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RESEARCH REPORT 36

RUFFED GROUSE HABITAT REQUIREMENTS AND MANAGEMENT OPPORTUNITIES*

By
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Madison Wis.

1968

*Originally published with photos and a yellow cover, this research report has been widely requested. It is now out-of-print and even loan copies are in short supply. Because reprinting of the original report is not anticipated (it should be updated first), photos from the report were removed and the report reassembled and xeroxed to make "keeper" copies available to persons requesting them.

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INTRODUCTION

The ruffed grouse is the most important game bird in northern Wisconsin. Will it be as important 20 years from now?

Scenery in northern Wisconsin is changing. Young, pioneer forests are converting to pole-sized or larger forests. We have been watching carrying capacities decline and entire grouse ranges eliminated. Must we continue to watch?

The time is ripe to answer some important questions about grouse and their future in Wisconsin.

1. What is optimum ruffed grouse habitat in Wisconsin?

2. What major problems face grouse habitat?

3. What can we do to maintain or improve ruffed grouse hunting?

The purpose of this report is to summarize what is known about Wisconsin ruffed grouse--their living requirements and what opportunities are available to us to maintain those requirements.

To get this information, we searched, summarized and condensed available data from the scientific literature, and supplemented them with information offered by field men of the Department of Natural Resources and the U. S. Forest Service.

The paper is written for land management field men, not basic research scientists or administrators. It is written to present the facts as boiled down as possible, and yet interesting to read. Some technical papers which are merely rehashes of other research or do not offer information applicable to Wisconsin are not cited here. Some ideas which are contradictory to "sound" recommendations for ruffed grouse management are not emphasized and will not be until such time that we feel the data are conclusively reliable and applicable to Wisconsin. Management implications stressed are those which we feel may be practical through forestry-wildlife coordination.

The result is this report--not intended as the final word, but to raise questions and create added interest in the possibilities for managing Wisconsin forest lands for ruffed grouse.

RUFFED GROUSE HABITAT REQUIREMENTS

Key to Abundance

What is the key to ruffed grouse abundance? What quality does habitat need? Some studies point to aspen (popple) as the

answer, others emphasize snow conditions, and some work suggests that the controlled use of fire can maintain an abundance of birds.

Aspen reduction has been linked with grouse declines in Minnesota. These sharp declines occurred as mature aspen was severely reduced. Spring populations dropped from 8.9 to 2.6 grouse per 100 acres; weights of established males declined (Gullion, 1966a). The decline in abundance was region-wide except for the one grouse population which had access to mature aspen (Gullion, 1966a). Most activity centers did not continue to be used after the mature aspen close to the center was removed (Gullion, 1967). A comparison of the distribution of aspen forest range in North America (Sharp, 1963) with the distribution of ruffed grouse (Bump et al., 1947) shows that the boundaries encircling ruffed grouse abundance fall into almost the exact position as the boundaries of commercial aspen distribution.

Along with quantity and quality of male aspen trees, winter snow conditions also affect grouse abundance in northern Wisconsin (Gullion, 1966a). The need for adequate roosting snow in northern regions has been well emphasized (Eng et al., 1962; Gullion, 1966c; Gullion, 1967).

Grouse were abundant during the late 1940's and early 1950's. These were the days following the timber barons and later, the flames on the horizon. Fires followed logging and partridge followed fires into brushy, well mixed-up habitat. Fire was indeed important in creating diversity (Gullion, 1966a).

So the grouse story is not a simple one. Grouse habitat is the result of climate, soil, disturbance and time. Fire, snow, aspen and all the other influencing factors interplay one with another. No single factor, by itself, will determine grouse abundance. To understand ruffed grouse habitat, we must find all the pieces and be able to fit them together in the proper order.

Habitat

Ruffed grouse live in small areas, generally 40 acres or less (Allison, 1966; Bump et al., 1947; Gullion, 1966b). Males are even less mobile. They may range to a 1/2-mile radius (Hale, 1963), but may remain within a 1/4-mile radius (Chambers et al., 1958; Palmer, 1963). One-half to two-thirds of a grouse population was found to use a year-around area of a 1/4-mile radius (Hale et al., 1963). Within that area, known as a grouse covert, are found the essential food and cover to meet year-around requirements.

Grouse habitat is a series of individual coverts. Occasionally birds can be found between coverts, but not on a sustained year-around basis. Number and quality of coverts, not total forest land, will have the greatest influence on grouse abundance.

Grouse habitat may be predominantly deciduous stands, especially aspen and birch (Gullion, 1967; Magnus, 1949 and 1951; Marshall et al., 1953), or a deciduous forest and brush combination (Magnus, 1951; Gullion, 1967). Second-growth deciduous and conifer forests mixed liberally with alders is typical habitat in northern Minnesota as well as in northern Wisconsin.

Grouse coverts are not as easily described. Covert location and quality results from the interplay of forest type composition, interspersion, succession and soil variations.

Grouse habitat is often thought of as a quiltwork of woodlands, fields and rolling hills--the widest possible assortment of preferred foods and vegetation (Hayes, 1964). Interspersion of forest types, age classes, brush cover, openings, and other aspects of grouse habitat is important (Chapman et al., 1948). In Wisconsin, Dorney (1959) found that thickets of berry shrubs and field-edge hazel helped to sustain local high grouse populations. The more different the adjacent communities, the more attractive the transition zone (edge) between them. Varied topography and a wide range of soil conditions, well interwoven, usually result in a good interspersion of plant communities. "The potential density of ruffed grouse is, within ordinary limits, proportional to the sum of type edges." (Bump et al., 1947).

Edges are not as important when a good variety of vegetation can be found within cover types. Here birds will use all or a good part of the type rather than just the edge. On poorer soils, fewer species are present, and grouse will use the edges rather than type interior.

Diversity refers to the variety of plants and plant communities that a soil can produce. Regardless of soil type, the greatest diversity occurs during young, pioneer stages. If two soils were managed for greatest plant variety, the richer soil would produce the greatest diversity.

In northern Wisconsin, we usually see the opposite result, partly because of current forest management practices and partly because most of the northern forest is pole-sized. Closed-canopy northern hardwood forests predominate on the richer soils. At pole stage, the stands are monotypic. Aspen communities predominate on sandy soils and severely disturbed sites. Typical aspen forests are not continuous or heavy canopied and are interspersed with small openings. Due to these characteristics, there is more plant variety in pole-sized aspen forests than in pole-sized northern hardwoods.

Succession changes characteristics of plant communities. Communities are constantly changing as each type grows into the next more advanced stage. Stands approaching maturity become less varied and more monotypic, regardless of site quality. Small acreages of pole or mature stands interspersed with more varied stands are an asset, but large areas of older stands will be essentially devoid of permanent ruffed grouse populations. Large tracts of mature forest of any kind are rarely used by partridge. Northern hardwood stands are unfavorable for breeding territory establishment (Dorney, 1959).

Considerations

Structure vs. species. Structure of cover might well be more important than species composition. Broods, for example, prefer a certain type of vegetation. In northern Wisconsin and Minnesota, the preferred conditions are met primarily by alder lowlands (Dorney, 1959; Gullion, 1967). Farther south, brushy field edges are primarily used by broods (Polderboer, 1939; Dorney, 1964; Porath, 1967). Brood use has been shown within forest openings and adjacent to openings in Iowa and Idaho (Polderboer, 1939; Hungerford, 1951). Male activity centers in northern Wisconsin occur predominately within aspen-alder stands. Farther south, activity centers are concentrated near field edges (Dorney, 1964; Porath, 1967).

Grouse preference for specific areas may be governed more by microclimate, insect and plant communities associated with a forest type rather than the specific forest cover type (Hungerford, 1951).

Flush data. There are biases in almost every technique used to census or measure cover use of ruffed grouse. A very serious bias to most habitat preference data could be this observation: "Forest situations in which we record the largest number of grouse by flushing are not necessarily the types having the highest density of birds. Ruffed grouse flush most readily where they are least secure." (Gullion, 1966a). We have always assumed, however, that the more birds flushed in a specific cover type, the more preferred that type.

The classic reference for habitat preference information is the New York study (Bump et al., 1947). This research, lasting 12 years and including 16,000 man days of observations, involved complete coverage of each area by men systematically walking as close together as needed to make flushes. The results were 19,619 grouse flushes, 1,515 broods and 1,270 nests located.

Since Lake States data based on flushes (Dorney, 1959; Palmer, 1961; Palmer, 1963) agree with New York's, any security bias present must be slight or compensated for by other biases. Rather than emphasis on how secure the bird feels, possibility of flushing would probably depend more on the interrelationship of sex, age, activity, weather, time of day, cover, closeness of a predator or reactions to being hunted (Bump et al., 1947).

Conifers and predation. Conifer and conifer-hardwood mixtures have been found to be valuable shelter against weather and predators (Magnus, 1951; Hayes, 1964). Dense clumps of balsam fir, spruce or young pines (up to 15-20 years) have been used for roosting during periods of insufficient snow (Gullion, 1967). Clearings in coniferous forests are often preferred snow-burrow roosting areas; snow becomes deepest and there are fewer obstacles for the plunge into the snow (Gullion, 1967). Part of the brood period may be spent in older mixed conifer-hardwood and hardwood forests; they often contain the greatest abundance of litter insects. "Pine forests with an understory of balsam or spruce seem to provide desirable cover and abundance of the important herbaceous and berry-producing ruffed grouse foods and afford high ruffed grouse carrying capacity." (Gullion, 1966a).

Since grouse commonly frequent spruce and balsam fir in northern Wisconsin, especially where associated with an aspen overstory, we have assumed the types are important. However, conifer stands may provide an even higher carrying capacity and hunting opportunity for predators of ruffed grouse, even though they may be good habitat and have a high carrying capacity for grouse (Gullion, 1966a). Minnesota studies further suggest that spruce and balsam fir have questionable value, and may even be a detriment to ruffed grouse (Gullion, 1967).

High tree pine stands can be hazardous to grouse. Security and value of ruffed grouse habitat seems to become worse, the more tall pines are present (Gullion, 1967). In 12 years, 88 percent of known predator kills at Cloquet were in or immediately adjacent to high tree pine stands (Gullion, 1967). Mean survival of male grouse varied from 12.6 months in closed canopy high pine stands to a high of 19.3 months in closed canopy hardwoods where no conifers were present (Gullion, 1967).

Several points should be clarified. Conifers, as used here, generally refer to tall tree pine stands with sparse underbrush. Most mortality refers to winter and early spring (before leaves are out) losses of ruffed grouse males established on activity centers. Activity centers are small and are periodically investigated by raptors. A closed pine canopy hides the raptor silhouette and also reduces understory shrubs. During winter and early spring, when greatest mortality occurs, grouse are emphasized against the snow cover, especially vulnerable in openings within a closed pine forest or if roosting on or above the snow surface (Gullion, 1967).

Important raptors include the barred owl, horned owl and goshawk. In Minnesota they kill about half of the fall population each winter (Eng et al., 1962). The goshawk is the most effective predator at Cloquet, accounting for about 87 percent of known raptor kills (Gullion, 1966a).

The Cloquet Forest Research Center is a unique combination of pine stands and predator populations which would be hard to find anywhere in Wisconsin: (1) The forest consists of 36 percent closed canopy, high tree pine stands; (2) it is being managed for conversion to and maintenance of pine stands; (3) mature pine trees are scattered throughout most of the grouse range where the pine does not occur as closed stands; (4) goshawks account for more than 50 percent of all annual mortality, most kills occurring during fall and early spring; (5) probably at least one pair of goshawks has nested in the study area since 1956; prior nesting records are scanty; and (6) goshawk predation was extremely heavy within a 1/2-mile radius of the nesting site but progressively less important farther away; the goshawk area of influence was approximately 5 square miles about the nest.

The Minnesota work suggests that some of the avian predators are a good deal more effective than was formerly realized. Rather than on physical condition of the population or individual birds, amount of predation may depend more on forest type, proximity of activities to aspen, snow conditions, color phase of the birds and status of activity centers (Gullion, 1967).

Fortunately, most of the grouse range in Wisconsin is probably not

susceptible to the same degree of predation as occurs in Minnesota. However, we are not sure at this time of the value of young spruce or balsam stands to ruffed grouse in northern Wisconsin. Experience indicates that they are important, but data from Cloquet presents contradictory evidence. Further research will shed more light on this significant management situation.

SEASONAL REQUIREMENTS

Spring

The spring period as used here extends from the start of drumming to the peak of hatching.

Drumming. Availability of drumming territories may be critical. Carrying capacity of grouse range is probably closely related to the percentage of the area suitable for male grouse territories (Palmer, 1961). Good drumming areas are thought to be good habitat for both sexes during most of the year (Gullion, 1967).

Grouse do need food and cover near the territory. Food does not have to be on the immediate site but must be close. One requirement at Cloquet is that mature male aspen be within 100 yards of the drumming log (Gullion, 1968, per. comm.). During some Aprils in Minnesota, most male grouse lived entirely on male aspen catkins. After the aspen catkins mature , willow catkins and red maple flowers were used (Gullion, 1967).

Overstory trees have little direct influence on drumming site locations, but may have a great effect on survival of the birds. Overstory pines may pose an extreme hazard to otherwise good drumming sites. Minnesota studies show that the highest grouse mortality occurs on sites under high tree pine stands (Gullion, 1967). Most kills are by goshawks and horned owls. The possible hazard of young spruce and balsam fir has not been adequately tested.

Although the immediate overstory need not be specific and the drumming log may be almost any object, we feel that a certain amount of brush protection is required about the drumming stage or that site and log will not be used. Protective cover seems to come primarily from understory vegetation. Sufficient shrub or young sapling cover is needed about the drumming log, for it protects the displaying male and may offer escape. Brush is more dense under certain stands, but this does not mean that these overstory trees are important as food or cover. They only help create a favorable cover.

Most drumming sites in northern Wisconsin and Michigan are in lowlands or in the lowland edges where adequate brush is present (Dorney, 1959; Palmer, 1961; Palmer, 1963). Mature swamp conifers offer few food or cover values, but edges and holes of conifer swamps are preferred drumming sites because of the brushy conditions in these locations.

Where sufficient upland brush is available or where lowland cover is deficient, drumming sites are commonly located on the uplands. This has been demonstrated in Alberta (Rusch, 1967) and Iowa (Porath, 1967). In our major Wisconsin grouse range, however, much of the upland is devoid of shrubs. High deer densities, control of forest fires and insects and diseases, heavy grazing, plantations, conversion to northern hardwoods and forest succession from shrub and sapling stages to mature stands have all helped to reduce upland brush.

Absence of suitable cover therefore may be an important reason why we do not find more drumming activity centers on the uplands. Although active sites have been found in upland situations (Porath, 1967; Rusch, 1967; Kubisiak, 1968, pers. comm.), the majority of drumming territories are in lowland or lowland edge.

If an area suitable for grouse territories is limited by the extent of lowland or lowland edge, then the number of breeding males will be limited. The number and distribution of breeding males will influence the total number of grouse that can be carried in the area (King, 1937; Palmer, 1961). In pens, polygamy and promiscuousness is common (Bump et al., 1947), and polygamy appears to be the rule in the wild (Gullion, 1968, pers. comm.).

Alder provides most of the log cover (Palmer, 1961 and 1963; Kubisiak, 1968, pers. comm.). The range of preferred cover density about a drumming log is rather narrow. The brush may be either too sparse or too dense (Bump et al., 1947). Michigan studies described log cover quantitatively (Palmer, 1961 and 1963). Perhaps one of the best ways to obtain a picture of what a site should look like is to examine first-hand the cover situation around all the drumming sites that can be located in an area.

Drumming logs have been well described. Absence of suitable logs may limit the population (Philips, 1964), but I doubt it. Old moss-covered conifer logs are preferred (Palmer, 1961 and 1963; Kubisiak, pers. comm.), but birds are remarkably adaptable and will use whatever perch is available. A variety of elevated objects including roots and dirt of wind-thrown trees, rocks, stumps, 1-inch diameter limbs and freshly cut trees have been used (Gullion, 1967). One eccentric bird used a snowdrift (Magnus, 1951). In Utah only aspen logs were used (Philips, 1964).

Drumming logs have been studied quantitatively. Measurements of 40 drumming logs in Michigan (Palmer, 1961 and 1963) came up with these mean results: 11.9 inches = height of the drumming stage from the ground; 13 inches = log width at the stage; and 19.8 feet = length of the log. Minimum measurements were 7.5 inches diameter and 5.5 feet length. Drumming logs varied between 10 and 24 inches in diameter and 7 and 40 feet in length in Iowa (Polderboer, 1940).

Nesting. Ruffed grouse usually nest in park-like forest stands (Gullion, 1967). Deciduous stands are preferred, but birds also nest in mixed deciduous-conifer or confier stands (Gullion, 1967), depending on forest types available. Mature or pole hardwood stands seem to be preferred (Polderboer, 1940; Gullion, 1967), but some studies emphasize

that deciduous sapling stands are also used (Bump et al., 1947). Most nests located in Wisconsin have been in relatively open pole or mature stands. Aspen or northern hard-wood stands provide the essentials.

We're not certain why grouse choose a particular nesting site. Proximity of site to male aspen clones, openings, or brood range have been cited as possibilities. Minnesota studies suggest that proximity to a stand of male aspen has more influence on nest location than the closeness of drumming logs, roads, forest edges or brood range (Gullion, 1966a). Male aspen leaves appear to be the primary food for nesting hens (Gullion, 1967). Hens often fly from the nest to feed on aspen leaves and, after feeding, return directly to the nest (Gullion, 1966a).

The aspen-nesting correlation contradicts earlier findings that nests were primarily located in relation to openings in the forest: nests were usually located in the edges of openings (King, 1937); three nests were found within 6 yards of open roads or paths (Polderboer, 1940); nests are commonly found within 100 feet of a trail, woods road or natural forest opening (Bump et al., 1947); the desirability of a nesting site varies inversely with its distance from an opening--derived from location of 924 nests (Bump et al., 1947). Minnesota radio-tracking data suggests also that brood range need not be close to the nest. Broods have traveled quite long distances to reach brood habitat (Gullion, 1968, pers. comm.).

Size, condition and other pertinent open characteristics have usually been inadequately described in the literature. Is the opening the result of a tree being felled, clearcutting, frost or an abandoned field? It makes a lot of difference to food and cover availability.

Nests are often located against the base of a tree, stump or log (Magnus, 1951) although they may be found on rocks (Porath, 1967) or in other less common situations (Bump et al., 1947, Edminster, 1947).

Most nests have been located in relatively brush-free stands. Grouse find dense brush near the nest undesirable and prefer being able to see 50-60 feet from the nest in all directions (Gullion, 1967). Bump agrees that undergrowth about the nest is not needed but that small forest slashings in the vicinity add to nest attractiveness. He also defines brush, not at the nest site, but in the general vicinity of the nest as neither particularly dense nor open (Bump et al., 1947).

Survival of nests is low and does not appear to be related to crown cover, undergrowth density or distance of the nest from an opening. In New York, 39 percent of 1,431 located nests were destroyed. Nests are more apt to be broken up by predators, primarily foxes, when under conifers (Bump et al., 1947). Nest destruction was found to be insignificant in Minnesota (King, 1937).

The availability of nesting sites is not a limiting factor. Park-like forest stands of light underbrush are abundant in most of Wisconsin's grouse range.

Summer

The summer period is defined here as that period between hatching and brood dispersal.

Adequate brood habitat is essential. If chicks are going to survive this critical period, they need a good variety of food and lots of it, and protection from predators and climatic extremes. Many types of cover will serve as brood habitat although certain patterns are preferred in different sections of the grouse range. Preferences may be more linked to use of microclimate than to cover type (Hungerford, 1951). Brood cover is successful if it can meet these requirements: (a) ample variety and quantity of herbaceous and insect food; (b) climatic stability; and (c) protection from predators.

Good brood habitat is best defined as a low, dense canopy vegetation, preferably close to forest openings (King, 1937; Polderboer, 1939). Basic cover patterns have been described by Bump et al. (1947) as:

(a) Broad, open bands of edge-type vegetation surrounding second-growth woodlands.

(b) Second-growth woodlands interspersed with substantial amounts of overgrown lands, old shrub-dotted pastures, brushy corners or briar patches.

(c) Small slashings in the briar, herb and small sprout stages, scattered through second-growth woods.

(d) Selectively lumbered deciduous stands in which the created openings are filled with plants characteristic of recently cutover areas though somewhat less varied and abundant.

(e) Alder runs separated by deciduous stands.

Variations of these patterns which are also commonly used by broods in Wisconsin are:

(f) Pattern of tag alder swales next to forest openings, providing variety of food and cover conditions.

(g) Lightly to moderately grazed aspen forest which has alder understory in part.

(h) Lush, clover-seeded woods trails adjacent to woodland brush.

Habitat that birds less than 4 weeks old pass through to reach brood habitat should not be confused with the more important habitat that holds the juveniles over summer. Most of the literature has not made this distinction.

Vegetative plant species making up brood range cover does not seem as critical as does structure of the vegetation. Broods require a certain overhead and side cover, plenty of plant and insect food and relief from summer heat (Hungerford, 1951) in some areas.

Brood range has been characterized as uniform in structure and perennial in use (Gullion, 1967). This seems applicable to northern alder swamps, but it does not adequately describe the brushy forest openings and field edges used by broods farther to the south. In most of northern Wisconsin, brood requirements are usually best attained along the edges of and within tag alder swamps (Dorney, 1959). Tag alder itself is not an important food plant but provides conditions of protection and food which are usually not available in other parts of the northern forest. In Alberta, where the upland forest consists of aspen with an alder understory, broods appear to be distributed randomly (Rusch, 1967).

Man-made openings in deciduous forest receive brood use in northern Michigan, at least during shrub stages (W. L. Palmer, 1967, per. comm.). Openings of 1/2 to 1 acre in deciduous types are valuable to broods in Pennsylvania (Sharp, 1957 and 1963).

In New York (Bump et al., 1947), southern Wisconsin (Dorney, 1959 and 1964), and northeastern Iowa (Porath, 1967), brood range is primarily brushy field edges or openings. Variety of vegetation along field edges in southern Wisconsin is much greater than in the northern part of the state and creates conditions for the variety of insects and herbaceous plants and protection that is provided for in the north by alders. Ground vegetation is important as food, cover and a stabilizer of climatic conditions. The irregular microrelief under alders provides conditions from standing water to dryness--thousands of microenvironments.

We used to think that early availability of green vegetation was crucial to good reproductive success (King, 1937; Gullion, 1967). It may be, but the weather with which young chicks must cope is probably more critical. Many of the chicks hatched in Minnesota during the first two weeks of June die from exposure during the cold wet weather typical of that period (Gullion, 1966a). Persistence of snow into late April or May would probably delay the peak of hatching to at least June 15--less chance of high chick die-offs from severe weather (Gullion, 1966a).

Bracken fern commonly grows in conjunction with aspen. If bracken areas are not too vast, do not shade out herbaceous and shrub species, and are only moderately dense (1-2 stems/sq. ft.), they may supply brood cover (Berner et al., 1967). King (1937) believed bracken was an important cover in Minnesota. We don't know whether bracken is an asset or a liability to grouse habitat in Wisconsin at this time. Let's hope it is an asset. We have no practical method of control for it.

The brood period is one of rapid chick growth. Chicks eat litter insects first, then seeds of sedges and succulent herbs. Later, tougher leafy foods like strawberry, blueberry, raspberry and other fruits and berries are used (Gullion, 1967). Even though grouse have rarely been observed drinking, there is usually a source of free water near brood cover (Hungerford, 1951). The importance of free water to broods has probably been overemphasized, at least in the Midwest.

Chicks must be able to roam freely (Dorney, 1959; Gullion, 1967) and can do so in tag alder where the ground is usually leaf matted and free of dense vegetation. Heavy grass, goldenrod, and other rank herbaceous vegetation discourage brood use (Dorney, 1959). Bunch grasses or tufted

sedges growing on alluvial soils under alders are important brood habitat in Minnesota (Gullion, 1968, pers. comm.).

There is growing evidence that suitable brood range does not have to be close to nesting cover. Minnesota radio-tracking studies show that the chicks used the hardwood stands where they were hatched for the first 3-4 weeks of life, probably for the greater abundance of litter insects there (Gullion, 1968, pers. comm.). Broods appear very mobile in this early stage, one brood moving as far as 19,000 feet in the first 14 days (Gullion, 1967). Once the alder or brushy brood habitat is reached, the chicks spend the rest of their brood period in relative confinement: 10-20 acres in Idaho (Hungerford, 1957); 30-40 acres in Minnesota (Eng, 1959; Gullion, 1967) depending on area characteristics. Broods and adults usually stay in alder swamps until frosts crumple ground vegetation and kill alder leaves (Gullion, 1967)

Molting adults seem to prefer the same cover situation as do broods. Adult males in northern Minnesota usually move into adjacent brood habitat during the molting period, if in close proximity, and remain there until loss of herbaceous ground vegetation and alder leaves (Eng, 1959; Gullion, 1967).

Potential dusting sites are common in almost any grouse area. All that is needed is suitable material and a little sunlight (Bump et al., 1947). Dusty roads, anthills, dirt-covered roots of windthrows and crumbling logs or stumps are used (Gullion, 1967). Entrances to wood chuck or fox holes and dry coniferous duff have also been used as dusting sites. Although dusting is most common in summer, it has been observed during January (Bump et al., 1947).

Grouse dust to rid themselves of lice, fleas and other skin parasites and to keep feathers in good conditions Bump et al., 1947)--and may even enjoy it!

Fall

Fall is the time of plenty for ruffed grouse. Food is varied and abundant and weather usually not severe. Most birds will be in the "grousy" habitats, but there will be birds in almost all forest habitats at this time, even in some unusual places (Edminister, 1947; Dorney, 1959; Gullion, 1967).

After brood dispersal, grouse frequent the uplands feeding on leaves of aspen, strawberry, wintergreen, gold thread, bunchberry and clover (Gullion, 1967) and practically any other type of available ground greenery. Mushrooms and berries are also eaten. Later in the fall, birds shift mainly to hazel, birch and aspen buds and catkins (Gullion, 1967). Conifers, basswood and birch are eaten but not preferred (Stollberg and Hine, 1952). There is no evidence that grouse feed on any conifer in Minnesota (Gullion, 1968, pers. comm.).

Certain foods act as magnets to attract partridge (Stollberg and

Hine, 1952; Dorney, 1959; Gullion, 1966a). Clover pulls in some adult birds and delays the dispersal of young. Berry- or nut-producing trees (dogwoods, thornapple, holly, mountain ash and oaks) also attract birds (Dorney, 1959). Aspen is an important fall food in northern Wisconsin and is probably used during all seasons (Stollberg and Hine, 1952).

As weather turns cooler, grouse will favor food in the sheltered situations where they can sun themselves and be protected from the wind.

Fall is not a critical period for ruffed grouse. There is no need to create or improve fall habitat except to improve hunting opportunity and success.

Winter

We do not understand the impact of winter conditions upon ruffed grouse populations, but, thanks primarily to the Minnesota work, some aspects are becoming clearer.

Weather can be a serious problem to ruffed grouse. Grouse are poorly adapted to prolonged exposure to temperatures below 0° F. (Gullion, 1967), and yet these temperatures are common in much of their range during long portions of the winter. Important to their survival, therefore, are snow depth and compaction.

Grouse have three winter roosting alternatives: snow burrows, snow bowls or roosting in trees. Partridge will snow burrow if there is enough soft snow (Bump et al., 1947). They need about 8-10 inches of uncrusted snow. Temperatures rarely drop below 23-25° F. under 7 inches of snow even though air temperatures may be well below zero degrees (Gullion, 1967). The short winter feeding periods don't expose the birds above snow for long (Gullion, 1967). When burrowing conditions are not possible and grouse are exposed to extreme cold, they lose weight and participate less in the following drumming and reproductive period (Gullion, 1968, pers. comm.).

A variety of forest types within the bird's home range is a safety valve--not only for the year-around benefits of edge and variety but for the different snow conditions offered under different stands. Snow accumulation and compaction vary under different forest stands. Sometimes grouse can't penetrate the crust under northern hardwoods but can penetrate under a dense conifer stand. Crusting can be disastrous when the crust is uniformly hard in all forest types for long periods (Gullion, 1966a). Feeding usually lasts until after sunset (Gullion, 1966a). By the time the birds return to snow roost, the crust will have hardened.

A varied topography can also be valuable in creating a good variety of snow depth and compaction conditions (Gullion, 1968, pers. comm.).

Partridge prefer to snow burrow in open forest stands or clearings (Gullion, 1967). Mature hardwood stands are preferred (Bump et al., 1947, Dorney, 1959) although conifers mixed with hardwoods appear to be often used. These are areas of deepest snow and fewest obstacles to the plunge into the snow. There was up to 5 times as much snow in the open as under

closed canopy pine in 1961 (Gullion, 1966a). Normally, there isn't this much difference.

If birds cannot roost in the snow, they will have to roost in bowls on top of the snow or in trees. Physical conditions will deteriorate (Gullion, 1967). Interspersion of vegetation is important in this respect. Birds bowl-roosting in the open lose heat 9 times faster than grouse bowl-roosting under a closed spruce or fir stand (Gullion, 1966a). In fact, spruce-fir stands, sphagnum bogs and muskegs are warmer roosting locations than the more upland situations.

How is predation affected by manner of winter roosting? The impact of predation will depend upon the type and abundance of local predators and how ecological conditions affect their hunting ability. It is reasonable that horned owls and goshawks, which rely chiefly on sight, are much more successful on grouse in snow bowls or trees than on grouse in snow burrows (Gullion, 1966a).

Mammalian predators probably take greater advantage of burrowed grouse. Studies in New York showed that grouse were frequently caught from burrows by foxes and in several instances by horned owls during periods of sufficient roosting snow (Bump et al., 1947). Sufficient snow for burrow roosting is rare in New York. Canada lynx seemed to prey very successfully on grouse in snow roosts in Alberta (Nellis, 1967). Mammalian predation appears to be insignificant in Minnesota (Gullion, 1967).

How important are conifers as winter cover? Conifers are considered important in areas from the east coast through the Rocky Mountains (Bump et al., 1947; Hungerford, 1953; Dorney, 1959; Hayes, 1964), although values vary depending on quality and quantity of other vegetation and on presence of adequate roosting snow.

Conifers are generally thought to be preferred winter cover near the southern portion of the ruffed grouse range. These are areas of generally inadequate roosting snow and scarcity of conifers. Young jack pine plantations are preferred winter cover in southwestern Wisconsin (Dorney, 1959). In the same region, scrub oaks were also used heavily (Dorney, 1959). Dorney felt that the persistent oak leaves offered grouse protection from predators and weather--serving the same function as conifers (King, 1937; Dorney, 1959). In contrast, Gullion (1966a) in emphasizing survival of grouse, suspected that the value of conifers to grouse decreases as one approaches the southern boundary of the grouse range.

Conifers are also generally considered important winter shelter in more northern ranges, although Dorney (1959) questions this. His data suggest that conifer types are used no more than aspen, northern hardwood and swamp hardwood types in northern Wisconsin.

In northern Wisconsin, aspen and northern hardwood types show increased use when mixed with conifers (Dorney, 1959). This might indicate that conifers provide a cover value, or that birds prefer ground plants found in this type of community.

Grouse are dependent upon deciduous buds and catkins in the upper

Great Lakes region for winter food. Aspen, birch, cherries, ironwood and hazel have been listed as primary winter foods in northern Wisconsin (Dorney, 1959). Both Magnus (1951) and Dorney (1959) found heavy winter use of northern hardwood types.

The critical winter food may be the male aspen flower bud (Gullion, 1967). Minnesota studies show that aspen is a preferred winter food; that trembling is preferred over big-tooth aspen; and that use of trembling aspen is usually restricted to older and usually injured, diseased, decadent or otherwise poor quality male trees (Gullion, 1967).

Aspen flower buds are nutritious foods--16 percent crude protein. The buds have slightly more protein than ironwood and yellow birch buds and 2-3 times more protein than oak acorns and most fruits and berries (Gullion, 1966a). Aspen flower buds are much richer than aspen leaf buds and twigs and are also rich in oils (Gullion, 1968, pers. comm.).

In southwestern Wisconsin, Dorney found little winter use of aspen buds, ironwood catkins and alder catkins, but heavy use of hazel catkins. Acorns and blackberries were also preferred (Dorney, 1959).

MANAGEMENT OPPORTUNITIES

Status of Ruffed Grouse Range

We are losing grouse habitat at an alarming rate. We still have good bird hunting in certain areas at the right times, of course, but we will probably never again experience the abundance found during the "good old days" of Wisconsin grouse hunting.

Our great pine forests were logged primarily from 1890 to 1910. Catastrophic wildfires followed the slashings, and were not adequately controlled until 1920 (WCD, 1962). Most of the forest seen from the car window dates from this period.

The after-effects of the great northern fires are almost gone. We do not find mile after mile of brush, charred stumps and a generally mixed-up, young looking landscape, nor do we find the numbers of partridge that thrived in these conditions.

Large areas of previously excellent grouse habitat have been or are in the process of being converted to monotypic stands, many of them pole-sized or larger northern hardwoods. Conifers are being planted to fill forest openings that still remain. Brushy field edges are also disappearing rapidly. Emphasis on mechanized logging points to a trend toward management of larger, monotypic forest types.

As a result, much of northern Wisconsin's grouse range is losing interspersion, aspen as a forest type, brushy woodlands, field edges

and possibly even lowland brush. The forest is growing older, losing its young and varied plant communities and the game bird species dependent upon them.

Scarcity of adequate brood and drumming areas are probably preventing Wisconsin grouse from becoming more abundant. Most northern Wisconsin broods are reared in alder swamps. Most drumming territories are also restricted to alder or lowland edges. If adequate brood and drumming habitat are of good quality and well distributed through the grouse range, the other habitat requirements of grouse will also be automatically provided.

Brood and drumming areas do not have to be restricted to lowlands. They were distributed throughout the uplands during the periods of young, interspersed, pioneer vegetation that followed the fires. In more southern areas, where adequate brush and young vegetation persist, grouse broods and drumming cocks are using the upland cover. If uplands could be put pack into the grouse production business, a lot more acreage would be added to the present grouse range.

We do know that we cannot have ruffed grouse in abundance without good habitat. But habitat management alone will not necessarily guarantee maximum sustained yields of birds. Other factors influence the grouse harvest, particularly hunting regulations and hunter distribution. Ruffed grouse cannot be stock-piled, and there will be about 50 percent annual mortality whether birds are hunted or not (Gullion, 1967).

Periodic fluctuations or "cycles" are important regulators of grouse abundance in northern Wisconsin, although they have less impact in the southern range. In years of cyclic lows, birds will be scarce throughout the region but less scarce in the better habitats.

Management Priorities

Habitat requirements have been categorized by season, functions, age, sex and cover type. Practically speaking, the answer always adds up to diversity. The ruffed grouse is typically a bird of young forests and pioneer vegetation--brush, aspen and generally a conglomeration of cover types and age classes. This is grouse country.

Research in Wisconsin and other states has defined what the outdoorsman knows as "grousy" habitat. This knowledge provides some guidelines on how to reproduce and maintain good grouse habitat. All of the answers aren't in yet. But what we know now, as summarized in this report, is enough to start on. To maintain good huntable populations of ruffed grouse for our children and grandchildren with the amount of money we have to spend, we should concentrate on fulfilling the basic obvious requirements which we know grouse need: Diversity, brush and aspen.

Optimum grouse habitat is characterized by the best possible mixture of brush, aspen, openings and access trails. We don't always expect optimum habitat, but the closer it approaches this, the better it will be.

The broad solution facing us is maintenance--to maintain elements of the young and pioneer forests that are important to grouse abundance. This course of action will be less costly and more effective than to try to create these elements where they no longer exist. We should concentrate management on the better grouse areas.

Coordination of forest and wildlife management is the only economical way to affect a significant portion of ruffed grouse range. Indications are that forest management will continue to accomplish most of the northern ruffed grouse management. Pulpwood sales, for example, have been of more benefit to Wisconsin ruffed grouse range than any other land management practice since the great fires.

Forest Management practices are not especially geared to optimum ruffed grouse management, but do produce some desirable results:

1. Continuous young growth
2. Edge effect between cuts
3. Better hunter access
4. Reduction of overstory--may increase shrub and sapling growth.

There are also conflicts. Some of the detrimental effects are:

1. Creation of monotypic northern hardwood stands
2. Elimination of northern forest openings by plantations
3. Elimination of aspen through conversion to other types over large areas
4. Elimination of upland brush
5. Tendency to cut larger blocks of forest lands, resulting in less edge effect and monotypic stands.

Our greatest management opportunities lie in more precise coordination of wildlife and forest management programs. Major changes are not required, but we can modify timber sales, planting and other forestry practices at often slight costs and greatly increased benefit to ruffed grouse.

Habitat improvement should be integrated with spraying, planting, timber stand improvement (TSI) and logging practices as part of the forest management plan. Some rough guides for accomplishing this relationship are:

1. Become familiar with local foresters, their problems and management procedures.
2. Search for opportunities to better improve grouse habitat through forestry practices. Suggest adjustments that the

forester can make without undue difficulty and expense.

3. After becoming familiar with what opportunities are available and acceptable, review compartment scheduling plans for all forest compartments within your district. Assign top priority to the compartments scheduled to be cut first.

4. Pinpoint management opportunities in each compartment.

5. Have modifications of practices written into compartment plans to be carried out simultaneously with forestry work by forestry personnel, as part of the forest multiple-use program.

6. The responsibility of the game manager is to formulate and negotiate the initial plans, modify them if better information becomes available and see that they are implemented as planned.

The purpose of coordination is to find those opportunities that will add to attractiveness of grouse habitat and not noticeably increase forest management's workload or expense. Improvements beyond this level must be supported by investment of game management funds.

Instead of habitat maintenance or improvement on all potential sites within public forests, intensive management of 160-acre land units at intervals of 3-4 miles may be more practical (Hale et al., 1963). This type of management would make most effective use of grouse mobility (1/2 - 2/3 of a grouse population uses a year-around area of only 1/2-mile diameter). Management units would have to be surrounded by generally suitable forest habitat (Hale et al., 1963).

Direct habitat improvement by game management is useful in specific situations, but should be restricted to problems which cannot be solved through coordination with compartment TSI and cutting plans. Such improvements may include use of controlled burning, bulldozing, herbiciding, post-sale treatment of aspen stands (KG), etc. which in the past have been primarily limited to wildlife management areas.

This type of management applies particularly to small public areas which are being managed primarily for game and where forest management is a secondary consideration. But the amount of land which can be treated in this way is a very small portion of Wisconsin grouse range and its contribution to the statewide grouse harvest will be insignificant.

Specific Techniques

Although the opportunity to work on public forests has not been fully probed, coordination with forest management programs would yield the greatest benefit per unit effort and encompass the largest acreage. All the habitat problems of ruffed grouse cannot be solved, for there is neither time nor money to do everything that needs to be done. The most effective use of the effort which can be directed toward ruffed grouse should be made. Maintenance of good ruffed grouse range and hunting opportunities should evolve about the obvious needs--aspen, access, brush and openings.

Aspen. The best extensive management that can be done at this time is to maintain aspen as a forest type in good grouse areas.

1. Commercial aspen cuts are encouraging conversion to northern hardwood stands. Conversion may take several aspen cuts or may occur after the first cut, depending on stand condition.

2. Commercial aspen distribution compares almost exactly with the core of the North American ruffed grouse range; botanical aspen range encompasses most of the area where ruffed grouse are found.

3. The short cutting rotation of aspen means that a young forest will be available for more years than longer rotation species.

4. Aspen value as winter and early spring food in the Great Lakes Region seems to be great. It is used to some extent all year.

5. Stands of aspen characteristically contain openings and brush, both important components of ruffed grouse range, but not as common in most other forest stands.

Maintain aspen as a forest type in the good or excellent grouse areas. These will be areas of a good mixture of forest types, scattered openings and brushy patches. Since it will not be possible to maintain all the aspen desirable, choose stands carefully. Stands must be large enough to be merchantable and distributed well enough to provide aspen to most of a grouse area. There should be aspen within a 1/4-mile radius of all the grouse range that you plan to maintain. Know what aspen cuts are coming up and where forest and wildlife management can reach agreements.

To maintain aspen, clear cuts are essential. Thirty square feet of basal area per acre is the breaking-off point. If more than 30 square feet of residual basal area remains after the cut, aspen regeneration will not be sufficient to insure maintenance of the type. Only one or more partial cuts of aspen may be possible before complete conversion. In northern Wisconsin, the stand usually converts to northern hardwood or balsam fir.

Any trees left in the stand should be felled within two years of the main cut. Best sprouting occurs when the residual trees are removed between October and April (Zehngraff, 1947; Strothmann and Zasada, 1957). Summer cutting produces a poorer stand primarily because of sucker competition from brush and other vegetation. Brush may take over the site; however, some studies show that within 2 years after logging, the number of suckers present on cutover areas is almost the same for both winter-cut and summer-cut stands (Strothmann and Zasada, 1957).

Game management needs aspen. More and more foresters would like to manage for aspen. Pulpwood demand looks good. The alternative of conversion to northern hardwoods is not particularly glowing on all forest sites.

Although we know the techniques to maintain aspen as a type, the major problem is who actually does the work or supplies funds for the

work. We have three major alternatives: the logger; forest management; or game management. Aspen management suggestions are listed by these categories to stimulate thinking about opportunities that might be practical in various game management districts:

Logger: His cutting specifications are largely controlled by economics and silvicultural requirements. Forest management prescribes cutting specifications and is responsible for enforcement of them. The following guidelines, if applied judiciously, would help perpetuate aspen stands.

1. Cut to 2-stick limit--most northern aspen stands can be maintained if cutters take all 2-stick trees. The residual stand would be less than 30 square feet of basal area.

2. Cut to 1-stick limit--necessary in some stands to reduce the basal area to less than 30 square feet.

Forest Management: These opportunities involve postcutting treatment by forest management crews or private parties under contract. The purpose would be to reduce the standing trees to less than 30 square feet. Several industrial companies are knocking down all standing trees.

1. Chainsaw and ax crews.

2. Top-killing of residual trees by aerial spraying.

3. Bulldozer or tree-cutter blade (KG) work (disking is not necessary and may even be detrimental to sprout potential).

4. Prescribed fire treatment.

Game Management: Opportunities to maintain aspen are the same as those available to forestry. The prime difference is the amount of money available to carry out these practices. If an apsen maintenance program or a major portion of it has to be supported by game management funds, the amount of land that can be treated is considerably reduced.

Start your program as soon as possible. The longer you wait, the less opportunity there will be to maintain existing range. Aspen conversion to northern hardwoods is taking place rapidly in most northern districts.

Access. Creation and/or maintenance of access roads and trails to distribute hunters into areas of good grouse populations is a long-term benefit. Coordination is the word, again. Many miles of logging or access roads are being built every year on public forests. We can influence location and looping of roads, number and specifications of parking lots and maintenance of both.

If the public agency plans the road location, you may suggest that it wind, go between desirable forest types or pose other ideas that would add to the hunting opportunity of that area.

When roads are put in by the operator, there is no choice unless he is subsidized in some way for his added effort. This is still less

expensive than doing it with game management funds.

After logging, the ends of roads that are as close as 200 yards should be connected. Connecting them may be a chance to weave between "grousy" cover types. Hunter loops are widely accepted as good management.

When permanent woods roads are being constructed, it takes little extra effort to shove out parking areas. Two- or three-car parking lots at intervals of 1/4 mile or at junctions of logging trails (which will later be seeded and gated) permit a good distribution of hunter pressure.

Log landings on driveable woods roads can be easily maintained as parking areas.

Some forest policies demand "pushbacks" along driveable roads for aesthetic reasons. Slash is pushed back a certain distance from the roadside, often leaving a potentially ideal parking lot.

The practice of clover seeding trails has had a good trial in northern Wisconsin. We don't know if the clover produces any more birds, but it does attract and concentrate them for the hunter. It is practical management that results in more grouse in the hunter's bag.

Consider seeding only those roads where enough sunlight is or will be available. Clover is a sun-loving plant and will not sustain itself under shade. Areas with water-loving plants (bulrushes, sedges, etc.) are too wet for clover establishment. Ignore very rocky roads and very rocky sections of an otherwise seedable road. There is usually not enough available soil to fill in the rock holes in such an area. Level the rocky section enough to get equipment across.

Concentrate seeding programs on newly constructed logging roads after woods operations have finished. If roads which have traditional use by hunters or fishermen are later closed to vehicles, harsh criticism can result.

Preparation for seeding:

1. If the road is disturbed, no other preparation is needed.

2. If seed bed disturbance is needed, a bulldozer is effective. Use it lightly to leave as much topsoil on the road as possible. One way is to push the soil to one side of the road for disturbance, then pull in back on the road surface. A rock rake is probably more effective. It removes rocks and boulders and leaves the topsoil. Some rock-picking usually is necessary.

3. Level the disturbed road by dragging if the bulldozer leaves the surface too rough for mowing.

Many seed mixtures have been tried, but considerations of cost, availability, growing conditions, reaction to extreme soil moisture and duration of catch has resulted in the choice of dutch white as the best clover for most of northern Wisconsin.

Seed in the spring when the ground is freezing and thawing (honeycomb effect allows seeds to work into soil well). Seeding on the snow in February or March also works. Do not seed in midsummer.

Roads can be seeded by game management personnel, sportsmen's clubs or civic groups. Effectiveness may have to be compromised for the sake of seeding more miles. Seeding may be done by hand, cyclone spreader, or vehicle-driven spreader. Generally, it takes 5-8 pounds of dutch white clover per mile of road.

What is the best width for a clover trail? Generally, clover will flourish and sustain itself if trail width is between a half to one time the height of surrounding trees. Road width through northern hardwoods (large canopy coverage) would have to be wider than through aspen (small canopy). A width equal to the height of surrounding trees would be playing it safe in most canopy situations. Of course, a wider trail is even better. More sunlight will reach the clover, and sportsmen will be even more satisfied with your grouse management.

Mow clover trails each summer. It will help clover to compete with other herbaceous and woody plants and will encourage hunter use.

If possible, gate or bulldoze the trail entrance to prohibit vehicle traffic. Traffic will compact the soil, tear it up during wet periods and generally reduce clover seeding effectiveness. Snowmobiles may cause frost damage but can be admitted during periods of adequate snow.

Brush. More upland brush would improve grouse range. In northern Wisconsin, upland brush is scarce. Lowland brush (primarily alder) is common and well dispersed in some areas but not over the entire range. Alder is commonly used as brood habitat and the alder edges as drumming sites. Upland brush with openings is used for the same functions when available.

In the southern grouse habitats, brush about field edges and throughout the woods provides brood and drumming areas. Upland brush is used for the same functions in Alberta and northern Michigan.

To maintain a high carrying capacity in good areas and to increase grouse abundance in poorer areas, we must increase brush or at least maintain it. There are numerous forest opportunities where brush may be maintained or improved. Most opportunities are possible through forestry programs, but some may have to be supplemental to it.

Locations presently offering opportunities for maintaining brushy areas within managed forests are:

1. Sides of clover-seeded roads
2. Edges of openings
3. Natural brushy areas
4. Aspen stands

5. Lowland-upland zones

6. Powerline rights-of-way

7. Tag alder swamps

Techniques used to maintain brush in these areas vary with the forest area and major uses, and depend upon a variety of factors, including stand characteristics, available equipment and manpower and the compromises game and forest management can agree upon.

Openings. Openings are an important ingredient of good ruffed grouse range. Permanent sodded openings (McCaffery, 1967) are being gradually eliminated from northern forests, and with them go the brushy edges, cherry, thornapple and other sun-loving food plants and insect populations so valuable to ruffed grouse.

Maintenance of these openings has been recommended (McCaffery, 1968), but progress on the program has been slow to date.

Temporary openings, created by forest cutting, are more important to grouse than the sodded openings. Forest management will be almost continuously creating temporary openings of suckers, sprouts and saplings. Their value to grouse will depend primarily on timing, size and distribution of cuts. Some of a bird's daily requirements (dry dusting sites, gravel, insect populations and succulent vegetation) are met only in openings or are more abundant in them (King, 1937).

It is too time consuming and costly to attempt to maintain specific, temporary openings. Grouse use them for the first 8-10 years after cutting (Sharp, 1963). With proper planning, commercial cutting can provide a continuous supply of such temporary openings.

CONCLUSIONS

Ruffed grouse populations in Wisconsin seem destined to decline. The northern forests, through natural and man-made processes, are rapidly changing. What has been good grouse range is now going downhill or is already gone.

Although habitat requirements of Wisconsin ruffed grouse are not completely understood, and more study is needed, there is a large accumulation of scientific data from this and other states which point to some of the basic requirements of grouse that we can do something about. Ruffed grouse need habitat diversity, edge, brush, aspen and forest openings. Grouse management will have to be better coordinated with forest management programs to affect a significant portion of grouse range. There are numerous opportunities to create better grouse habitat and improved hunting through slight modifications of forest practices. We have the techniques and tools to do what is needed.

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