

Deer Census - How to Use It to Calculate Harvest

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The Wildlife Business

Wildlife is big business in Texas, especially white-tailed deer hunting. Private lands and strong trespassing laws have established a market for trespass rights for hunting. This can be attested to by the fact that there are consultants such as myself, paid by landowners to assist in managing their wildlife. State and federal agencies also acknowledge the importance of wildlife by providing assistance to ranchers. Such groups as the Texas Parks and Wildlife Department, the Texas Agricultural Extension Service and the USDA Soil Conservation Service all have wildlife biologists who act as specialists for game management. The fact that there is considerable income generated from hunters leasing trespassing rights to hunt on private lands also demonstrates the financial importance of Texas wildlife. Hunters in Texas depend upon the private landowner for hunting opportunities. The private landowner, likewise, is encouraged by this system to protect his investment, the game and the habitat, through proper management.

I will discuss the purpose behind an aspect of that management—the deer census—and talk about its limitations and benefits, the types of censuses available for deer and some examples of how to calculate harvest.

The Purpose of Census

A crucial aspect of deer management is estimating the number of animals available for utilization (harvest). This information is determined from a count or census. The purpose of a census is generally two-fold; the first is to determine what the harvest can be and the second is to indicate how the animals are affecting the habitat. The method employed in making the estimate or census must be chosen specifically for the particular species, in this case white-tailed deer. The time, location, purpose and financial constraints of the landowner all should be taken into account in selecting the census technique.

Need of an Overall Plan

Please keep in mind, survey data is just one element of an adequate management plan. Proper deer management of a ranch must take other characteristics into account, such as: condition of the deer herd; productivity and condition of the habitat; livestock operations; availability of water; and outside disturbances. And I would like to emphasize that if you wish to enter into a deer management program, it should be a total program,

not just a program which utilizes a census to gain information for deer harvest. It should be one based on long range and short range goals for the ranch, one that manages habitat, collects harvest data and manages livestock in a coordinated fashion with the management of the deer herd.

Census – Assumptions

The term census is synonymous with survey but is in fact an inventory of animals. Deer surveys are used primarily to estimate population numbers and determine harvest quotas. Four assumptions for census are:

1. that the population is closed (no immigration or emigration);
2. that the probability of sighting an animal remains constant during the period of collection of data;
3. that all animals are equally susceptible to being counted; and
4. that the number of animals seen equals the number of animals present.

Types of Census

There are two different types of counts which can be done, direct and indirect counts. There are generally two methods of a direct count, a true census and an estimate. The major assumption of both techniques is that the ratio of the sample count equals the ratio of the actual population (i.e., precision is high). The true census is a count of all animals present on a given area. Theoretically, the true census is accomplished with a total area helicopter census. The estimate is derived from a sample count, or a partial count of the population.

Four partial count methods are: The Hahn walking line, the spotlight line, the driving cruise line and the aerial survey (for a discussion of these techniques: Ramsey 1981). There are two types of aerial partial counts, fixed wing and helicopter. Fixed wing is always a partial or strip count. Helicopter surveys can be a strip (partial) census or a total area count. The two partial counts I prefer are the spotlight and the aerial strip with a helicopter (for a review of spotlight counts: Guynn 1982). These techniques rely on statistical analysis to determine the precision of the counts.

The total area helicopter count is the one usually preferred by wildlife biologists conducting game surveys, especially in South Texas (also used in Trans Pecos and Hill Country, Weishuhn 1982). I prefer this technique because more animals and country are seen, giving a more complete picture of the quality of the deer herd and the condition of the ranch. However, the total area counts are not without their limitations. The assumption is that all the animals were seen. In fact this usually is not the case. Some deer are less likely to be seen the more helicopter work was done on the land previously. Deer may also be difficult to see even if there has been no previous helicopter work. How often should you census? If you use it to set harvest rates, then you should census each year before the hunting season. For the purpose of this paper, we will not consider how the data was collected, only that it is presented and it is correct.

Looking at the Numbers

The census information is straightforward. It will usually be delivered in a variation of this form:

Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total
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The categories that are standard on census reports are described as:

Acres per adult deer

The number of acres of the ranch divided by the estimated number of adult deer. This figure is important for comparisons from year to year on the same ranch as well as comparisons between other ranches. Typically, low acres per adult deer implies an overpopulation of deer or more deer than the habitat can sustain at that time. When we talk about acres per deer (or deer per hectare) it is primarily for comparison. One possible shortcoming is it assumes that the productivity of the ranch is proportional to the size of the area. But in fact different ranches, and even different pastures within those ranches, have the ability because of their soils to sustain different population levels of deer. It must be remembered that productivity and condition of the habitat are two factors critical to any comparison.

Buck to Doe Ratio

This number is the ratio of adult male to female deer. It is indicative of past hunting pressure (assuming most pressure is put on the bucks). It is also the ratio which receives the most attention. The buck is the individual with the greatest financial value and is almost always the standard of a good or bad deer management program. This ratio, when analyzed with the total number of deer for the ranch, gives information to be considered for harvest. A percentage can then be determined for harvest of either bucks, does or both. A potential problem with accuracy of the buck to doe numbers is the small (less than 1-inch)

antlers on some spikes during a drought year. This may not affect the harvest quota, but it will affect results of censuses in future years. Counted as does, they could affect the buck to doe ratio.

Fawns per Doe or Fawn Survival (Percent)

This ratio gives an estimate of the fawn survival (productivity) of the deer herd or how many fawns survive from birth into fall. It is important from the evaluation of your deer herd in terms of the population and for evaluating nutrition of the deer herd. A high fawn survival implies the deer herd is on good range and that there is not an overpopulation of animals. A low fawn survival implies that the deer herd is close to the number it can support for that year. If harvest records have been kept, this productivity can be correlated with those in later years, especially from the standpoint of cohort individual's weights.

Acres per Buck

This comes from ranch acreage divided by estimated number of bucks. This figure is good for comparisons between years and as a good indicator of bucks available for harvest. The buck herd composition should be considered with the acres per buck to determine the relative condition of the buck herd.

Buck Herd Composition

Climate (rainfall, freezes) affects habitat quality and therefore the quality of bucks, both in the developmental stages and for each season of their later years. Older bucks, if they have not been nutritionally deprived in their earlier, developmental stage, and are receiving adequate nutrition, will reach their potential in antler and body development. If they have been nutritionally deprived in the developmental stage, from birth to about 2 years, they will never reach their genetic potential. Likewise, any buck that does not receive adequate nutrition in the current antler growing period will not have as good a quality set of antlers or body weight as he could with good nutrition. Since antler growth is the secondary recipient of nutrition, after the body condition, then it can be a good indicator of the deer herd condition.

The census tabulation should include a table showing the percentage of bucks in each quality class by pasture and a total for the ranch. This information is especially helpful in assessing the quality of a deer herd on a ranch and the condition of the pastures for deer production. Other factors determined can be

whether there is a void in any quality class. For instance, last fall on a number of ranches I surveyed, I witnessed very small percentages of small eight point bucks. This group should have been the largest. This has implications for 3 to 4 years in the future when they would become the trophy class. Theoretically, if a population is normal, the younger age class has the greatest numbers of animals, decreasing in size to the oldest cohort, which should be the smallest number of animals. Each age class is termed a cohort. The results of any reduction in the numbers of a particular cohort will affect the buck herd composition until that cohort dies out. This can be seen in years of depressed productivity (a smaller number in the cohort than we would expect). The normal population should have the form of a pyramid, the most animals in the youngest cohort. This reduced productivity has appeared to happen on some ranches in the last couple of years because of the drought and the result may well be a depressed cohort.

Further Considerations

If all of the above information is available, there now exists a fairly complete population picture of the deer herd of the ranch. We have an estimated population, ratios of acres per deer, acres to bucks, does per buck and fawns per doe, as well as quality of habitat available to correlate with the quality of buck deer. Even with this information available, it is necessary to answer a few more questions for the total census picture. Do your survey results show concentrations of deer in certain pastures? If so, this may affect where you want to concentrate your harvest. Do your neighbors have a high population of deer? You should consider harvesting in pastures of concentration or along fencelines if it benefits your program. There will probably be other considerations important specifically to your ranch. What is your goal? Is it trophy management or management for the greatest number of harvestable deer? There are many other possible goals.

The deer herd can be manipulated by harvest to alter the buck to doe ratio and overall population numbers. If your population has a high doe to buck ratio, then harvest can adjust that ratio. You can take a yield of bucks and a yield of does to attain a certain ratio. If you have a high fawn production but are trying to reduce the population, you should harvest in excess of the fawn numbers. Another goal of harvest is to bring deer numbers into harmony with the environment.

Harvest should be considered in conjunction with ratio adjustment and the optimum use of your habitat by the deer herd. This brings to mind the principle of carrying capacity. Simply put, carrying capacity is the number of animals the land resources within an area can support with minimum maintenance. This number represents the equilibrium number of animals in the population.

McCullough (1984) calls this the residual population or K carrying capacity.

Therefore, the theory of carrying capacity is tied strongly to the production of the habitat. The habitat, if it were not influenced by climate or seasons or various ranch uses, could be easily used as a constant with predictable results. The phrase, "This land should have a population of a deer to 15 acres," is said with an average in mind and considering as much information as is needed for a wise decision. Different pastures and different ranches have different habitat types and different soil productive levels, and climate varies greatly from year to year. But for purposes of the presentation today, these elements will be assumed to be constant.

Twenty percent harvest of a population is the standard recommendation. Problems can arise because there are no standard situations. The percentage harvest of a population should be based on the census results and the management goals. However, I do not believe you can go wrong with a 20 percent harvest from census figures, unless your population is depressed (lower). Additionally, harvests based on census are usually conservative. Most census techniques underestimate animal numbers. The Caesar Kleberg Wildlife Research Institute in Kingsville, Texas has reported discrepancies in number of deer and number of deer counted. Their preliminary results show total helicopter counts as low as about 25 percent or as high as about 45 percent of the total number of animals seen (Sam Beasom, PC). The final results are not complete but the implications follow previously reported patterns. Spotlight count numbers usually correlate fairly well with aerial census. However, aerial census, especially total area counts by helicopter, give the most complete picture of the ranch and its resources.

No census technique is without limitation, McCullough (1979) discusses some results or limitations with a census technique called the drive count, thought to be the best way to count deer, although it is very labor intensive. McCullough reported deer surreptitiously escaping through drive counts. McCullough also stated in 1984 that, "The goal of a deer management program is arbitrary, not scientific. Science does not make the decision, people do." He then goes on to say it is better to collect the information in the most scientific way possible to allow the decision to be made. The information you get should be as complete and precise as it can be because it will be used for subjective evaluation and harvest setting. So you should be aware of the limitations of the various census techniques.

But how do you calculate the harvest from the census? I was requested to take the magic out of setting harvest from census. There is no magic—education and experience can be acquired by anyone. Just as preparing a legal document could be done by anyone, it is more likely to be done with accuracy by an

experienced lawyer. Setting harvest from census data can be done by anyone, and due to the forgiving aspect of nature, it is not usually to the detriment of the deer herd. However, to optimize yield and protect the herd is a more sophisticated goal. This is done using maximum sustained yield. This is closer to the technique I use, but I include the fluctuation in climate and condition of the habitat for South and Central Texas.

I will give a couple of examples of harvest calculations. However, be aware that I have seen examples such as these in my experience, but there are always other factors as important to consider in setting harvest. These should be considered only building blocks for development of your program. Deer populations are as different as the goals of the people managing them. Wildlife problems are site specific (meaning each problem is different) and must be dealt with in that manner.

There are two questions that should always be answered. How has the habitat been during the critical antler growing period (has there been sufficient rain)? Are the weights of the harvested animals satisfactory, or are they undersized for their age class?

Let's say that the previous two questions are answered yes. This deer herd is already at a population level you find satisfactory. The effort then should only be to manipulate the buck to doe ratio. The harvest of bucks should be about 20 percent mainly from the trophy class 5 1/2 years and older and bucks that do not have desirable antler characteristics. The number of does to be harvested should then be the remainder of the fawn crop. Total fawns (32) minus 20 percent of the bucks (8) leaves 24 does to be harvested. Ranches I have been working with demonstrate an average harvest of 15 percent fawns mistaken for does. We assume a 50 percent males to 50 percent females fawn crop, so by next year (assuming there is no other mortality) the posthunt figures should look like this:

	Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total
Preharvest	3,000	40	160	32	232	20%.	1:4	15	13
Harvest		-8	-20	-4	-32				
Survival		+14	+14	0					
Postharvest		46	154		154		1:3.3	15	

Example 1

This first example is of a 3,000 acre ranch. The census has shown that the buck herd composition is pyramidal, or the youngest age class has the greatest number of bucks, decreasing up to the oldest age class. Your goals for your deer herd are to achieve a 1 to 2 buck to doe ratio and a population of one adult deer to 15 acres and to produce trophy bucks.

Everything else besides the buck to doe ratio remained the same. As you approach your goal of a 1 to 2 buck to doe ratio (given a constant fawn crop of 32) you will want to reduce your percentage of doe harvest to keep the number of adult deer at 15 acres per deer. This percentage will drop to about 9 percent.

But the fawn crop does not stay constant and some years have better crops than others. During these years of higher fawns you may want to consider increasing your harvest to remove a number of fawns as well as adults to bring the population into line.

Census Results									
Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total	
3,000	40	16	32	232	.20	1:4	15	13	

Example 2

Census Results								
Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total
3,000	80	320	96	496	30%	1:4	7.5	6.0

Let's assume your goals are identical and your census figures correct. There is one adult deer to 6 acres. Then harvesting 20 percent of the bucks would be 16, and 30 percent of the does would be 96. The buck to doe ratio has been reduced by this action, but the acres per deer has been affected little.

and the acres per adult deer have decreased by almost 5 acres. However, you will have a buck herd with a larger number in the 1 1/2 year old age class next year. For next year, given the census results, I would suggest harvesting trophies and obvious culls

	Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total
Preharvest	3,000	80	320	96	496	30%	1:4	7.5	6
Harvest		-16	-82	-14	-112				
Survival		+41	+41	0					
Postharvest		105	279		384		1:3.3	7.8	

In this instance an increased harvest of antlerless deer is necessary to achieve the goals. Perhaps the harvest could be as high as 40 percent of the doe herd of 128 animals depending upon the age of the doe herd and how this would affect next year's production. You have increased the acreage per animal by almost 1/2 acre. Next year's harvest should again be used to reduce the number of animals to attain your goals.

Example 3

The last example is of a deer herd that is coming out of a drought period. The population is depressed. There is a high acre per deer figure. The survival will probably be high and this figure should be used to assist in calculating harvest.

in this age class until your population is at a satisfactory level.

All of this was based upon the following assumptions:

1. that climate does not cause fluctuations;
2. that the information from the census is correct;
3. that fawn crops are always steady;
4. that only 15 percent of the fawn crop is mistakenly shot for antlerless;
5. that there is no other major mortality involved; and
6. that there is no movement of deer into or out of the area.

Census Results								
Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total
3,000	24	96	29	149	30%	1:4	25	20

This is the most unlikely of all the examples. However, given the same goals, this deer herd should be harvested lightly to build up to a suitable population. After the buck herd composition has been determined, you should attempt to harvest only trophy bucks out of the 24 animals. I would set these four as my harvest goal (it is only 14 percent) and I would not harvest any does. This would result in:

The buck to doe ratio is reduced from 1 to 4 to 1 to 3.3

	Acres	Bucks	Does	Fawns	Total Deer	% Fawn Survival	Buck/Doe Ratio	Acres/Adult	Acres/Total
Preharvest	3,000	24	96	29	149	30%	1:4	25	20
Harvest		-4	0	0	-4				
Survival		+14	+15						
Postharvest		34	111		145		1:3.3	20.6	

Summary

What do I look for in a census? I look at a myriad of things. If you came to me and asked me what you could do with census results, my reply might be, "I feel fairly secure that you could harvest 20 percent of your male animals and harvest does based on a buck to doe ratio goal until you reach the particular goal of what you

want." But you would have to develop in your own mind a sense of the number of animals that your habitat can support. Once you have this sense then you can harvest a percentage of the animals given the condition of your deer herd, or better yet of your habitat.

What do I do when I consider a deer herd for harvest? I assess the soil productivity of the ranch. I try to get a feel for the current and past uses of the ranch to analyze why it is in the current condition it is in. I attempt to look at any harvest or census data that is available and get a feel for the deer herd quality. From this information I arrive at a conclusion as to what percentage of does and bucks should be the maximum harvest. I then attempt to devise a harvest which will accomplish the goals that the landowner is trying to achieve, be those large antlered bucks, a maximum sustained yield or an overall production in the number of animals. McCullough (1984) discusses in depth the management of deer herds by a maximum sustained yield graph. Whenever we attempt to add all of these factors into an analysis of the condition of a ranch or deer herd, we are essentially modeling. This means we are trying to simulate nature to predict results.

One of the major problems confronting a resource manager is the year to year or season to season variation in habitat quality due to variance in precipitation, severity of winter, presence or absence of acorn crops, etc. These are beyond managerial control, but white-tailed management programs must take them into account if the programs are to be predictive. The program should give the biologist or manager the ability to develop predictive models based on density dependent responses of a population and follow a consistent management plan. If this program is not devised, then management system decisions will need to be made on a year to year basis by collecting all the data and comparing it with past years.

To conclude, a person in control of the harvest of a deer herd should organize in the following manner.

- Set goals pertaining to the quality of animals, buck to doe ratios and adult deer per acre.
- Obtain the best census results possible.
- Note the condition of the habitat and deer herd.
- Calculate a harvest to approach the management goals.
- Collect and analyze harvest data.

From this information, the calculation of next year's harvest will be based on complete information.

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