BROOD CHARACTERISTICS AND SUMMER HABITATS OF RUFFED GROUSE IN CENTRAL WISCONSIN

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ABSTRACT

Brood characteristics and summer habitats of ruffed grouse (*Bonasa umbellus*) were studied on approximately 800 ha encompassing four major cover types (alder-aspen, sapling aspen, pole-sized aspen, and pole-sized oak) on the Sandhill Wildlife Area from 1967-75. Flushing surveys resulted in 134 broods and 187 adults observed. Average brood size was 6.8 ± 0.5 for 134 broods observed on surveys and another 48 broods seen on Sandhill incidental to other field work. Hatching was initiated during the last week in May and continued until the second week in July, with the peak occurring in the first week of June.

The composition and structure of habitats with a history of high brood use and no disturbance by cutting was measured to better determine reasons for brood preferences. Factors contributing to grouse use of aspen habitats were higher woody stem densities and a greater variety of herbaceous food and cover species in the ground layer. Generally, various berry-producing plants and evergreen herbs dominated by the family Rosaceae and the genus *Rubus* were most abundant in aspen habitats.

Broods and adults were not randomly distributed ($P<0.01$) among the four major habitats. We allowed for brood movement up to 100 m during flushing surveys and found that broods were still not randomly distributed ($P<0.01$). Relative occurrence of broods and adults was highest in all aspen types. Lowest use occurred in oak. Highest use occurred in alder-aspen, particularly by adults. However, consistent year-to-year use of upland habitats, particularly aspen, also occurred. Analysis of flushing data showed that 94% of all broods and all adults were flushed either in aspen or within 100 m of an aspen stand.

The management program should be designed to obtain good interspersion of forest types and varied aspen age classes, while maintaining alder-aspen associations.

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INTRODUCTION

Habitat use by ruffed grouse broods has not been adequately described in the oak and aspen forests of central Wisconsin. Brood use in the more northern forests has been concentrated in alder thickets (Dorney 1959, Kupa 1966, Godfrey 1975b). In more southern range, broods were commonly found in young forests characterized by frequent openings and brushy borders (Polderboer 1942, Porath and Vohs 1972). Neither the extensive alder thickets typical of the northern forests nor the open woodlot character typical of more southern forests occur in central Wisconsin. Our research quantifies brood use of the four major habitats in which ruffed grouse occur in central Wisconsin. The composition and structure of each habitat was measured to better determine reasons for brood preferences. Other related findings reported are summer habitat use by adult grouse, chicks/brood, hatching dates, and association of two or more broods.

STUDY AREA

The Sandhill Wildlife Area is located approximately 27 km southwest of Wisconsin Rapids, within the unglaciated, driftless region of Wisconsin. The major soil types are loamy sands and sedge peat overlaying very fine sands. Topography is generally flat with large marshes and low islands. Aspen (*Populus tremuloides* and *P. grandidentata*) and oak (*Quercus ellipsoidalis* and *Q. alba*) dominate, with 65% of the upland forest in pole-sized stands.

The remaining 35% of the upland forest has been logged or treated following guidelines in the Sandhill Long Range Plan (Department of Natural Resources 1970). These guidelines were directed to maintain aspen and oak types and improve their age class interspersion. Most stands with volumes greater than 3 cords/acre were commercially logged with several modifications to benefit ruffed grouse. The size of commercial sales was restricted to 8 ha (20 acres) or less, and some stands were cut before or after normal rotation age. In addition, aspen is now being clearcut in scattered strips from a 160 ha (395 acre) experimental tract to achieve better age interspersion. Trees remaining after commercial sales were removed with chain saws, KG-mounted dozers or through controlled burning to obtain sufficient aspen regeneration.

METHODS

GROUSE FLUSHING SURVEYS

Habitat use by ruffed grouse broods and adults was sampled on approximately 800 ha of upland forest. It included aspen and oak stands with narrow zones of alder-aspen mixtures adjacent to lowland types. A 494 ha tract was surveyed from 1967 through 1970, and a second 300 ha tract was surveyed from 1970 through 1972 and during 1975.

Field censuses were carried out on 23% (134 ha) of one tract and 34% (102 ha) of the second tract using randomly located strips. Twenty-eight 4.05 ha strips were surveyed in 15 replications on the first area, and 15 strips of various sizes were surveyed in eight replications on the second tract.

The flush counts were generally carried out at two-week intervals between the first of July and middle of August. Crews ranged from five to ten persons depending upon available manpower and habitat density. Distance between crew members was maintained at approximately 10 m in dense habitat and 20 m in open habitat. We feel space between observers was adequately close to flush all grouse, particularly broods which are considered even more prone to flush than adults. Strips were 80-100 m wide and ranged from 300 to 1,500 m in length, although most lengths were 400 m or less.

Flushes of broods and adults were recorded by habitat type and age class. A brood was defined as one or more chicks with or without an adult. Precautions were taken to flush all brood members, prevent splitting broods, and avoid counting reflushes. Detection of a chick or adult was immediately followed by hand clapping, other loud noises, and a thorough search of the general area. Age of broods was determined to the nearest week using the photographic key developed by Bump et al. (1947).

HABITAT MEASUREMENTS

Vegetation was measured during August 1975 in each of the four major brood habitats. These included alder-aspen, sapling aspen, pole-sized aspen, and pole-sized oak. Brood use in the past was largely restricted to these four major habitats. Other potential brood habitats including sapling oak, jack pine, white pine, and upland brush were not included in this study because of their limited acreage and scattered distribution on Sandhill. Vegetation was sampled in five stands in each of the habitats. Two criteria for selection of stands included a history of intensive brood use and no disturbance through timber sales or habitat treatments during the study period. Sampling procedures were from Ohman and Ream (1971) with several modifications. Ground-layer species composition and coverage (visual estimate) were recorded on twenty 0.18 m^2 quadrats in five stands within each major habitat. Understory coverage of shrubs and seedlings was included with herbaceous ground cover. Herbaceous species were given a 1% coverage rating even if they were not recorded in quadrats but were present in the stand. Shrubs and tree seedlings taller than 30 cm were tallied by species on 4 m plots. Diameter classes used for basal area calculations were assigned by species dependent on the typical diameter class of each species. Basal area was tallied with a 10-factor angle gauge.

Each species was ranked according to an index of relative importance called Importance Value (Curtis and McIntosh 1951). This index is a summation of three relative measures (frequency, density, and dominance) and indicates the alignment of each species within that community. Species with importance values $\geqslant$ 2.0 were tabulated, but only plants with food and cover values for grouse are discussed. Data were analyzed by stand and by each of the four major habitats. Plant nomenclature followed Gleason and Cronquist (1963), and statistical tests were according to Snedecor (1956).

RESULTS AND DISCUSSION

During this study, 134 broods and another 187 adults without broods were flushed. Four of the 134 brood flushes on Sandhill appeared to be made up of at least two separate broods. Flushes of 14, 18, and 22 chicks were accompanied by two adult hens. Another flush of 22 chicks was accompanied by a single hen. Chick ages were similar in each flush group. Thus, it appeared that some intermixing of broods may have occurred. It has been observed that broods commonly have spatially over-lapping ranges (Bump et al. 1947), but these ranges are occupied at different times according to Godfrey (1975b). Godfrey's study involved detailed radio-tracking, but the sample size was small. Only two of his six broods were radio-tracked for more than 30 days. A larger sample might have shown some intermixing of broods in time as well as space.

BROOD SIZE

The average brood size recorded from 1967 to 1975 was 6.8 ±0.5. Data included 134 broods aged during the survey and 48 broods seen on Sandhill incidental to other field work. Brood size was substantially greater than that found in New York (Bump et al. 1947) but similar to other findings from the Great Lakes Region. Dorney and Kabat (1960) reported brood sizes of 7.4 in July and 6.8 in August in northern Wisconsin during high population years. Porath and Vohs (1972) reported brood sizes of 5.5 and 6.6 during 1966 and 1967, respectively, in Iowa while Rusch and Keith (1971b) recorded sizes of 6.7 and 7.4 during the same years in Alberta. It is likely we underestimated brood size, especially for the very young broods as suggested by Godfrey (1975a). On the Sandhill area only one brood with 4 chicks estimated to be a week old was reported during the nine years of observations. Broods less than four weeks old averaged only 5.4 chicks compared to 7.1 chicks for broods at least 4 weeks of age.

HATCHING DATES

Approximate hatching dates were determined by backdating brood ages recorded during surveys (Fig. 1). Hatching was initiated during the last week in May and continued until the second week in July, with the peak occurring the first week in June. Approximately 74% were hatched before June 15. Somewhat different results were reported in other areas, but these studies

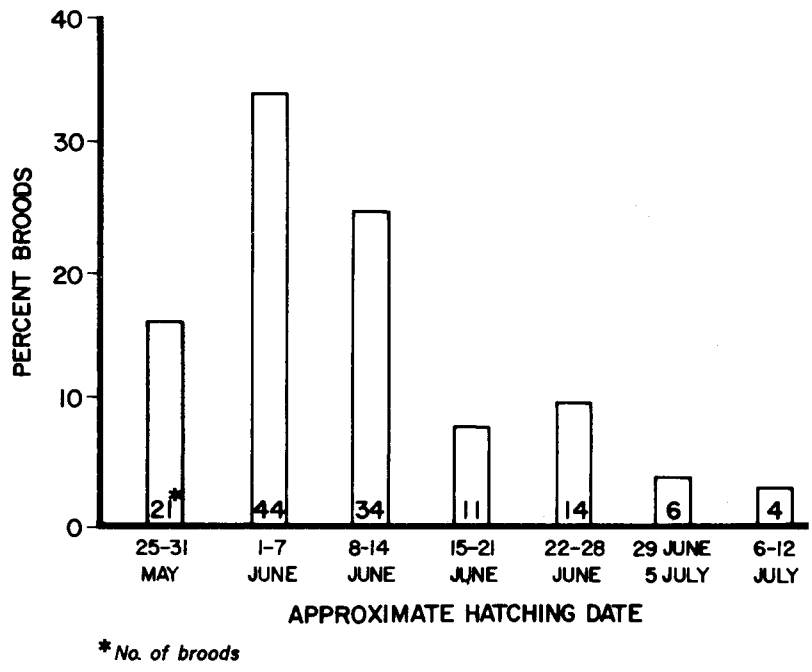

FIGURE 1 Approximate hatching dates of grouse observed on flushing surveys, Sandhill, 1967-75.

TABLE 1. *Vegetative characteristics of ruffed grouse brood habitats, Sandhill Wildlife Area*

Habitat	Age	Site Index	Basal Area	Number Per Acre: Trees	Saplings	Shrubs and Seedlings	Number Herbaceous Species	Total Species
Alder-aspen	35-45	60-65	66	190	95	22,420	70	92
Sapling aspen*	7-15	60-65	67	137	1,341	24,980	85	102
Pole-sized aspen	35-45	60-65	88	254	224	33,050	64	84
Pole-sized oak	35-45	50-55	93	243	94	15,510	64	79

*7-15 years at the time the stands were measured in 1975. When ruffed grouse surveys were made a few years earlier, some of the saplings were from 2-5 years.

TABLE 2. *Major shrubs and trees in the four brood habitats studied.*

	Alder-Aspen	Sapling Aspen	Pole Aspen	Pole Oak
Rubus allegheniensis	3.9*	*14.3*	*13.9*	6.3
Prunus serotina	3.9	*14.0*	*13.1*	*14.6*
Quercus ellipsoidalis	3.8	*9.0*	10.5	4.0
Populus tremuloides	-	8.8	3.1	-
Rubus spp. (Dewberry)	-	8.6	-	-
Rubus strigosus	3.9	8.1	-	-
Corylus americana	-	7.3	3.6	*23.1*
Aronia melanocarpa	2.2	4.8	6.3	-
Vaccinium spp. (Blueberry)	-	3.7	4.1	3.8
Spiraea latifolia	-	3.7	-	-
Salix spp.	-	3.4	2.7	-
Spiraea tomentosa	-	3.0	-	-
Alnus rugosa	*47.0*	-	-	-
Ilex verticillata	*12.0*	-	3.4	-
Acer rubrum	*8.0*	-	*11.0*	-
Gaylussacia baccata	-	-	8.5	5.4
Amelanchier spp.	-	-	6.7	*16.0*
Quercus alba	-	-	2.8	-
Myrica asplenifolia	-	-	-	7.6

*Importance value

TABLE 3. *Major ground layer species of importance to grouse in the four brood habitats studied.*

Species	Alder-Aspen	Sapling Aspen	Pole Aspen	Pole Oak
Pteridium aquilinum	-	*12.4*	*25.0*	*9.4*
Vaccinium spp. (Blueberry)	-	4.5	4.7	*9.6*
Rubus allegheniensis	-	*5.8*	4.4	5.4
Rubus spp. (Dewberry)	*10.6**	*17.9*	*8.5*	-
Acer rubrum	2.0	-	2.5	2.5
Alnus rugosa	*19.1*	-	2.0	-
Maianthemum canadense	*5.2*	-	2.0	-
Carex spp.	4.8	-	-	-
Osmunda spp.	4.5	-	-	-
Ilex verticillata	3.4	-	-	-
Dryopteris austriaca	2.9	-	-	-
Viola spp.	2.7	-	-	-
Cornus canadensis	2.4	-	-	-
Fragaria virginiana	-	3.8	-	-
Prunus serotina	-	3.7	-	4.6
Solidago spp.	-	3.4	-	-
Rubus strigosus	-	3.3	-	-
Quercus ellipsoidalis	-	3.2	-	3.3
Aster spp.	-	2.0	-	-
Corylus americana	-	-	-	7.7
Amelanchier spp.	-	-	-	3.4
Lysmachia quadrifolia	-	-	2.7	3.1
Rosa spp.	-	-	-	2.0
Gaultheria procumbens	-	-	*7.7*	-
Gaylussacia baccata	-	-	2.4	-
Uvularia sessilifolia	-	-	2.2	-

*Importance value

covered a period of two years or less, whereas Sandhill data reflect seven years. Hale and Wendt (1951) found that 90% of 69 broods were hatched by June 16 in northern Wisconsin in 1949. Kupa (1966) found that 75% of the grouse broods at Cloquet in northern Minnesota hatched before June 12, and the hatching period ranged from June 4 to June 20. Porath and Vohs (1972) observed that a major hatching peak occurred in the last week of May in Iowa, with a secondary peak occurring the third week of June. They felt the hatching season extended from May 21 to June 26. Hungerford (1953) also indicated nearly all broods hatch in late May or during the first half of June in Idaho.

VEGETATIVE COMPOSITION OF HABITAT

Vegetative characteristics are reported in Table 1. Habitats with pole-sized trees were 35-45 years old, and sapling aspen habitats ranged between 8-17 years. Site indexes were 60-65 for the three aspen habitats and 50-55 for the oak habitat. Basal area ranged from 66 to 93, and the highest density of trees occurred in the pole aspen and oak stands. Of the total number of trees, aspen comprised 86% in sapling aspen, 81% in alder-aspen, 77% in pole aspen, but only 15% in oak stands. The higher percentage of aspen means more sunlight reaching the ground, which is reflected in a higher density of saplings, seedlings, and shrubs in aspen stands. Highest density of saplings, seedlings, and shrubs occurred in sapling aspen and the lowest in oak. Sapling aspen also contained the highest number of herbaceous species although only minor variations in the number of herbaceous species occurred among the four habitats.

Blackberry (*Rubus allegheniensis*), black cherry (*Prunus serotina*), and jack oak (*Quercus ellipsoidalis*) were prevalent shrub and tree seedlings in all habitats (Table 2). Speckled alder (*Alnus rugosa*), black alder (*Ilex verticillata*), red raspberry (*Rubus strigosus*), and chokeberry (*Aronia melanocarpa*) dominated lowland alder-aspen habitats. Blueberry (*Vaccinium* spp.) and American hazel (*Corylus americana*) dominated upland habitats. Chokeberry was also prevalent in both upland aspen habitats, and red raspberry and dewberry (*Rubus* spp.) were important species in sapling aspen.

Speckled alder was a prevalent ground layer species providing cover in

Highest use occurred in alder-aspen, particularly by adults. These habitats provide a good variety of grouse foods and dense protective overhead and ground-layer cover.

Little brood and adult use was observed in sprouting aspen under 5 years old. Broods appear to use the edges of these clearcuts where they border preferred habitats. Although persistent residual slash inhibits brood use, these habitats can provide temporary escape cover or foraging opportunities.

High use by broods and adults also occurred in sapling aspen habitats, which provide a variety of choice foods in conjunction with optimum cover. This habitat appears to reach its prime for grouse sometime after 5 years in most stands.

Sapling aspen continues to provide optimum summer habitat for grouse after 15 growing seasons, and will continue to be productive for many more years.

Lowest summer use by grouse occurred in pole oak habitats. Greatest use within this type occurred in stands with hazel understories.

Broods and adults utilized upland pole aspen habitats throughout the study. These habitats appear to have the greatest potential for grouse where they are interspersed with alder-aspen or sapling aspen. Bracken fern dominates the ground-layer and the genus Rubus *and wintergreen are major food sources for grouse.*

alder-aspen, and bracken fern (*Pteridium aquilinum*) dominated in all upland habitats (Table 3). American hazel also contributed considerable ground layer cover in oak stands.

The genus *Rubus* was a prevalent food species in the ground layer of all habitats (Table 3). Dewberry was important in all types except oak, and blueberry and blackberry dominated in all upland communities. Canada mayflower (*Maianthemum canadense*), sedges (*Carex* spp.), violet (*Viola* spp.), and bunchberry (*Cornus canadensis*) were dominant food species in alder-aspen. Wintergreen (*Gaultheria procumbens*) was most predominant in pole-sized aspen and strawberry (*Fragaria virginiana*) in sapling aspen. Black cherry and serviceberry (*Amelanchier* spp.) were major food species in oak.

Generally, a variety of berry-producing plants and evergreen herbs dominated by the family Rosaceae and the genus *Rubus* were most abundant in upland aspen habitats, and to a lesser extent in alder-aspen and oak. The relative importance of these plants as grouse food has been confirmed by several investigators. Bump et al. (1947) reported that blackberries made up 58% of the July diet of grouse chicks, and blackberries and cherries constituted 65% of all plant food in August in New York. They also found sedges, raspberries, and strawberries to be important summer foods. Vanderschaegen (1970) reported use of evergreen herbs such as shield fern (*Dryopteris* spp.), wintergreen, strawberry, and goldthread (*Coptis trifolia*) in northern Minnesota. His studies indicated members of the family Rosaceae are the most important fruit producers which have some value to grouse in summer. Raspberries, cherries, serviceberry, and thornapple (*Crataegus* spp.) were included in this category. Members of the genus *Cornus* were also important, with bunchberry and woody dogwoods used. Use of green plants was also very significant in Missouri where Korschgen (1966) found that unidentified green plant materials accounted for nearly 80% by volume of all foods taken in July and 46% in August.

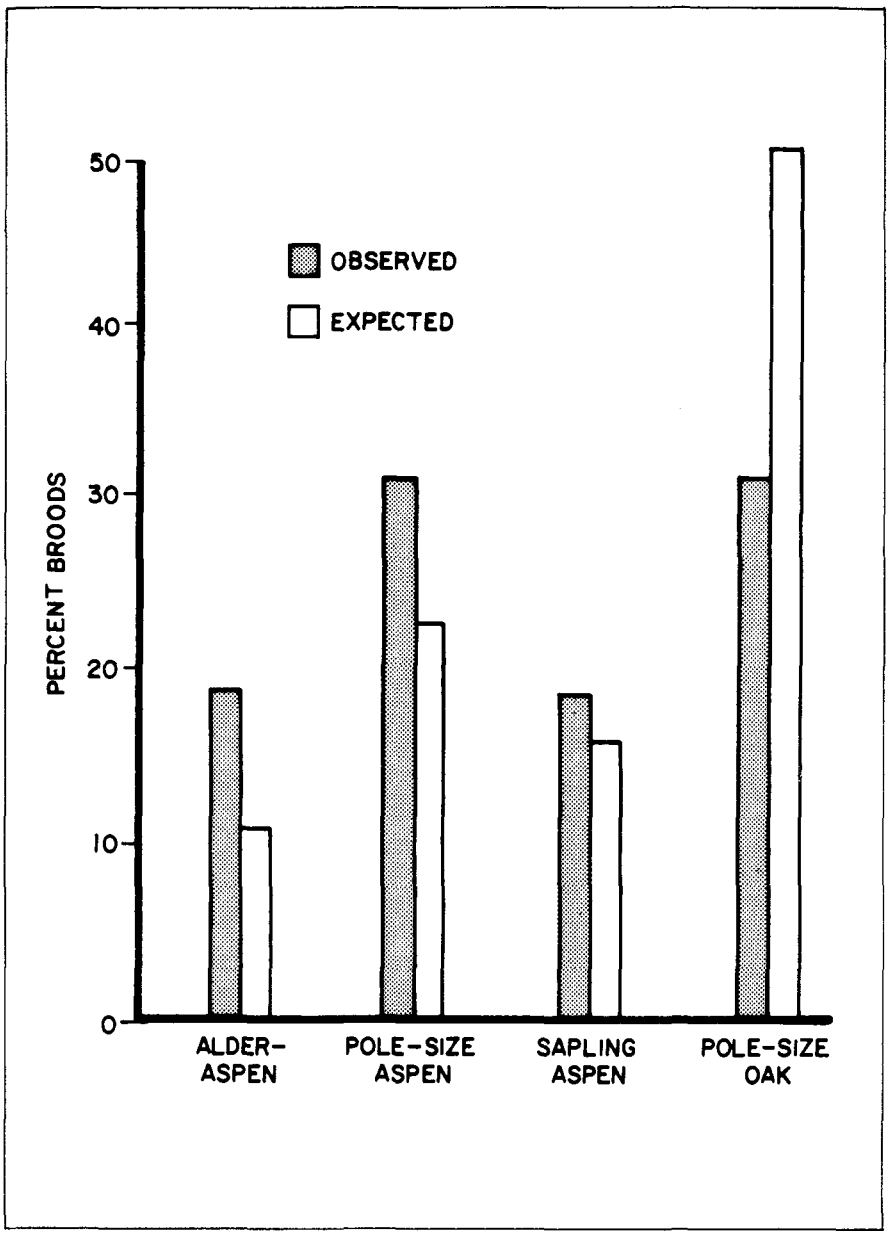

FIGURE 2. Occurrence of broods in four major habitats, Sandhill, 1967-75.

HABITAT USE

Habitat use was documented from low through high densities of grouse (Moulton and Kubisiak 1978, in prep.). Population levels apparently had no differential effect upon habitat use nor was there a significant difference ($P < 0.05$) in habitat use among years for either adults or broods.

Ruffed grouse broods were not randomly distributed ($X^2 = 23.40$, 3 df, $P < 0.01$) among habitats. Schladweiler (1965) observed that some radio-tagged broods attempted to avoid observers. We allowed for possible brood movement up to 100 m during flushing surveys and found broods were still not randomly distributed ($X^2 = 35.34$, 3 df, $P < 0.01$). Relative occurrence of broods was highest in alder-aspen based on a comparison of percentage use in relation to availability among the four habitats (Fig. 2). Lowest relative use occurred in oak. Although broods appeared to prefer alder-aspen, its relatively small acreage did apparently limit its use. Only 19% of the total number of broods were flushed in alder-aspen. Moreover, a consistent year-to-year occupancy of the other three habitats was observed. In all, 108 broods (81%) were flushed in upland aspen and oak types. Sixty-five broods were flushed more than 200 m, and another 32 broods were flushed more than 400 m from alder-aspen. This intensive use of upland habitats in central Wisconsin contrasts with other studies where alder was more available. Dorney (1959) found alder swamps were used almost exclusively during hot summer months. Kupa (1966) observed most broods in alder or spruce and Eng (1959) located most brood use in alder. A radio-tracking study (Godfrey 1975b) in the same

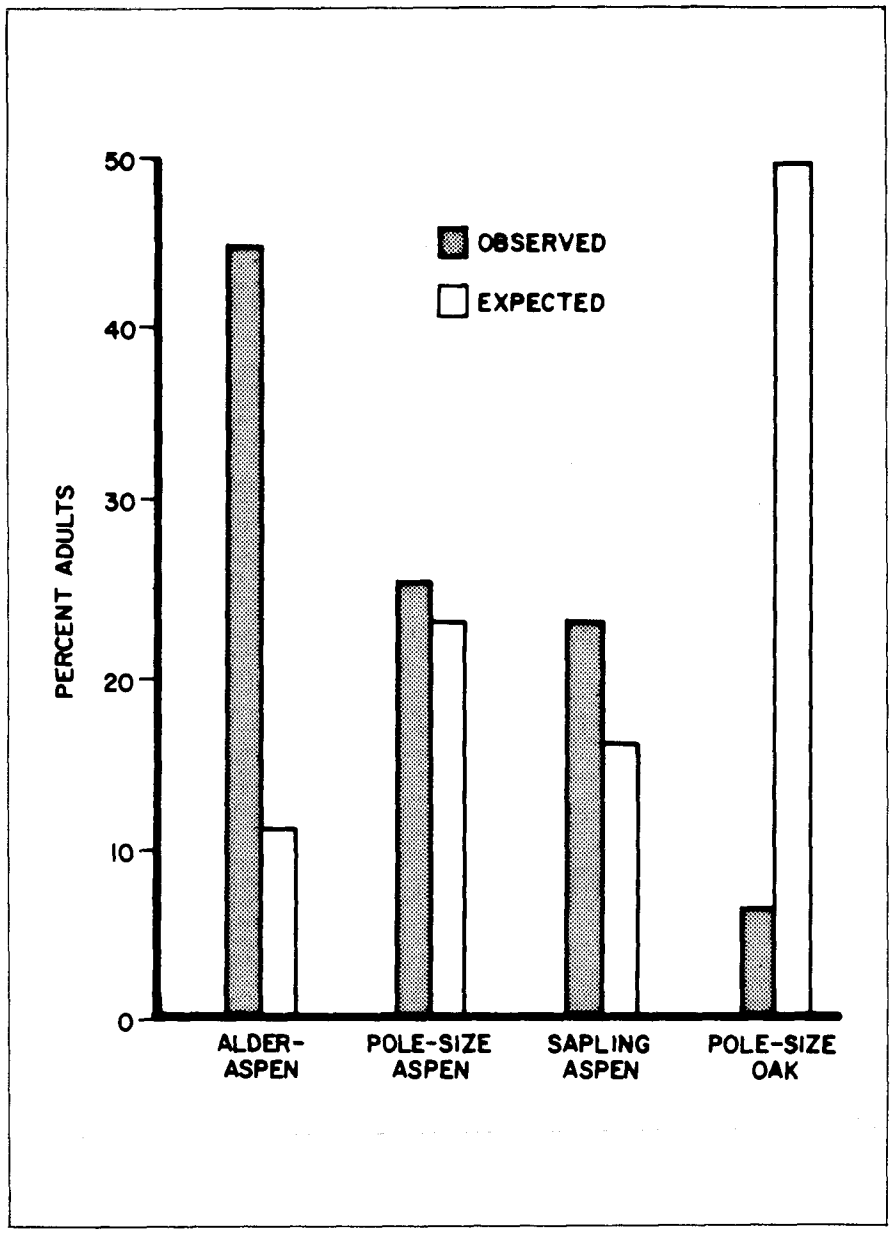

FIGURE 3. Occurrence of adults in four major habitats, Sandhill, 1967-75.

area as Kupa's and Eng's research showed that 64% of the brood locations were in alder swamps and another 23% were located on the lowland edge. He only observed 13% of brood radio-locations in upland communities.

Brood use in sapling aspen occurred in stands from 2 to 15 years after cutting. We were unable to measure brood use in 16- to 25-year-old stands because this age class comprised an insignificant acreage on the study area. Twenty of the 26 brood flushes were in 7- to 15-year-old stands. Six other observations were in 2- to 5-year stands. Both broods in the 2-year-old stand were flushed from dense logging slash. Gullion (1972) had reported that aspen stands can provide brood cover up to 15 years, but that the first few years after cutting are the most productive.

At Sandhill, broods appeared to avoid large stands with slash or entangled brushy growth, especially in recent cutover or sheared areas. However, broods did use edges of recent clearcuts (under 5 years old) and stands with scattered slash piles, windthrown trees, or small brushy thickets as temporary escape or roosting cover, particularly in close proximity to more desirable habitats. Generally, extensive "horizontal" cover characterized by large amounts of slash, uprooted trees, or dense impenetrable brush are considered unattractive to broods (Gullion 1972). Avoidance of extremely dense ground cover or deciduous brush by grouse broods was also observed by Porath and Vohs (1972), Schladweiler (1965), and Clarke (1936).

Adult grouse were also not randomly distributed (X^2 = 275.58, 3 df, $P < 0.01$) among habitats, and habitat use was somewhat different than that noted for broods (Fig. 3). Alder-aspen received the highest use, and oak the lowest. In addition, the percentage of adult flushes in alder, as compared to brood flushes, was much higher. Conversely, the percentage of flushes in oak were considerably less than for broods. Adults also used sapling aspen habitats slightly more and pole aspen somewhat less.

Grouse were strongly oriented to aspen habitats on Sandhill during summer. Relative occurrence of broods and adults was consistently higher in aspen habitats based on a comparison of percentage use in relation to availability of aspen and oak (Figs. 2-3). Sixty-nine percent of all broods and 94% of adults were flushed in aspen habitats. Further analysis of flushing data indicated that 94% of all broods observed and all adult grouse were flushed either in an aspen stand or within 100 m of an aspen stand. Rusch and Keith (1971a) also found that aspen woods were preferred by single grouse and hens with broods during summer in Alberta. At Sandhill, most aspen habitats provide a variety of foods combined with good protective cover, especially where an interspersion of aspen age classes and alder occur. This need for habitat diversity is corroborated by Sharp (1963), who indicated that grouse broods depend on the interspersion of feeding and shelter areas, and that they must have frequent access to succulent herbaceous vegetation.

Drumming male grouse have also shown a strong preference for aspen stands on Sandhill (Moulton and Kubisiak 1978, in prep.). Porath and Vohs (1972) observed a similar pattern in Iowa where broods chose cover similar to that utilized by drumming males. Adult males and females without broods also frequented cover types very similar in structure to those used by drumming grouse in Michigan (Berner and Gysel 1969). The reason that broods and adults in particular utilized oak considerably less than aspen (Figs. 2-3) appears to relate to the lack of diversity of food and cover species. Thus the presence of grouse in oak sites may be the result of using this habitat as a route to more desirable habitats and only utilizing available foods found here in transit. Godfrey (1975b) found that broods will travel through less desirable habitats to occupy adjacent alder thickets within their home range.

SUMMARY AND CONCLUSIONS

The results of this study emphasize the importance of the aspen forest type to ruffed grouse in summer in central Wisconsin. Alder-aspen associations still remain an important component for broods and adults in summer, but where this type is lacking or deficient, ruffed grouse appear to seek suitable cover in upland communities, especially where aspen predominates. According to Moulton (1968) brood areas do not have to be restricted to lowlands since grouse were distributed throughout the uplands during the periods of young, interspersed, pioneer vegetation that followed the fires in central and northern Wisconsin.

Thus, the greatest potential for ruffed grouse lies in the maintenance of a good mixture of young and old forests, particularly in upland dominated by aspen. We can expect to produce grouse populations four times higher in aspen than in oak, using drumming grouse densities as an indicator of the productive capacity of these habitats (Moulton and Kubisiak 1978, in prep.). While higher grouse populations can be consistently expected in the aspen forest type, it is necessary to prevent or minimize conversion of these habitats to monotypic pole-sized stands or forest types which have significantly lower potential as grouse habitat. Management programs should be designed to obtain optimum interspersion of forest types and aspen age classes, while emphasizing maintenance of associations.

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