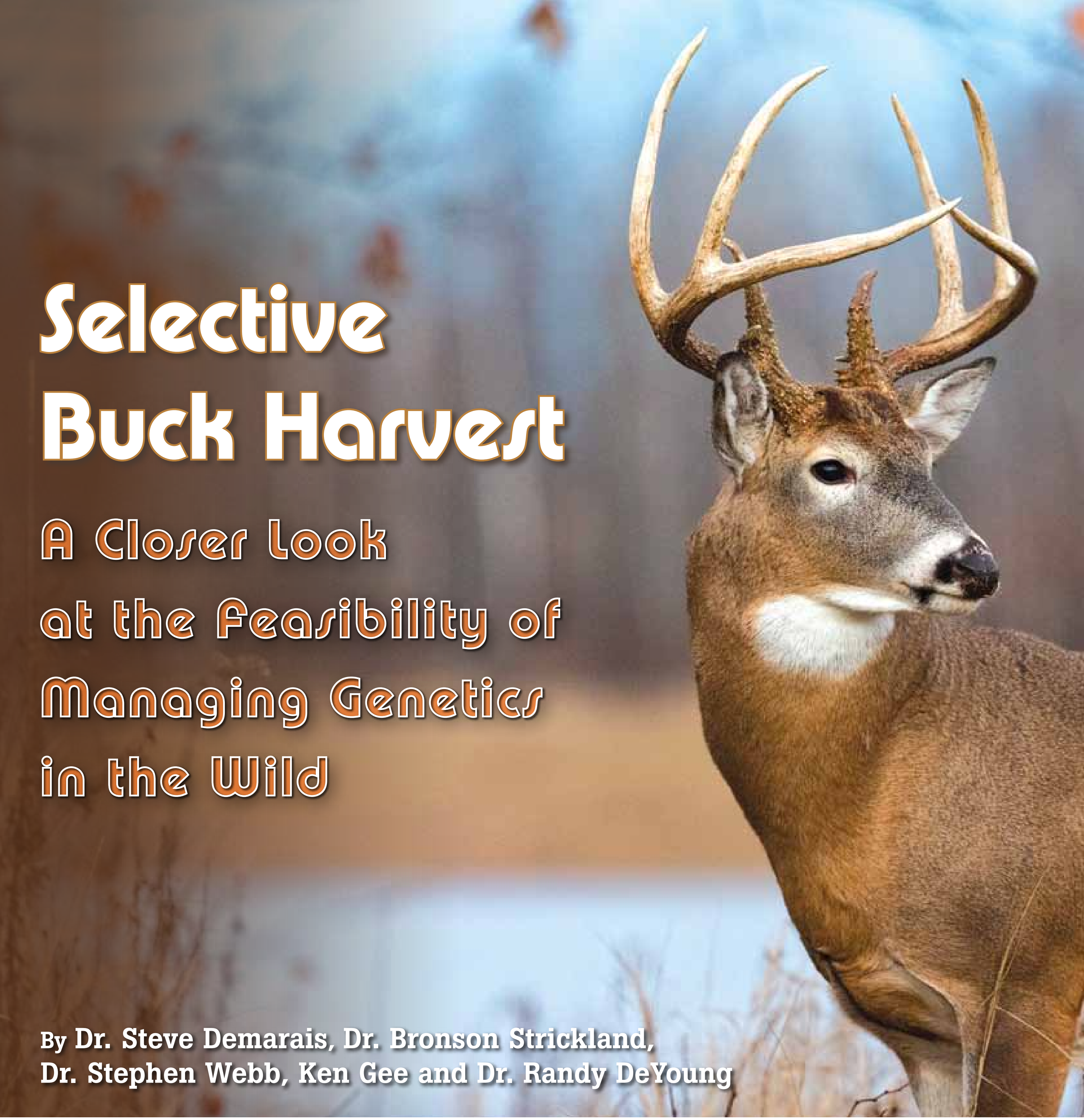

Selective Buck Harvest

A Closer Look at the Feasibility of Managing Genetics in the Wild

By Dr. Steve Demarais, Dr. Bronson Strickland, Dr. Stephen Webb, Ken Gee and Dr. Randy DeYoung

In the last issue of *Quality Whitetails*, in the first article in our selective buck harvest series, we took a close look at the difference between "standing crop" management and genetic management. Standing crop management involves improving the bucks that currently live on the land you hunt, while genetic management involves trying to improve future generations of bucks by manipulating genetics. It turns out that selective harvest gets a lot less confusing when we can put it into its correct context. What we didn't delve deep enough into in the last article, though, is why exactly genetic management is the less feasible option of the two, especially when it comes to wild populations. So, let's get to it!

Yes, selectively harvesting bucks in wild deer populations can positively influence antler size in the standing crop (the deer age classes or cohorts alive on your property). If you have improved survival of larger-antlered bucks, and a live buck will certainly breed more does and sire more offspring than a dead buck, then why can't you change the genetic composition

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of the population? Let's take a close look at some recent research that should make this understandable.

Mitch Lockwood and others biologists with Texas Parks & Wildlife Department conducted eight years of intense selection on antler size to determine if they could change the antler quality of deer in a controlled (non-wild) breeding environment. Buck fawns from 6 months to 18 months of age received a sub-optimal diet consisting of one half of the normal quantity of protein pellets, and about 6 percent crude protein. This level of crude protein content allows deer to survive and maintain themselves, but does not provide enough nutrition to express their full potential for antler growth; allowing them only one-half their normal intake rate insured they were nutritionally stressed. They figured that bucks that grew the biggest antlers in a nutritionally-stressed environment must have the best possible genetics for antler growth. Each year, the Texas researchers selected the yearlings that grew the largest antlers and used them to sire the next generation. They also removed some mothers that produced sons that grew small antlers and replaced the original does with doe offspring of the larger-antlered sires as they became available. In other words, they intensively selected both bucks and does that did the best job of expressing a genetic capability for larger antlers. After eight years of intensive selection, they recorded an increase of 3.2 total antler points and a 36-inch increase in gross Boone & Crockett score of yearling bucks. They provided strong evidence that intensive selection of buck and doe deer **in the controlled environment of a breeding pen** could change the genetic potential for antler development.

Although no actual data is available on genetic management in the wild, there is good news – we are able to simulate the process here at the Mississippi State University (MSU) Deer Lab using computer models. We simulated an intensive harvest program to determine how efficient selective harvest would be at altering genetic composition to increase antler size in wild populations. We made sure our model simulations were accurate by comparing our results with the Texas population of deer used for controlled breeding experiments. Now, we realize this is not exactly the same as measuring the effects of selective harvest on a wild deer population, but it is the closest alternative anyone has found to date. Here is what we learned.

Making The Models

The first thing we knew we needed to do was overcome the limitations of previous models and find a way to be more realistic to conditions encountered in the wild. So, we used a modeling approach that simulated real-world transmission of genes between generations. Also, the computer models allowed us to adjust parameters to simulate different scenarios. That's a definite plus!

We set up our first simulation to be comparable to conditions in the intensive selection study conducted by Texas Parks

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and Wildlife Department. Setting up our simulation to model an actual research population gave us a way to validate our computer modeling approach. This way, we would be able to compare our simulation results to actual results to make sure our model was accurately replicating real-life scenarios. In this simulation, we were able to apply selection criteria to both bucks and does, since breeding can be controlled in captive populations.

For our second simulation, we modeled response to selection under conditions that simulated free-ranging populations where factors such as deer population size, age structure, mating success, and heritability were varied. In these scenarios, we applied selection only to bucks since breeding is not controlled in the wild as it can be in captivity. The intensity of selection is an important part of our simulation; each year of the simulation we removed a number of antlered bucks equivalent to the number of buck fawns produced to replace them. Fawn survival was good in our simulations, which allowed us to apply heavy selection to our buck population. The model removed an average of 42 percent of the buck population every year based on antler size. In other words, if there were 100 bucks in the population, it removed the 42 bucks with the smallest antlers. And one last point to make – our computer model is much more effective than the typical group of hunters on a property; it evaluated antler size of every living buck and selectively removed only the smallest antlered bucks. Because our simulations offer a best-case scenario of selective harvesting of deer with the smallest antlers, obtaining changes in antler size in the real world comparable to, or greater than, our results will be highly unlikely.

Our Results

Our first round of simulations was a resounding success. Our captive simulation showed improvements in antler points and antler score that were very similar to the observed values of the actual captive population studied in Texas. This proved that our model accurately represents selection for genetic effects in white-tailed deer. So guess what that means for our free-ranging simulation? Since our captive simulation results were accurate, our free-ranging simulation results should accurately model the process of selection in free-ranging populations, too.

So, what did our simulated selection in free-ranging populations show? Well, contrary to findings from our captive simulations, selection for increased antler points in free-ranging populations did not result in significant improvements, even after 20 years of selection. This long effort amounted to selective removal of almost one-half of all bucks every year for seven generations of deer. For all of the effort, the number of antler points increased by less than 1 point for 3½-year-old and 7½-year-old bucks! We didn't model improvement rate for total antler score in the free-ranging simulations (for technical reasons) but it would likely improve at an equivalent rate as antler points. **We conclude that selective harvest for genetic management is very difficult, if not impossible, to achieve in the wild.**

Let's translate this rate of improvement to your property. What's the best-case scenario you could expect after 20 years of removing about half of your buck population every year? If your average 4½-year-old buck has 9 points and a gross Boone & Crockett score of 119, then after

20 years you could expect to have 4½-year old bucks averaging 9.6 points and 127 B&C. Do you think that's a worthwhile effort that's in the best interest of your recreational enjoyment of deer hunting?

Why Won't It Work?

Well, the lack of observed response in free-ranging deer populations is complicated by a number of factors. Some of these factors we can control and others we have no ability to influence.

Intensity of selection is another limiting factor in managing wild populations. Our MSU models removed about half of all bucks every year and made no harvest mistakes. The Texas penned study simulation removed an amazing 85 percent of their bucks from the population every year! **There is no way that a wild population of deer could ever be harvested with anywhere near these levels of effectiveness, nor would you want to!** A large percentage of younger bucks must survive to have a reasonable number of older bucks available for appreciation and ultimately for harvest.

The inability to apply selection to the doe segment of a wild population is another critical limiting factor. Obviously, females cannot be selected based on the expression of antler size.

What's the best-case scenario you could expect after 20 years of removing half of your buck population every year? Your average 4½-year-old buck has increased from 9 to 9.6 points and from 119 inches to 127.

Another major problem when it comes to changing the genetic composition of wild populations is the constant movement of deer among populations, or dispersal. The immigration of yearling bucks constantly introduces genetic diversity back into the managed population. This dilutes the affected gene pool, potentially negating any change you're trying to produce through careful selection. Oh, and not only will new bucks immigrate into your population, the bucks you're trying to select for will also emigrate out of it. As you can imagine, all this coming and going makes it very hard to have much control over the genetic makeup of a wild deer population.

Finally, heritability of antler characteristics in free-ranging populations is affected by environmental variance. For example, year-to-year variation in rainfall changes the expression of genetic potential for antler size, which affects your ability to decide which animals should be removed from your population. In other words, the changing environmental conditions that deer experience weaken our ability to effectively select for genetic potential in antler development. With captive populations, environmental factors are largely under control, allowing the actual genes for antler size to be more accurately targeted for selection. This controlled environment allows for more rapid response to selection, as seen in the Texas penned study and our simulation of penned breeding.

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Why Can't We Manage Genetics?

The MSU researchers concluded that manipulation of deer population genetics is not possible under any reasonable deer management scenarios. Here are some of the major reasons why:

- Nearly half of all living bucks in the computer model population had to be removed annually – and without any harvest mistakes – to achieve even a small amount of genetic change after 20 years. Most hunters cannot achieve this level of harvest intensity, nor would they want to!

- Hunters of free-ranging deer have no way of knowing which does possess greater genetic potential for antler size. This means half of the genetic equation cannot even be managed in free-ranging deer.

- The immigration of yearling bucks through dispersal constantly introduces genetic diversity back into a population, and the bucks you're trying to select for will also emigrate back out of it.

- Environmental factors disrupt your ability to detect genetic antler potential. For example, does that buck have low-scoring antlers because of genetics or because there was a drought this year and nutrition was below normal?

What Does It All Come Down To?

After 20 years of intensive selective harvest, with a yearly removal of about half of all bucks, we improved yearling antlers by only 7 percent. That's a lot of effort and time for very little gain. **We conclude that manipulation of population-level genetics is not possible under any reasonable deer management scenarios.** The simple fact of the matter is the response in free-ranging deer to a selective harvest program will be less than the response in controlled populations, and likely less than our "best-case" modeled free-ranging simulations. The best analogy is that a genetic management program is akin to pouring a few gallons of fresh water into the Gulf of Mexico – it may decrease the salinity level an infinitesimal amount, but certainly not in any way that you can observe or measure.

Here is the MSU Deer Lab's advice: When you talk about selective buck harvest, always qualify the context. For free-ranging properties you should forget about selective harvest for genetic management. It has too many uncontrollable variables, takes too long and has very limited effectiveness. However, selective harvest in free-ranging populations is a valid part of your toolbox that can be applied to control population numbers and improve average antler size among your current standing crop of deer – as we explained in the first article in this series.

So, don't waste your time and energy worrying about deer genetics when it just isn't going to happen. Focus on things you can control – manage population composition and habitat quality and get the most bang for your buck.

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About This Article

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