

CHARACTERISTICS OF WHITE-TAILED DEER FAWN BEDS, BLACK HILLS, SOUTH DAKOTA

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CHARACTERISTICS OF WHITE-TAILED DEER FAWN BEDS, BLACK HILLS, SOUTH DAKOTA

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Abstract. - Forty-two white-tailed deer fawns (*Odocoileus virginianus dakotensis*) were captured and fitted with radio transmitters and observed from June through September 1991 and 1992 to determine diurnal bed site use in the Black Hills of South Dakota. Fawns were monitored biweekly during daylight hours and 259 bed sites were located. In addition, 301 random sites were measured for comparison. Of 31 habitat variables measured, 8 were significant to determine use by fawns for a bed site when compared with random sites. Sites used by fawns were in relatively open stands of ponderosa pine (*Pinus ponderosa*) with mean basal area of approximately 11 m²/ha compared to 16 m²/ha in random sites. Fawn bed sites had greater mean vegetation cover, which ranged from 28.1% to 36.0%, compared with 19.9% and 33.8% at random sites in 1991 and 1992, respectively. Mean vegetation height was 101 cm at bed sites compared to 75 cm at random sites. Current timber harvest standards for stocking levels of pine range from 14 m²/ha to 18 m²/ha in the Black Hills, which are similar to our random sites. These levels preclude adequate development of understory characteristics used by white-tailed deer fawns for bed sites.

Key words: white-tailed deer, *Odocoileus virginianus dakotensis*, fawns, bed sites, habitat, herbaceous cover, ponderosa pine, Black Hills.

Winter often is considered the most critical time for many cervid populations in northern North America, and most earlier habitat research has emphasized winter range. White-tailed deer (*Odocoileus virginianus dakotensis*) in the Black Hills are no exception; conditions on winter range are critical to these migratory populations (Seig and Severson 1996). There is, however, a growing awareness that conditions on northern summer ranges may be equally important, particularly those relating to types and quality of habitat available to lactating females and their fawns.

Spring and summer habitat use patterns of adult females have been examined in the Black Hills (Kennedy 1992, Stefanich 1995, Deperno 1998), but fawn bed site use has not been studied. A fawn's choice of bed site is limited to the general area (macrohabitat) chosen by the doe. Although specifics for white-tailed deer are sparse, studies on other ungulates suggest the actual bed site is selected by the fawn (Marchinton and Hirth 1984, Huegel et al. 1986). Bed site location is critical to fawn survival because as neonates fawns spend most of their time lying down, often at a considerable distance from dams (Schwede et al.

1994). Cover at bed sites functions to hide deer from predators and to provide thermal cover (Huegel et al. 1986, Hyde et al. 1987).

The objective of this study was to examine habitat characteristics of white-tailed deer fawn bed sites to develop effective habitat management guidelines. The null hypothesis tested was that there are no differences in selected vegetative and physical attributes between fawn bed sites and randomly selected sites.

Study AREA

The study was conducted in the northeastern Black Hills, South Dakota. The area includes about 39,000 ha, most of which is administered by U.S. Forest Service, Black Hills National Forest, although private lands are interspersed throughout. It is bounded by Interstate 90 on the east, U.S. Highway 14A on the north, U.S. Highway 385 on the west, and Nemo Road on the south.

Elevations range from 1068 m to 1677 m. Average annual precipitation ranges from 422 mm at Rapid City, just southeast of the study area, to 737 mm at Deadwood on the northwest.

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Average monthly temperatures during the coldest and warmest months (February and August) are -7.7° and 21.9°C at Rapid City and -8.8° and 16.1°C at Deadwood (NOAA 1994).

The study area is dominated by ponderosa pine (*Pinus ponderosa*) forest. The prevailing habitat type is ponderosa pine / snowberry / bearberry (*Pinus ponderosa* / *Symphoricarpos albus* / *Arctostaphylos uva-ursi*), as described by Thilenius (1972). White spruce (*Picea glauca*) with scattered stands of aspen (*Populus tremuloides*) occur sparingly on lower portions of north-facing slopes. Aspens also are found as stringers within upper drainages and often form a border between the ponderosa pine forest and riparian meadows. These meadows, dominated by Kentucky bluegrass (*Poa pratensis*) and mostly privately owned, were grazed by cattle and horses and/or hayed. National forest lands were grazed by cattle. Harvest of ponderosa pine, primarily by seed tree cuts or overstory removal, has been conducted throughout the study area.

METHODS

Capturing and Monitoring Fawns

White-tailed deer fawns were located via ground searches using doe behavior as an indicator of fawn presence (Huegel et al. 1985). Initial fawn searches encompassed the entire study area. Captured fawns were fitted with radio transmitters attached to expandable break-away collars. Total weight of transmitter and collar was 165 g. Collars were colored brown to match fawn pelage, and for 2 wk prior to placement they were stored in plastic bags containing fresh vegetation and/or pine needles. Handlers wore vinyl gloves during capture and collaring activities.

A total of 28 male and 14 female fawns were captured and fitted with radio transmitters over the 2-yr period. We monitored individual fawns during daylight hours every other week. Observations of 22 fawns began on 9 June 1991, and of 20 fawns 15 June 1992, ending 28 September 1991 and 21 September 1992. Vegetation was measured on a biweekly basis corresponding to fawn bed site location. Once bed sites were located, we marked the area and took vegetation measurements the following day.

Microhabitat Measurements

Microhabitat measurements were taken at all fawn bed sites and at random sites within

the study area. Random sites were selected by computer-generated random numbers (Universal Transverse Mercator coordinates) within each section of the study area.

Using a 10-factor prism, we estimated tree basal area (BA) at each bed and random site center (Sharpe et al. 1976). Canopy cover of shrubs, grasses, and forbs, all by species, was estimated in twenty-four 0.1-m^2 quadrats (Daubenmire 1959) spaced at 1-m intervals along 2 perpendicular transects crossing at bed or random site center. Percent of area covered by slash, litter, rock, and bare ground was estimated in the same plots. We used a modified Robel pole with 2-cm alternating orange and white bands to estimate height density (based on visual obstruction, VOR) of understory vegetation (Robel et al. 1970). The pole was placed at bed/random site center and at 4 evenly spaced locations (90°) 2 m from center. Readings were taken at 4 evenly spaced locations (90°) around each pole for a total of 20 observations at each site. The 4 observations around the pole were read from a distance of 4 m at a height of 1 m. Following the same procedure, we used a 250-cm pole to estimate vegetation height. Overstory canopy cover was estimated using a spherical densiometer at site center and at the end of each transect for a total of 5 observations.

Statistical Analysis

We reduced data collected from each fawn bed and random site to 1 mean per attribute per site, for a total of 31 habitat variables. Data were examined for heterogeneous variances using Bartlett's test. When heterogeneous variances were detected, data were $\log_{10}$ transformed. Averages of bed and random sites were compared using multivariate testing of hypothesis based on centered bootstrap adjusted P-values (Wright 1992). Data could have been analyzed for each variable separately, but our concern was correlations among variables for the same observation. More specifically, the P-value produced in separate tests could be correlated, likely causing an incorrect declaration of significance in some cases. The multitest adjusts P-values to account for multiple correlation. We examined the variables year (1991, 1992), biweekly intervals (1-8) type (fawn, random), and interactions to test the hypothesis that fawn bed sites do not differ from random

sites. Statistical inferences were made at a probability level of 0.10 for type I error to decrease type II error.

RESULTS AND DISCUSSION

A total of 42 fawns were captured, 22 in 1991 and 20 in 1992. Biweekly tracking of fawns resulted in the measurement of 259 diurnal bed sites, 127 of which we measured in 1991 and 132 in 1992. The number found per biweekly interval ranged from 12 to 20 in 1991 and 7 to 20 in 1992. Death losses were 23% and 35% for 1991 and 1992, respectively. As the season progressed, the number of fawns found biweekly declined because of mortality. Locations of bed sites were balanced among fawns that survived. Measurements also were collected on 301 randomly selected sites, 147 in 1991 and 154 in 1992. During each biweekly interval we measured 17–20 sites in 1991 and 14–22 in 1992.

We tested 31 habitat variables. Heterogeneity of variances could not be tested on 15 because of a preponderance of zero data. Since sample means were also small, we considered these variables relatively unimportant as components of fawn habitat and eliminated them from further consideration. Among these were percentage cover of rock ($\leq 1\%$), bare ground ($\leq 1\%$), and 10 shrub species (each $< 1\%$). Included were variables with low basal area for birch (*Betula papyrifera*), $1.3 \text{ m}^2/\text{ha}$; bur oak (*Quercus macrocarpa*), $0.3 \text{ m}^2/\text{ha}$; white spruce, $\leq 0.1 \text{ m}^2/\text{ha}$; and ironwood (*Ostrya virginiana*), $0.3 \text{ m}^2/\text{ha}$. No differences between bed and random sites were detected for 8 of the remaining 16 habitat variables; differences were found for the other 8 ($P \leq 0.10$). The 8 nonsignificant variables were vegetation height 2 m out from bed site, VOR at bed site and 2 m out from bed site, total understory canopy cover, total forb cover, Engelmann spruce (*Picea engelmannii*) basal area, canopy cover of bearberry and of Oregon grape (*Mahonia repens*).

Fawns used bed sites with greater mean grass cover ($P \leq 0.001$) in 1991; but no difference ($P = 0.112$) was noted in 1992 (Figs. 1a, b). While dense, herbaceous vegetation seems important for fawn hiding cover, there was less need for specific site selection in 1992 because there was more mean grass cover than during

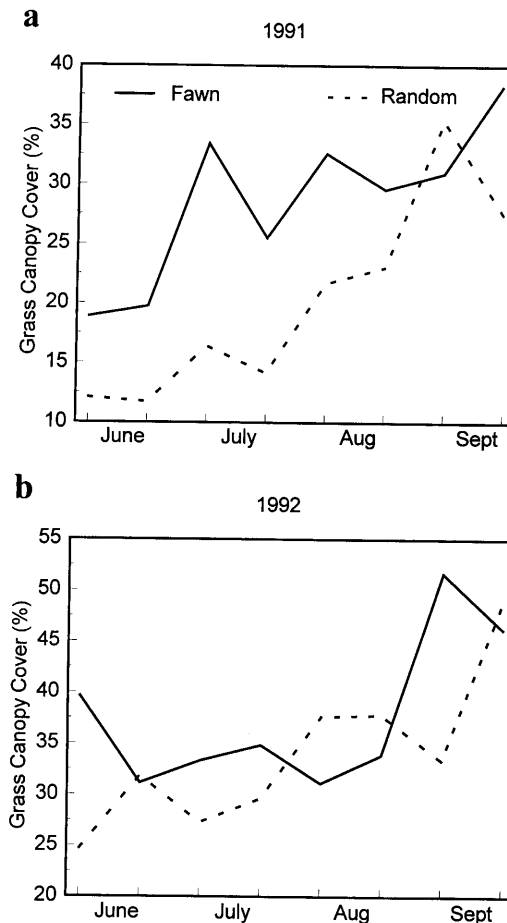


Fig. 1. Total canopy cover of grass (%) at white-tailed deer fawn bedding sites versus random sites at biweekly intervals from early June to late September 1991 (a) and 1992 (b), Black Hills, South Dakota. Significant at $P = 0.10$.

the previous year. Mean grass cover in 1991, for example, was only $19.9 \pm 0.5\%$ (mean $\pm s_{\bar{x}}$) on random sites, while in 1992 it was $33.8 \pm 1.6\%$. Fawns selected sites with $28.1 \pm 1.6\%$ and $36.0 \pm 0.8\%$ total grass cover during each respective year.

White-tailed deer fawns also used taller vegetation for bed sites than that found on random sites ($P \leq 0.001$). Mean vegetation height was $100.5 \pm 8.3 \text{ cm}$ on sites used by fawns and $75.4 \pm 13.2 \text{ cm}$ at random sites (Fig. 2). No differences were noted between years ($P = 0.897$).

Forbs were a relatively minor component of the flora. Mean forb cover was $17.7 \pm 0.6\%$ compared to $29.4 \pm 0.9\%$ and $27.0 \pm 0.6\%$ for grasses and shrubs for both years combined,

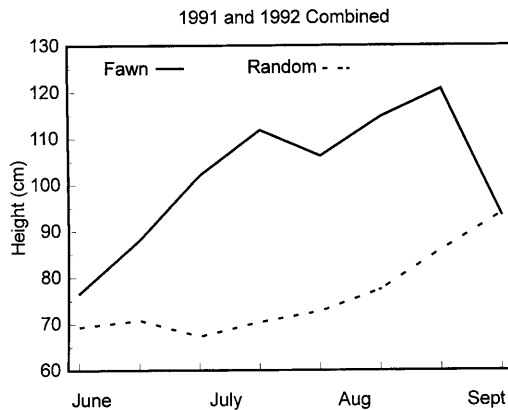


Fig. 2. Height of vegetation at bed sites used by white-tailed deer fawns versus random sites from early June to late September 1991 and 1992 combined, Black Hills, South Dakota. Significant at $P = 0.10$.

respectively. Even when many species of forbs are present, they often contribute less to total understory cover than grasses or shrubs, especially under pine canopy (Uresk and Severson 1989).

Although mean density (VOR) of vegetation tended to be greater at fawn bed sites in 1991 and 1992, differences were not significant ($P = 0.586$ and 0.924 , respectively). Bed sites had a vegetation density of 16.3 ± 1.6 cm in 1991, while random sites had 12.6 ± 1.4 cm. Densities on bed and random sites in 1992 were 21.4 ± 2.5 and 17.7 ± 1.9 cm, respectively. Our results on VOR measurements differ from those of Hyde et al. (1987) and Huegel et al. (1986), who concluded that density of vegetation, based on VOR, is an important component of bed sites. We believe our results may have been influenced by a preponderance of taller grasses, such as wheatgrasses (*Agropyron* spp.), whose culms contribute to vegetation height but not as much to vegetation density.

With the exception of VOR, our results, emphasizing adequate herbaceous growth at fawn bed sites, are generally supported by other studies. Hyde et al. (1987) determined that percent canopy cover of grasses and forbs is greater at bed sites than on random sites. Huegel et al. (1986) also found that mean percent canopy cover of most herbaceous components is greatest at bed sites, but there were fewer tall grasses and low and medium forbs in that study.

Fawns in our Black Hills study used areas having less tree canopy cover ($P \leq 0.001$), but use differed between years ($P \leq 0.001$; Figs. 3a, b). Fawn use of areas with less mean tree cover, apparent only from mid-June to early August 1991, lasted all season in 1992. Mean percentage tree cover averaged $28.8 \pm 0.7\%$ and $20.5 \pm 0.6\%$ at fawn bed sites and $36.4 \pm 0.6\%$ and $39.4 \pm 0.6\%$ at random sites in 1991 and 1992, respectively. Fawns also used bed sites with lower ponderosa pine basal area ($P \leq 0.001$), but because use did not differ between years ($P = 1.000$), we combined years (Fig. 4a). Fawn bed sites contained a mean pine basal area of 11.0 ± 0.4 m²/ha, while random sites averaged 16.5 ± 0.2 m²/ha.

Changes in tree cover, especially ponderosa pine overstory, directly affect understory development in the Black Hills (Uresk and Severson 1989). Fawns used relatively tall, dense, grass-dominated herbaceous vegetation for bed sites, and the best opportunities were under thinned pine stands. Uresk and Severson (1998) reported that total grass production is nearly twice as great under pine stands stocked at 9 m²/ha than at 14 m²/ha basal area. Further, grass species that decrease most rapidly with increasing pine basal area are the taller ones, such as wheatgrasses. Herbaceous species capable of providing adequate fawn cover are virtually absent in ponderosa pine stands with basal areas above 14 m²/ha (Uresk and Severson 1998).

Fawn use of ponderosa pine forest in the Black Hills may be somewhat unique to the area within which this study was conducted. Pine is dominant throughout, occurring on 91.1% of random sites; aspen, the next most abundant species, is found on only 32.9% of random sites. In an earlier study in the northwestern portion of the Black Hills, Kennedy (1992) concluded that closed deciduous habitats (aspen and aspen/birch) are important for providing feeding and loafing sites and optimum hiding and security cover for does during fawning. His study focused on the dam and not the fawn, but the area did contain extensive aspen stands of varying ages. Our data indicate fawns use areas with less aspen basal area ($P = 0.013$) than that found in random sites (Fig. 4b). In our study area aspens often are scattered within some white spruce and more mesic pine stands. Small patches or stringers of aspen occur, but only in the bottoms

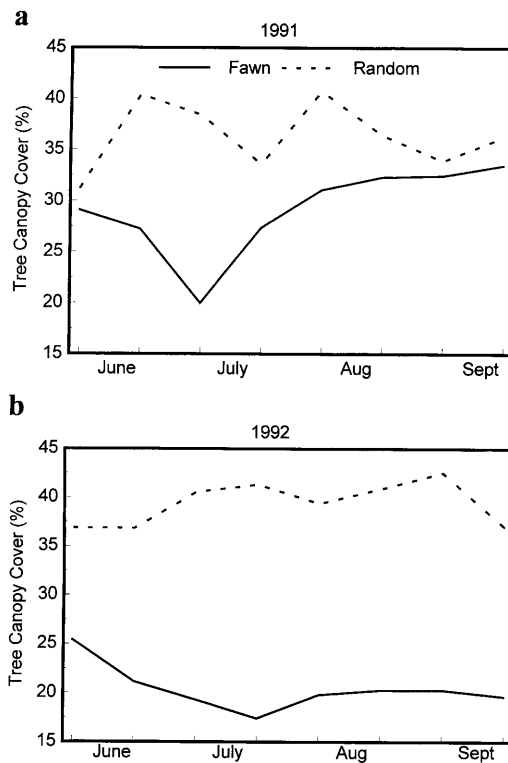


Fig. 3. Tree canopy cover (%) at white-tailed deer fawn bed sites versus random sites in 1991 (a) and 1992 (b) from early June to late September, Black Hills, South Dakota. Significant at $P = 0.10$.

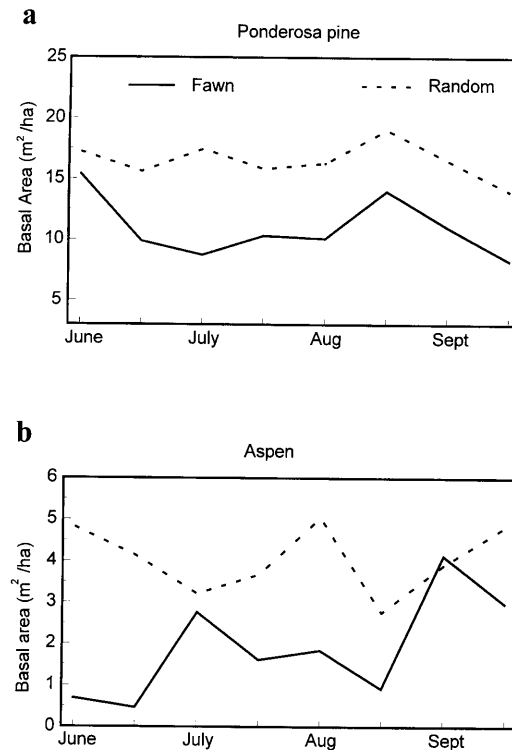


Fig. 4. Basal area (m²/ha) at white-tailed deer fawn bed sites versus random sites for ponderosa pine (a) and aspen (b) from early June to late September 1991 and 1992 combined, Black Hills, South Dakota. Significant at $P = 0.10$.

of upper drainages or as a narrow, discontinuous, transitional band between open meadows and the pine forest. Extensive, continuous aspen stands as described by Kennedy (1992) do not occur in our study area.

Slash was more prevalent at bed sites than random sites ($P = 0.054$). This may be related to seasonal development of the herbaceous understory. Understory in the Black Hills is not fully developed in early June, and early fawns may have had to use alternative cover types. Most differences occurred during June (except for the first 2-wk period) and the first 2 wk in July, but not after mid-July (Fig. 5a).

Fawns used bed sites with less shrub cover ($P \leq 0.001$) than at random sites (Fig. 5b). Other studies of white-tailed deer fawn bed sites reached different conclusions regarding woody vegetation. Bed sites contained more woody cover than did random sites in Iowa (Huegel et al. 1986) and southern Texas (Hyde et al. 1987). Mean shrub cover averaged $22 \pm$

14% at Black Hills fawn bed sites compared to $31 \pm 14\%$ at random sites. Further, nearly half the shrub cover, 11% on fawn bed sites and 13% on random sites, was composed of mat-forming (e.g., bearberry) or low-growing (e.g., Oregon grape) shrubs that contribute little to fawn hiding or thermal cover. Taller woody shrubs, with few exceptions, are not a substantial part of the total landscape.

Lack of shrubs tall enough to hide a reclining fawn is a common feature of ponderosa pine understory in portions of the central (Uresk and Severson 1989) and northeastern Black Hills. Thilenius (1972) noted that the 2 most common habitat types in the northeastern Black Hills lack a tall shrub stratum. Twenty-two tall shrub species (including tree seedlings) occur on the study area. Seventeen average $<1.0\%$ cover, which indicates limited, scattered distributions. Extensive tall shrub patches are rare. Most common are dense patches of western snowberry (*Symphoricarpos*

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