

# Making Sense...

The rut is not just a wild game of chase.

There are predictable patterns in the search strategies of most bucks.



**By Aaron Foley**

with Randy DeYoung, David Hewitt, Mick Hellickson, Ken Gee, Mitch Lockwood, Karl V. Miller and David Wester.

Hunters spend countless hours trying to pattern buck movements during the rut, attempting to decipher the “code” that unlocks the secret to buck locations. Some hunters use trail-camera photos to decide where to hang a treestand in hopes that a buck will return. Other hunters believe that buck movements are simply random and chaotic, thus they may set up a blind with a good view, hoping to see some antlers moving through the brush. Both approaches sometimes meet success.

Given the seemingly erratic and unpredictable movements of whitetail bucks, it is quite remarkable they are able to locate and mate with nearly all does in a population in only two to three weeks, especially considering that does almost always outnumber bucks, and does are in estrus for only 24 to 36 hours! How are bucks able to do this? Do they have search strategies?

We, as humans, employ search strategies all the time. Suppose your vehicle is running low on fuel. It would be more advantageous to drive directly to the nearest town where a gas station is likely to be found than to cruise around the countryside randomly in hopes of finding a

pump before the engine dies. Obviously a strategy based on prior knowledge of doe locations, rather than random searching, would be an advantage for bucks.

## Tracking Down Answers

In 2008, scientists at the Caesar Kleberg Wildlife Research Institute partnered with the King Ranch, Texas



Aaron attaches a GPS tracking collar to one of the bucks captured for his study. More than 100 bucks were tracked, including 60 that were 3½ or older.

Parks and Wildlife Department, Samuel Roberts Noble Foundation, QDMA, and the Warnell School of Forestry at the University of Georgia to initiate a five-year project with the goal of describing rut search patterns. On a 10,000-acre tract on the King Ranch in South Texas, we captured bucks and attached GPS radio-collars programmed to record locations every hour from November to February.

The deer density at this site was 25 deer per square mile with a balanced sex ratio (one buck per two to three does), and deer harvest was minimal. During the five-year study, we captured and collared 101 bucks, including eight 1½-year-olds, 33 2½-year-olds, and 60 bucks 3½ or older. Most bucks collared were 3½-plus due to an advanced buck age structure (harvest on the ranch is limited to bucks 4½ years and older).

We categorized bucks into three age groups (1½, 2½ and 3½-plus) because mature bucks have been through several ruts and may have different search strategies than young bucks that may be inexperienced as well as subordinate. Returning to the analogy of a driver running low on gas, a teenage driver may search for a while before finding a gas station, whereas an experienced driver is likely to know exactly

# of the Madness

PHOTO BY BILL MARCHEL

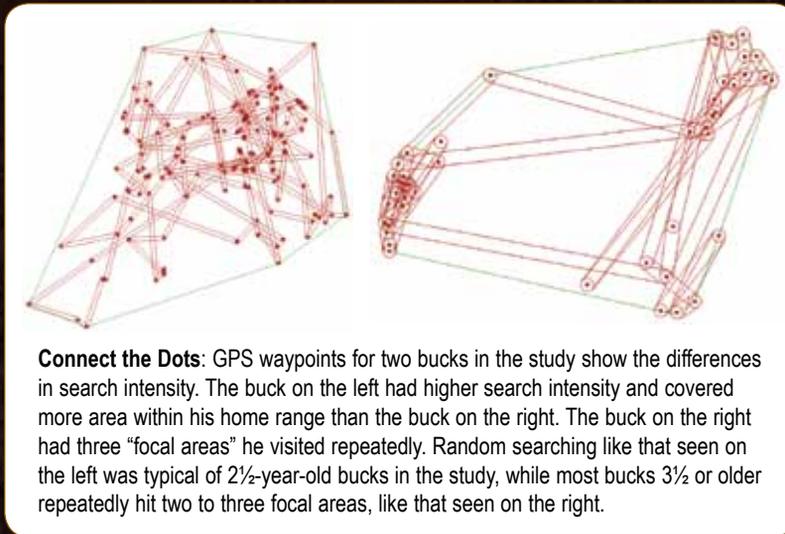
where a gas station is. Furthermore, a teenager with little cash is likely to pump \$5 or \$10 of gas at a time, while an adult with a good job can afford to fill up. The experience and greater resources probably explain the fact that mature bucks have been found to sire 70 percent of fawns in populations with good age structure.

We separated the rut into four, two-week long phases based on conception dates of fetuses obtained from does harvested at the King Ranch:

Early (November 18 to December 1)  
Peak (December 2 to 15)  
Late (December 16 to 29)  
Post (December 30 to January 12)

Each rut phase reflects the relative abundance of receptive does, which may affect movement patterns exhibited by the three age classes. For instance, during early rut, when few does are ready to be bred, some experienced bucks may not bother searching whereas some younger bucks may excitedly search for does.

We assessed four movement parameters: movement rate, search intensity, a search strategy termed the “Levy walk,” and focal areas. Let’s spend some time defining the four parameters.



**Connect the Dots:** GPS waypoints for two bucks in the study show the differences in search intensity. The buck on the left had higher search intensity and covered more area within his home range than the buck on the right. The buck on the right had three “focal areas” he visited repeatedly. Random searching like that seen on the left was typical of 2½-year-old bucks in the study, while most bucks 3½ or older repeatedly hit two to three focal areas, like that seen on the right.

**Movement rate** is simply the distance moved per hour. We expected bucks to increase movement rate during peak rut when most does are receptive. Mature bucks have greater fat reserves – more gas money – than young bucks and may have the ability to spend more time searching for does versus foraging. Therefore, we anticipated higher movement rates from mature bucks relative to younger bucks.

**Search intensity** is the proportion of area used within a buck’s home range. Increased search intensity indicates a buck used more area within its home range. A search intensity of 80 percent indicates a buck was nearly everywhere within its home range – as if the young driver in search of fuel used many roads to find

the gas station – whereas a search intensity of 30 percent indicates the buck was within the same area repeatedly, just as an experienced driver knows which road leads to the gas station. We expected lower search intensities from mature bucks because mature bucks may be more experienced and familiar with their surroundings whereas young bucks may search new areas within their home range.

**The Levy walk**, which basically means random searching, is optimal for finding dispersed resources. This search strategy has been observed in many different animals, from bees to marine mammals. Without getting into the complicated statistics, the Levy walk in our case represents bucks that exhibited movement patterns indicative of searching for unpredictable resources. In other words, these bucks may have had difficulty locating does or did not know in advance where does are likely to be. Conversely, a buck who knows where does are likely to be would exhibit a “Brownian walk” movement pattern. We anticipated Levy walks to be common during early, late, and post rut when relatively few does were receptive. We also predicted that mature bucks,

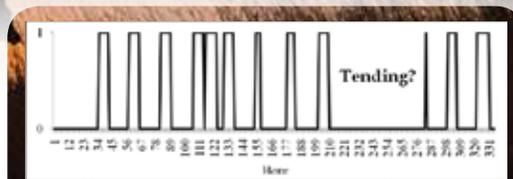
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due to their experience, would be more likely to be Brownian walkers – knowing where to look for does – relative to young, inexperienced bucks.

**Focal areas** are areas within buck home ranges that had relatively high use and were revisited frequently. Bucks that return to a location repeatedly during the rut are attracted to these areas for some reason. We evaluated the change in number of focal areas, number of visits, size of focal areas, whether the focal area was revisited regularly, and location of focal areas relative to the focal areas of other bucks. The map on the right shows a buck repeatedly visiting two focal areas.

### Looking For Love in All the Right Places

After analyzing the data, we detected high variation in movement patterns among bucks, which likely indicates individualistic behavior. This is no surprise to experienced hunters. Some bucks were seemingly nomadic and roamed across the landscape, whereas other bucks seemed to stay within very



The chart above shows one buck's use of a "focal area" across the two-week peak rut. In the data, "1" means the buck was inside the focal area, while a "0" means he was not. This buck visited the focal area for about the same length of time on each visit. He also visited the focal area at regular intervals, except for a significant gap during the second week. Researchers suspect this is a result of a tending behavior. The buck may have isolated a doe outside the focal area and is staying with her for the typical 24 to 48 hours of mating. The map below shows one such example. This buck visited two focal areas periodically but left his home range briefly. Since focal areas are checked by multiple bucks, he may have been isolating a receptive doe away from the competition.



small home ranges throughout the rut. However, we were able to detect several interesting trends in the patterns.

During peak rut, yearling bucks (1½ years old) moved 24 to 28 percent less than the other age groups, 2½ and 3½-plus. This suggests that yearlings may be conserving their doe-search effort until later years, when they are better able to compete with other bucks. Or, yearlings may be doing the best they can by hanging out near does until a mating opportunity arises, as evidenced by long periods of time yearlings spent within focal areas relative to older bucks. Where yearlings averaged 11 hours per visit, older bucks spent five to six hours per visit.

The 2½-year-old bucks had very similar movement patterns to mature bucks, however, 2½-year-olds were more likely to be Levy walkers – random searchers. In contrast, nearly all mature bucks were Brownian walkers, as if they knew where to look for does. Because 2½-year-old bucks were Levy walkers, we interpret this as 2½-year-olds having difficulty locating does due

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### About This Article

This article was published in *Quality Whitetails* magazine, the journal of the nonprofit Quality Deer Management Association (QDMA). To become a QDMA member and receive *Quality Whitetails* six times a year, or to learn more about deer and habitat management, visit:

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to inexperience – they did not know where to find a doe – or because of competition with mature bucks. Recall the study population had a high proportion of mature bucks, therefore, 2½-year-old bucks likely faced stiff competition.

Search intensity was surprisingly low for all bucks at 20 to 40 percent, which indicates bucks generally used the same areas repeatedly rather than exploring widely within their home ranges. We analyzed the focal areas and found that during peak rut, most bucks had two to three focal areas within their home ranges, and these were visited often but briefly. This suggests bucks were homing in on specific locations within their home ranges, staying a few hours, and moving on to the next focal area, and later repeating the entire pattern. Interestingly, about 60 percent of these bucks returned to their focal areas periodically, usually every 24 to 28 hours. Because does are in heat for 24 to 36 hours, we concluded that these focal areas were associated with doe core areas. Bucks probably revisit these focal areas to check does using behavioral and scent cues.

Interestingly, we detected several instances of gaps in repetitive visitations to

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By being an active member of QDMA, you help fund and support deer research like the study featured in this article – research that leads to knowledge that will enhance your hunting enjoyment and deer management success. When this study of buck rut movements was first proposed, QDMA secured \$28,000 in National Fish & Wildlife Foundation grants to help these researchers purchase GPS tracking collars and other necessary equipment. Since 2006, we have contributed more than half a million dollars to deer research and have helped design and coordinate many of the studies, ensuring they produce information that is useful to deer hunters. Help us continue to fund and guide practical deer research by renewing your QDMA membership or recruiting a friend or neighbor into the QDMA team today. Thank you!



focal areas, which may reflect occurrences when a buck was able to locate a receptive doe and isolate her from other bucks. Further, we know that during peak rut, bucks are intolerant and aggressive toward other bucks. We found that focal areas of

many different bucks overlapped, which strongly suggested that does are within these areas. It appears that bucks are daily revisiting two to three focal areas in their home ranges, spending about five to six hours in each, to assess the receptiveness of does.

### Doe Behavior

We assume bucks are revisiting these focal areas during the rut to check does. That assumption relies on whether does reduce movement rates to increase the likelihood of being located by bucks. In other words, for this to work, does must make their locations predictable to bucks. Some previous studies have found does perform excursions – brief forays outside of their home ranges – or increase movement rates during peak rut, whereas other studies have shown that does reduce movement patterns.

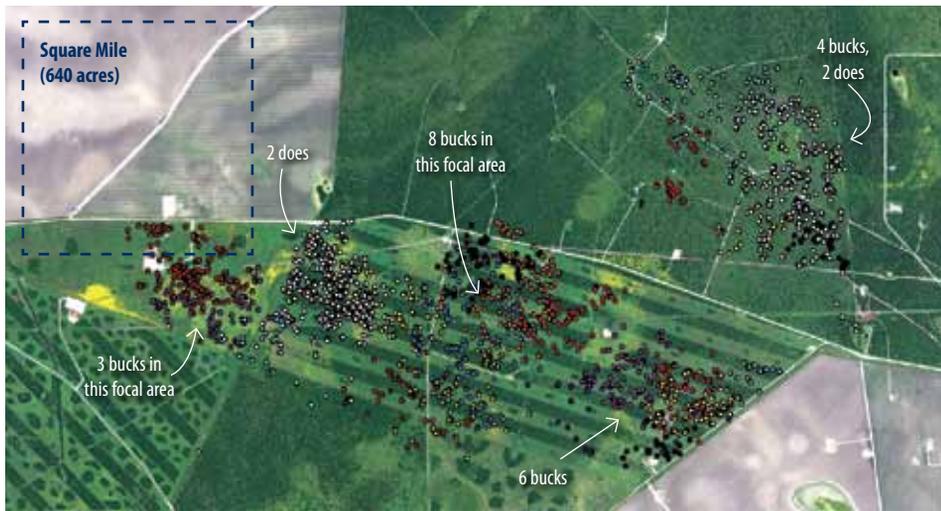
We analyzed movement patterns of five does that were captured on the study site to assess whether their locations would be predictable to bucks revisiting discrete areas. Because physically mature does are more likely to be bred than young does and may exhibit different movement pat-



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In this depiction of GPS waypoints in focal areas, white dots are doe locations, while all other colors represent individual bucks. Note that multiple bucks are repeatedly visiting each of the individual focal areas. Also note that most of the focal areas overlapped or were adjacent to doe locations. Over 100 bucks were tracked on this study site but only five does, so it's likely that additional doe core areas existed where these buck focal areas were located.

terns as a response to rut search activities, we separated the does into two age groups (1½ to 2½, and 3½-plus). While our sample size is small, we did document most does decreased movement rates by 2 to 36 percent from early to peak rut. Also, all mature does had a single core area, and the sizes of their core areas (37 to 59 acres) were slightly smaller than the sizes of buck focal areas (44 to 82 acres). This observation suggests that mature doe locations would be predictable during the rut, which would enable bucks to locate does periodically and check their receptiveness.

Finally, we detected several bucks had focal areas near or overlapping the locations of doe core areas. The overall movement patterns of does appear to fit with our hypothesis that bucks revisit discrete areas repeatedly to assess receptiveness of the predictably located does.

Furthermore, the intervals between visitations are a very good strategy for allocation of a buck's time and resources. If a buck assessed the doe too frequently, he could lose out on the opportunity to locate additional does. Too long between assessments, and the buck would miss the mating opportunity.

### What Does All This Mean?

For us scientists, it was very exciting to quantify rut search strategies that could never be fully studied through direct observation. Whitetails just spend too much time hidden in thick cover. The data also remarkably document the apparent

use of “spatial memory” in white-tailed deer. Bucks remember where does are located and spend most of their time in one or more focal areas, or traveling in between.

However, additional research is needed to better understand the tactics bucks use to locate receptive does. Do scrapes assist with conveying information between the two sexes to make doe locations predictable? How do differences in age structure, sex ratios, and hunting pressure affect search behaviors exhibited by bucks during the breeding season? For instance, high deer density may result in less obvious periodic movements exhibited by bucks, since they are in a “target-rich environment.” Or, high hunting pressure may cause doe locations to be less predictable.

However, one old adage comes to mind and seems most fitting:

*Hunt the does during the peak rut.*

In addition, if you see a buck in the same area more than once during peak rut, he will probably be back... hopefully during legal hunting hours! 🦌

**About the Author:** Aaron Foley earned his Ph.D. in wildlife science from Texas A&M-Kingsville, and this article is based on his doctoral research project. His co-authors on the project included Randy DeYoung, David Hewitt, Mick Hellickson, Ken Gee, Mitch Lockwood, Karl Miller and David Wester. For more information about Aaron's research, see “Purposeful wanderings: mate-search strategies of male white-tailed deer,” published in the *Journal of Mammalogy* Vol 96, Issue 2.