Relationship of ruffed grouse to forest cover types in Wisconsin. Number 18 1959

Dorney, Robert S.

Madison, Wisconsin: Wisconsin Conservation Department, 1959

E. E. Hoehler

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TECHNICAL BULLETIN NUMBER 18

WISCONSIN CONSERVATION DEPARTMENT
Madison, Wisconsin
1959

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RELATIONSHIP OF RUFFED GROUSE TO FOREST COVER TYPES IN WISCONSIN

By

ROBERT S. DORNEY

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ACKNOWLEDGEMENTS

A major share of the field work was done by Frederick V. Holzer and Russell Mattison. Without their careful observations, this study would not have been possible. I am also indebted to Cyril Kabat for providing the initial impetus for the study and for his advice on the preparation of the report, Donald R. Thompson for statistical service, Arthur D. Doll and A. E. Smith for help in interpreting cover maps of the national forest lands involved, Robert S. Cook for providing considerable grouse data from the Bad River Indian Reservation, Frank H. King and James B. Hale (Game Management Division) and William R. Jordan (Forest Management Division) for critically reading the manuscript.

This study was financed by the Wisconsin Conservation Department with Federal Aid to Wildlife Restoration Funds under Pittman–Robertson Project No. W–79–R.

Edited By Ruth L. Hine

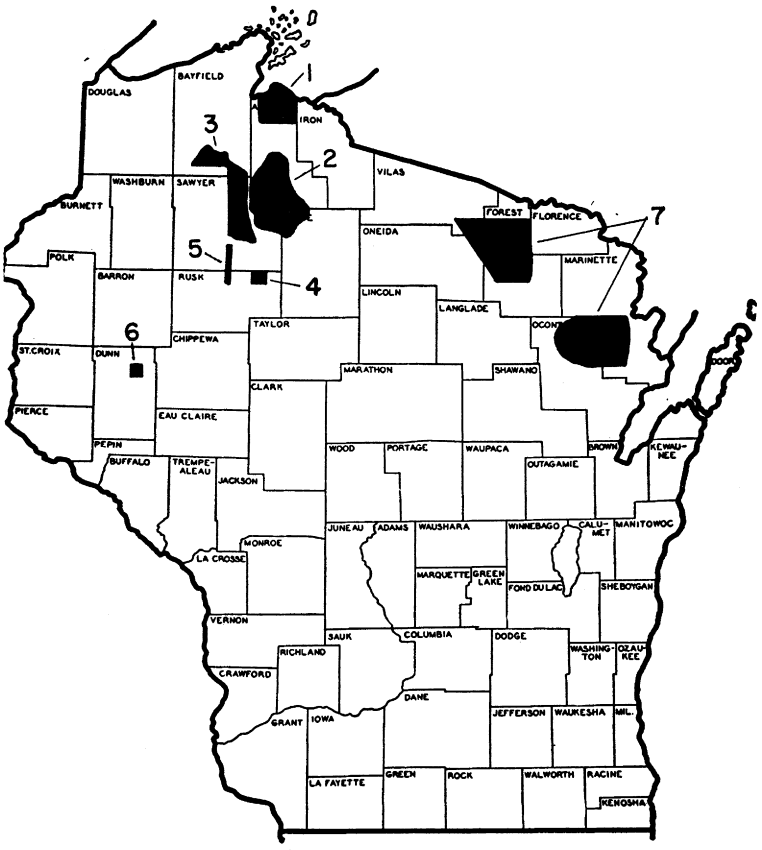
CONTENTS

INTRODUCTION

During the past 20 years sharp-tailed grouse *(Pedioecetes phasianellus)* and pinnated grouse *(Tympanuchus cupido)* have steadily declined in Wisconsin as a result of changing land-use patterns. On the other hand, ruffed grouse *(Bonasa umbellus)* in Wisconsin have increased since the middle thirties, and at present are one of the major game birds in this state. This population increase coincides with the regrowth of forests following the fires and logging that occurred in the period 1900–1938. To determine how to maintain these favorable environmental conditions, basic research on the habitat requirements of ruffed grouse was needed. This information could then be integrated with forest management and silvicultural practices. Since the grouse habitat work of Bump, Darrow, Edminster and Crissey (1947) in New York and Hungerford (1953) in Idaho was done in forest types quite different from those in the Lake States, it was felt that a reappraisal of their results was needed before a management program could be initiated in Wisconsin.

Many foresters and game managers feel that current forest management practices in the Lake States are compatible with the maintenance of ruffed grouse populations. This appears to be generally true under present conditions. However, if we look at the German forests where silvicultural practices are extremely intensive, we find that this management has almost completely eliminated the hazel hen *(Tetrastes bonasia),* a close relative of our ruffed grouse (Pynnonen, 1954). Admittedly, our forestry practices are not as intensive as those in Germany, but with increasing human populations in this country the time may be close at hand when our forest management will shift from semi-extensive to highly intensive. If we know what land configurations produce huntable populations of ruffed grouse, it will be possible to integrate spraying, planting, timber stand improvement and logging practices so that maximum populations of ruffed grouse can be maintained.

This report is intended as a preliminary guide for foresters and game managers. It describes the results of our studies on winter forest types used by ruffed grouse with some general comments on spring, summer and fall cover use. Suggestions for maintaining and encouraging ruffed grouse are also included. Only years of additional experimental management research, however, will provide a completely satisfactory method-



1. Bad River Reservation
2. Glidden Unit
3. Round Lake Unit
4. Cedar Rapids Study Area
5. Highway 27 Study Area
6. Otter Creek Study Area
7. Nicolet Forest Units

Figure 1. Areas studied with spring pellet-group counts or winter track and roost counts.

ology of forest land management that will produce maximum yields of both fiber and game. If this paper serves as a beginning for understanding the basic ecological requirements of this game bird in Wisconsin, it will have accomplished its purpose.

STUDY AREAS

Seven areas were studied in Wisconsin (Fig. 1). The Bad River, Glidden, Round Lake, Cedar Rapids, and Nicolet areas are generally solid forest stands of northern hardwoods and aspen unbroken by farms

or large clearings. The Highway 27 and Otter Creek areas have an interspersion of farms with the resulting field and pasture edges. The Highway 27 area is primarily northern hardwoods and aspen, Otter Creek scrub oak on the hills and aspen–jackpine–alder on the bottomland. The topography is flat to gently rolling on all areas except in Otter Creek.

METHODS

To determine quantitative use of forest types in winter, two techniques were used. Grid lines were set up on the Highway 27, Cedar Rapids and Otter Creek areas and covered once by walking in January, February or March in 1956 and 1957. Figure 2 shows the grid lines cruised in the Cedar Rapids area. In the Otter Creek area, the grid lines were set up on 9 wooded areas varying in size from 17 to 162 acres. These 9 areas were felt to be representative of the entire 18-square-mile Otter Creek area. When grouse tracks or roosts were intersected while cruising these grid lines, the general timber type (aspen, conifer, etc.) was noted, as well as the estimated number of birds which made the sign.

Complete cover maps of the Cedar Rapids and Highway 27 areas were prepared from 1952 aerial photos. About two-thirds of the Cedar Rapids area had already been typed by the Forest Inventory Section of the Wisconsin Conservation Department from 1952 photos. The remainder of the typing was done by Dorney and Holzer. The Otter Creek area was typed by Dorney by cruising the plots on foot in 1957. Using these cover maps, the percentage composition by type of the study areas was determined.

With our second sampling method, ruffed grouse winter roosts were tallied in the springs of 1956 and 1957 on 1/50th acre circular plots. Most of these 1/50th-acre plots were primarily designed to count deer-pellet groups. A ruffed grouse roost on the plots was defined as an accumulation of four or more droppings. Bennett, English and McCain (1940) and others have discussed the deer-pellet sampling technique in considerable detail. The occurrence of grouse roosts was related to cover types in the following manner. In the Otter Creek, Cedar Rapids and Bad River areas, as each 1/50-acre plot was taken, the surrounding timber type was recorded. In these first two areas, the same grid lines used previously in the winter sampling (see Fig. 2) were cruised and 1/50-acre plots spaced 2 to 4 chains apart along these grid lines. In the Bad River, Glidden, Round Lake and Nicolet Units, 1/50-acre plots in clusters of five were laid out by using a random-number-selection system, but were stratified so that coniferous deer wintering areas were

more heavily sampled. The plot centers on the Glidden, Round Lake and Nicolet Units were then located on a 1952 cover map prepared by the U. S. Forest Service, and the cover type at each plot recorded directly from the type map.

In investigating spring cover-type use, all drumming logs on the Cedar Rapids and Otter Creek areas were located and typed directly in the field in the springs of 1956 and 1957. No field sampling was carried out on cover preferences for birds during the nesting season, summer brood-rearing or fall hunting seasons.

The timber types used in this report were adapted from the classification used by the Wisconsin Forest Inventory and are shown in Table 1.

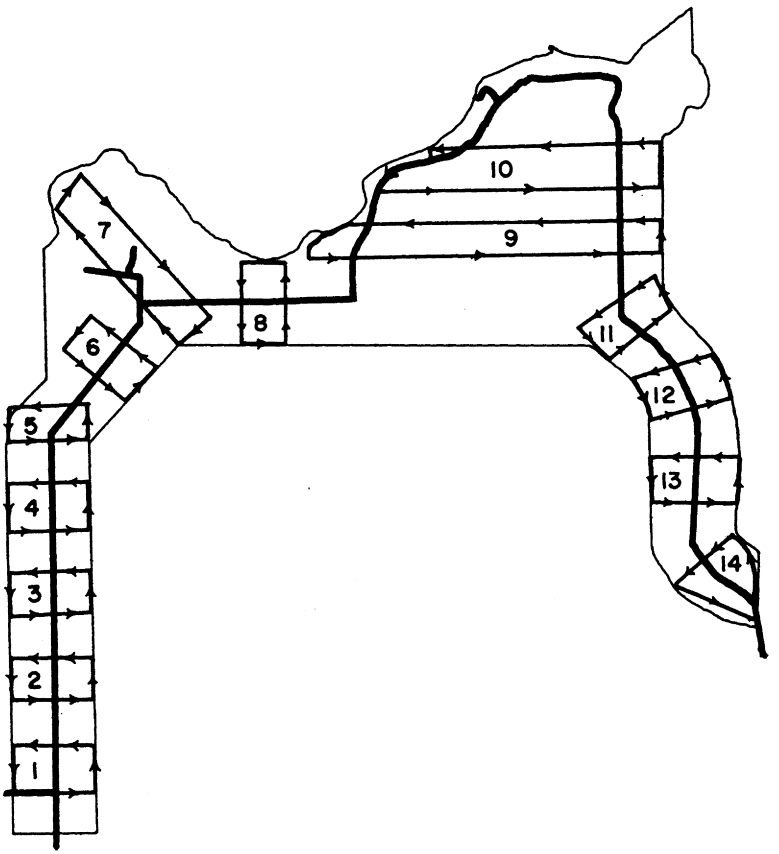


Figure 2. Fourteen courses cruised on the Cedar Rapids area for determination of winter habitat use (winters 1956, 1957)

TABLE 1

Composition of Timber Types Discussed in This Report

Type	Abbreviation	Composition
Aspen-birch	Aspen	>50% aspen (*Populus* sp.), white birch, (*Betula papyrifera*)
Northern hardwood	No. hdw.	>50% sugar maple (*Acer saccharum*) yellow birch (*Betula lutea*), basswood (*Tilia americana*), etc.
Swamp hardwoods	Swp. hdw.	>50% black ash (*Fraxinus nigra*), red maple (*Acer rubrum*), American elm (*Ulmus americana*), etc.
Scrub oak	Scrub oak	Oak (*Quercus* sp.) type which will only produce fuelwood
Conifers	Conif.	>50% needle-bearing trees including tamarack (*Larix* sp.)
Open	Open	Open land <10% stocked with forest trees.
Lowland brush	Alder	Wet areas generally alder (*Alnus* sp.) and willow (*Salix* sp.)

RESULTS

Northern Wisconsin Sample Areas

Winter Cover Use

The cover-type use indicated by tracks and roosts tallied in the winter of 1956 and 1957 along the grid lines in the Cedar Rapids area is presented in Table 2. The roosts and tracks, combined to give a comparative winter-use index for the six major cover types, show that the open type is infrequently used. Further, these data suggest the northern hardwood type is more preferred for roosting than aspen, swamp hardwood, conifer and alder. Bump *et al.* (1947:835) has also shown that grouse selected mature hardwoods when soft snow was available for roosting. With a sample size of only 244 roosts and tracks, a more detailed comparison between type use is probably not justified. The data were secured in such a way that no statistical test of relative use between types is possible. Both years are combined in this winter sample because of no apparent differences between the years.

If this winter-use index is then compared in Table 2 to the percentage of 1/50th-acre plots the following spring having winter grouse roosts present, the open type again appears to be little used with all other types showing about equal usage. A X^2 test applied to the entire 1/50th-

TABLE 2

Winter Roost and Track Usage of Cover Types, Winters of 1955–56 and 1956–57, Compared to Roost Tally Based on the Deer Pellet-Group Technique, Spring 1957, Cedar Rapids

Type	Winter Sample				Total Area	Use Index	Spring Tally**
	No. Tracks	No. Roosts*	Roosts and Tracks	(A) Per Cent Tracks and Roosts	(B) Per Cent of Types in Area	Comparative Type Use A/B	Per Cent Roosts* Present on Total Plots by Type
Aspen	53	27	80	33	36	0.9	26/150 or 17
No. hdw.	47	74	121	49	31	1.6	18/84 or 21
Swp. hdw.	6	4	10	4	4	1.0	19/69 or 28
Conif.	8	13	21	9	11	0.8	17/61 or 28
Open	--	3	3	1	12	0.1	1/48 or 2
Alder	2	7	9	4	6	0.7	4/21 or 19

*Any accumulation of four or more droppings.
**$X^2 = 15.4$ (5 d.f.); see text for significance.

acre spring roost data, shows a X^2 value of 15.4 (5 d.f.) which is highly significant. However, as Dorney (1958) has shown, the roost frequency data do not follow a Poisson distribution, hence this significant X^2 value is merely an indication that usage may vary between types. It cannot be considered an exact test for significance. Since it appears that these 1/50th-acre roost counts show the same quantitative type use as the winter sample, the 1/50th-acre roost plots were considered to be a reasonable sampling technique in Cedar Rapids for determining relative forest-type use.

By extrapolation, the spring roost counts were assumed to show representative type use in Bad River, Round Lake, Glidden, and Nicolet Units, since the cover types and topography on all these areas are similar to Cedar Rapids.

Information on winter cover type use with 1/50th-acre plots in spring on five northern areas is shown in Table 3. Inspection of these data again shows the open type was little used in winter. The over-all X^2 value for the total sample in Table 3 is 15.7 (highly significant, 5 d.f.), suggesting that the open type does have a lower use than the other five types. Perhaps some of this variance can also be attributed to the higher use of swamp hardwood. Conifer types as shown in this sample again appear to have little differential attraction for ruffed grouse.

Another sampling problem in connection with these 1/50th-acre plots is shown in Table 4. Here use of types is broken down both by frequency of occurrence and by total roosts present on plots in 1957 for the northern Wisconsin samples. This table shows that the use of frequency data for handling the roost material does not appear to bias the results, although there is no exact way to test this statistically. Hence, for convenience, only frequency data for the northern Wisconsin samples are presented in Tables 2, 3, 5 and 6.

Table 5 shows a further breakdown of aspen, northern hardwood and swamp hardwood types into stands with and without admixtures of conifers. In these mixed stands, the conifers made up less than 50 per cent of the stand, and could be present as either understory, overstory, or the same height as the major stand components. A total X^2 test of pure versus mixed stands gives a value of 11.2 (highly significant); suggesting that aspen especially appears to be more attractive when intermixed with conifers. It should again be emphasized that this X^2 value is not an exact statistical test but serves merely as a general guide since the frequency data are not distributed as a Poisson.

Table 6 compares cover usage shown by the 1/50th-acre plots in northern Wisconsin with data from central New York (Bump *et al.*;

1947:819). Since Bump used different cover-type differentiation, it was necessary to change some of our forest-type groupings. Our aspen and lowland brush types are combined, and swamp hardwoods are deleted since this type did not occur in New York. This table shows the extreme selection by birds for conifer cover in New York in winter which contrasts sharply with our samples from northern Wisconsin.

Spring Cover Use

Table 7 shows cover types in the Cedar Rapids area in which cocks located their drumming logs in spring, during 1956 and 1957. Some of the individual logs were used in both years and occur twice in the sample. Open types, conifers and northern hardwoods are less used than other types.

Brood Cover Use

No quantitative counts were kept of cover types used by broods in June, July and August. However, based on six years of my own field observations in the Cedar Rapids area and throughout the northern half of Wisconsin, alder swamps and to a lesser extent swamp hardwoods are almost exclusively used once the weather becomes hot (late June, July, early August). In the early morning, broods may feed and take dust baths on the upland, but during the hot part of the day they appear to prefer alder areas.

The heavy growth of goldenrod and grass on ungrazed uplands may also discourage brood use, while in contrast, the alder type in summer remains open enough for young birds to walk around easily.

Fall Cover Use

In northern Wisconsin when broods break up in early September, young grouse may be found in all forest types. Generally, areas with berry or nut-producing trees, such as dogwoods (*Cornus* sp.) mountain ash *(Sorbus americana)* or oaks, and openings with succulent green foods, such as clover *(Trifolium sp.),* attract birds. No quantitative records were kept of cover use in fall, since this does not appear to be a critical time for grouse in terms of either food or cover.

Southwestern Wisconsin, Otter Creek Study Area (Dunn County)

The results from Otter Creek are considered separately since this study area is more closely related, in respect to its cover and topography, to the wooded hills of southwestern Wisconsin than to northern Wiscon-

TABLE 3

Winter Habitat Use on the Bad River, Glidden, Round Lake, Nicolet and Cedar Rapids Units as Shown by Percentage Occurrence of Grouse Roosts on Plots by Forest Types
(Spring 1956 and 1957)

Type	Bad River		Glidden Unit		Round Lake		Cedar Rapids		Nicolet (Both Units)		Grand Total	
	Ratio*	Per Cent	Ratio	Per Cent	Ratio	Per Cent	Ratio	Per Cent	Ratio	Per Cent	Ratio	Per Cent
Aspen	107/692	16	23/178	13	9/108	8	26/150	17	21/188	11	186/1316	14
No. hdw.	23/119	19	52/410	13	2/61	3	18/84	21	7/199	4	102/873	12
Swp. hdw.	5/53	9	15/78	19	1/10	10	19/69	28	0/2	0	40/212	19
Conif.	21/104	20	30/239	13	8/81	10	17/61	28	16/185	9	92/670	14
Open	1/12	8	8/48	17	0/13	0	1/48	2	3/66	5	13/187	7
Alder	5/20	25	2/40	5	1/22	5	4/21	19	1/14	7	13/117	11
Total	162/1000		130/993		21/295		85/433		48/654		446/3375	

*Ratio of number of plots with roosts to total plots of each cover type.

TABLE 4

Comparison Between Frequency of Plots Having Roosts and Total Roosts on Plots by Cover Types, 1957

Type	Plot Frequency of Roosts				Total Roosts on Plots				Av. No. Roosts Per Plot for Plots Having Roosts Present
	Cedar Rapids	Bad River	Glidden Unit	Total	Cedar Rapids	Bad River	Glidden Unit	Total	
Aspen	26/150	50/349	9/89	85/588	34/150	77/349	12/89	123/588	1.4
No. hdw.	18/84	10/62	17/205	45/351	37/84	15/62	26/205	78/351	1.7
Swp. hdw.	19/69	2/25	7/38	28/132	23/69	3/25	11/38	37/132	1.3
Conif.	17/61	11/51	18/117	46/229	25/61	11/51	26/117	62/229	1.3
Open	1/48	0/3	2/24	3/75	1/48	0/3	2/24	3/75	1.0
Alder	4/21	3/10	0/20	7/51	8/21	3/10	0/20	11/51	1.6
Total	85/433	76/500	53/493	214/1426	128/433	109/500	77/493	314/1426	

TABLE 5

Comparison Between Aspen, Northern Hardwood and Swamp Hardwood Types and These Types Mixed with Conifers*

Type	Bad River		Glidden Unit		Round Lake		Nicolet		Total	
	Ratio**	Per Cent	Ratio	Per Cent	Ratio	Per Cent	Ratio	Per Cent	Ratio	Per Cent***
Aspen	70/530	13	13/134	10	5/60	8	12/132	9	100/856	12
No. hdw.	19/102	19	50/396	13	2/53	4	7/192	4	78/743	10
Swp. hdw.	4/41	10	11/46	24	1/10	10	0/2	0	16/99	16
Asp./conif.	37/162	23	10/44	23	4/48	8	9/56	16	60/310	19
No. hdw./conif.	4/17	24	2/14	14	0/8	0	0/7	0	6/46	13
Swp. hdw./conif.	1/12	8	4/32	12	None	None	None	None	5/44	11

*Cedar Rapids left out since no two-layered communities exist there.
**Ratio of number of plots with roosts to total plots of each cover type.
***Over-all X^2 highly significant; see text for interpretation.

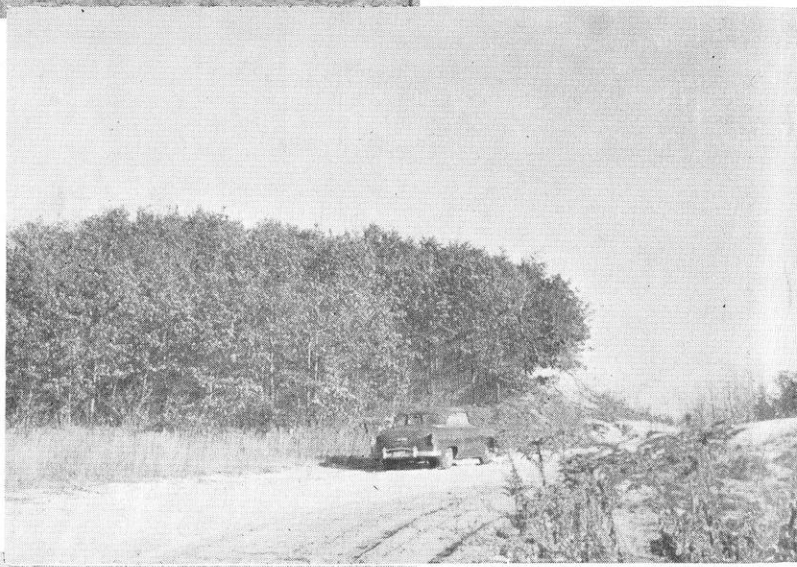
TABLE 6

Comparison Between New York and Northern Wisconsin Winter Cover-Type Usage

Wisconsin Type	Bump's Type	New York		Northern Wisconsin	
		No. Flushed Per Acre of Type	Comparative Percentage	Frequency of Roosts on Total Plots	Comparative Percentage
Aspen, alder	(B)	0.4	9	113/973	12
Northern hardwood	(C, E, F, J)	0.4	9	78/743	10
Conifers	(H)	2.8	64	92/670	14
No. hdw. /conif.	(FH, EH, D)	0.7	16	6/46	13
Open	(I)	0.1	2	13/187	7
Total		4.4	100		

Alder swamps are the prefer

The Dunn County study area is typified by an admixture of conifers, aspen and often alders along the creek bottoms (foreground) while the steep hillsides are covered with scrub oak types (background). Dairy farming predominates while soybeans are a major cash crop. The soils in the valleys are sandy and often produce poor yields in dry summers. (Above)



The scrub oaks hold their leaves throughout the winter and simulate coniferous types. This is a 15- to 25-year-old stand on a hillside in the Otter Creek study area, Dunn County 1957. (Above)

Where alder is intermixed with aspen to form a large quantity of alder-aspen edge, ideal ruffed grouse habitat is usually produced. This woodlot in the Otter Creek study area has consistently produced large numbers of broods and provided excellent hunting in fall. (Left)

ed summer cover for broods.

In much of northern Wisconsin unbroken forest stretches as far as the eye can see (Rusk County, 1957).

Abandoned beaver meadows are slowly invaded by alder. If this pond is not reflooded, it should become within the next twenty years an important alder summering area for grouse broods. A few clumps of invading alder are visible in the foreground. (Left)

Light pasturing of upland aspen produces optimum ruffed grouse habitat (Rusk County, 1957). (Right)

TABLE 7

Types of Cover Used by Ruffed Grouse Cocks in Spring for the Location of Drumming Logs, Spring of 1956 and 1957, Cedar Rapids

Type	No. Logs in Each Type	(A) Per Cent Logs in Each Type	(B) Percentage Composition of Area	Ratio A/B
Aspen	73	54	36	1.5
No. hdw.	36	27	31	0.9
Swp. hdw.	8	6	4	1.5
Conif.	9	6	11	0.5
Open	0	--	12	0.0
Alder	10	7	6	1.2

sin. The scrub oak types found here are the result of succession following fire. The bulk of these oak stands are now about 25 years of age and occur on the dry hillsides occupying about one-half of the study area. The other 50 per cent of the Otter Creek area is characterized by flat topography and a light sandy-loam soil. The forest types in the flat valleys are aspen, jack pine and alder with farm fields intermixed. One characteristic of this study area, already mentioned, is the tremendous interspersion of farms and dissection of the wooded areas.

Winter Cover Use

A broad comparison of the winter-cover-type use in oak and aspen-alder-jack pine is shown in Table 8. As indicated, grouse live in the scrub-oak type throughout the winter and spring. Furthermore, oak types can carry fairly good breeding populations of ruffed grouse. These data are not affected by bird movements since the oak areas sampled are part of a large continuous area of scrub oak. Also it is of interest to note that the grouse populations were low during the two years shown in this table, demonstrating that the oak type can sustain birds throughout unfavorable environmental circumstances.

Table 9 shows the winter roosts found in the spring using 1/50-acre plots in the various cover types, with sampling along the same grid lines as those that were used in winter. The scrub-oak type is omitted since pawing for acorns by deer and squirrel as well as the dropping of oak leaves in spring tends to cover roosts. In comparing aspen to conifer use, it is apparent that these two types have about the same frequency of use, but that conifers have much greater total use than aspen. This

TABLE 8

Comparison of Use by Grouse of Scrub Oak and Aspen, Jack Pine, Alder Types, Dunn County

General Type	Acreage of Types Sampled	Number of Winter Samples 1955–56, 1956–57 Tracks	Roosts	Population Density of Spring Cocks Per 100 Acres of Forest Cover 1956	1957
Scrub oak	335	75	32	3.3	3.0
Aspen, jack pine, alder, open	240	84	24	7.5	6.7

means that only one out of five plots in conifers had roosts, but when roosts did occur, an average of 3.1 was found per plot in conifers compared to 1.4 for aspen plots. This shows that specific coniferous areas are used over and over again, perhaps by the same bird or birds. The samples of open types and alder are too few to be meaningful.

Unfortunately, no statistical comparison can be made between the average number of roosts per plot for aspen (1.4) and conifers (3.1). However, in view of the sample sizes, it would seem logical to conclude that this difference represents an actual selection by grouse for specific coniferous areas and is not due to small sample sizes. This is in contrast to data in Table 4 from northern Wisconsin which showed no difference between frequency data and total roost data on plots for the various cover types.

Brood and Fall Cover Use

No quantitative records of summer and fall cover use were kept for Otter Creek. However, general observations indicated that grouse broods used alder, aspen pastured by cattle, and scrub oak. In fall, all types were used with little tendency for concentration of birds.

DISCUSSION

Northern Wisconsin Areas

In the data presented on cover-type use, little mention of stand size and stocking (density) has been made. The data presented mean little without some mention of these factors. Much of the Cedar Rapids area was heavily burned in the 30's, and almost pure stands of trembling aspen seeded in on the burns. The same conditions prevailed over much of northern Wisconsin during this period. The majority of these

TABLE 9

Comparison of Cover Types Used by Grouse in Winter, Based on Roost Counts Made in the Spring of 1957, Dunn County

Type	Occurrence of Roosts on Plots	Per Cent Frequency	Total Roosts Present on Plots	Per Cent of Total Occurrence	Av. No. Roosts Per Plot For Those Plots Having Roosts Present
Aspen	12/52	23	17/52	33	1.4
Conif.	19/94	20	59/94	63	3.1
Open	2/5	40	2/5	40	1.0
Alder	3/17	18	3/17	18	1.0

aspen stands are now 3–7 inches d.b.h. and of varying densities. The size classes of the aspen, northern hardwood, swamp hardwood and conifers are shown in Table 10 for the entire Cedar Rapids area. This breakdown of timber size classes is typical of much of northern Wisconsin as shown by the Wisconsin Forest Inventory reports currently being published by the Wisconsin Conservation Department (1954–present).

General observations in Cedar Rapids and on Highway 27 indicated that upland aspen and northern hardwoods were not used to any extent by grouse until these stands had reached 4 inches d.b.h. of medium to heavy stocking; over 7 inches d.b.h. they lost their attractiveness for grouse. Since the upland stands in the Cedar Rapids study area are primarily in the 4–7″ d.b.h. class, this area has probably reached its maximum grouse production and will decrease slowly in the future if the forest remains undisturbed by man. Since the Cedar Rapids area is generally even-aged—that is, the bulk of the aspen–northern hardwood stands are about the same size (4–7″ d.b.h.), it is not possible to determine the relative differential importance of the 1–5″, 11″ + stands to grouse on this area.

Winter Cover Use

For the Connecticut Hill Study Area in New York, Bump *et al.* (1947:157) stated that coniferous cover in winter "attracts grouse like a magnet". Hungerford (1953) and Marshall (1946) in Idaho also found ruffed grouse using coniferous cover heavily in winter. The evidence from our samples in northern Wisconsin, however, does not point to such a clear-cut attraction. As Tables 2, 3, 4 and 6 have shown,

conifers in northern Wisconsin are used at about the same rate as aspen types, northern and swamp hardwoods, as contrasted to a 7 to 1 differential for New York. However, when aspen and northern hardwood types are mixed with conifers in northern Wisconsin, grouse use these types considerably more (Table 5). This indicates that conifers have some value as protective cover for ruffed grouse in our northern areas, but certainly far less than that shown by the New York and Idaho studies.

Further evidence for the minimal importance of coniferous winter cover was forthcoming from our studies on the Highway 27 area (Fig. 1.) Of a series of eight circular 132-acre plots along Highway 27, five of the plots were part of an extensive area (one-half mile radius or more) completely devoid of conifers except for an occasional tree or trees. The spring population density of cocks in 1955 and 1956 on the 5 plots devoid of conifers is compared in Table 11 to the 3 plots with stands of conifers present. Cedar Rapids cock densities are also shown for comparison. As indicated, areas devoid of conifers carried comparable numbers of birds. Our winter cruising of plot lines also established the presence of birds on all Highway 27 plots with or without conifers. Hence these areas devoid of conifers can sustain both excellent wintering and breeding populations of ruffed grouse. By contrast, Chapman, Bezdek and Dustman (1948) found a definite relation in Ohio between grouse numbers and presence of conifers. Bump *et al.*

TABLE 10

Timber-Size-Class Breakdown for the Cedar Rapids Area, (All Three Stand Densities Combined)

Type	Size (d.b.h.) in Inches	Acres
Aspen	1–5	1,060
	5–11	396
	11+	-----
No. hdw.	1–5	647
	5–11	442
	11+	170
Swp. hdw.	1–5	89
	5–11	79
	11+	6
Conif.	1–5	69
	5–9	189
	9+	178

TABLE 11

Comparison of Spring Cock Populations on Areas With and Without Conifers Present (Spring of 1955 and 1956 Combined)

	Highway 27 Area		Cedar Rapids
	With Conifers	Without Conifers	With Conifers
Wooded acreage studied	373	570	4,042
Total no. spring cocks present	20	33	108
Total cocks per 100 acres	5.4	5.8	2.7

(1947:305) also stated that "areas which lack sufficient coniferous shelter seldom maintain a good grouse population".

In comparing our results with the New York, Ohio and Idaho data, it should also be mentioned that many of the coniferous areas sampled throughout northern Wisconsin including Cedar Rapids are heavily browsed by deer; consequently little or no needle-bearing limbs are present within 6 feet of the ground. Any use of these conifer stands for cover would be primarily for tree roosting only, rather than ground roosting under the low-hanging limbs. What effect this heavy coniferous deer browsing has on ruffed grouse conifer use is speculative but may account for a decreased attractiveness of these types.

There is also an additional consideration. In northern Wisconsin soft snow is commonly present throughout 2 to 3 of the 4 winter months. This soft snow is used for roosting and furnishes protection from wind and insulation from cold temperature. Since ruffed grouse obtain most of their buds and catkins from upland tree species, the presence of soft snow allows the birds to feed and roost in the same general area, a convenient arrangement. It seems that this soft snow for roosting could account for the lack of use of conifers by our birds. Unfortunately, there was not enough sampling done when the snow was heavily crusted to see what additional use might be made of conifers under these circumstances. The type use shown by this paper should be rechecked in a mild winter. Bump *et al.* (1947) did not present data on the frequency of soft snow in the Connecticut Hill Study Area, therefore it is not possible to compare his data with ours.

It appears that the equal occurrence of grouse on all major cover types in winter in northern Wisconsin should be extremely advantageous for the maintenance of maximum grouse densities. The absence of winter concentration in any one type should effectively reduce predation and

disease as well as any psychological stresses due to intraspecific competition. For these reasons, the management of our forests must emphasize those winter food plants that will maintain this current winter grouse-use pattern.

Spring Cover Use

The cover-type breakdown in Table 10 for the Cedar Rapids area shows that a higher percentage of the northern and swamp hardwoods, as well as the conifers, have passed the 5-inch size limit than have the aspens. The conifers and northern hardwoods over 5 inches d.b.h. are usually devoid of shrub and sapling cover as a result of deer browsing and crown closure, and hence offer little security for the drumming cock. As Edminster (1947:33) has pointed out, the cock selects a log which has good escape shelter close to it. Therefore the lack of shrub and sapling cover apparently accounts for the low use of northern hardwoods and conifers in our Cedar Rapids area (Table 7). In swamp hardwoods the shrub density is apparently sufficient to provide good drumming sites, although this type occurred as only 4 per cent of the area.

An interesting illlustration of the value of shrub cover around a drumming log was noticed in 1955. A mirror trap was set for a drumming cock on a log surrounded by a dense stand of hazel and red maple. The cock was disturbed by the trap and moved to a more open log to drum. He was subsequently killed by a hawk or owl on this unprotected log. This same sequence of events was also observed in the spring of 1957.

In a trip to the Rifle River Study Area in Michigan in 1955, Walter Palmer, research biologist for the Michigan Conservation Department, showed me how an exceptionally heavy deer population had eliminated the shrub layer in upland aspen stands in central Michigan. Ruffed grouse cocks in these areas were drumming almost exclusively in thick alder and cedar swamps. This seemed to indicate again that ruffed grouse cocks will not set up drumming territories if they do not have a sufficient density of shrubs surrounding the drumming site.

This same principle is noticeable on small wooded areas (10–100 acres in size) in Wisconsin. If the timber is uniformly large and dense so that there are no trees or shrubs in the 1- to 6-foot layer, breeding territories are not established. Ordinarily northern hardwoods over 9″ d.b.h. are devoid of drumming cocks. Heavy pasturing of timber, if allowed to proceed to the point of eliminating the shrub layer will also effectively exclude territorial males.

As our aspen stands on heavy soils mature, northern hardwood types will generally replace them. As the drumming-log evidence shows in Table 7, the hardwood stands are not attractive for territories in Cedar Rapids. Since northern hardwood stands ordinarily require 60–100 years before they become merchantable, such long rotations will be very unfavorable for drumming territory establishment, and will either result in a reduction in grouse breeding levels or a heavier concentration of cocks in the remaining young stands, or an undesirable combination of both.

Fall Cover Use

The fall concentration of ruffed grouse in northern Wisconsin on logging roads deserves some additional comment. This concentration is the result of two factors. One is the high mobility of young ruffed grouse, and the second is the apparent high palatability of succulent greens (primarily clover) in September and October. In those areas where berry-producing shrubs such as holly *(Nemopanthus mucronata)*, mountain ash *(Sorbus americana)* and choke cherry *(Prunus virginiana)* still retain their fruit, ruffed grouse appear to select these foods in preference to succulent greens. It is my hypothesis that the tremendous populations of grouse which concentrate on these logging trails in fall are due to the lack of berry-producing shrubs in our northern forests. The reason that these shrubs are absent is that advanced forest succession has eliminated many of the openings needed to encourage them, and secondly, a high deer population feeds heavily on many of them. This hypothesis is strengthened by observations in the Otter Creek study area where ruffed grouse are rarely seen along the roads feeding on green plants. This area has large numbers of natural forest openings as well as field edges along which berry-producing shrubs and hazel (as catkin source) are abundant. Acorns in the oak types no doubt also help to disperse the birds.

Forested areas with fall populations less than one bird per 15 acres will not be hunted on foot under present hunting conditions. On areas of this nature, a harvest of these low populations can only be achieved by the concentration of young birds along clover trails and roads. The deliberate maintenance of mowed firelanes for fall attraction of young birds will produce birds for the gun without having to resort to a more generalized type of habitat improvement sufficient to raise the general breeding levels on large areas.

Recommendations for Cover-Type Management

Before recommending management, the primary winter foods on which the grouse are feeding must be considered. These winter foods,

based on our general observation in the aspen-birch type, are the buds and twig tips of aspen, white birch, cherries (*Prunus* sp.) and hazel (*Corylus* sp.) and very often, the catkins of white birch and hazel. In the northern hardwood type, the catkins of ironwood *(Ostrya virginiana)* and of yellow birch *(Betula lutea)* are most commonly taken. In coniferous, lowland brush and swamp hardwood types, admixtures of any of the above tree species provide food to the birds, although rarely alder catkins may be taken.

ASPEN–BIRCH: Underplanting with conifers should increase winter grouse use (see Table 5). The openings in the stand must be maintained to encourage the light-demanding cherries and hazel. Although hazel can tolerate some shade, it does not appear to bear catkins in shaded situations; hence for winter-food production these openings are important.

NORTHERN HARDWOODS: The heavy use of this type in winter (Tables 2 and 3) raises the question as to what principal foods the birds are using in this type. Cherry, aspen, white birch, and hazel are usually rare in northern hardwood stands since these species cannot compete with red and hard maple successfully. Yellow birch catkins, although apparently very palatable, are seldom found since the large trees have been cut because of their high commercial value for veneer, and the small yellow birch reproduction is highly palatable to deer and often overbrowsed. It is unlikely that this species will ever again become important as a food source for grouse in northern Wisconsin. Thus, by the process of elimination, ironwood would appear to be the principal species accounting for the heavy winter bird use of northern hardwood types.

Corroborating this possibility, Stollberg and Hine (1952) have shown that ironwood catkins are heavily selected by ruffed grouse as early as October in northern Wisconsin. General field observation also indicates a strong winter use of ironwood. The maintenance of ironwood as a mature tree in the forest canopy thus appears to be important if we are to insure a good distribution of grouse throughout their winter range. In logging jobs, this species should not be thought of as a "weed" tree to be exterminated. Consideration should be given to leaving as many ironwoods for grouse as is feasible. The recent acceptance of ironwood by the pulpwood mills makes this especially important. The eradication of this species in our northern forest could seriously reduce the winter carrying capacity of our winter range since about

20 to 30 per cent of our northern forests are now in northern hardwood types. Clearly more autecological research should be done on ironwood so we can better understand how to perpetuate it in forest stands. In addition, some feeding experiments on nutrition and palatability should be done with the various species of twigs and buds utilized for winter food. Perhaps certain of these catkins provide essential amino acids or vitamins important to the maintenance of good populations of grouse.

CONIFERS: The underplanting of conifers in aspen types would no doubt be a desirable technique. Planting narrow strips 20–50 feet wide adjacent to aspen or northern hardwoods would probably have the same effect as underplanting. It does not seem necessary to preserve large coniferous stands for winter grouse use, as is the case for white-tailed deer. This was demonstrated on the Highway 27 area where plots devoid of conifers still maintained good populations. Edminster (1935) also showed how grouse in New York failed to penetrate over 300 feet into solid coniferous stands.

LOWLAND BRUSH: This type, although it may make up as little as 5 per cent of the total land area, must be maintained, since its almost exclusive use by broods suggests that it is vital to grouse production. If the recent experimental use of herbicides to eradicate alder and encourage lowland conifers should become common forestry practice, grouse production could be seriously endangered.

OPEN TYPES: It would appear desirable to leave these open areas undisturbed since they provide valuable edge. As many authors have pointed out (Bump *et al.,* 1947 and Sharp and English, 1952), upland openings are needed to maintain or encourage grouse. Wholesale tree planting on these types would almost certainly reduce the grouse populations after the plantations closed in. However, the open type by itself is little used at any time of the year. Its chief value seems to be that it provides edge where light-demanding shrubs can bear fruit and catkins. Hence openings of only a few acres in size are very useful.

WOODLAND GRAZING AND GROUSE PRODUCTION: In two of our study areas (Highway 27, Otter Creek) some light grazing by cattle and sheep occurred on some of the forest lands. The effect of this grazing markedly increased the ruffed grouse population. For this reason some comment should be made about the use of controlled grazing for ruffed grouse production. The two areas which were lightly grazed (about 7–9 heifers per 40 acres) were primarily aspen, intermixed with alder, northern hardwood and jack pine. One of the areas

was 60 acres, the other 80 acres. Grouse breeding densities and fall populations were consistently higher on these grazed areas compared to similar areas of adjacent ungrazed land. General observations in spring and fall on other lightly grazed areas in northern Wisconsin also corroborated the conclusion that both breeding and fall grouse numbers were increased by light grazing. It is possible that proper use of grazing could increase grouse density two- to threefold, on land that warrants intensive grouse management.

The ecological effect of light grazing seems to favor grouse for the following reasons: Light grazing on young aspen stands (3–5″ d.b.h.) opens up numerous trails which provide dusting spots, succulent greens (e.g. clover, plantain, dandelions) and seems to encourage the growth of some berry shrubs such as dogwood, blackberry and raspberry. Perhaps the bare ground resulting from the trampling of the stock provides the necessary seedbed for these shrubs. Furthermore, the cow manure attracts insects, and thereby may help the young chicks with this necessary part of their spring diet.

Aspen stands seem to be the best type for the use of controlled grazing, since the 1– to 6–foot shrub layer is usually more prevalent. This shrub layer is important since grouse cocks will not use areas for breeding if they are devoid of sufficient shrub or young sapling cover to protect their drumming logs. On the other hand, northern hardwoods and scrub oak ordinarily should not be pastured since the shrub cover is usually already too sparse in these types. Pasturing of these types will in most cases rapidly eliminate ruffed grouse by eliminating suitable drumming sites. In the hilly southwestern portion of Wisconsin, pasturing of hardwoods in hilly terrain has the added disadvantage of accelerating erosion and runoff.

Some experiments on controlled grazing should be undertaken in northern Wisconsin since in many areas it might be economically feasible to devote unproductive off-site aspen–alder areas to grouse production, and pay for a portion of the management by the limited livestock production on the area. As many experiments in livestock feeding have shown, woodlots are a poor substitute for improved pasture. However, if small cultivated openings were placed within the forested area to be lightly grazed, the level of nutrition for the livestock would be improved, while the benefits to grouse would be derived by the wandering of stock through the adjacent forested area. Five or six small open fields of one-half to one acre planted to legumes, mixed with an 80-acre wooded matrix would provide an ideal interspersion for grouse. Flush rates of 5–25 birds per hour on lightly grazed aspen–

alder areas are not uncommon in northern Wisconsin. The economics of this type of grouse management should be explored, since we have many off-site aspen-alder areas that are determined by current forestry practices as unsuitable for growing commercial timber crops. Some of these areas perhaps can economically be made into highly productive ruffed grouse hunting grounds.

Southwestern Wisconsin

Unfortunately, only the Otter Creek area in this region of the state was studied. Thus our analysis of habitat usage is not as well documented as that for northern Wisconsin. The large amount of field edge in the Otter Creek area, however, results in a tremendous growth of hazel. General observations of winter feeding habits showed that hazel catkins are highly relished and make up the bulk of the winter food when available. In many winters, the hazel catkins are so heavily taken that a "browse line" is noticed. This "browse line" is formed as the birds walk along on top of the snow, picking all catkins within reach. In addition, acorns and blackberry (*Rubus* sp.) buds are used. In only a few cases were aspen buds, ironwood catkins and alder catkins taken. However, ironwood is a very rare tree in this area while aspen and alder are both abundant.

The persistence of leaves on the young oaks throughout the winter no doubt provides protection from predators as well as from the wind. From a cover standpoint, these scrub oaks simulate conifers. In the entire southwestern area, including Dunn County, the winters are noticeably milder, and crusted snow is more often present than in northern Wisconsin. This perhaps accounts for the more definite selectivity for conifers that was shown in Table 9. It was noted while running the roost counts that the young jack pine stands with limbs present all the way to the ground were preferred in comparison to the older jack pine stands that had become self-pruned.

Field openings in this area of the state are maintained by farming and will be present in the future. The heavy growth of berry-producing shrubs, primarily dogwood (*Cornus* sp.) and blackberry, plus the hazel thickets along these field edges certainly help sustain the high populations of grouse in this area.

Recommendations for Cover-Type Management

OAK AND SCRUB OAK TYPE: Maintain openings in the canopy by spot or group selection logging. This type of cutting will produce desirable openings for hazel and berry-producing shrubs. If the tops

of logged trees are left intact, desirable escape cover and roosting sites can be created. If logging can take place in late summer or early fall while the leaves are still on the trees, these tops will retain these dried leaves for one to three years, and produce very effective escape cover. In addition, the young oak coppice following logging retains its leaves, thereby simulating conifer cover in winter.

PLANTATIONS: Probably can be very useful if planted in small blocks adjacent to aspen or oak types. The pruning of lower limbs should not be done on those portions of plantations being managed for grouse. The possibility of planting juniper *(Juniperus virginiana)* on suitable sites in the extreme southern counties deserves some consideration.

JACK PINE: These stands are used as young trees before their lower branches are self-pruned. Mature jack pine should be rapidly harvested on areas managed for grouse, since jack pine loses its usefulness for grouse beyond 5 inches d.b.h. in fairly dense stands.

ASPEN: Although apparently little used for food in winter in this region, aspen stands nevertheless provide some insurance against possible winter food shortage.

LOWLAND BRUSH: Although not a common or extensive type in this region, it does occur in valleys or side hills with spring seepage. Because a large number of broods are known to use this type in the Dunn County study area, alder stands that do occur should be protected.

SUMMARY

Cover types utilized by ruffed grouse in Wisconsin were studied so that management recommendations could be formulated to better integrate timber and ruffed grouse production on forest lands. Sampling of tracks in winter and winter roosts remaining after the snow left in spring showed that the ruffed grouse in northern Wisconsin were distributed equally throughout all forest types, with the exception of open or unforested land where few ruffed grouse signs were noted. Hardwood types intermixed with conifers were more heavily used in winter than either pure conifers or hardwoods. Wisconsin grouse were not as strongly dependent on conifers for winter shelter as is the case in New York, based on comparative studies.

An inspection of spring drumming territory sites indicated that a heavy shrub understory is needed in the vicinity of the drumming log. The absence of shrubs in young northern hardwood stands due to

shading and crown closure apparently is responsible for the rapid elimination of ruffed grouse territories in this type. Thus the management of northern hardwood stands on a 60- to 100-year rotation will be detrimental to breeding-territory establishment.

Forest management that will maintain or increase ruffed grouse populations includes underplanting aspen with conifers, protection of ironwood because of its value as a winter food source, maintenance of alder for summer brood use, perpetuation of forest openings, and light grazing of off-site aspen by livestock. The group selection cutting of oak to promote young coppice growth which then retains its leaves simulating conifers offers some promise as a management technique in oak types.

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