The Role of Fire in Ruffed Grouse Habitat Management

WARD M. SHARP[1]

THE background for this report on ruffed grouse habitat and its management is based on 20 years of field research in Pennsylvania while an employee of the Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior. The present management unit is situated in the oak-hickory association of the Ridge and Valley Province in central Pennsylvania (Centre County). The long-term investigation not only involved the preferred habitat types, life histories and ecology of key food plants, and operations in habitat restoration, but it also entailed studies of various idiosyncrosies of the bird in the field. The response of ruffed grouse to habitat change was given particular attention. The purpose of this paper is to present information on the role of fire as an essential tool in successful habitat management of ruffed grouse.

It was felt necessary, for the sake of clarity, to define ruffed grouse range and habitat in the introduction as they apply to management terminology and use. My definition of a ruffed grouse range, based on Leopold (1931) and King (1938), is a unit or piece of land suitable for year around use, and capable of sustaining a huntable population. The unit of land should comprise a minimum of 160

[1] Formerly Research Biologist and Upland Ecologist (Retired May 2, 1970), Bureau Sport Fisheries and Wildlife, Section of Upland Ecology, Denver Wildlife Research Center, Denver, Colorado.

acres in order to provide all seasonal needs. Factors of site such as topography, soils, subsurface drainage and moisture are qualities of a unit of range. Habitat pertains to the vegetation. This habitat must contain the essential ingredients of all requirements of foods and coverts, for both sexes and all age classes, for all seasons, and for all species activities.

RUFFED GROUSE HABITAT AT THE TIME OF COLONIZATION

Little is known about the habitat types of ruffed grouse at the time of colonization by our forefathers. Published information deals with their habitat after white settlers reshaped the landscape to conform to the needs of the agricultural era prior to 1910. We follow the false notion that the land area east of the Mississippi River was a vast region of closed canopy forest when white man made his appearance.

A reconstruction of occupied ruffed grouse habitat as white man found it prior to 1750 may give clues as to its physiognomic characteristics. The geographical range of the eastern prairie chicken or heath hen (*Tympanuchus cupido cupido*) included most of Massachusetts, Connecticut, and Rhode Island; southeastward along the coast states including southeastern New York, eastern Pennsylvania; all of New Jersey and Delaware, and eastern Maryland. This range was considered a vast discontinuous prairie-fire climax (Aldrich 1963). Judged in light of present day physiognomic classification, the vegetation types probably were composed of an interspersion of marshes, bogs, prairie, savanna, woodland, thickets of shrubs and brambles, with discontinuous units of forest types.

The aforementioned fire climax type was not confined to the Northeastern and Middle Atlantic seaboard. Based on notes of early surveyors and journals of early travelers, the region including New York, Pennsylvania, and West Virginia was not comprised of continuous unbroken forest, but was interspersed by open areas. These areas with continuous ground cover of grasses and forbs, with scattered trees and shrubs and woodland types, were called glades by early settlers in central Pennsylvania. Occurrence of prairie species in Pennsylvania are presently associated with these former grassland sites. An extensive fire disclimax area in Centre and

Huntingdon Counties in central Pennsylvania—known as the "Barrens"—was maintained by repeated fires up to 1930. Big bluestem *Andropogon Gerardi*—a prairie species—and Porter's reed-bentgrass *Calamagrostis porteri*—a dry savanna-woodland species—occur in these wildlands. Such areas were most prevalent in localities of greatest Indian activity and habitation.

The type specimen of Eastern Ruffed Grouse (*Bonasa umbellus umbellus*) was taken by Bartram around 1750 near Philadelphia, Pennsylvania—probably in western New Jersey. The region was well within the area occupied by the Heath Hen. Edwards (1754) believed that our ruffed grouse was closely related to England's heathcocks or moorgame. Perhaps the general habitat of the Eastern Ruffed Grouse in 1750, comprising cranberry bogs, blueberry glades, etc., further suggested a relationship with the English heathcock or red grouse.

Judd (1905) stated that on his tramps in the countryside in the vicinity of Chocorua, New Hampshire in 1892 and 1898 he seldom encountered grouse in heavy forests remote from houses or clearings. He frequently met them near farms or in clearings. A favorite summer habitat, he stated, was the clearings of an abandoned farm. The fields were becoming scattered with young birches and poplars, remnant old apple trees, and the abandoned pastures contained an abundance of blackberry and blueberry bushes. Numerous brooks and springs occurred in the area. The aforementioned represents present day optimal ruffed grouse habitat.

CHANGING TRENDS IN LAND USE: AGRICULTURAL VS INDUSTRIAL ERAS

Ruffed grouse habitat is maintained by the periodic disturbance of the plant communities thus creating a disclimax condition. In early times, fire was the chief means of perpetuating this condition. With the development of the Agricultural Era in eastern North America, white man's disturbance of woody vegetation by clearing and burning, pasturing livestock, burning wildlands for berry production, or the virtual clearcutting of forests by the lumbering industry were the methods of setting back woody vegetation. A wildfire in the

landscape created little concern especially in those units that were burned repeatedly.

The first 25 years of the present century ushered in the Industrial Era. The Agricultural Era—so prominent up to 1910 in eastern America—waned. Employment and future prospects for rural youth caused a movement from rural to urban areas. Farm abandonment was accelerated—the more marginal farms were the first to go idle. Land in farms and pastures in New York, for example, were recorded in 1910 at 22,600,795 acres; but by 1950 this acreage had, through abandonment, declined by 40 percent to 13,672,937 acres (Coklin 1954). A similar or even greater abandonment of farm and pasture land since 1910 occurred in Pennsylvania and most northeastern states (Frey *et al.* 1957). This trend is continuing according to forest surveys.

In the absence of fire, an abandoned field or tract of forest land reverts to even aged stand of closed canopy poletimber forest. The reversion process of abandoned fields is a slower process than the regrowth of a clearcutting. Bump (Bump, G. 1950) found that forest cuttings reverted to closed-canopy pole stands in 20 years. Sharp (1963) reported that clear cutting for grouse benefited broods for only 7 to 8 years after which height of coppice resurgence rendered these areas of little future value. Between 1930 and 1950, a poletimber forest had grown up and eliminated much of optimal ruffed grouse habitat created by previous agricultural and lumbering practices.

The lumbering industry represented an early phase of the Industrial Era. Tracts of timber were virtually clear cut for lumber and other wood products. By 1910, expanses of forest land had been reduced to brush fields. Many of these tracts had been burned following timber removal mostly by the careless acts of the timber operators themselves. Reforestation based on European practices gained universal acceptance by the public and foresters. Among the first acts was the discouragement or abolishment of use of fire in fields and forests.

Academic institutions, especially those supporting forestry programs, were firmly opposed to the use of fire in the landscape. Even plant ecologists believed fire was a detriment, judging by the treat-

ments of fire in early textbooks on plant ecology. Fire apparently presented a roadblock to the validity of the monoclimax theory of plant succession.

Only a very few dedicated and courageous individuals saw the benefits derived from controlled burning. It took dedication, courage, and fortitude to pioneer in the practical use of fire in game management. Grange (1948), in Wisconsin, lauded the value of fire in the grouse range but so far as is known he did not use it. Only H. L. Stoddard in Georgia had this courage, dedication, and full support of his superiors to pioneer in the practical use of fire in quail management on privately owned lands. The present use of controlled and prescribed burning for grouse management in Middle Atlantic states also appears to be confined to private ownership. Bringing the use of fire North, in my opinion, was a result of the educational programs of the annual Fire Ecology Conference sponsored by the Tall Timbers Research Station at Tallahassee, Florida.

METHODS USED IN MANAGING RUFFED GROUSE HABITATS

Cutting Practices:—The New York ruffed grouse investigation, initiated in 1930, was the earliest intensive study (Bump *et al.* 1947). The use of fire was mentioned but not recommended with enthusiasm. In fact the detriments of fire were given precedence over its merits. Cutting practices in timber operations were favored instead; and this viewpoint has persisted over the years. This attitude is understandable in that investigators would perceive only those agricultural and forestry practices as the only way to ruffed grouse habitat management. Fire was generally looked upon as a destructive agent in plant communities. Edminster (1934) stated that both fire and grazing were detrimental to grouse habitats.

My experience with cutting practices for improving grouse habitat was based on a 12-year study initiated in central Pennsylvania in 1950. The first 7 years were devoted to annual rotation cutting and evaluating grouse response (Sharp 1958), and the last 5 years—1957 to 1962—were a continuation study in evaluating grouse response and habitat change. The final report on this study was published in the Grouse Symposium in the Journal of Wildlife Management (Sharp 1963).

This study revealed that canopy removal only released those plants already present in the ground layer, but where plants were absent they did not subsequently appear as a result of seed germination. Following cutting operations, coppice from stump sprouting and suppressed oak advance reproduction made rapid growth. At the end of 7 growing seasons, coppice saplings were about 6 feet in height, and the low canopy of dense, leafy, brushy cover closed over the intervening open spaces.

The cutting operations did not create an equal distribution of grouse food plants in the ground layer of the openings. When coppice and saplings overtopped the ground layer vegetation by the seventh year following the cutting, the site had gone by for grouse brood use. Since cutting operations are mandatory in removing tree canopies, it represents only phase one of the complete habitat management operation.

Cutting followed by burning:—In order to see the real benefits from fire in a grouse range, one must, first of all, have worked with managing habitat in the absence of fire. This is the real test by which one can judge its merits. I feel qualified to speak from experience on both uses, having evaluated the value of fire in a unit of ruffed grouse range in an oak-hickory forest type since 1966—a period of 5 years.

Since areas of optimal grouse habitat have grown up to a closed canopy forest type over the years, cutting must be done in order to move back the advanced woody vegetation. Fire follows the cutting operations. Since this paper does not deal with methods and techniques, I will proceed with a discussion of the functions of fire in ruffed grouse habitats.

FUNCTIONS OF FIRE IN OAK-HICKORY RUFFED GROUSE HABITATS

The use of fire, in my experience, contributes triple benefits towards managing or upgrading units of ruffed grouse habitat. These benefits are (1) clean up of litter and accumulated mulch, (2) rejuvenation of food plants, and (3) prevention and control of diseases of grouse food plants.

1. Removal of undesirable plant wastes and tangles:—The fallen leaves of oak-hickory forest communities are firm (subcoriaceous) and rich in tannin content. This characteristic retards moisture absorption and delays decay. These successive accumulations of leaves develop a mulch which excludes forbs, sedges, etc., in the ground stratum. In addition to the leaf mulch acting as an inhibitor to ground vegetation, the accumulation of tree tops following cutting operations develop tangles that serve as barriers that are avoided by grouse especially in the summer months.

Fire is an efficient tool for the manager in removing these undesirable plant wastes. Adult grouse as well as hens with chicks respond promptly to these cleanup operations. Since grouse flushed from burns may be the result of random wandering, the best clue is signs of continuing use. Dusting sites appear by early May following the early spring burn and their continuing use of these sites suggests attraction to burned areas. Dusting sites used by broods reveal continuing use into the summer.

2. Rejuvenation of key food plants:—Key food plants appear as germinates in the burns. Since no trace of these plants were to be found prior to burning, the seed source would need to be stored in the soil beneath the layers of leaf mulch for a period of years.

(a). *Forb and graminoid response following burning:* Of the graminoids, sedge (*Carex*) seedlings appeared by early May in spring burns. Panic grasses (*Panicum*) appeared to have established as seedlings by mid summer. In the initial phases of burning operations, key forb or leaf food plants were not detected until mid or late summer following a spring burn. But it was discovered in later years that the tiny seedlings were overlooked because of failure to recognize and identify them in the cotyledondry stages. With more experience, for example, one was able to detect seedling violets in early May. Therefore, it is safe to state that forb and sedge germinates appear as soon as weather permits following early spring burns.

It was gratifying to find barren strawberry (*Waldsteinia fragarioides*) establishing from seed the summer following spring burns in sites where the plants were absent prior to burning. In my

earlier studies from 1950 to 1956, when only cutting practices were used, neither this species nor others appear following canopy removal (Sharp 1963). Juvenal violets, germinating in spring burns, produced an abundance of seed pods by late August from cleistogamous flowers.

My studies of the life histories of some ruffed grouse food plants also disclosed that woodland violets produce an abundance of seed pods in late summer from seed germinated that spring. These pods, containing numerous seeds, are an important summer food for grouse chicks. Speedwell (*Veronica officinalis*) is another key grouse food plant that resurges from seeds following spring burns. Evidence suggests that the majority of forb and graminoid grouse food plants are rejuvenated after burns from seeds stored in the soil.

(b). *Response of shrubs to burning:* Shrubs benefit in two ways from periodic burning, namely, revitalization of declining clones and induced germination of seeds stored in the soil.

The berry producing low shrubs and brambles must be rejuvenated periodically by removal of dead or decadent stems and clones. Clones of lowbush blueberries (*Vaccinium angustifolium, V. myrtilloides*, and *V. vacillans*) persist for years, but the clones decline through aging and fruit yield is nil. Many dead stems occur throughout the clones. The use of fire for rehabilitating blueberries in wildlands has been practiced for centuries. Research was conducted in Maine where blueberry production in wildlands was an important resource. The final report on this long term study was published by M. F. Trevett in 1962 (Trevett 1962). The recommended rotation was burning followed by two berry crop years followed by burning. This rotation means burning every fourth spring.

My experiments were initiated on clones that had not been burned previously; they contained numerous dead or decadent tops, they had been suppressed by shading, and they were at a low nutritional level. Under these circumstances, it required three growing seasons, following the first burn, to bring these clones back to a satisfactory level of nutrition and vigor.

One cannot expect blueberry yields in a unit of managed grouse

range to compare to those managed purely for the berry crop. Grouse feed on the flower buds during the winter especially by February. Their cropping of flower buds reduces the number that would produce flowers and set fruits. Fall and winter browsing by cottontails and deer also posed problems. Deer and cottontails browsing the juvenal stages of elderberries (*Sambucus*, etc.) also pose a problem in maintaining shrubs.

Seedlings of many shrubs appear following spring burns. Most prominent of these are the brambles (*Rubus*). Blackberry and raspberry seedlings may appear at high densities per square foot in sites ranging up to 400 square feet in area. These sites were probably occupied by colonies that died out years previously as the tree canopy closed, but had deposited a seed source. The germinates of sumac (*Rhus*), wild grape (*Vitis*) and elderberry occurred in a random pattern throughout spring burns. This distribution pattern suggested they were dropped by birds over the years. Aspen (*Populus*) seedlings occur if a seed source is in the vicinity. They appear to germinate and survive best in sites where ash deposits are moderately heavy.

3. Fire as an agent in control of plant diseases:—Little is known of the deteriorating and mortality affects of plant diseases in the ruffed grouse range. Studies of these plants by mycologists, were confined to taxonomy and host relationships of fungi. Compared to agricultural crops, native forbs and sedges are usually considered weeds. Plant pathologists have not been encouraged nor financed to work with these groups. The wildlife profession has been inclined to take for granted that plant diseases present no problem.

In my study of the ecology and life history of key grouse foods, the savanna or slender-stalked sedge (*Carex debilis*) was chosen for its abundant year to year seed yield and its adaptability in upland sites. Because of this potential, it rated high in the summer diet of ruffed grouse chicks and adults in New York (Bump *et al.* 1947). It is a fire adapted sedge with bunch type habit of growth. It is a long-lived perennial and it is competetive with woodland and savanna

It was discovered that splotching and leaf die back was occurring grasses and forbs under optimal conditions.

in second year plants in some sites. It finally became apparent that these seedlings eventually died. Further observations over a period revealed that by August the russet-brown splotches on leaves were producing tiny fungal fruiting bodies. Material was taken to Dr. Leonard Fergus, plant pathologist, Pennsylvania State University, University Park, Pennsylvania, for diagnosis. The fungus was identified as leaf spot.

The Index of Plant Diseases in the United States (1960) lists several genera of leaf spot identified on sedges. The six most common genera are as follows: *Cercospora, Septoria, Helicosporium, Phleospora, Phylosticta,* and *Ramularia.* But not all species of these genera occur on sedges. Species of the genus *Cercospora* occur on white clover (*Trifolium repens*) and on species of woodland violets In addition to the aforementioned genus, species of *Phylosticta* and *Ramularia* infest violets.

Leaf spot fungi belong to the *Fungi Imperfecti* complex which is a difficult group even for pathologists. My concern was prevention and control of this plant disease in grouse habitats. To control this disease, burning was the only practical approach. It was reasoned that early spring fires while sedge plants were dormant, would be the logical time for burning. It was believed that spore producing bodies would also be dormant and dissemination not yet initiated.

Seedlings infested with this fungus were transferred outside the infested area, while others were propagated within the infested area. Spring burning eliminated the fungus when all tops were consumed by fire. In the infested area, reinfestation occurred, but in the non-infested area the disease was eliminated. In areas where sedges are infested, the entire area must be placed on an early spring burning cycle. Inspection of the burned areas by August will reveal sites where light reinfestation might be recurring.

INTERSPERSION OF FIRE WITHIN A UNIT OF GROUSE RANGE

The importance of interspersion and juxtaposition of essential habitat components throughout a unit of grouse range was emphasized by King (1938). His findings continue to be valid. To bring interspersion and juxtaposition into focus, the components are com-

parable to that of building a picture puzzle in the landscape. When all the pieces of the puzzle fall into their proper positions to develop optimal habitat, the resulting picture is a mosaic of interspersed parcels of various outlines and sizes. In order to accomplish this feat, the manager or manipulator must be a habitat architect, he must be a gardener in the wild landscape. These abilities may be terminal because the manager must, first of all, have a sound background in plant ecology and an intimate knowledge of the needs of ruffed grouse.

Management of a ruffed grouse range not only involves methods of interspersing components of the habitat, but it also entails methods of interspersing the spring burns. Some parcels need to be burned on shorter rotations than others. In those parcels where sedges predominate the burning rotation may be practiced every 2 years, but for those managed for blueberries, the rotation is at 4 to 5 year intervals.

Rotations are further altered, for example, in blueberry management it is inadvisable to burn all sites the same year. In case of blueberries, interspersion in rotation of burns is important otherwise one would eliminate the entire blueberry crop the summer following the spring burn. The aforementioned is one example for the necessity of interspersion of the fire rotation in the proper management of ruffed grouse habitat. In this respect, the use of fire in managing ruffed grouse habitat may differ from that in managing quail habitat.

FACTORS DISCOURAGING USE OF FIRE IN HABITAT MANAGEMENT

I find three factors contributing to the avoidance of fire in habitat management. These roadblocks are as follows: (1) Antifire propaganda, (2) Fear associated with fire, and (3) Public concern.

1. Antifire propaganda:—It is understandable that fires in the landscape are looked upon with apprehension by the citizenry. The public is continually being bombarded with propaganda regarding the ravages of fire in forest and field. Only the detrimental effects are presented before the public with the pretense that there were no possible benefits to be derived. There is no distinction between in season and out of season periods for burning, there is no distinction

between late summer fires in periods of severe drought and spring fires occurring after rains. Since most citizens never witness a fire in progress in brush or field, they immediately associate its detrimental affects with that comparable to a burned out residence or factory. In the latter, monetary losses can be closely determined, but those losses due to fires in brush or field are mostly fictitious estimates with the accrued value carefully avoided. News media quote field fires *in acres of land destroyed* when the forester cannot, in good conscience, report a dollar loss.

2. Fear associated with use of fire:—When I initiated a long term study of the value of forest cuttings for improving grouse habitat in a poletimber tract of forest in central Pennsylvania in 1950, I was skeptical of the use of fire. My problem was that I had no confidence in how to control it. I had no previous experience in the use of fire. I knew nothing of the behavioral traits of fire except to fear it. This lack of confidence, stimulating fear, is perhaps the dominating factor in avoiding the use of fire. Bump and Edminster (Bump *et al.* 1947: 638, 642) state that fire is potentially the most dangerous of all methods and cost may be high in maintaining grouse coverts because of difficulties in keeping it under control. Perhaps statements of this nature only exaggerated my fear of fire in 1950.

The first reaction to moving fire in leaf litter or dry grass is one of panic. Fear seizes one who is not trained in proper field procedures in fire management under field conditions. The beginner must see, feel, and help to manipulate a fire under cool headed leadership in order to learn the techniques and some of its idiosyncrosies. In the training process his confidence will be restored and panic will have vanished. To avoid this problem, each participant must have been tutored under someone experienced in the management of fire. The instructor must not have been trained as a fire fighter because fire fighters are afraid of fire.

My confidence was greatly bolstered when I spent an afternoon at one of the Tall Timbers Fire Ecology field demonstrations at the Greenwood Plantation near Thomasville, Georgia. In E. V. Komarek's remarks that afternoon before the fire was started, he made a statement all should ponder. The gist of his remark was that one must casually watch a fire in the field, study its behavior, and even feel it.

3. Public concern:—Fires, even small fires, in field or forest attract considerable attention and concern by the local citizenry at least in the region of Pennsylvania. The habitat manager is under stress and experiences a feeling of guilt when conducting a burn. He may imagine hearing fire sirens bearing down from all directions. He may even sense fire wardens with fixed bayonets, stalking, ready to charge at the proper distance and to gore his innards.

One must have the confidence and respect of his neighbors. One must inform them when burns will be made and his reasons for it. People just like to know the other fellow's business especially when he is doing something which is not a routine practice in the neighborhood. One must inform the nearest volunteer fire department that a burn will be made on a particular day. These notices are appreciated since they may prevent an unnecessary trip and a waste of time in case the fire is reported by a motorist. These precautions go a long way toward fire acceptance.

One must know his state laws and local ordinances and work within their framework in the use of fire. In the case of local ordinances, one must see that they have safeguards permitting use of fire in management operations. State laws in Pennsylvania, for example, pose no restrictions on the landowners use of fire. Rural townships, as a rule, also have no binding restrictions on the use of fire.

CONCLUDING REMARKS ON RUFFED GROUSE AND FIRE

Only temporary benefits accrue to a ruffed grouse population from agricultural or forestry practices. Ruffed grouse are adaptable to these methods of management only to a degree. Forest cutting practices in timber or wildlife management in the absence of controlled or prescribed burning create only temporary or short term benefits. The result is a low carrying capacity of this unit of habitat and a low population of grouse. A grouse per 10 or more acres is considered a reasonable population while units, under fire management, will produce and carry one bird per each 2 to 4 acres of optimal range.

Evidence from various sources poses the hypothesis that the ruffed grouse is a fire climax species or one that benefits from recurring fires

in its habitats. Its basic or key food plants are fire induced at crucial stages of development such as, by stimulating seed germination and seedling establishment, by rejuvinating decadent plants or clones, or by controlling plant diseases. Fire is a stabilizing agent in a unit of grouse range by retarding or delaying the encroachment of the closed canopy forest. Areas that have had a history of recurring fires in Pennsylvania continue to be traditional units of land that support a grouse population even though these units have not been burned in recent years.

Nesting sites preferred by ruffed grouse suggest adaption to fire. The majority of nests are located on the ground which is devoid of low vegetation and ground litter. Nesting cover as one thinks of it for ring-necked pheasants or wild ducks would be avoided by ruffed grouse when such cover occurs in their nesting habitats. Fire occurring in a unit of range prior to egg-laying (April 15 in Pennsylvania) would have no appreciable effects on the quality of nesting cover. But uncontrolled burns after April 15 would destroy clutches or the chicks if after May 20 in this region. Spring burns attract rather than deter use by adults and by broods later in the season. It can be postulated that ruffed grouse evolved with and followed fire into the early landscape. Now they are slowly but gradually going out of this landscape along with the abolishment of fire.

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