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# The Influence of Hunting on Deer Proximity to Roads


## Abstract

*I tested the null hypothesis that hunting does not influence the average distance of white-tailed deer* (Odocoileus virginianus) *from roads. Ten radio-collared, adult female white-tailed deer were located daily beginning 12 days prior to the opening day of the Montana general firearm season and ending 14 days after opening day. Four deer occurred on land that was hunted; six did not. Hunted deer stayed significantly further from roads during the hunting season ($\bar{x}$=540 m) than just prior to the season ($\bar{x}$=210 m). Non-hunted deer were closer to roads during the hunting season ($\bar{x}$=180) than before ($\bar{x}$=270). Distances of deer to forest openings between the two time periods were not significantly different for either group. I concluded that the hunted deer perceived and responded to intensive road-based hunting pressure, while the non-hunted deer did not.*


**Key words:** distribution, forest openings, hunting pressure, *Odocoileus virginianus*, roads, white-tailed deer

## Introduction

Hunter distribution and deer movements under intensive hunting pressure are often examined. Deer hunter distribution is generally influenced by road and trail access (Johnson 1943, Peterson 1969, Thomas et al. 1976). Stenlund et al. (1952) and Fuller (1988) reported that most hunters never go more than 0.8 km (0.5 miles) from a drivable road or trail , and very few hunt more than 1.6- 3.2 km (1-2 miles) from roads or trails. These distances vary with topography and vegetation (Peterson 1969). Also, the number of hunter visits to a particular area depends on its proximity to a foot-trail, and camping or parking area (Thomas et al. 1976).

White-tailed deer movement patterns can change in response to the opening of deer hunting season. Generally, movement increases as hunting pressure intensifies (Marshall and Whittington 1968, Root et al. 1988). Deer tend to remain within individual home ranges when subjected to heavy hunting pressure, although Root et al. (1988) reported that female white-tailed deer move greater distances and have larger home ranges in comparison to other times. Marshall and Whittington (1968) reported similar behavioral patterns. Deer well-adapted to the features of their home ranges likely resist displacement by maximizing use of escape cover (Kufeld et al. 1988), and by spending considerable time in habitats with relatively dense understory (Marshall and Whittington 1968, Swenson 1982, Kufeld et al. 1988, Root et al. 1988).

I have not found studies that directly address deer response to roads during hunting seasons. Certainly hunter success would be influenced by deer associating roads with hunting pressure. I examined the null hypothesis that hunting does not influence the distances that deer occur from roads. I compared distances to roads of hunted deer before the firearm season with distances during the season.

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*f*=3.074, *P*=0.081) or deer type (*f*=3.421, *P*=0.066) on distance to nearest road. However, there was a significant interaction between type of deer (hunted/not hunted) and date (before/during the hunting season) (ANOVA, *f*=26.089, *P*<0.001). Deer on lands open to hunting responded by staying further from roads during the hunting season ( $\bar{x}$ =540 m) than just before ( $\bar{x}$=210 m, t-test, *P*<0.001, Table 1). As a group, non-hunted deer were located closer to roads during the hunting season ($\bar{x}$ =180) than just before ( $\bar{x}$=270, t-test, *P*=0.043). Three hunted deer had locations significantly further from roads during the hunting season compared to before (t-test, *P*<0.05) whereas the fourth deer on hunted lands showed no significant difference (*P*=0.114). Two non-hunted deer had locations significantly closer to roads during the season (t-test, *P*<0.04); the remaining four showed no significant difference (t-test, *P*>0.19).

Distribution of the type of road hunted deer were located closest to was strongly skewed toward open roads for two individuals, closed roads for another, and was fairly evenly divided for the remaining deer. Given this small sample size, I did not statistically compare the mean distances of locations closest to open roads with locations closest to closed roads. The deer that occurred near both road types on average stayed similar distances from open and closed roads both before (220 m vs. 190 m) and during the hunting season (450 m vs. 400 m).

## Minimum Distance to Nearest Opening

There was no significant interaction between deer type and date for minimum distance to nearest opening (ANOVA, *f*=0.404, *P*=0.526). The main effect of date was insignificant (ANOVA, *f*=0.602,*P*=0.493). However, the main effect of type of deer on the variation in distance was significant (ANOVA, *f*=22.643, *P*<0.001). Non-hunted deer were located closer to forest openings ( $\bar{x}$=110) than hunted deer ( $\bar{x}$ =260 m), both before and during rifle hunting season (Table 2). I found no significant difference between mean distance to opening before versus during the hunting season for three hunted deer and five non-hunted deer (t-test, Table 2). Locations for deer number 4 were closer to openings during the hunting season (t-test,

**Table 1.** *Mean distances to nearest road for hunted and non-hunted deer before vs. during the hunting season, and significance of t-tests performed with data from individual deer.*

| | DISTANCE TO ROAD | | | | | | |
|---|---|---|---|---|---|---|---|
| | BEFORE SEASON | | | DURING SEASON | | | |
| Deer # | n | mean(m) | std.dev. | n | mean(m) | std.dev. | *P*-value |
| hunted | | | | | | | |
| 1 | 10 | 220 | 150 | 8 | 330 | 170 | 0.114 |
| 2 | 10 | 130 | 180 | 12 | 180 | 80 | 0.043 |
| 3 | 11 | 250 | 210 | 10 | 360 | 230 | 0.05 |
| 4 | 11 | 240 | 180 | 10 | 1310 | 1260 | 0.006 |
| total | 42 | 210 | 180 | 40 | 540 | 770 | <0.001 |
| not hunted | | | | | | | |
| 5 | 12 | 220 | 210 | 12 | 190 | 160 | 0.371 |
| 6 | 14 | 200 | 220 | 9 | 210 | 160 | 0.971 |
| 7 | 12 | 200 | 190 | 12 | 210 | 130 | 0.489 |
| 8 | 13 | 350 | 250 | 13 | 130 | 120 | 0.039 |
| 9 | 12 | 330 | 220 | 13 | 160 | 160 | 0.017 |
| 10 | 12 | 290 | 200 | 13 | 200 | 200 | 0.193 |
| total | 75 | 270 | 220 | 72 | 180 | 150 | 0.043 |

**Table 2.** *Mean distances to nearest forest opening for hunted and non-hunted deer before vs. during the hunting season, and significance of t-tests performed with data from individual deer.*

| | DISTANCE TO FOREST OPENING | | | | | | |
|---|---|---|---|---|---|---|---|
| | BEFORE SEASON | | | DURING SEASON | | | |
| Deer # | n | mean(m) | std. dev. | n | mean(m) | std.dev. | P-value |
| hunted | | | | | | | |
| 1 | 10 | 280 | 270 | 8 | 380 | 270 | 0.279 |
| 2 | 10 | 190 | 370 | 12 | 80 | 110 | 0.836 |
| 3 | 11 | 230 | 270 | 10 | 260 | 200 | 0.568 |
| 4 | 10 | 460 | 510 | 6 | 280 | 310 | 0.029 |
| total | 41 | 300 | 360 | 36 | 220 | 230 | 0.931 |
| not hunted | | | | | | | |
| 5 | 12 | 90 | 140 | 12 | 80 | 100 | 0.495 |
| 6 | 14 | 110 | 130 | 9 | 140 | 150 | 0.651 |
| 7 | 12 | 130 | 190 | 12 | 40 | 70 | 0.062 |
| 8 | 13 | 130 | 170 | 13 | 60 | 100 | 0.172 |
| 9 | 12 | 210 | 230 | 13 | 80 | 160 | 0.073 |
| 10 | 12 | 140 | 200 | 13 | 180 | 150 | 0.049 |
| total | 75 | 130 | 190 | 72 | 90 | 140 | 0.21 |

$P$=0.029). Locations for deer number 10 were further from openings during the hunting season (t-test, $P$=0.049).

## Discussion

Deer in areas receiving hunting pressure were further from roads during the hunting season than prior to the season. On average, deer that roamed on non- hunted land showed a closer association to roads during the hunting season (Table 1). I am unable to explain this observation. Though the average air temperature was cooler after the opening day of the season (a difference of only 7°C with three sub-zero days), there was no distributional shift in elevation that could have resulted in shorter distances to the main Ninemile Road situated through the bottom of the valley. Deer were not displaced out of their usual areas by hunter activity on public lands adjacent to the private land. This closer association to roads could be due to random movements or sampling error. An average difference of 90 m where distances were measured in 50 m increments is probably not an accurate reflection of true change, especially because locations were estimated from triangulation polygons. Of much more dependable significance is the difference of 330 m between before and during season locations for hunted deer.

I found no difference between the two time periods in distance to forest openings (Table 2). Non-hunted deer were significantly closer to openings than were hunted deer. Deer in areas receiving hunting pressure perceived and responded to an increased threat, or at least annoyance, associated with both open and closed roads. They apparently either did not perceive forest openings as a potentially dangerous place to be in or near once the hunting season began, or they always stayed sufficiently far from openings for safety, perhaps utilizing them with darkness.

Deer number 4 was displaced to an area away from main roads with a lower density of primitive roads. Livezey (1991) reported similar observations with female Columbian black-tailed deer *(O. h. columbianus)*. Four of 15 collared individuals moved 0.6 - 2.5 km out of their usual home ranges and away from roads during a males-only hunting season.

Hunted deer tended to stay further from all roads. Whether deer actually associate roads with disturbance or only perceive the disturbance is unclear. Rost and Bailey (1979) and Perry and Overly (1977) reported road avoidance by mule deer and elk was greater along more heavily traveled roads. Whitmer and deCalestra (1985) reported a significant departure from the expected frequency of female Roosevelt elk *(C. e. roosevelti)* locations within 500 m of paved and 125 m of 8spur roads open to vehicular traffic. They found no differences for elk locations around spur roads closed to vehicles. In Ninemile, an average of 72 vehicles on weekends and 44 on weekdays traveled each of the main roads on every day of the first two weeks of the general firearms season. Also, many hunters utilize the easier walking travel and increased field of vision provided along roads closed to vehicle traffic; however, there are many times more miles of closed roads than roads open for vehicle travel in the Ninemile system. Because these closed roads are so extensive, I assume it is unlikely that on any given day hunters walked even half of the miles of closed roads.

Obtaining the results that I did while incorporating roads closed to vehicles leaves the possibility that the association is with roads, and not necessarily actual pressure from hunters using roads, because foot traffic on any closed road was undoubtedly much less than vehicle traffic on open roads. Conversely, humans on foot possibly have a greater impact than motorized vehicle travel on deer perception of danger. I have often (nearly exclusively not during the hunting season) observed deer in close proximity to roads watching motor vehicles drive by without retreating. Deer would almost always flee if the vehicle stopped and someone got out. Neff (1977) reported similar observations and suggested there is a four-point scale of impact by human activity with rapid and steadily moving vehicles on smooth roads being least disturbing. Car doors opening, persons disembarking, and humans on foot constitute the highest level of disturbance.

If the observed distributional shift away from roads is only a result of avoiding actual hunters using roads, I would expect a decrease in avoidaince of closed roads past a given distance from the point of closure (assuming that most hunters walking closed roads do not venture past this distance). Because of small samples of marked deer, my data can not adequately test this prediction. If it is true and I were to exclude that portion of roads far from a gate or other closure, the difference between before and during season distance to road for hunted deer would be greater than what I report here.

A November 1995 inventory of Region 1 roads under US Forest Service jurisdiction (USFS Region 1 Engineering, unpubl. data) listed 58 percent of Lolo NF roads closed to motorized vehicle travel, and an average of 49 percent of roads closed in Region 1 forests. Given that the Lolo NF has a slightly higher proportion of closed roads than the regional average, deer response to roads in areas open and accessible to hunting should be similar to what I observed, and therefore these results may be considered for management of other white-tailed deer populations in the Northern Region.

For management purposes, it may be helpful to know that hunter distribution and areas of high disturbance may affect deer distribution; especially if deer learn where they are likely to encounter pressure, or associate pressure with a component of the landscape, and avoid these places. Areas with low road densities or tracts with more than 5 km (3 miles) between roads receiving hunting use likely serve as a daytime refuge for legally hunted deer, because as others reported, hunters will usually not walk half that distance from a road or trail (Stenlund et al. 1952, Fuller 1988).

It is conceivable that the security benefits of adjusting diurnal spatial distributions during the hunting season become lower when other physiological and physical factors are present, such as the breeding season or early winter storms. The observations reported here may only hold true for female white-tailed deer, and further work should be conducted with male deer, especially during the breeding season.

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