Evaluation of a Ruffed Grouse Reintroduction in Tennessee

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Abstract: Thirty-six ruffed grouse (*Bonasa umbellus*) trapped in eastern Tennessee were released in western Tennessee during fall and winter 1985–86. Birds were monitored by radio telemetry and/or observation through spring 1986. Drumming surveys were conducted in the spring of 1986 and 1987. Thirteen drumming logs were located. Two activity centers were delineated in 1986, and 4 in 1987. Characteristics of drumming logs and surrounding habitat are comparable with those reported in the literature.

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Tennessee is on the southern edge of ruffed grouse range. The bird's historical distribution in Tennessee included the Western Highland Rim physiographic province, though it is now restricted to the eastern one-third of the state (White and Dimmick 1979). Prompted by improvement of forest habitat on the Western Highland Rim, a program was initiated to restore grouse to their former range. Successful restorations have been accomplished in Indiana (Backs 1984) and Missouri (Hunyadi 1984). Previous restoration attempts in western Tennessee achieved limited success (Gudlin and Dimmick 1984), or were failures (White and Dimmick 1978, Jones 1979). Those reintroductions were made in habitats comprised primarily of pole and sawtimber hardwoods, with small amounts of forest in young hardwood regeneration. This study was done to evaluate a reintroduction of grouse into an area with a program incorporating both even-aged and uneven-aged hardwood management. The purpose of this paper is to describe movements, habitat use, and breeding activity for 36 birds released in fall and winter 1985–86.

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Study Area

The release area is in Humphreys County at Cuba Landing on Kentucky Lake. Upland terrain ranges from stream terraces and undulating valley floors to steep (up to 80% slope), highly dissected ridges with reliefs exceeding 60 m. Soils on the ridges are weakly developed, cherty, excessively drained, leached, and acidic (Welles et al. 1946). Alluvial and colluvial soils in valleys are richer than those on ridges, but of limited extent.

Vegetation varies from old fields to mature second growth woodlands. Ridges are dominated by chestnut oak (*Quercus prinus*) and white oak (*Q. alba*), with post oak (*Q. stellata*), scarlet oak (*Q. coccinea*), and pignut hickory (*Carya glabra*). Farkleberry (*Vaccinium arboreum*) thickets occur on ridge tops and upper south-facing slopes. Extensive patches of brambles (*Rubus* spp.) and Japanese honeysuckle (*Lonicera japonica*) occur along old ridge top logging roads and in valleys, respectively. Bottomlands support numerous woody species, predominantly maples (*Acer* spp.), sweetgum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), and tulip poplar (*Liriodendron tulipifera*). Small stands of loblolly pine (*Pinus taeda*) and eastern red cedar (*Juniperus virginiana*) are scattered thinly over the area.

Methods

Trapping and Handling

Ruffed grouse were trapped at Bays Mountain Park and Holston Army Ammunition Plant (HAAP) in northeastern Tennessee. These sites occur on a single landform dominated by the convergence of 2 parallel ridges having a relief of over 300 m. The ridges are predominantly wooded while surrounding land is urban or agricultural. Grouse were captured with interception traps (Liscinsky and Bailey 1955, Gullion 1965). Trapping was done in the Park during the fall 1985 dispersal period and on HAAP grounds during late winter 1986.

Captured birds were weighed, banded, and sexed according to completeness of the tail band (Davis 1969) and number of spots on the rump feathers (Roussel and Ouellet 1975). Birds were classed as juveniles or adults based on sheathing on the outer primaries (Hale et al. 1954), and juveniles were aged to week by progression of the remige molt (Bump et al. 1947:84). Antibiotic powder was applied to scalp wounds in cases where the skull was exposed.

Captive grouse were held ≤ 5 days in a darkened pen made of straw bales and netting, and fed crushed acorns and cultivated grapes. They were transported to the study area in cardboard chick boxes. Most grouse were released before mid-afternoon. The release site was selected to encourage birds to move into favorable escape cover.

Monitoring Grouse Activity

To monitor survival, movements, and habitat use of released grouse, 14 birds were fitted with radio transmitters. Total weight of the unit, including an 18-month NiCad battery and a vinyl bib-style mount (Armstrup 1980), averaged approximately 20 g. Tracking began when the birds were released and continued sporadically thereafter. As a supplement to telemetry information, all incidental flushes of non-telemetered birds were recorded. Records were also solicited from several observers, including local wildlife officers, hunting clubs, and bird-watching clubs.

Field crews conducted surveys of drumming males in spring 1986 and 1987 to verify occurrence of reproductive activity and to augment survival information. Ridges within the area bounded by all radio location points were searched for active drumming logs, identified by the presence of fresh droppings on the drumming stage (Gullion 1966). All drumming logs were permanently tagged and described following the methods used by Hale et al. (1982). Circular plots were centered on the drumming stage to sample vegetation. Plot sizes were 4, 20, and 100 m^2 for groundstory, understory, and overstory, respectively.

Results and Discussion

Capturing and Transplanting Grouse

Forty-two ruffed grouse were captured from 1 October to 6 December 1985. Twenty-seven traps were operated for 1,056 trap days, giving an overall trapping success rate of 25 trap-days per bird. Thirty-three survived to be released. Three additional grouse were transplanted from HAAP in February and March 1986.

The age ratio of the released cohort was 177 juveniles per 100 adults. Sex ratio was 80 females per 100 males. Adult females comprised only 11% of the cohort. All juveniles were at least 16 weeks old. Mean weight at capture was 632 g. Many birds sustained slight to severe scalp injury during temporary confinement in the traps, but all were healing upon release. All grouse showed good mobility when liberated.

Movements and Habitat Use

Fifty-three radio locations were obtained from October 1985 to May 1986. This represents a mean of less than 4 records per bird, with a range of 1 to 13. By the end of fall, dispersal and/or death had reduced the telemetered cohort to 7 grouse. These birds remained within about 1 km primarily east or south of the release point, an area comprising approximately 200 ha. Predation reduced the cohort to 3 telemetered birds by March and 2 by April.

Telemetry data and numerous incidental observations suggested that grouse used farkleberry thickets or hardwood regeneration on or near the ridge tops in fall and spring, and hardwood regeneration or honeysuckle thickets in the hollows in winter. Grouse selected habitats similar to those selected by grouse released elsewhere on the Western Highland Rim (White and Dimmick 1978, Jones 1979, Gudlin and Dimmick 1984).

Two telemetered grouse, an adult male and a juvenile female, survived into the breeding season. Their exploratory ranges overlapped, but during the drumming/nesting season they were widely separated. The male's range included most of the drumming logs found in 1986 and 1987.

Reproductive Activity

Six active drumming logs were found in 1986; 9 were found in 1987, including 7 previously unused logs. Because only 1 grouse was heard on any day in either year, it was difficult to cluster the logs into activity centers (Gullion 1967). This difficulty was compounded by the lack of an obvious primary log (Gullion 1967) in some apparent groups of logs. However, the spatial distribution of the logs suggested that 4 centers were represented by the 13 logs.

Reported maximum distances between logs within an activity center range from 150 to 170 m (Gullion 1967; J. Everett, unpubl. rep., 1986). Minimum distances to a different activity center range from 58 to 135 m (Archibald 1976; W. M. Ford, pers. commun., 1987). The maximum distance between logs in an activity center comprised of 6 logs on our study area was 230 m. Though this wide spacing suggests 2 centers, mean distance between neighboring logs (54 m) and location of the group at the end of a spur ridge led us to conclude that these logs were used by only 1 bird. Drumming surveys suggested that the bird shifted its activities within this center by 100 m during the season, moving from 3 south-facing logs in March to 3 north-facing logs in April. Six logs are within reported ranges of 1 to 7 and 2 to 8 logs per center (Gullion 1967, Longwitz 1985).

Drumming log searches covered the same areas in 1986 and 1987. Two activity centers were held the first year and were used again in the second year. Two additional centers, both farther from the release point, were also occupied in 1987. Assuming that all males occupied drumming logs and all activity centers were located, these results imply that a small population has persisted on the area during 2 breeding seasons following transplanting.

Drumming Log Characteristics

Most logs were positioned parallel to the contour on the upper slope of a west or north-facing ridge. At the drumming log site, slope ranged from 10% to 40%. All drumming stages faced downhill, aligned with the slope and perpendicular to the long axis of the log. Mean stage height was 26 cm (SD = 5.6, range 15–35), and mean log length was 7.6 m (SD = 2.1, range 3.0–11.3). These characteristics are comparable to those described from other areas in Tennessee (Taylor 1976, Longwitz 1985).

Mean overstory canopy closure was 29% (SD = 17, range 10–80). On our study area, overstory basal area ranged from 0 to 16.33 m^2/ha and averaged 6.26 m^2/ha (SD = 5.0), lower than reported for the Cumberland Plateau (17 m^2/ha, Longwitz 1985) and Missouri (12–19 m^2/ha, Hunyadi 1984). Overstory canopy closure was greater in Missouri as well, ranging from 53% to 66%. The low

basal area and canopy cover at Cuba Landing may reflect poor site quality and selective logging practices.

Understory cover around the logs varied. Mixed hardwoods was the most common type, followed closely by farkleberry thickets (Table 1). Farkleberry was less common than mountain laurel (*Kalmia latifolia*) around drumming logs on the Cumberland Plateau (Longwitz 1985) and in northern Georgia (Hale et al. 1982). Understory stem density ranged from 2,500 to 28,000 stems/ha and averaged 14,800 stems/ha (SD ± 6,800). This average is very close to that reported by Hale et al. (1982). Understory growth was denser on the Plateau sites than reported here, averaging 33,000 stems/ha (Longwitz 1985). In Minnesota, aspen (*Populus* spp.) regeneration in the 14,000–20,000 stems/ha stage provided the best cover for drumming grouse (Gullion 1977). Most authors consider the understory layer to be the most important habitat component (Cade and Sousa 1985). Despite differences in topography and plant species composition, transplanted grouse were able to locate drumming sites generally comparable to those in their native range.

Implications for Restoration

This and other reintroductions of ruffed grouse in western Tennessee have demonstrated that problems somewhat unique to ruffed grouse must be solved if restoration is to be successful. A natural tendency for ruffed grouse to disperse during fall, and an inclination to remain isolated from conspecifics during winter, rather than gather in flocks or coveys, decrease the likelihood that males and females in a small population will locate one another during breeding. This may be circumvented partially by releasing large numbers of grouse, and perhaps by releasing segments of each cohort in 3 or more adjacent locations. Based on our observations of dispersal patterns of grouse in Tennessee, we suggest that the locations be separated by approximately 1 km of contiguous forest. Consequently, birds dispersing from 1 group may move into the home ranges of birds from another group.

Selecting an appropriate area for release is crucial. Prime ruffed grouse winter habitat is early- to mid-successional forest of dense saplings, and has a life of 10 to 20 years as good protective cover. If restoration is to be permanent, the area selected should be actively managed hardwood forest with clear-cutting in small blocks as a predominant management practice.

The source of grouse for reintroduction may not be critical, provided they are wild, healthy birds. A limited population established elsewhere in Tennessee by Gudlin and Dimmick (1984) used birds from central Wisconsin, whereas this release in Humphreys County birds transplanted from eastern Tennessee.

Demographic characteristics of the 2 released cohorts yielding sustained breeding activity were quite different. Mean weight of the birds from Tennessee was much greater than that of birds from Wisconsin (632 vs. 475 g). The Tennessee cohort contained a much larger proportion of adult birds (36% vs. 8%), and the juveniles were at least 5 weeks older than the birds from Wisconsin. Both cohorts had approximately equal proportions of females.

Table 1. Vegetation around 13 drumming logs used by ruffed grouse in Humphreys County, Tennessee spring, 1986 and/or 1987.

Log	Activity center	Understory type	Stem Density (1000's stems/ha)		Ground cover (%)	Overstory canopy closure (%)	Overstory basal area (m^2/ha)	Distance to opening (m)	Distance to nearest log (m)	Distance[a] to other cover (m)
			understory	groundstory						
191	1	farkleberry	28.0	10.0	<1	30	8.77	[b]	19	15 S
192	1	mixed hardwoods	12.5	42.5	<1	40	12.32	[b]	25	30 F
193	1	sassafras	19.0	67.5	<1	20	3.98	[b]	19[c]	30 F
195	2	mixed hardwoods	11.0	135.0	<1	20	6.09	6	40	76 H
196	2	farkleberry	23.5	377.5	<1	25	12.22	7	40[c]	61 H
197	2	farkleberry	19.0	45.0	<1	10	6.09	17	100[d]	91 H
131	3	mixed hardwoods	12.0	5.0	<1	20	16.33	26	17	25 B
132	3	farkleberry	13.0	30.0	<1	25	5.18	20	17[c]	19 B
133	3	mixed hardwoods	2.5	0.0	<1	25	1.33	175	59	108 F
134	3	oak regeneration	9.0	0.0	<1	30	6.61	15	24	14 B
135	3	mixed hardwoods	13.0	0.0	<1	30	1.23	13	24[c]	12 B
136	3	elm regeneration	10.0	2.5	<1	20	0.00	20	70	10 B
137	4	cedar/farkle/gum	20.0	35.0	<1	80	1.23	23	100[d]	40 B
		$\bar{X}$	14.8	57.7	—	29	6.26	32	36	41
		SD	6.8	103.3	—	17	5.00	51	21	33

[a] S = sassafras stand, F = farkleberry thicket, H = hardwood regeneration, B = blackberry thicket.
[b] None nearby.
[c] Paired with other logs—excluded from calculations.
[d] Possibly in a separate activity center—excluded from calculations.

From these analyses we conclude that the primary factor determining success is habitat on the restoration area. Though we did not evaluate success related to size of the released cohort, our observations on survival and dispersal behavior of transplanted birds indicated that within limits, the likelihood of successful restoration of ruffed grouse increases as the number of birds released increases. The successful program in Missouri has utilized nearly 3,000 birds, with 60 or more birds usually released at a site (Hunyadi 1984).

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