

ECOLOGICAL STUDY OF RUFFED GROUSE  
BROODS IN VIRGINIA

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THE RUFFED GROUSE (*Bonasa umbellus*), commonly called "pheasant" throughout the southern Appalachian region, is a popular game bird in the mountains of Virginia. Unfortunately, however, the grouse populations in this State have declined noticeably during the past fifty years. Because of this, special field studies were designed through the cooperation of the U. S. Fish and Wildlife Service and U. S. Forest Service, which would provide information that could be used in devising more efficient grouse management practices. As part of this program, I was assigned to investigate the ecology and habits of this species in the Shenandoah Mountains during the spring and summer of 1941. These studies were conducted within the George Washington National Forest in northwestern Augusta County, southwestern Rockingham County, and northeastern Highland County, Virginia.

Special attention was given to the habitat requirements and behavior of young grouse from May 28, when the first brood was found, until the end of July. Concentrated effort toward this phase of the study resulted in a total of 98 contacts with grouse broods. In addition to information on broods, analyses of crop and stomach contents of 29 grouse chicks produced information on food habits.

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*Habitat.*—Most grouse broods were found in lowland areas along streams in coves or ravines, or on the higher knobs and ridges at elevations above 4000 feet during the first few weeks following hatching, in late May, June, and early July. These situations support moist types of forest and altogether do not comprise more than 15 per cent of the total forest land in the Shenandoah Mountains. Small areas of moist forest also occur locally on steep north slopes, but this type of terrain is apparently shunned by broods. The forest type found along streams in the coves or ravines, and on steep north slopes,

probably could be classified as the Mixed Mesophytic Forest Association (Braun, 1950). The more important trees in this type include: hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), sweet birch (*Betula lenta*), white oak (*Quercus alba*), red oak (*Quercus rubra*), tulip poplar (*Liriodendron tulipifera*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), basswood (*Tilia* sp.), and black gum (*Nyssa sylvatica*). On the higher ridges and knobs, the forests are composed chiefly of red oak and sweet birch, while a fairly dense sprout-growth of chestnut (*Castanea dentata*) is also characteristic.

Broods of young grouse were scarce or absent during early summer on most slopes, ridges, and knobs at elevations below 4000 feet. These areas, comprising the most extensive portion of the Shenandoah Mountains, are covered with a much drier type of forest, in which various species of oaks are usually predominant. According to Braun's (1950) classification, this forest probably would be considered as part of the Oak-chestnut Forest Association. Chestnut oak (*Quercus prinus*) and scarlet oak (*Quercus coccinea*) are abundant over much of this area. Locally, and especially on southern and western slopes, scrub pine (*Pinus virginiana*), pitch pine (*Pinus rigida*), and Table Mountain pine (*Pinus pungens*) are common, while extensive tracts of scrubby bear oak (*Quercus ilicifolia*) occur on some of the more level expanses.

Intermediate moisture conditions were found to exist in the forests on the broader valley floors and occasionally on eastern slopes. These forests were composed chiefly of white oak, black oak (*Quercus velutina*), and various hickories (*Carya* spp.), while locally, nearly pure stands of white pine were found. During the early summer, a few scattered broods were located in these areas, although they were much less common there than in the forests of the ravines and high ridges and knobs.

Practically all broods of the younger grouse were found in or near forest-edge habitats. Most of them were distributed within the moist forest types along small or narrow semi-shaded clearings, such as secondary roads, wagon-roads, trails, and natural forest openings. The preference for these situations is probably due to the more luxuriant growth of ground vegetation that characteristically develops on them. The relative abundance of young woody sprouts and seedlings appeared to be especially important. While a few broods were found in openings almost entirely devoid of this type of plant-growth, it was noticed that areas which supported the greatest number of broods were those in which many recent small clearings or slashings had resulted in an abundance of woody sprouts. The

outstanding area supporting this observation was found in Ramsey's Draft in Augusta County, where 26 brood contacts were made. A newly constructed road extended for over four miles up this cove, and along its margins, sprouts and seedlings of the more succulent types of trees were found in abundance, including such species as sweet birch, tulip poplar, cucumber tree (*Magnolia acuminata*), sugar maple, and basswood. This lush growth of small woody plants, undoubtedly served as a rich source of insect food near the ground within reach of small chicks and at the same time provided excellent protective cover for them.

In Table 1, the various species of plants found in the environs of 90 brood contacts during late May, June, and early July were classified into four strata, designated as overstory, middlestory, understory, and ground cover. A rating system was devised in an attempt to evaluate the relative abundance of the component plant species for each vegetative layer. According to this system, the three most abundant species within each stratum were rated for every brood contact by assigning 3 points for the most abundant species, 2 points for the second most abundant species, and 1 point for the third most abundant species. These data, from all contacts, were then tabulated for each stratum by computing the percentage of total points comprised by each species. The tabulation represents a composite analysis of the vegetation of the grouse brood environment during late May, June, and early July.

Table 1 helps to illustrate the great variety of plants that are characteristic of Ruffed Grouse brood habitats in the Shenandoah Mountains. Most of the predominant species are those that are adapted to moist forest conditions. Many species, particularly in the understory and ground cover, are largely restricted to edge situations such as are found in small forest openings. The prominence of hemlock and white pine in the overstory is believed to be significant only to the extent that these species are characteristic of the moist forests of this region, since no preference for coniferous cover by broods was indicated.

An abrupt change was noted in the habitat preferences of broods following the first week of July. Whereas, previously, it was generally possible to locate at least one brood during a day's work in the field, thereafter it was difficult to locate more than two broods a week. The most significant change, however, was the almost total absence of broods in the moist forest areas, where they previously had been common. Nearly all of the broods were found instead in the drier forest associations of the mountain slopes. Only two broods were

TABLE 1  
VEGETATION OF EARLY RUFFED GROUSE BROOD ENVIRONMENT

Overstory			
per cent	per cent		
Hemlock ( <i>Tsuga canadensis</i> ) . . . . .	16	Sweet birch ( <i>Betula lenta</i> ) . . . . .	5
White oak ( <i>Quercus alba</i> ) . . . . .	13	Scarlet oak ( <i>Quercus coccinea</i> ) . . . . .	4
Red oak ( <i>Quercus rubra</i> ) . . . . .	11	Sugar maple ( <i>Acer saccharum</i> ) . . . . .	4
Red maple ( <i>Acer rubrum</i> ) . . . . .	10	Basswood ( <i>Tilia</i> sp.) . . . . .	4
White pine ( <i>Pinus strobus</i> ) . . . . .	8	Tulip poplar ( <i>Liriodendron tulipifera</i> ) . . . . .	3
Hickories ( <i>Carya</i> spp.) . . . . .	8	Other (13 species) . . . . .	14
Middlestory			
per cent	per cent		
Witch hazel ( <i>Hamamelis virginiana</i> ) . . . . .	27	Hornbeam ( <i>Carpinus caroliniana</i> ) . . . . .	5
Black locust ( <i>Robinia pseudo-acacia</i> ) . . . . .	12	Serviceberry ( <i>Amelanchier</i> sp.) . . . . .	4
Chestnut ( <i>Castanea dentata</i> ) . . . . .	10	Staghorn sumac ( <i>Rhus typhina</i> ) . . . . .	4
Flowering dogwood ( <i>Cornus florida</i> ) . . . . .	9	Alder ( <i>Alnus</i> sp.) . . . . .	3
Sassafras ( <i>Sassafras albidum</i> ) . . . . .	8	Hawthorn ( <i>Crataegus</i> sp.) . . . . .	3
Striped maple ( <i>Acer pensylvanicum</i> ) . . . . .	7	Other (10 species) . . . . .	8
Understory (including vines)			
per cent	per cent		
Blackberry ( <i>Rubus</i> sp.) . . . . .	19	Poison ivy ( <i>Rhus radicans</i> ) . . . . .	4
Mountain laurel ( <i>Kalmia latifolia</i> ) . . . . .	16	Woodbine ( <i>Parthenocissus quinquefolia</i> ) . . . . .	4
Rose ( <i>Rosa</i> sp.) . . . . .	10	Wild grape ( <i>Vitis</i> sp.) . . . . .	4
Greenbrier ( <i>Smilax</i> sp.) . . . . .	7	Thimbleberry ( <i>Rubus odoratus</i> ) . . . . .	3
Wild hydrangea ( <i>Hydrangea arborescens</i> ) . . . . .	7	Azalea ( <i>Rhododendron</i> sp.) . . . . .	3
Minnie bush ( <i>Menziesia pilosa</i> ) . . . . .	5	Blueberry ( <i>Vaccinium</i> sp.) . . . . .	3
Dewberry ( <i>Rubus</i> sp.) . . . . .	4	Other (9 species) . . . . .	11
Ground Cover (Forbs)*			
per cent	per cent		
Cinquefoil ( <i>Potentilla canadensis</i> ) . . . . .	24	Bedstraw ( <i>Galium</i> sp.) . . . . .	4
Violets ( <i>Viola</i> spp.) . . . . .	10	New York fern ( <i>Dryopteris noveboracensis</i> ) . . . . .	3
Wood aster ( <i>Aster divaricatus</i> ) . . . . .	10	Wood sorrel ( <i>Oxalis stricta</i> ) . . . . .	3
Teaberry ( <i>Gaultheria procumbens</i> ) . . . . .	5	Selfheal ( <i>Prunella vulgaris</i> ) . . . . .	3
Wild strawberry ( <i>Fragaria virginiana</i> ) . . . . .	4	Partridge berry ( <i>Mitchella repens</i> ) . . . . .	3
Hog peanut ( <i>Amphicarpa bracteata</i> ) . . . . .	4	Other (45 species) . . . . .	23
Jewelweed ( <i>Impatiens</i> sp.) . . . . .	4		

\* Ground cover also included numerous seedlings and sprouts of overstory species.

recorded in the moist cove forest during this period, and these were observed to ascend the adjacent slopes immediately after flushing, so that it is probable that they had returned to the cove merely for water. All of the broods located on the slopes were found in the vicinity of ripened blueberries. This fruit is largely restricted to the drier habitats and apparently is of major importance in relation to the distribution of grouse broods in late summer, since five chicks collected at this time had been feeding predominantly on it (see Table 3). It is also of interest to note that the change in habitat preference occurred at approximately the same time that blueberries began to ripen.

TABLE 2  
GENERAL FOOD TYPES OF RUFFED GROUSE CHICKS  
(FIGURES REPRESENT VOLUMETRIC PERCENTAGES)

	May 28- June 14 (12 chicks)	June 18- June 30 (12 chicks)	July 10- July 13 (2 chicks)	August 5- August 25 (3 chicks)
<i>Animal Food</i>	(91)	(44)	(10)	(1)
Snails	4	5	+	—
Insect Larvae	34	23	2	—
Adult Insects	50	15	8	1
Misc. Animal Food	3	1	+	+
<i>Plant Food</i>	(9)	(56)	(90)	(99)
Small Seeds	1	44	18	—
Fleshy Fruits	8	6	67	63
Green Leaves	—	—	+	21
Misc. Veg. Matter	+	6	5	15
	100	100	100	100

Similar habitat requirements for Ruffed Grouse broods have been reported from studies made elsewhere in the United States, although important differences have also been noted in certain areas that contain entirely different types of biotic communities. King (1937) described the situation in Minnesota as follows: "Ideal brooding cover is a low, dense canopy adjoining openings that support a variety of plant and insect life . . . plants must be low-growing (ground cover) if they are to be available to the young, and the greater the variety of plants, the greater the number and kinds of insects and plant materials present." In New York Bump *et al.* (1947) found that broods prefer cover types in which the crown cover is sparse, and report further: "It is the early stages of woodland succession with their profusion of fresh herbaceous growth, that are attractive . . . where summer slopes are dry as in our Adirondacks, the moister alder beds are prime favorites . . . a strong tendency for young birds to favor flat lands and moderate slopes rather than steep hillsides." Edminster (1947) emphasizes the need in New York for brush openings, preferably of a hardwood type. In Ohio (Chapman *et al.*, 1948), broods were found to occur in ". . . slashing or brush area with small clearings where insects and fruits are plentiful and where brambles and greenbrier tangles offer protective cover." In north-eastern Iowa (Polderboer, 1942), broods were found to frequent "clearings, trailsides and bramble patches in valleys and at the mouths of open ravines" during the first half of June; "in late June and throughout July, bramble patches and clearings on ridge tops were used." During the late summer in Michigan (Fisher, 1939), a tendency was found for "the female to keep young birds near the borders of coniferous swamps where it is much cooler and where more moisture accumulates

during the hot days of July and August." In northern Idaho, Hungerford (1951) describes the early brood habitat as "any kind of coniferous cover adjacent to clearings or openings on the ridges or upper slopes," while in late summer, he reports a movement to lower slopes and ravines.

In general, throughout the range of the Ruffed Grouse, broods during the early stages may be found in moist forest habitats that are typical of regions characterized by cool climates. In certain regions, such as the Great Lakes area and southeastern Canada, these habitat conditions are fairly extensive, and here Ruffed Grouse broods are quite generally distributed. In other regions including the southern Appalachians and Rocky Mountain area, the requisite habitat conditions are more local and restricted in area, and as a consequence Ruffed Grouse broods are somewhat "spotty" in their distribution. It would appear that the presence or absence of appropriate brood habitat conditions, is a major limiting factor concerning the geographical distribution of this species.

*Food Habits.*—The food of young grouse was determined from the analyses of the crop and stomach contents of 29 chicks, all of which were collected within the George Washington National Forest in Augusta, Highland, and Rockingham counties, during the years 1939 through 1941. Since out of the total number studied, only 2 chicks were collected from the same brood, the food analysis should be fairly representative, especially for the month of June. Although only 5 chicks had been collected in July and August, the analyses of their crop and stomach contents at least serve as an indication of feeding trends.

The data in Tables 2 and 3 indicate that the food of grouse chicks steadily changes from a diet during early June in which animal food is predominant to a diet in July and August that is composed chiefly of plant foods. The principal animal foods include the larvae of Tenthredinidae (sawflies) and Phalaenidae (loopers or measuring worms) and the adults of Coleoptera and Homoptera, particularly those belonging to the families Chrysomelidae (leaf beetles) and Membracidae (tree-hoppers). Numerous other insects as well as snails (Gastropoda) are also of some importance. During early summer the predominantly animal diet is supplemented with the fruits and seeds of such species as violet (*Viola* sp.), strawberry (*Fragaria* sp.), and sedge (chiefly *Carex laxiflora*). Fleshy fruits, especially blueberries (*Vaccinium* sp.), are of major importance in the late summer diet, while fungi (Agaricaceae) and the green leaves of ferns and other plants are also consumed in fair quantities at this time.

TABLE 3  
 SPECIFIC FOOD TYPES OF RUFFED GROUSE CHICKS  
 (FIGURES REPRESENT VOLUMETRIC PERCENTAGES)

	May 28- June 14 (12 chicks)	June 18- June 30 (12 chicks)	July 10- July 13 (2 chicks)	August 5- August 25 (3 chicks)
<i>Animal Food</i>				
Gastropoda (Snails)	4	5	+	-
Insect Larvae				
Tenthredinidae (Sawflies)	24	11	1	-
Phalaenidae (Measuring Worms)	10	11	1	-
Lepidoptera (Butterflies, Moths)	+	1	-	-
Other	+	+	-	-
Adult Insects				
Coleoptera (Beetles)				
Chrysomelidae (Leaf Beetles)	12	1	+	-
Elateridae (Click Beetles)	1	2	1	+
Lampyridae (Fireflies)	1	1	1	-
Curculionidae (Snout Beetles)	1	+	+	+
Coccinellidae (Ladybirds)	1	+	+	-
Scarabaeidae (Scarabs)	1	+	+	-
Carabidae (Ground Beetles)	1	+	-	-
Other	+	1	1	-
Homoptera				
Membracidae (Tree-hoppers)	7	+	-	-
Aphididae (Aphids)	3	+	+	-
Cicadellidae (Leaf-hoppers)	1	+	1	-
Cercopidae (Spittle-bugs)	1	+	-	-
Aleyrodidae (Whiteflies)	1	-	-	-
Fulgoridae (Lanternflies)	1	-	-	-
Other	1	1	-	-
Hymenoptera				
Formicidae (Ants)	+	6	1	-
Ichneumonidae (Ichneumon Flies)	1	+	+	-
Other	+	-	-	-
Orthoptera				
Tettigoniidae (Long-horned Grasshoppers)	-	-	3	1
Locustidae (Short-horned Grasshoppers)	2	+	-	-
Plecoptera (Stoneflies)	3	1	-	-
Mecoptera (Scorpionflies)	4	-	-	-
Hemiptera				
Lygaeidae (Chinch Bugs)	1	1	+	-
Other	1	+	+	-
Diptera				
Empididae (Dance Flies)	1	+	-	-
Tipulidae (Crane Flies)	1	+	-	-
Other	1	+	+	-
Heterocera (Moths)	1	1	-	-
Trichoptera (Caddiceflies)	1	+	-	-
Misc. Animal Food				
Araneae (Spiders)	2	1	+	+
Phalangida (Harvestmen)	1	-	+	+
Insect Eggs and Pupae	+	+	-	-
<i>Plant Food</i>				
Small Seeds				
Violet ( <i>Viola</i> sp.)	+	28	+	-
Sedge ( <i>Carex</i> sp.)	+	15	18	-

TABLE 3—Continued

	May 28– June 14 (12 chicks)	June 18– June 30 (12 chicks)	July 10– July 13 (2 chicks)	August 5– August 25 (3 chicks)
<i>Plant Food</i> —Continued				
Rue Anemone				
( <i>Anemonella thalictroides</i> )	1	—	—	—
Other	+	1	+	—
Fleshy Fruits				
Strawberry ( <i>Fragaria</i> sp.)	8	4	—	—
Service-berry ( <i>Amelanchier</i> sp.)	—	2	+	—
Blueberry ( <i>Vaccinium</i> sp.)	—	+	67	63
Other	+	+	+	+
Green Leaves				
Bracken Fern ( <i>Pteridium aquilinum</i> )	—	—	—	16
New York Fern				
( <i>Dryopteris noveboracensis</i> )	—	—	—	3
Sweet Golden-rod ( <i>Solidago odora</i> )	—	—	—	2
Other	—	—	+	—
Misc. Plant Food				
Fungi (Agaricaceae)	—	2	5	15
Flowers and Twigs of Mt. Laurel				
( <i>Kalmia latifolia</i> )	—	2	—	—
Fragments of Acorns ( <i>Quercus</i> sp.)	—	2	—	—
Misc. Flowers, Buds, and Twigs	+	+	—	+

General food habits studies of grouse chicks by Judd (1905), as well as local studies in New York (Bump *et al.*, 1947) and Wisconsin (Grange, 1948) show that similar types of food are taken elsewhere within the range of the Ruffed Grouse. A noticeable shift during the summer from a diet of animal food to plant food is also indicated. The late summer diet in New York, however, differed in that blackberries and raspberries were taken in large quantities, while blueberries were of minor importance.

*Summary.*—In the Shenandoah Mountains of Virginia, broods of young Ruffed Grouse during late May, June, and early July were found to be largely restricted to the moist forests of the ravines and to similar forest types on the higher knobs and ridges at elevations above 4000 feet. A definite preference was shown for forest-edge situations such as are found along small or narrow semi-shaded clearings including secondary roads, wagon-roads, trails, and natural forest openings. They were found to be most numerous along the margins of openings with an abundance of herbaceous plants, woody sprouts, and seedlings. In late summer following the first week in July, a marked change occurred in their habitat distribution. At this time they were found scattered in the more extensive, drier forest associations of the mountain slopes, where ripened blueberries abound. Apparently similar habitat conditions are required by broods elsewhere within the range of this species.



The food of grouse chicks steadily changes from a diet that is composed predominantly of animal matter in early June to one that is largely vegetarian in July and August. The principal animal foods include the larvae of Tenthredinidae (sawflies) and Phalaenidae (loopers or measuring worms) and the adults of Chrysomelidae (leaf beetles) and Membracidae (tree-hoppers). Numerous other insects as well as snails (Gastropoda) are also of some importance. The chief vegetable foods during the early summer include the fruits and seeds of strawberries (*Fragaria* sp.), violets (*Viola* sp.), and sedges (*Carex* sp.). In late summer, fleshy fruits, especially blueberries (*Vaccinium* sp.), are consumed in large quantities, and these are supplemented to a considerable extent with fungi (Agaricaceae) and the green leaves of ferns and other herbaceous plants.

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