may be talking about trying to influence a suite of related genes and that adds a bit of complication to our efforts.

A trophy is in the eye of the beholder. One trophy hunter may be satisfied with a buck that another hunter has already passed up in her search for what she feels is a trophy. If one hunter's trophy is another's reject, it becomes very difficult to discuss the genetic effect of removing "trophy" deer. In fact, many trophy hunters are actually taking the oldest deer, not the most genetically superior.

Any deer population is made up of a mixture of small-, medium- and large-antlered deer of varying ages. Many analyses have shown that there is too much overlap between whitetail antler size and age class for a hunter to tell what is a 3-1/2- or a 6-1/2-year-old. Some exceptional 3-1/2-year-olds are indistinguishable from poor 6-1/2-year-olds.

In reality, trophy hunters might not take the largest bucks in each age class, but rather the largest buck they encounter within rifle range, during the season, during daylight hours, while they are in the field. In trophy management, the harvest of a low percentage of bucks won't noticeably affect the proportion of good quality antler genes in a population.

ANTLER-BASED HARVEST RESTRICTIONS

The second scenario where mature bucks are removed from the population disproportionately is through rules on what deer hunters can harvest. These usually take the form of certain antler criteria that a buck must possess before a hunter can harvest him. These criteria can be number of antler points, minimum spread, main beam length, etc. Antler-based restrictions are usually implemented when managers have a high number of hunters with access to the deer herd and they want to limit harvest to allow bucks to reach an older age.

In addition to antler point restrictions, other harvest restrictions based on antler spread were added to the mix. One hunting club had a simple rule for which bucks were eligible: "You shoot it, you mount it."

Although some hunters saw all these restrictions as a trophy management scheme, biologists tried to articulate that the purpose was really just to allow the age structure to mature somewhat. In most cases, depending on the criteria used, these restrictions really mostly allow yearlings to survive another year. In heavily hunted areas most bucks are removed as soon as they reach the minimum criteria.

Therein lies the concern over genetics in the minds of some. There is a variation everywhere in yearling antler size; some (usually large) proportion will be spikes and some will be branched. If you have heavy harvest and antler restrictions so that bucks must have forked antlers to be legal, all the best yearlings of each fawn crop are removed as potential future breeders. This is a much more intensive selection scenario than a conservative trophy hunting program.

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B.C. GLASSCOCK PHOTO

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In 1995, Mississippi initiated statewide regulations making only deer with four total antler points legal. After analyzing the first 10 years of harvest data on public lands, they felt that in some regions of the state average antler size was declining within the same age class. Although there was no experimental control to this analysis to tell for sure, other reasonable explanations did not explain this change.

This effect was only detected on heavily hunted Wildlife Management Areas and not on private lands where most hunters are willing to pass up a legal buck. I have always been skeptical this was a genetic effect, but no one has offered an alternative explanation.

Another thing that the Mississippi data illustrated was the importance of tailoring antler restrictions to harvest data from the area being managed. Antler size within age class varies due to nutritional and possibly genetic conditions. Because of this, antler-based harvest criteria in one area may only protect 50 percent of the yearling age class, yet in a less productive area of the state, all of the yearlings plus half of the 2-1/2-year-olds may be protected. How well the criteria fit the deer population will have a bearing on how intensive (or not) the genetic selection.

In 2002, the Texas Parks and Wildlife Department (TPWD) established antler-based harvest restrictions in six counties in an effort to protect young bucks and improve hunter satisfaction. Legal bucks were defined as those having six points or more, or 13 inches inside spread, or having a spike antler on at least one side.

The six-point requirement has since been dropped, but these regulations intended to protect young bucks with branched antlers, yet allow for the harvest of spikes and three-point deer. From a genetic standpoint, the idea is to try to balance any differential removal of the best young deer by allowing the harvest of spikes on the lower end. These restrictions have been popular and expanded to about 60 counties with more possible next year.

While on solid theoretical grounds, concerns about negatively affecting the gene pool of a deer population are commonly overstated. Only in the most intensive selection scenarios could we measurably affect the age-specific antler size.

All of the many (and powerful) obstacles to selection discussed in Part 2 help cushion any negative effect harvest strategies may have on the population. To evaluate the negative genetic effects of antler-based harvest restrictions, we have to know how intensive the selection is against deer with good genetic potential, not just what kind of deer are legally harvestable.

CULLING

Hunters are not just concerned with negatively affecting the antler potential of a deer population; there is much more interest in improving it. Talk of culling inferior genetics from the herd is not a new concept, but was introduced to most people with the publication of "Producing Quality Whitetails" in 1975. A recent survey of 187 South Texas ranches by Caesar Kleberg Wildlife Research Institute (CKWRI) and TPWD revealed that 82 percent of them culled bucks.

Some advocate culling deer out of the older age classes, but this is too difficult to be practical because of the overlap in antler size between "good" young bucks and "poor" mature deer (unless you are capturing and ageing the deer).

You may want to, on occasion, remove a mature deer that is an obvious underachiever from the gene pool. However, without knowing the actual age of all bucks you could not cull accurately enough in the mature age classes to make a genetic difference at the population level.

The whole concept of shooting adult "management bucks" is, at best, an inefficient attempt to alter the gene pool. Of those responding to the CKWRI and TPWD ranch survey, 36 percent said they were culling bucks older than yearlings.

The most familiar form of culling is focused on the yearling age class. Barrels of ink have been typeset about the practice of removing spikes from the population and so the summary in Part 1 of this series will suffice as

background for more recent work that has been continued. There is some confusion about whether spikes are inferior, but the preponderance of evidence from both captive and free-ranging herds indicates spikes do not go on to produce antlers as large as their forked-antlered cousins.

A long-term study called the South Texas Buck Capture Project lead by David Hewitt, Mickey Hellickson and Fred Bryant collected data from thousands of wild-captured bucks to evaluate the spike vs. forked yearling antler development later in life. Thus far they have pretty compelling information that wild, free-ranging bucks that were spikes as yearlings do not, on average, grow as large as those that were forks.

A new, and well-designed, study is underway by CKWRI and TPWD to capture bucks on three study areas, measure them and remove those meeting certain culling criteria. After 10 years they will evaluate whether this intensive culling, by age class, has made any measurable improvement in antler size due to a genetic shift.

Shooting spikes in poor nutritional years (when a higher percent of yearlings are spikes) or with late born fawns is not selecting against poor genetics of those deer. This leads many to recommend against shooting spikes in dry or poor nutritional years.

As mentioned in the last issue, TPWD biologists have suggested that during dry years culling spikes might remove most of your yearling age class, but it will certainly result in a very intensive selection, leaving only the very best antlered yearlings to reproduce.

If this was done several times in a 10-year period it might be enough to realistically shift the gene pool in favor of breeders with better genetic potential for antler quality. This is a drastic step and not likely to be palatable to most managers. It would require a solid knowledge of herd-specific antler development by age class to make the genetic selection meaningful (it wouldn't work in areas or years where all yearlings are spikes).

Also, it could not be done too frequently or for an extended period of time or managers would find themselves with a decided lack of bucks in the population. These limitations make it hard to envision a wide application of culling to improve the average quality of antlers in the deer herd.

TRANSLOCATIONS

Wildlife translocation is a common technique for restoring populations to suitable habitat. Whenever you take a small group of animals and move them to a new area you bring only a subset of the genetic material of the original source population. If the new animals, by chance, bring with them a disproportionate amount of desirable characteristics, these traits will be common in the new population.

Wildlife translocation has been a very successful tool in repopulating historic and currently vacant habitat. More recently, this concept has been used by deer managers to "improve" their herd.

Biologically, there are several problems with this

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B.C. GLASSCOCK PHOTO

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approach. First, deer are usually brought into an area with existing native deer that are better adapted to the local habitat and the survival of the new arrivals is low. Secondly, there are biological differences in deer from different geographic areas that can have negative effects on the herd being "improved."

Captive studies have shown that deer from Michigan do not have some of the immunity to disease that the native Mississippi deer had and the newcomers died at a higher rate when exposed to disease. Also, the Michigan deer were genetically programmed with a different breeding time and this genetic difference carried forward through a couple of generations.

In Mexico, biologists discovered a case of dystocia where the fawn of a Texas whitetail and Coues whitetail mating was too big for the Coues' birth canal. These are only a few examples of the many unintended consequences that can happen when we start mixing very different gene pools.

Translocation research recently done by CKWRI showed that only about half the deer survived and stayed on the ranch where they were released. Bringing a few big bucks into a ranch is not going to change the entire gene pool. Because of the lower survival and the overwhelming number of native deer in the area, any genetic material from these translocated individuals would be diluted within a few years.

Depopulating a high-fenced ranch and restocking it with new animals is obviously a more intensive scenario. I think we can all agree that would change the gene pool! Like other human manipulations of the gene pool, the degree of change depends on how much the action affects a majority of breeders for the next generation of deer.

BREEDER PENS

Some deer management programs have gone as far as to select the best sires and does related to good bucks and produce a crop of fawns in captivity for eventual release in the wild. In terms of intensity, this certainly allows for intensive selection and we have already seen what can be done in captivity.

Whether the released deer can affect changes to the free-ranging population depends once again on what percent of the total herd they represent. Breeding pens releasing an annual crop of fawns onto a 1,000-acre facility is much different than the release of 20 fawns onto a 20,000-acre ranch.

Depending on the source of the breeders, some of the same concerns with disease and subspecies differences may apply here, as well. Past experience with releasing pen-raised fawns shows that they will suffer a higher mortality than wild-raised fawns.

As a CKWRI graduate student, Tom McCall released 13 pen-reared bucks in LaSalle County, Texas, and within one year only five survived, whereas all nine wild-raised fawns in the same study were still alive. These issues represent more barriers for those trying to use these methods to alter the gene pool.

CHANGING YOUR GENES

Biologists wanting to manage for trophy deer can manipulate deer populations and habitat to provide good nutrition and then establish a very light harvest of bucks to allow them to mature before being harvested. Manipulation to change the overall genetic quality of a free-ranging population is much more difficult.

In captivity, intense selective pressures can be brought to bear on a group of animals (as has been done for years with domestic animals), but the gene pool of a wild population is extremely diverse and constantly changing in response to an infinite number of environmental pressures.

Computer modeling has indicated changes to the gene pool are possible under some circumstances, but may happen so slowly they are not detectable for many human generations. The high genetic diversity in deer, along with all the other selective pressures, works to "reshuffle" the genetic card deck, inhibiting a unidirectional change in the overall antler quality of a deer herd.

If we are able to exert selection intensive enough to change gene frequencies in a wild population, we should be very cautious about other genetic changes that occur, such as those related to disease resistance, reproductive performance or survival savvy.

Harvest is not the only thing removing deer from the population, nor is potential antler size the only criteria for removal. If you want to increase the proportion of "good" genes in the herd, your selective removal has to be the overwhelming influence in who breeds next year. All management actions should be evaluated in this light.

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