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The Bell Curve of Mature Buck Antler Scores: When You Manage a Buck Herd, You Manage a Bell Curve of Antler Scores

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Part II—Chapter B (of IV Parts): The Bell Curve as a Management Tool

Chapter A of Part II describes the two most useful applications of bell curve analysis: 1) the effects of bell curve shifts on the number of trophy bucks and 2) the effect of changes in deer density on the size of the bell curve. This Chapter B of Part II explores the impact of combining the two bell curve changes and explains how a manager can estimate the number of trophy bucks on his ranch or lease.

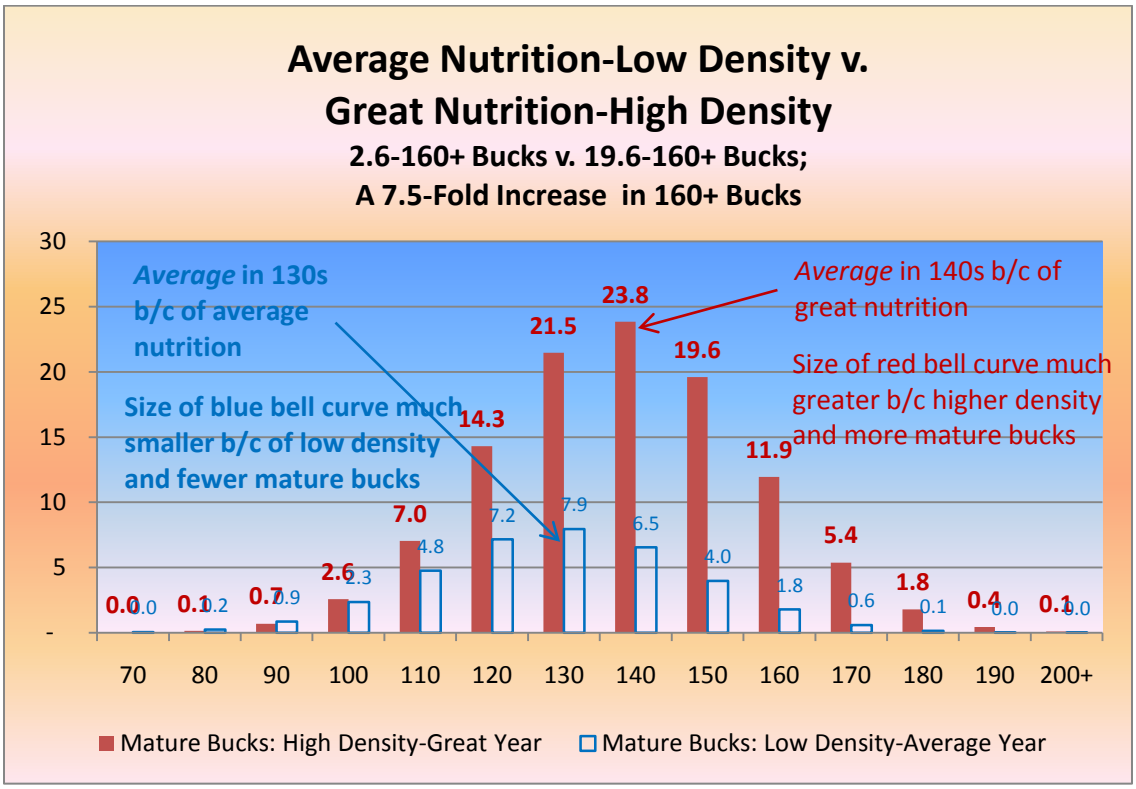
Combining Bell Curve Nutritional Shifts and Deer Density Changes

I have discussed the impact of nutritional shifts on the number of 160+ bucks and I have explained the impact on 160+ bucks of higher deer density. But what if you did both—i.e. you increased the nutritional plane AND you increased the number *buck fawns on the ground* (and therefore the eventual number of mature bucks)? Supplemental feeding allows a manager to do both.

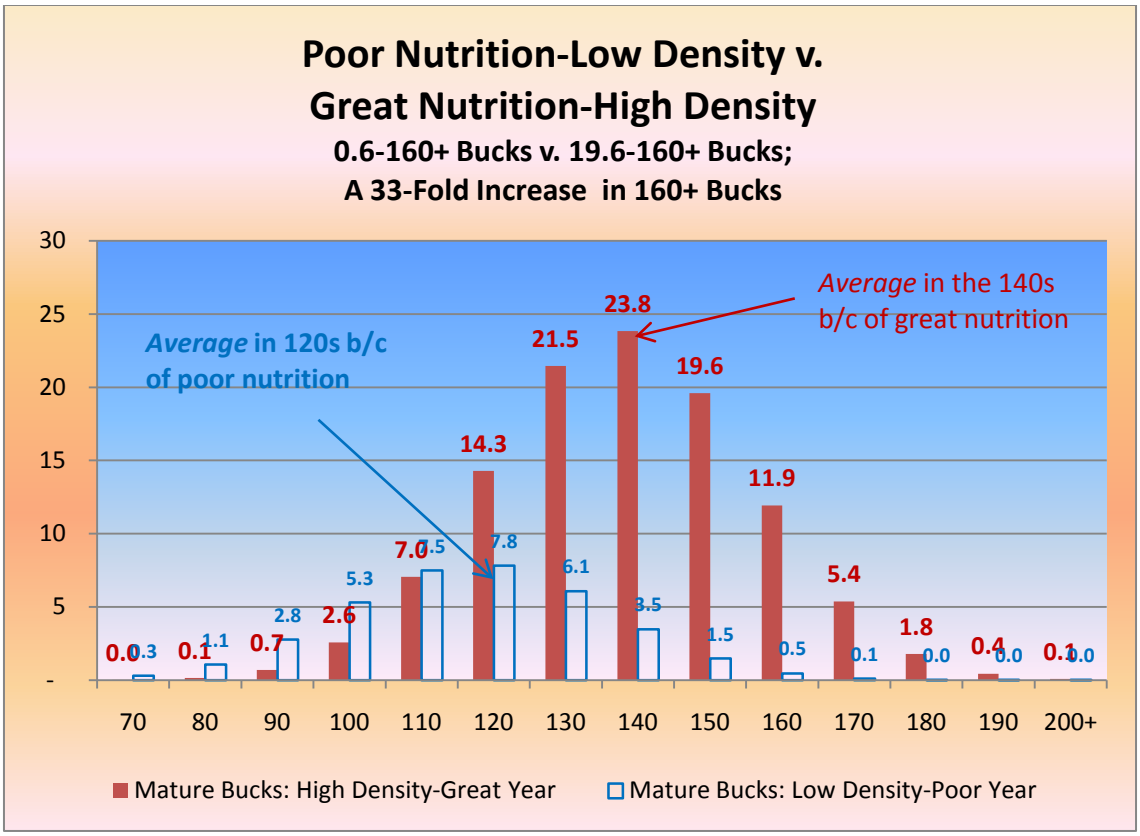
The math is cumulative and powerful: if you can increase the number of 160+ bucks 2.5-fold from average to great nutrition AND you triple the number of mature bucks by increasing density from 25 to 8.3 acres per adult deer, you will have **7.5-fold increase in the number of 160s** from Average Nutrition-Low Density to Great Nutrition-High Density (2.5 * 3 = 7.5). The following table presents these combined impacts in numerical form:

5,000 Acre Illustrative Ranch: Combining Nutritional Shifts and Deer Density Changes				
Acres per Adult Deer	# of 160+ Bucks in a Poor Nutritional Year	# of 160+ Bucks in an Average Nutritional Year	# of 160+ Bucks in a Great Nutritional Year	More 160+ Bucks with Higher Density ↓
25.0	0.6	2.6	6.5	
12.5	1.2	5.1	13.1	
8.3	1.8	7.1	19.6	
More 160+ Bucks with Improved Nutrition →				

If you look at this graph as you should—i.e. imagining what your 5,000 acre ranch or lease would look like with the number of 160+ bucks in that table—you will understand the impact of combining great nutrition with more mature bucks. But a bell curve of mature buck antler scores makes this numerical data visually clear. The following bell curve combines the Average Nutrition-Low Density bell curve with the Great Nutrition-High Density Bell Curve—a 7.5 fold increase in the number of 160+ bucks:



From Poor Nutrition-Low Density to Great Nutrition-High Density, the results are even more dramatic: a manager should achieve a 33-fold increase in 160+ bucks (11.1-fold increase from a poor to great year * a 3-fold increase from low to high density = 33-fold increase). The math is actually simple but a bell curve illustrates this dramatic increase:



These bell curves show that combining the huge impact of nutritional shifts to the right with the power of increased mature buck numbers should be primary objectives of a deer manager. A manager can achieve both with supplemental feed. Bell curve analysis makes these concepts clear.

<u>Where Do These Numbers Come From? (and how you can use a probability table to create a bell curve on your ranch and estimate the number of 160+ bucks)</u>

The bell curves and the distributions in Part II of this bell curve series come directly from the 11-year Faith Ranch random capture data set. The *standard deviation* (18), the poor year *average* (121), the average year *average* (133), and the great year *average* (143) all come from the Faith Ranch random capture data. I used the Normal Distribution formula in Excel to build a table of probabilities for each antler score from 70 to 300 and then grouped those probabilities into antler classes. The result is a table that shows the probabilities of each B&C class in poor, average, and great years:

Probablity Distribuiton of Buck Classes			
Standard Deviation = 18			
Average	121	133	143
B&C Class	Poor	Average	Great
70	0.8%	0.1%	0.0%
80	2.9%	0.6%	0.1%
90	7.6%	2.4%	0.6%
100	14.5%	6.4%	2.4%
110	20.5%	13.1%	6.4%
120	21.5%	19.6%	13.1%

130	16.6%	21.8%	19.6%
140	9.5%	17.9%	21.8%
150	4.0%	10.9%	17.9%
160	1.3%	4.9%	10.9%
170	0.3%	1.6%	4.9%
180	0.1%	0.4%	1.6%
190	0.0%	0.1%	0.4%
200+	0.0%	0.0%	0.1%
Totals	99.8%	100.0%	100.0%
160+	1.6%	7.0%	18.0%
170+	0.4%	2.1%	7.0%
180+	0.1%	0.5%	2.1%
190+	0.0%	0.1%	0.5%

A manager can use this table to estimate the number of bucks in each class he will have in a particular season. The first step is to determine the type of year. Without supplemental feed, a very rough guide (March-April rainfall explains some but not all of the variation in antler quality) is the following:

Gauging Nutritional Quality of an Antler Year	
March-April Rainfall	Nutritional Quality
Less than 1 inch	Poor
1.5 inches to 4.5 inches	Average
4.5 inches and greater	Great

If a manager provides supplemental feed, the Poor year is probably eliminated and the Average and Great years require less spring rainfall. The precise impact of supplemental feed and rainfall on antler quality still requires further research.

Once a manager determines the antler year quality, he then needs to estimate the number of mature bucks in his herd. A helicopter census is probably the best way to do that. Armed with the number of mature bucks, the number of bucks he can expect in each antler class can be easily calculated in an Excel spreadsheet using the probability numbers from the Probability Distribution table above to create a table that looks like this (I assume 100 mature bucks in this example):

Frequency Distribuiton of Mature Bucks			
Mature Bucks =			100
B&C Class	Poor	Average	Great
70	1	0	0
80	3	1	0
90	8	2	1
100	15	6	2
110	21	13	6
120	21	20	13
130	17	22	20
140	10	18	22
150	4	11	18
160	1	5	11
170	0	2	5
180	0	0	2
190	0	0	0
200+	0	0	0
Totals	100	100	100
160+	2	7	18
170+	0	2	7
180+	0	0	2
190+	0	0	0

Note that I highlighted in green the predicted numbers of 160+ bucks to demonstrate the power of nutritional bell curve shifts.

Let me describe the steps in list form for a manager to do this very informative exercise:

1. Determine your nutritional year—poor, average, or great—based on March-April rainfall and the existence of a supplemental feeding program.
2. Conduct a helicopter census and count the number of mature bucks.
3. Multiply the number of mature bucks counted in a helicopter by 2.5 to adjust for a typical undercount from a helicopter. Helicopter undercounting will vary but a multiplier of 2.5 will get close to actual numbers (see Charles A. DeYoung's email blast "What Do You Do With Helicopter Results?" http://ckwri.tamuk.edu/research-programs/deer-research-program/deer-associates-program/deer-associates-enews)
4. For each B&C class (70, 80…160, 170…) multiply the probability of that B&C class (for the appropriate nutritional year) by the total number of mature bucks.
5. Do this for every B&C class and you will create a bell curve of mature buck antler scores for your ranch or lease.

A cautionary note. The Faith Ranch dataset from which I derived the above probability table comes from an unhunted, unfed ranch. It represents a South Texas baseline of what a buck herd should look like. But if you cull or if you harvest immature trophy bucks, the bell curve you create for your ranch based on the above table will not represent reality since you would have distorted nature's bell curve through harvest practices.

Summary and Caveats in Bell Curve Analysis

The two most powerful uses of bell curve analysis are 1) **Bell Curve Shifts (Right and Left) As a Result of Nutritional Changes** and 2) **Changes in the Size of the Bell Curve (i.e. Numbers of Mature Bucks).** A manager can also use the Probability Distribution to estimate the number of bucks in each antler class in a particular year. Although estimating classes of bucks on one's ranch is based on a Probability Table is a very useful way of thinking about the potential in a particular year, it will never be exact for the following reasons:

1. Bell curves are statistical representations of the probabilities of the occurrence of bucks in an antler class. They get close but there are always variations. Just as a coin could come up heads 10 times in a row, a manager could find an extreme outlier (200+) in a poor year.
2. As I mentioned above, culling lops off the lower end of the bell curve.
3. Likewise, harvesting great young deer before maturity will lop of the higher end of the bell curve. A manager will have to take past harvest practices into account when estimating the shape of his mature buck antler bell curve.
4. The impact of supplemental feed on the bell curve is not known. I do know supplemental feed requires less rainfall to produce average or great antler years, but I do not know by how much. I also believe that sustained and diligent supplemental feeding over time will shift the bell curve dramatically to the right.
5. Variation (*standard deviation*) could (and probably does) change as *averages* shift—particularly as *averages* shift dramatically to the right as a result of sustained nutrition over time.
6. The shape of the bell curve (*fat tails*, for example) could change as *averages* increase. I explore this possibility further in Part III of this series.

The greatest value of thinking of a buck herd in bell curve terms is that it forces a manager to think statistically. The results of that analysis may not entirely match what a manager experiences in a given year, but the bell curve of mature buck antler scores—its position along the horizontal axis and its size—absolutely describes what deer manager deals with. When you manage a buck herd, you manage a bell curve of mature buck antler scores.