Western North American Naturalist 61(2), © 2001, pp. 236–240

# RUFFED GROUSE (*BONASA UMBELLUS*) DRUMMING LOG AND HABITAT USE IN GRAND TETON NATIONAL PARK, WYOMING

Matt L. Buhler[1] and Stanley H. Anderson[2]

ABSTRACT.—We described 15 Ruffed Grouse (*Bonasa umbellus*) drumming logs and adjacent habitat within Grand Teton National Park, Wyoming. Drumming logs and adjacent habitat differed from 30 random non-drumming sites. Drumming logs had fewer limbs (8; $P = 0.003$) and a smaller percentage of bark remaining (12%; $P = 0.0001$). These logs were in advanced stages of decay but were still firm to the touch. Additionally, drumming logs were found close to clearings but in areas with increased amounts of undergrowth and mature trees. Adjacent habitat analysis (0.04-ha circular plot centered on logs) indicated drumming locations had significantly greater average canopy height, more vegetative cover consisting of conifer and total canopy cover, and more vertical foliage between 0.3 m and 3.0 m in height. Adjacent habitat was in advanced stages of maturity as indicated by significant numbers of both large-diameter logs and large-diameter lodgepole pine (*Pinus contorta*) and quaking aspen (*Populus tremuloides*) snags. Tree species dominating the canopy and subcanopy were large-diameter Engelmann spruce (*Picea engelmannii*), lodgepole pine, and quaking aspen. Subalpine fir (*Abies lasiocarpa*) and quaking aspen saplings were more numerous at used sites. Ruffed Grouse drummed in coniferous areas within close proximity of quaking aspen.

*Key words: conifer forest, drumming logs, Grand Teton National Park, habitat use, Ruffed Grouse,* Bonasa umbellus, *screening cover, Wyoming.*

Ruffed Grouse (*Bonasa umbellus*) drumming sites have been described primarily in eastern or midwestern deciduous forests (White and Dimmick 1979, Hale et al. 1982, Backs 1984, Thompson et al. 1987). These sites typically have increased shrub and woody stem densities, canopy closure, and understory foliage, indicating that males are using areas with thick vegetation growth (Boag and Sumanik 1969, Stoll et al. 1979, Stauffer and Peterson 1985a, Thompson et al. 1987). Dense stands of eastern red cedar (*Juniperus americana*) in the understory have been described as being important at drumming sites in Missouri (Thompson et al. 1987, Thompson and Fritzell 1989). Quaking aspen has also been found to be important to Ruffed Grouse (Boag and Sumanik 1969, Gullion 1977, Stauffer and Peterson 1985a, 1985b, Gormley 1996).

Increased amounts of screening cover appear to be crucial for drumming sites because of the conspicuous nature of the male (Boag and Sumanik 1969, Thompson et al. 1987). The purpose of this study was to determine habitat use at Ruffed Grouse drumming sites and compare it to random logs and surrounding habitat. We were specifically interested in the amount of horizontal and vertical cover surrounding the drumming site as well as the condition of the log used as a stage. While drumming, male Ruffed Grouse can be detected from some distance. We wondered if, to avoid predation, Ruffed Grouse were using areas that contained more vegetative cover.

Drumming was assumed to increase the male's vulnerability to predation. Primary predators of Ruffed Grouse in northwestern Wyoming conifer forests are Northern Goshawks (*Accipiter gentilis*), American marten (*Martes americana*), coyote (*Canis latrans*), bobcat (*Felis rufus*), and red foxes (*Vulpes vulpes*). Dense horizontal and vertical screening cover, however, make it difficult to pinpoint a grouse's exact location and thus make it harder for predators to approach undetected.

## STUDY AREA

We surveyed 40 km of the Snake River riparian corridor within Grand Teton National Park in northwestern Wyoming, from Jackson Lake dam downstream to Moose, Wyoming.

[1]Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Box 3166, Laramie, WY 82071. Present address: 13620 SW Beef Bend Rd #107, Tigard, OR 97224.
[2]United States Geological Survey, Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Box 3166, Laramie, WY 82071.

The width of the riparian corridor ranges from 0.25 to 2.6 km (mean = 1.4 km). Elevation varies from 1968 m to 2066 m. The upper 10 km of the study site consists of mature stands of closed-canopy lodgepole pine and Engelmann spruce that are contiguous with surrounding forest (Mattson and Despain 1985). The lower 30 km is isolated from forest habitat and is dominated by big sagebrush (*Artemisia tridentata*) and silver sagebrush (*Artemisia cana*). Understory along the entire 40 km is dominated by russet buffaloberry (*Shepherdia canadensis*), grouse whortleberry (*Vaccinium scoparium*), common juniper (*Juniperus communis*), red baneberry (*Actaea rubra*), wild rose (*Rosa woodsii*), quaking aspen, Engelmann spruce, and subalpine fir.

## METHODS

We placed 7 transects each in the middle of lodgepole pine, Engelmann spruce, and mixed cottonwood/conifer cover types throughout the 40-km study area. Transects originated at the river's edge, running perpendicular to the channel within the cover type. Transects were 100 m in length and were marked at 10-m intervals as well as 50 m to each side for a total search area of 10,000 $m^2$ (1 ha). Surveys were conducted in early morning (0530–1030) and evening (1900–2200) hours between 20 May and 30 June 1996 and 15 May and 30 June 1997. The observer listened 30 minutes for drumming males and then located the logs. Only males that were drumming within the 1-ha search area were used for habitat analysis.

Using a stratified random design, we selected 30 random logs. Of 15 drumming logs identified, 8 were in lodgepole pine, 5 in Engelmann spruce, and 2 in mixed cottonwood/conifer. We therefore randomly selected 16 sites in lodgepole pine, 10 in Engelmann spruce, and 4 in mixed cottonwood/conifer. Randomly generated numbers for length along and distance from the transect determined a point of inspection. At that point the closest log was used as the random log. Drumming logs were measured as follows: diameter at drumming position, length, number of limbs, percent bark remaining, and height above ground at drumming position. Random logs were measured for similar variables, with log diameter and height off ground being measured at the largest end.

Habitat adjacent to the logs was sampled using a 0.04-ha circular vegetation plot centered on the log as described by James and Shugart (1970) and Noon (1981). The same individual conducted all vegetation sampling to decrease variability from observer bias. Transect lines, which were established through the center point (logs), ran in each cardinal direction (north–south and east–west) to divide the circle into quarters for vegetation sampling. We determined vertical foliage with a density board placed at each of the 4 points where transect lines intersected the edge of the 0.04-ha circle. The density board was divided into 4 heights of 0.0–0.3, 0.3–1.0, 1.0–2.0, and 2.0–3.0 m, corresponding to low and high ground cover and low and high shrub cover, respectively. Values were averaged for each height. Dominant shrub and ground species $<1$ m tall and $<3$ cm dbh were recorded from most numerous to least in the entire plot. Nearest tree and largest log within each quarter were determined as to distance, diameter, and species of closest living tree ($\geq 3$ inch dbh) and largest fallen log to the center point. We selected 5 representative trees from the 0.04-ha plot, determined their height with a clinometer, and averaged the results. Both ground cover and canopy cover were estimated with an ocular tube with crosshairs at one end. The observer peered through the tube at the ground and at the canopy at 10 locations spaced 1 m apart along each transect. The number of "hits" was recorded. A hit occurred when the crosshairs intersected vegetation. To determine total percent cover, we divided the number of hits by 20. Shrub density was determined as the observer proceeded along each transect and counted the number of woody stems $<3$ cm dbh that intersected the body and outstretched arms at breast height. The total number of shrub stems per hectare was estimated by multiplying the total number of stems encountered from both transects by 125. Deciduous and coniferous shrubs were recorded separately. Tree diameter of all tree species $\geq 3$ cm dbh was recorded within the entire circular plot. We also recorded total number and species of snags $>3$ cm dbh within the 0.04-ha plot.

Statistical analysis of log use and adjacent habitat (0.04-ha circle) varied and was considered significant at $P \leq 0.05$. We performed univariate comparisons with Mann-Whitney U and 1-way analysis of variance (ANOVA) through paired $t$ tests by comparison of means, as some variables were nonparametric (Minitab Inc. 1996). Two-sample $t$ tests were used for variables that were found to have normal distributions (Wilk Shapiro > 0.95). Logistic regression was used to compare tree-diameter classes between drumming and random sites. Trees were broken down into species and divided into 9 classes (3–8, 8–15, 15–23, 23–38, 38–53, 53–69, 69–84, 84–102, and >102 cm), with the 10th class being total number of trees found in the plot. Logistic regression analysis revealed which diameter class of tree species dominated the habitat surrounding the drumming log.

## RESULTS

Compared with random logs, drumming logs had fewer remaining limbs ($8 \pm 4.6\ s$; $P = 0.003$) and a smaller percentage of bark remaining ($12\% \pm 8.2\ s$; $P = 0.0001$). They were in advanced stages of decomposition as evidenced by remaining bark and fewer limbs (Table 1).

Habitat composition surrounding drumming logs was significantly different from random locations (Table 2). Of 15 drumming logs, 8 were located in lodgepole pine, 5 in Engelmann spruce, and 2 in mixed cottonwood/conifer. Of 30 random logs, 16 were in lodgepole pine, 10 in Engelmann spruce, and 4 in mixed cottonwood/conifer. Lodgepole pine and Engelmann spruce dominated the canopy and provided increased total and conifer canopy cover, average canopy height, total number and size of Engelmann spruce and lodgepole pine. Subalpine fir and quaking aspen tree stems dominated the subcanopy. Lodgepole pine and quaking aspen snags were in greater abundance. Ground cover variables that were significantly greater were largest log dbh and vertical foliage between 0.3 m and 3.0 m in height.

## Discussion

Ruffed Grouse drumming logs were significantly different from random logs, suggesting that particular logs were used for courtship displays (Table 1). Drumming logs were typically found close to clearings with large amounts of undergrowth. On average, they had larger diameters (84 cm) than random logs, with the top of the log 42.5 cm off the ground. The most marked difference between drumming and random logs was the degree of decomposition. On average, only 8 limbs and 12% of the bark remained on drumming logs, indicating advanced stage of decomposition (Masen et al. 1979). Past research indicated that drumming logs were not different from random logs but that Ruffed Grouse were using areas with greater vegetation cover (Boag and Sumanik 1969, Stauffer and Peterson 1985a). However, we found Ruffed Grouse using specific logs that were relatively free of bark and limbs for drumming.

Analysis of adjacent habitat showed several differences between drumming and random log sites (Table 2). Drumming sites were typically located within mature stands of lodgepole pine and Engelmann spruce with thick understory of saplings and shrubs. Drumming sites were found only within the upper portion of the river that is surrounded by contiguous conifer forest. Large-diameter lodgepole pine and Engelmann spruce provided increased conifer and total canopy cover as well as taller-than-average canopy height. Lodgepole pine and quaking aspen snag diameter and stem densities were greater for drumming sites, indicating use of sites from middle- to late-successional forest stages. Additionally, large-diameter logs on the forest floor indicated mature stands. The subcanopy consisted primarily of quaking aspen of all size classes ranging from saplings to mature trees (>48 cm). Engelmann spruce and subalpine fir saplings were also found in greater abundance.

Quaking aspen has been determined to be important to Ruffed Grouse as cover and a food source (Boag and Sumanik 1969, Gullion 1977, Stauffer and Peterson 1985a, 1985b). We found Ruffed Grouse in close association with quaking aspen in all forms from saplings to mature trees. Drumming locations were typically located either within or close to quaking aspen stands.

Ground cover was dominated by russet buffaloberry, grouse whortleberry, wild rose, and red baneberry. The combination of large quantities of shrubs, saplings, and tree species produced greater-than-average amounts of vertical foliage between 0.3 m and 3.0 m high. While searching for drumming males, we had to get close to the birds before we could locate them. Higher density of ground and subcanopy vegetation cover has been shown to be

TABLE 1. Comparison of variable means from 15 Ruffed Grouse drumming logs and 30 random logs in Grand Teton National Park, Wyoming.

| Variable | Drumming logs $\bar{x}$ ($s$) | Random logs $\bar{x}$ ($s$) | $P$-value |
|---|---|---|---|
| Log dbh (cm) | 84.33 (16.3) | 75.43 (8.9) | 0.401 |
| Log height (cm) | 42.5 (19.4) | 34.75 (12.9) | 0.205 |
| Log length (m) | 33.5 (6.8) | 28.5 (12.9) | 0.495 |
| Number of limbs | 8.5 (4.6) | 40.7 (14.1) | 0.003 |
| Percent bark remaining | 12.6 (8.2) | 77.4 (20.4) | 0.0001 |

TABLE 2. Comparison of habitat variable means from 15 Ruffed Grouse drumming sites and 30 random sites. Drumming sites were 0.04-ha circular plots adjacent to and centered on drumming logs. Random sites were adjacent to and centered on random logs.

| Variable | Drumming sites $\bar{x}$ ($s$) | Random sites $\bar{x}$ ($s$) | $P$-value |
|---|---|---|---|
| Largest log dbh (cm) | 84.33 (8.3) | 45.89 (18.6) | 0.048 |
| Conifer canopy cover (%) | 73 (12.2) | 48 (6.9) | 0.0001 |
| Total canopy cover (%) | 86 (4.3) | 59 (25.8) | 0.035 |
| Vertical foliage 0.3–1.0 m (%) | 95 (5.9) | 65 (15.7) | 0.003 |
| Vertical foliage 1.0–2.0 m (%) | 90 (12.2) | 50 (19.4) | 0.009 |
| Vertical foliage 2.0–3.0 m (%) | 90 (11.9) | 35 (21.1) | 0.0001 |
| Average canopy height (m) | 114.84 (27.5) | 89.14 (19.9) | 0.044 |
| Subalpine fir total stems | 18.5 (8.7) | 2.3 (12.2) | 0.003 |
| Quaking aspen tree dbh (cm) | 48.3 (14.8) | 14.5 (5.9) | 0.001 |
| Lodgepole pine snag dbh (cm) | 62.3 (5.8) | 24.8 (7.1) | 0.008 |
| Quaking aspen snag dbh (cm) | 38.6 (8.4) | 10.2 (2.7) | 0.018 |
| Engelmann spruce total stems | 39.4 (16.5) | 5.5 (1.7) | 0.029 |
| Lodgepole pine total stems | 41.6 (17.5) | 22.6 (18.6) | 0.001 |
| Quaking aspen snag total stems | 8.4 (2.3) | 1.9 (1.5) | 0.048 |
| Lodgepole pine snag total stems | 11.0 (6.5) | 5.2 (3.2) | 0.002 |
| Quaking aspen total stems | 14.2 (3.2) | 2.5 (1.5) | 0.0001 |
| Lodgepole pine tree dbh (cm) | 65.3 (13.3) | 31.6 (15.7) | 0.001 |
| Engelmann spruce tree dbh (cm) | 86.5 (8.3) | 53.9 (11.7) | 0.007 |

important for drumming locations (Boag and Sumanik 1969, Stauffer and Peterson 1985a). Ruffed Grouse appeared to be using drumming logs with greater-than-average amounts of screening cover.

Since mate attraction is accomplished through auditory means, visual cues are probably not as important (Thompson and Fritzell 1989, Gormley 1996). Because drumming makes males more conspicuous to predators, large amounts of screening cover may be needed to avoid predation. Aerial predators such as the Northern Goshawk may have trouble pinpointing a grouse's location due to increased canopy cover and tree density. Increased vertical foliage from ground cover, shrubs, subcanopy trees, and mature trees could also conceal a male grouse from terrestrial predators. When we approached a drumming male, he would remain motionless on the log before slipping silently into nearby shrubs. If pursued, the grouse would flush and fly to nearby trees. Marshall (1946) determined that Ruffed Grouse initially remain motionless and then fly to conifer tree species when flushed. Any approaching predators would be detected through noise or motions, making it hard for those predators to effectively take a drumming male. Large amounts of vegetation, therefore, appear to decrease the potential of predation and are an essential part of Ruffed Grouse drumming habitat.

Ruffed Grouse in Grand Teton National Park used drumming logs in areas with greater-than-average amounts of vegetation. Drumming sites had more vertical and horizontal cover, which appeared not only to more effectively hide the drumming male, but to make it hard for a predator to approach undetected. Although males significantly used logs with fewer limbs and less remaining bark, large amounts of vegetation, both vertical and horizontal, surrounding the log appeared to be the most important factors influencing use of drumming positions.


## ACKNOWLEDGMENTS

Financial support was provided by the National Park Service–Grand Teton National Park and Wyoming Game and Fish Department. Logistic support and equipment were provided by the Wyoming Cooperative Fish and Wildlife Research Unit and University of Wyoming. We thank J. Lovvorn and B. Reiners for constructive comments on early revisions.


## LITERATURE CITED


BACKS, S.E. 1984. Ruffed Grouse restoration in Indiana. Pages 37–58 *in* W.L. Robinson, editor, Ruffed Grouse management: state-of-the-art in the early 1980's. North Central Section of the Wildlife Society.

BOAG, D.A., AND K.M. SUMANIK. 1969. Characteristics of drumming sites selected by Ruffed Grouse in Alberta. Journal of Wildlife Management 33:621–628.

GORMLEY, A. 1996. Cause of mortality and factors affecting survival of Ruffed Grouse (*Bonasa umbellus*) in northern Michigan. Master's thesis, Michigan State University, East Lansing.

GULLION, G.W. 1977. Forest manipulation for Ruffed Grouse. Transactions of North American Wildlife Natural Resource Conference 42:449–458.

HALE, P.E., A.S. JOHNSON, AND J.L. LANDERS. 1982. Characteristics of Ruffed Grouse drumming sites in Georgia. Journal of Wildlife Management 46:115–123.

JAMES, F.C., AND H.H. SHUGART, JR. 1970. A quantitative method of habitat description. Audubon Field Notes 24:727–736.

MARSHALL, W.H. 1946. Cover preferences, seasonal movements, and food habits of Richardson's Grouse and Ruffed Grouse in southern Idaho. Wilson Bulletin 58:42–52.

MASEN, C., R.G. ANDERSON, K. KROMAT, JR., J.T. WILLIAMS, AND R.E. MARTIN. 1979. Dead and down woody material. Pages 78–85 *in* J.W. Thomas, editor, Habitats in managed forests: the Blue Mountains of Washington and Oregon. USDA Forest Service Agriculture Handbook 5.

MATTSON, D.J., AND D.G. DESPAIN. 1985. Grizzly bear habitat component mapping handbook for the Yellowstone Ecosystem. National Park Service and United States Forest Service. 37 pp.

MINITAB INC. 1996. Minitab™ for Windows™ release 11.21. Prowers Printing Company, Lebanon, PA.

NOON, B.R. 1981. Techniques for sampling avian habitats. Pages 42–52 *in* D. Capen, editor, The use of multivariate statistics in studies of wildlife habitat. USDA Forest Service General Technical Report RM-87, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

STAUFFER, D.F., AND S.R. PETERSON. 1985a. Seasonal microhabitat relationships of Ruffed Grouse in southeastern Idaho. Journal of Wildlife Management 49: 605–610.

______. 1985b. Ruffed and Blue Grouse habitat use in southeastern Idaho. Journal of Wildlife Mangement 49:459–466.

STOLL, R.J., JR., M.W. MCCLAIN, R.L. BOSTON, AND G.P. HONCHUL. 1979. Ruffed Grouse drumming site characteristics in Ohio. Journal of Wildlife Management 43:324–333.

THOMPSON III, F.R., AND E.K. FRITZELL. 1989. Habitat use, home range, and survival of territorial male Ruffed Grouse. Journal of Wildlife Management 53:15–21.

THOMPSON III, F.R., D.A. FREILING, AND E.K. FRITZELL. 1987. Drumming, nesting, and brood habitats of Ruffed Grouse in an oak-hickory forest. Journal of Wildlife Management 51:568–575.

WHITE, D., AND R.W. DIMMICK. 1979. Survival of habitat use of northern Ruffed Grouse introduced into west Tennessee. Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies 32:1–7.



*Received 24 November 1999*
*Accepted 27 April 2000*