ard of devotion, modesty, skill, and thoroughness. It will be no small task for those who survive him to live even partially up to his mark.

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WINTER FOOD OF THE SHARP-TAILED GROUSE AND PINNATED GROUSE IN WISCONSIN

BY F. J. W. SCHMIDT

INTRODUCTION

The present paper is the first of a series summarizing the findings of the Wisconsin Grouse Investigation since 1930.

A research bureau of the Wisconsin Conservation Department was organized in 1928 by Wallace B. Grange and Dr. Merritt L. Jones to begin a study of the Prairie Chicken and the Sharp-tailed Grouse. Its findings up to 1930 were published in the "Progress Report of the Wisconsin Prairie Chicken Investigation" by Dr. Alfred O. Gross.

I took over the study during the winter of 1930-1931, which was spent observing the feeding habits of grouse at grain food patches and feeding stations. In March 131 sharptails were banded. Since then 550 Sharp-tailed Grouse and 275 Prairie Chickens have been banded. Studies of nests were made during the springs of 1931, 1932, 1933, and 1934. Moving pictures were made of Sharp-tailed Grouse and Prairie Chickens on their dance grounds. Dance ground flocks were counted through a series of successive years. During the summer of 1932 Prairie Chickens were raised at the state game farm. During the summer of 1934 the food habits of Marsh Hawks and Cooper's Hawks were studied in their relation to grouse. During open seasons grouse crops and stomachs were collected and sex counts were made from hunters' bags. The investigation was discontinued in January, 1933, and resumed in May, 1934, as a game management project at the University of Wisconsin under the direction of Aldo Leopold.

The term "grouse" is here used for Prairie Chickens, Sharp-tailed Grouse, and Ruffed Grouse collectively, unless otherwise stated.

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SCOPE

The present paper deals with winter food only. It is based on observations at winter feeding stations and grain food patches; on observations of migrant Prairie Chickens on their wintering grounds; on observations of grouse budding in trees; on observations made by back-tracking flushed grouse; on artificial feeding of grouse in pens; and on the crop contents of nineteen grouse collected during the winter. A larger series of winter crops and gizzards is being collected for a report on the percentage of the various foods eaten. In addition, a large series of summer and fall crops have been collected, but are not here reported.

The dietaries of the Sharp-tailed Grouse and the Prairie Chicken overlap, but are nevertheless essentially different, the sharptail being a northern bird extending into Wisconsin from the northwest, while the Prairie Chicken is a more southern bird extending into Wisconsin from the south. Originally the chicken was probably mainly a migrant. It became a permanent resident when a new food supply was introduced by agriculture. The winter food habits of the two species are here discussed separately, from the standpoint of grouse management, with special reference to the question of how much if any grain and cultivated weed seed is necessary, and at what seasons.

THE PRAIRIE SHARP-TAILED GROUSE (*Pedioecetes phasianellus campestris*)

The following winter foods are grouped according to the length of time during which they are usually available.

Browse is available throughout the winter, and is the most important class of winter food. Wisconsin sharptails browse on the buds, catkins, and twigs of white birch, aspen, balsam, poplar, willow, bog birch, and leather-leaf. All these may be regarded as staple winter

foods. The kind of browse eaten depends somewhat, of course, on the kinds available in any given area.

Climbing Plants. The seeds of climbing false buckwheat (*Polygonum dumetorum*) are, while they last, always held above the snow. It has been determined by observation and by tracking that sharptails feed on the seed of this plant.

Grain. To understand the rôle of grain in the grouse dietary, it is necessary to hark back to the day when all grouse lived without it. At the present time there are still sharptails inhabiting grainless range, whereas all Prairie Chickens now know and use grain to some extent. Few Ruffed Grouse as yet know or use grain.

Grain is available in fall, but tends to become exhausted or covered during winter. The only exception is shocked corn. In November and December, when the ground is bare, sharptails gather in packs of from twenty to several hundred to feed on harvested fields of oats, buckwheat, soy beans, and corn. Buckwheat seems to be preferred, yet the biggest pack I have ever seen was one of more than 400 birds on an oat field at Hawkins in Rusk County. The cultivated grains mentioned above may be classified as preferred fall foods for those sharptails which know and have access to them.

All sharptails, in winter, tend to revert to a diet of browse. The details of this change are discussed later.

At the time Leopold (1933, p. 261) was preparing a table of the palatability sequence of winter foods, I classified corn as an emergency food for sharptails. At that time the existence of grainless sharptails, and the general winter preference for buds, was not understood. Corn should now be classified with the other grains as a preferred fall food.

The peculiarities of sharptails in relation to artificial feeding of grain are covered in detail later.

Seeds, Berries, and Leaves. These foods are available when not covered by snow. Sharptails do not feed on weed seeds as extensively as Prairie Chickens do. When snow does not cover the ground, sharptails eat the seeds of smartweed (*Polygonum pennsylvanicum* and *Polygonum hydropiper*), the berries of wintergreen (*Gaultheria procumbens*), snowberry (*Symphoricarpos albus*), and cranberry, and the leaves of white, red, and alsike clovers, sweet clover, alfalfa, goldenrod, strawberries, and sheep sorrel. These greens and fruits may be classified as "tonic, mineral, or vitamin foods" (Leopold, 1933, p. 268). The available variety of these foods is of course much smaller in winter than in summer. With the exception of sheep sorrel they

are eaten in small quantity. Sheep sorrel, until snowed under, is taken in large amounts when sufficiently abundant.

Red Grouse and Sharptail Compared

It is interesting to note that the Red Grouse of England and Scotland and the Sharp-tailed Grouse have eight foods in common. The following Red Grouse foods taken from "The Grouse in Health and Disease" (pp. 76, 83, 85) are also eaten by Wisconsin sharptails:

1. *Vaccinium* sp. blaeberry, blue whortleberry, blueberry. The stem, leaves, flowers, and berries are eaten.
2. *Vaccinium oxycoccos*, bog cranberry. The leaves and berries are eaten.
3. *Arctostaphylos uva-ursi*, red bearberry.
4. *Salix* sp., willow. The leaves and shoots are eaten. In the summer the willow furnishes food in the form of galls.
5. *Myrica gale* and *Myrica asplenifolium*, sweet gale, sweet fern. The buds and catkins are eaten.
6. *Rumex acetosella*, sheep sorrel. The seeds are eaten by Red Grouse and the leaves by sharptails.
7. *Betula* sp., birch. Chapman, p. 25, states that Red Grouse feed on birch, but he does not state what kind of birch.
8. *Polygonum aviculare* and *Polygonum persicaria*, smartweed. The seeds are eaten by both species.

Sharptail Food in Other Regions

Below are a few references to the winter food of sharptails in regions north and west of Wisconsin.

Judd (1905, p. 22) lists the leaves of cottonwood, alder, blueberry, juniper, and larch (tamarack) as foods of the sharptail. It is probable that they also feed on the buds of these plants during the winter. Judd also quotes Hearne as saying that sharptails in winter feed on the tops of dwarf birch, and on poplar buds. Otherwise he does not distinguish between winter foods and foods eaten at other seasons.

Coues (1874, p. 418) refers to the winter food of the sharptail along the Missouri River as follows: "Killed under these circumstances, the food of the Grouse is readily ascertained; in the dead of winter it consists chiefly of the berries of the cedar, and buds of the poplar or cottonwood and willow, still closely sealed awaiting the coming of spring."

Bendire (1892, pp. 102-103) quotes a letter from George Bird Grinnell as follows:

"The Sharp-tailed Grouse, which in certain sections is called 'Speckled Belly' and 'Willow' Grouse, I have found in various years almost everywhere west of the Mississippi River, east of the Sierra Nevadas, and north of the Platte River. In the old days it used to be very common all along the Platte and the Loup Rivers in Nebraska, and in the country which lies between these two streams. I have also found it nearly as abundant in the mountains, sometimes even late in the autumn, coming upon single birds or a considerable brood, far up toward the edge of timber in the most narrow wooded ravines. This species is partly migratory, and there is the very greatest difference in the habits of the bird in summer and winter. As soon as the first hard frosts come in the autumn the birds seem to take to the timber, and begin to feed on the buds of the willow and the quaking aspen. At this time they spend a large portion of their time in the trees and are very wild. In the Shirley Basin, in western Wyoming, a locality where I have never seen any of these birds in summer, they are abundant in winter. At this season they live in quaking aspen thickets along the mountains, and there I have seen hundreds of them roosting on top of a big barn which stands just at the edge of a grove of quaking aspen timber."

Dery (1933, p. 4-7) found ironwood (*Ostrya virginiana*) and mountain ash to be the most important foods of the migrating northern sharptails in Quebec. The buds and catkins of ironwood were found in nineteen stomachs and varied from 8 per cent to 98 per cent, averaging 61 per cent of the total food. Mountain ash berries and buds varied from a trace to 71 per cent, averaging 26 per cent. Other winter foods were birch buds and catkins, aspen buds, cherry buds, alder catkins, willow buds, rose hips, seeds of *Viburnum opulus* and *Cornus canadensis*, *Rubus* sp., hazel buds, *Aralia hispida*, *Cornus paniculata*, tamarack buds and twigs, and *Unifolium canadense*.

As the foods in Dery's list were determined from the northern sharptails which appeared in Quebec in 1932, it is possible that they may be different from those eaten by this subspecies on regular winter range.

Bent (1932, p. 286) lists the buds and sprouts of *Betula glandulosa*, willow, aspen, and larch, and the buds of juniper as food of the northern sharptail. Presumably he means winter food.

Bendire (p. 104) thinks that in Manitoba rose hips are eaten as grit. He quotes Ernest E. Thompson (Ernest Thompson Seton) as follows: "To illustrate the importance of this shrub (prairie rose) . . . I append a table of . . . the contents of crops and gizzards of Grouse killed during various months:

January—Rose-hips, browse, and *Equisetum* tops.
February—Rose-hips and browse.
March—Rose-hips and browse.
April—Rose-hips and browse of birch and willow.
November—Rose-hips, birch and willow browse, and berries of arbutus.
December—Rose-hips, juniper berries, and browse.

"This is of course a mere list of staples, as in reality nothing of the nature of grain, fruit, leaves, or insects comes amiss to this nearly omnivorous bird, but it illustrates the importance of the rose-hips, which are always obtainable, as they grow everywhere, and do not fall when ripe."

Grinnell, Bryant, and Storer (1918, p. 563) say of the Sharp-tailed Grouse (all races): "Especially during the winter when other kinds of food are difficult to procure do these birds feed rather extensively on buds and leaves. . . . The wild rose supplies the Sharp-tail with about 17 per cent of its fruit food, the stony-seeded hips being taken in great quantity; in places where gravel is lacking these seeds seem to serve for grinding other materials in the stomach."

Dery (pp. 4-7) reports rose hips in eleven of nineteen stomachs. The amount varied from a trace to 21 per cent of the stomach contents.

In Wisconsin, possibly due to a good supply of grit, rose hips are not very extensively eaten.

Errington (1931, p. 8) has shown by feeding experiments that rose hips are low in nutrition value for quail and this may also be true for grouse. It is possible, however, that they may digest them more efficiently than quail do.

According to observations made on Red Grouse (*The Grouse in Health and in Disease*, p. 99), fruit stones are poor substitutes for gravel and may cause more harm than good. When thornapple stones were eaten the gizzard was found to be unable to retain the more useful quartz, and when this happened at a time of grit shortage, the Red Grouse was unable efficiently to digest browse.

We can conclude either that the sharptail is better adapted than the Red Grouse to grind browse with only rose or thornapple stones as grit, or that the American authors above quoted have over-rated fruit stones as an effective substitute for mineral grits.

In general, the principal differences in the winter diet between Wisconsin and other sharptails are the heavier consumption of willow buds in other regions, and the inclusion of certain foods not available in Wisconsin, such as juniper buds and berries, mountain ash buds and berries, ironwood buds, and cottonwood buds.

Artificial Feeding of Grain

Experiments have been conducted to determine the amount of grain that may be eaten and the best methods of feeding it.

Buckwheat food patches were planted in central and northern counties. They were used in fall, but not after the first snow.

It was found that sharptails did not know how to eat corn from shocks, but learned the trick from Prairie Chickens when the two occurred in the same flock. Sharptails have been observed feeding with Prairie Chickens on shocked corn in Wood, Portage, Adams, Washburn, and Burnett Counties. Corn, however, was not found to be an important item in the diet of the sharptail, as very little corn is raised in northern Wisconsin.

Numerous experiments were made on hopper feeding. Sharptails learned almost at once to eat buckwheat from hoppers and would go under shelters to feed. Shelled corn, wheat, rye, and oats fed in adjacent hoppers were not eaten. Sharptails did not at first recognize ear corn as a food. They gradually learned to feed on husked ears placed on the ground where they were feeding on buckwheat. Later they even learned to strip the husks from ears. Once they knew how to eat ear corn, they would fly up to platforms where ear corn was stuck on spikes. This system was first used to feed Prairie Chickens (see Figs. 36-37).

In Juneau and Wood Counties where sharptails were fed for the purpose of banding, it was found that approximately 2,000 birds ate 3,000 pounds of buckwheat and 1,000 pounds of corn, or two pounds of grain per bird per month. The cost of the grain amounted to only four cents per bird per month, but labor and equipment brought the total cost to fifty cents per bird per season.

Evidence that Winter Grain Is Unnecessary

Ignoring of Food Patches. As evidence that winter grain is not necessary for sharptails, Mr. E. R. Van Wormer of Babcock informs me that even when stacks of buckwheat were opened up in a food patch located right in a budding area, only a few of the birds which had fed in the patch during November made their appearance there as long as there was snow. After the snow had melted in March, the birds returned to feed on the buckwheat.

Another instance: In northern Juneau County a flock of ten cocks and eleven hens fed in a patch of buckwheat until the advent of snow about December 1, when they changed to a bud diet. Buckwheat shocks and a hopper filled with buckwheat, together with corn shocks and ear corn, were placed in the food patch. Apparently they no

FIG. 36. Prairie Chickens feeding on ear corn stuck in snow and on ear corn held in woven wire container. Photograph was taken from a blind built of snow.

FIG. 37. Prairie Chickens feeding on ear corn impaled on spikes and stuck in the snow.

longer recognized the food patch as a source of food, although buckwheat shocks were in plain sight of the white birches on which they budded and only 100 yards away. Neither did they think of visiting the food patch to see if any grain were available. On January 18 grain was strung along on top of the snow from the birch trees on which they budded to the feeding station. They followed the path of grain and located the grain in the hopper and in the shocks. They continued to feed at the hopper until spring. It does not necessarily follow that they needed this grain, for they had been getting along very well without it.

I conclude that sharptails use food patches in fall until the first snow of winter, and again in the spring, but not during the winter budding season. Additional winter grain appears not only to be unnecessary, but may be ignored by the birds unless literally "thrust under their noses". Prairie Chickens, on the other hand, seek out grain even during the budding season.

Changes in sharptail population levels are brought about by causes other than available winter grain and deep snow. This seems to be positive evidence that winter grain is unnecessary for survival and increase. Thus in northern Wisconsin where not more than 10 per cent of the sharptails were within reach of winter grain, and where the snow was deep, there was an increase during the summer of 1933, the license reports indicating a larger kill than in 1932.

It might be mentioned as negative evidence that during the summer of 1933 there was a big drop in the number of sharptails in Wood and Juneau Counties. This drop in numbers followed a nearly snowless winter and two winters of extensive feeding of grain by means of hoppers.

Bud Feeding Experiments. Two captive sharptails were fed on white birch and willow buds only. One lost five ounces in two weeks, while the other lost three ounces in the same time. A third sharptail fed on mixed grains and buds lost three and one-half ounces in the same time. As the control lost weight at about the same rate as the two birds fed on buds only, it is probable that the loss of weight was due to being in a pen, and not to the diet.

Feeding experiments should be conducted with more birds and over a longer period. At present there is no reason to doubt the ability of the sharptail to keep in good condition for several months on a browse diet.

Management

Winter feeding of grain is not recommended for sharptails, but where Prairie Chickens are being fed there is, of course, no harm in feeding both.

There can be no doubt, however, that the availability of grain in fall increases the carrying capacity of sharptail range during the pre-budding season. Food patches of buckwheat, standing corn, oats, and soy beans are especially needed in wild regions where there are no farms, and hence few weeds and no grain. In farmed regions farmers should be encouraged to raise more buckwheat. A harvested buckwheat field is an excellent source of early winter grain, provided it is not fall-plowed. Farmers might, if offered share-cropping privileges, be willing to plant buckwheat on wild state land several miles from their farms, just as they now go five to thirty miles to make hay in a hay marsh. On the Upper Mississippi Wild Life and Fish Refuge farmers are given permits to cut marsh hay, and also land on which to raise corn on a share basis. The farmer gets free hay "stumpage" and part of the grain; the government gets the remaining grain for feeding purposes without cash outlay.

Reflooding of drained marshes unfit for agriculture will be beneficial to the winter food supply of sharptails. Such flooding is now under way in Juneau, Jackson, and Wood Counties. White birch will become abundant on all wet borders without artificial planting. A growth of white birch, bog birch, and white pine has already taken place on the borders of flooded areas belonging to cranberry growers in Wood, Jackson, and Monroe counties. If hay marshes are developed on flooded areas, bog birch will come in around the edges of the hay land. The importance of hay marshes will be more fully explained in a paper on grouse range.

Budding grouse of all species prefer trees that are at the edge of a thicket, standing alone, or in small groups. A dense stand of white birch or aspen is of little use as a bud supply except for a few trees around the edge. It is not known whether the buds are larger or better on trees in the open, but it is apparent that a stocky, bushy tree has more buds and is easier to climb around on than a slim tree in a dense thicket. Budding trees which meet these specifications can be provided either by planting isolated trees, or by thinning thickets which are too dense, either by cutting or pasturing.

On some of the drained marshes of Portage County, where the farms are large and have many small patches of aspen, budding grounds are very good. This is especially true of the region west of

Bancroft. Farmers generally should encourage small patches of aspen and white birch in treeless areas. Why not leave a patch of fast growing aspen to grow stove wood and to feed grouse at the same time?

The Greater Prairie Chicken or Pinnated Grouse
(*Tympanuchus cupido americanus*)

Browse. At first it was believed that Prairie Chickens did not bud to any extent in Wisconsin, but more recent observations indicate that Prairie Chickens feed on buds and catkins all through the winter. They differ from sharptails first in that the hens migrate in winter to the southerly counties, where they have ready access to both corn and buds. Second, they differ in that the wintering cocks which remain in the north seek out grain and weed foods, whereas sharptails do not. I have evidence proving that the wintering cocks can subsist on browse plus a small amount of weed seed. A flock at Swamp Lake, Oneida County, wintered on browse, no grain, and very little weed seed.

There are not many records of Prairie Chickens feeding on buds. Judd (p. 18) says: "Naturally the prairie hen is much less given to budding than the ruffed grouse, but it has been known to pluck buds of poplar, elm, pine, apple, dwarf birch (*Betula glandulosa*), and black birch (*B. lenta*)." In Wisconsin chickens browse mostly on the buds and catkins of white birch, bog birch, hazel, and aspen. This applies to both hens and cocks.

Grain and Seeds. The hen chickens, having repaired to the southern counties and mixed with the resident birds of both sexes, feed with them on weed seeds and small grains until about December 1, after which they begin eating corn. I have not yet found out just when buds become a large item in the dietary, but I know they are taken regularly as soon as regular corn-eating begins. The food of cocks remaining in the north is similar, except, as already stated, there may be no corn.

Of the weed seeds eaten, the most common are ragweed (*Ambrosia artemisiifolia*), sedge (*Carex intumescens*), green foxtail (*Chaetochloa viridis*), lamb's quarters (*Chenopodium album*), barnyard grass (*Echinochloa crusgalli*), smartweed (*Polygonum pennsylvanicum*), common smartweed (*Polygonum hydropiper*), climbing false buckwheat (*Polygonum dumetorum*), black bindweed (*Polygonum convolvulus*), and knotweed (*Polygonum cilinode*). Ragweed and climbing false buckwheat form a regular part of the diet whenever available, while the other weeds are eaten only occasionally.

Leaves. Leaves and greens are eaten regularly in summer and fall, and in winter when not snow-covered. The green leaves eaten include willow, clover, alfalfa, sweet clover, sheep sorrel (*Rumex acetosella*), goldenrod, wild strawberries, and other leaves that remain green all winter. A considerable amount of green hay is eaten when the hay is hauled out of the marshes during the winter. In February it was found that pieces of green grass were present in Prairie Chicken droppings, although due to deep snow there was no green grass available. The mystery was cleared up when the source was found to be green hay picked up on stack bottoms.

Wintering Grounds. Food determines what range is habitable in winter, but so does cover, particularly roost cover. The sexes seem to differ as to the kinds of both food and cover needed, and this may account for the fact that the hens but not the cocks migrate. Migration and cover will be discussed in separate papers. I am here considering only the food needed for winter range.

The male Prairie Chickens winter a few miles of their booming grounds, and seek whatever grain is available, not necessarily corn. Thus in Burnett County a flock of thirty cocks fed on soybeans when there was no snow. When the snow was deep they picked grain from straw stacks and from the manure and straw that the farmers spread on the snow. There seems to be a definite correlation between wintering cocks and farms even if there is no grain. Perhaps the weed seeds, however scarce, that occur on farms, are enough to supplement buds. On the other hand, the sharptails on the winter cock range are found as far away from farms in winter as in summer.

The hen chickens which travel southward apparently move until they find a combination of food and cover that suits them. For the upper Mississippi Valley this winter food requirement may at present be said to be corn and buds. At least they seem to migrate far enough to reach bountiful corn and buds, and there they stop.

Cooke (1888, p. 105) tells of the migration of hens into Iowa. Leopold (1931, p. 174) shows this movement still persists, and must come from Minnesota because there are virtually no nesting birds in Iowa. The distance hen chickens move is therefore several hundred miles.

In Wisconsin, however, a shorter movement seems to answer the purpose. The accompanying map, derived from banding records, indicates that the northern Wisconsin hens winter in the southern half of the state.

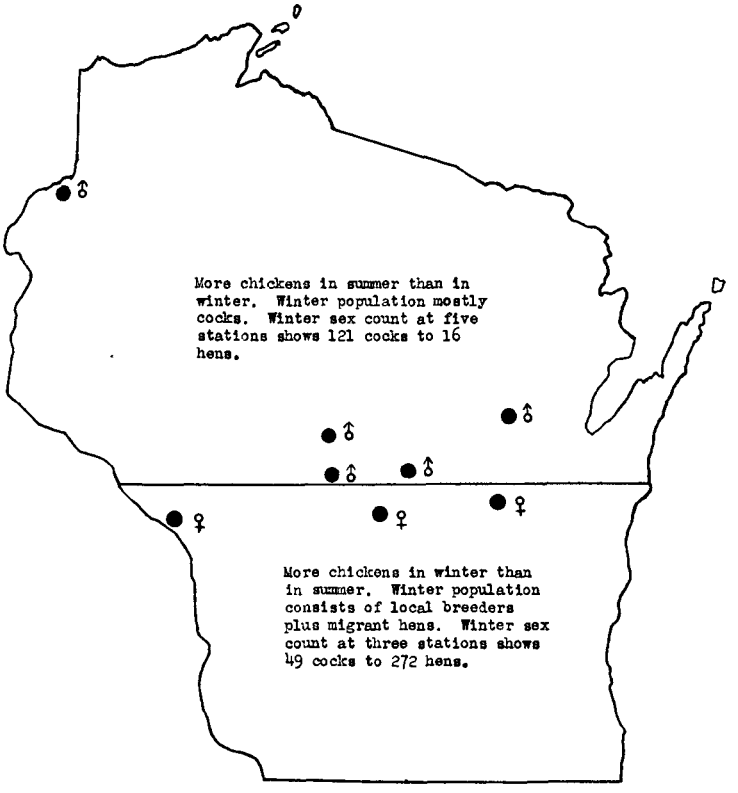

FIG. 38. In winter the range north of the horizontal line holds mostly cocks. Range south of the line holds a resident population plus the northern hens.. Dots show banding stations, and which sex predominates in the winter-caught chickens at each station.

I suspect that a wintering ground, to be acceptable, must offer certain essential elements. I tried to analyze this by comparing the composition of two typical wintering grounds: O'Brien County, Iowa, and Adams County, Wisconsin. In Iowa there is about ten times as much unhusked and shocked corn as there is roost, while in Wisconsin the opposite is true. In Wisconsin Prairie Chickens live almost entirely on buds when the temperature is above zero, but eat, and probably need, corn when it is below zero. In Iowa corn is eaten regularly and clover is eaten as a substitute for buds when it is not covered by snow. Chickens migrate to northern Iowa in the fall and may resume migration in midwinter. Resumption of migration southward across Iowa on snowy winters when there is no shortage of available corn is probably due to a shortage of roosting places, a shortage of buds, and snow covering the clover. In Wisconsin where good roost grounds and plenty of buds are available, there is no migration during the winter no matter how much it snows. What migration there is occurs in late fall.

It is therefore probable that corn, roosts, and buds, or a substitute for buds such as available clover leaves, may be the essential elements and that the low percentage of roost and buds in Iowa is tolerated only because of an abundance of corn and only when clover leaves are available. If this is correct, it would follow that the Iowa range could be strengthened by more roost and buds, and the Wisconsin range by more corn.

Hen Prairie Chickens prefer shocked corn to small patches of standing corn. Thus in Adams County a farmer left out one acre of standing corn next to a field of shocked corn. Chickens refused to feed in the standing corn as long as there were shocks. In Iowa standing corn is preferred because it is in large fields and the stalks are constantly being broken down by cattle so that the ears can be reached by the birds. In February, 1935, several hundred were feeding in a 25-acre field of unhusked standing corn at Trempealeau, Wisconsin. The farmer stated that ordinarily there is no unhusked standing corn in the vicinity. This year it was left because deep snow halted husking. It was noted that the chickens fed almost exclusively in the northwest corner of the field where the stalks were bent over or broken by the northwest blizzards.

Hen Prairie Chickens wintering in eastern Wisconsin on the Wolf River and Lake Poygan marshes feed on shocked corn and on the grain and seeds in the manure which is spread on the snow.

Range Extension. Increase in Prairie Chicken population and an extension of range resulted from the extensive growing of corn by the early settlers. This indicates that corn replaced some other staple food eaten in pre-settlement days which could be obtained by migration from the summer range. I suspect that this may have been acorns or some legume. The exact winter range of the Prairie Chicken is not known, but it was probably Oklahoma, Texas, Arkansas, Missouri, southern Illinois, and eastern Kansas. Judd (p. 12) quotes Audubon as saying that chickens were abundant in winter at Henderson, Kentucky, in 1810. These were probably local birds plus winter migrants from Ohio. The fact that the birds came into the streets and farm-yards indicates that Kentucky did not have a good supply of natural winter food and perhaps was not original winter range.

The increase in population is best noted in Illinois. Judd (p. 12) quotes Hatch as saying that as late as 1836 a hunter was lucky to bag a dozen in a day. Bogardus (1874, p. 66) states that he and another hunter killed 600 in ten days in McLean County, Illinois, in 1872. Bogardus (p. 87) states further that in Logan County native chickens were abundant in 1860, but by 1874 the main shooting was on fall migrants from counties to the north where unbroken prairie suitable for nesting was still abundant.

Leopold (1931, p. 165) speculates that the Indians did not leave enough corn out to give the chickens a chance to learn to eat it.

In Wisconsin chickens followed settlement until now they have reached Lake Superior. In certain central counties they are still extending their range. Thus they became established in northern Clark and southwestern Taylor Counties as recently as 1928.

Gross (1931, p. 28) quotes Spurrell as observing that after 1880 "corn became a common crop [in Sac County, Iowa] and birds wintered as well as nested abundantly", whereas previously there had been a marked migration.

Management

Grain. Corn, preferably shocked, should be provided wherever not already available. Food patches of other small grains and harvested fields of buckwheat and soybeans are valuable supplements to corn when there is no snow, but should not be relied upon as the chief source of winter grain in regions of heavy snowfall.

Feeding stations may also be used to furnish winter grain to chickens. Ear corn may be impaled on sharp sticks that may be set upright in the snow. This system was used by John Worden of Plainfield as early as 1928.

A similar device consists of two parallel boards, one with spikes to stick the corn on, and one for the birds to sit on, erected as a rough table high enough above the ground to be rabbit-proof.

Poles with spikes work equally well. The poles should be three feet above the ground, six or eight inches apart, and every other pole should be without spikes. Where two-inch poles are available, the only cost for such a feeding station would be ten cents' worth of spikes.

Ear corn may be tied in strings with bindertwine and tied around a cornshock. This system works well but is more work than the spike system. Ear corn may also be fed in a wire cylinder from which the corn may be worked out as it is eaten (see Fig. 36). Prairie Chickens do not like to eat grain from a hopper, as they dislike to enter the shelter necessary to protect the hopper from rain and snow. Hoppers for this reason are not recommended.

All Prairie Chicken feeders should be placed in the middle of a field, as Prairie Chickens like to feed where they can see in every direction (see Figs. 36-37).

Browse. If browse for chickens needs improvement, the following differences in browse requirements of Wisconsin grouse should be noted. Browse requirements of Prairie Chickens and Sharp-tailed Grouse are approximately the same except that chickens do not feed on leatherleaf and sharptails do not feed on hazel. Both differ from Ruffed Grouse in that they do not browse on alder to any extent. Ruffed Grouse, like Prairie Chickens, are very fond of hazel catkins. These differences may be due to availability, which depends on the type of range inhabited by the different species of grouse, and not to a difference in palatability. For Prairie Chickens the buds and catkins of white birch, bog birch, hazel, and aspen are important staple foods and an abundance of these plants greatly improves the winter food supply. They may be in hedges or scattered in pastures. Hazel hedges are especially recommended. As snow drifts into the hedge, more and more of the catkins become available to browsing chickens and other grouse.

Summary

The table of grouse foods given below corresponds to that given by Leopold (1933, p. 261) except that the subspecies of sharptails are distinguished from each other and Ruffed Grouse is added for comparison. For definitions of the various classes of winter feed see Leopold (1933, p. 259).

TABLE 1. Palatability Sequence of Winter Foods.

CLASS	SPECIES AND EXAMPLES OF FOOD IN EACH CLASS			
	PRAIRIE SHARP-TAILED GROUSE (Gross, Coues, Schmidt, Bendire) Wis., Nebraska, Dakotas	NORTHERN SHARP-TAILED GROUSE (Dery, Bent) Quebec	PINNATED GROUSE (Gross, Schmidt, Judd) Wisconsin, Iowa	RUFFED GROUSE (Schmidt) Wisconsin
Preferred Foods (eaten mostly before snow)	Buckwheat Corn Soy beans Oats Sheep sorrel Acorns Clover leaves	?	Buckwheat Soy beans Barley Oats Ragweed Smartweed Acorns Rye Climbing false buckwheat	Clover leaves Strawberry leaves Acorns Mountain ash berries
Staple Foods (eaten mostly after first snow)	White birch buds* Bog birch buds Aspen buds Leatherleaf leaves and buds Willow buds Cedar berries Cottonwood buds	Ironwood buds (*Ostrya virginiana*) Mountain ash berries Aspen buds Willow buds Juniper buds	Corn Hazel buds White birch buds Bog birch buds Aspen buds Black birch buds	Aspen buds White birch buds Hazel buds Willow buds Alder buds
Emergency Foods	Blueberry buds Pincherry buds Climbing false buckwheat Tamarack buds Alder buds	White birch buds Cherry buds Tamarack buds Alder buds	Maple buds Elm buds Willow buds Pine buds Apple buds	
Mineral Tonic Vitamin	Green leaves Rose hips Sweet fern buds Weed seeds Berries	*Rubus* Rose hips *Aralia* Berries	Various weed seeds Rose hips Hay Sorghum seeds Mullein seeds Green leaves	Sweet fern buds Sumac berries Rose hips Corn
Grit	Gravel Rose stones	Gravel Rose stones	Gravel Rose stones	Gravel Rose stones Cherry stones

*In this table buds include catkins and twigs.

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THE FIRST DESCRIPTIONS OF NORTH AMERICAN BIRDS

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Many a biologist has longed for the opportunity to examine the fauna and flora of some land never before visited by a naturalist. Few have had that opportunity, and usually the information on a new country has accumulated over a period of time, through uncertain channels, much of it poorly collected and poorly preserved. Here in America we particularly wonder what birds the first Europeans noted and what they thought of them. The Baltimore Oriole and the Yellow Warbler were the first ones mentioned by Maximilian when he landed at Boston, but that was in 1833, more than 300 years after the arrival of the first explorers. One can hardly doubt that these two species were among the first to be observed by others. Christy (*Auk*, 50:275-283) found the Sandhill Crane, Flicker, Blue Jay, Bluebird, Red-winged Blackbird and Towhee in what he believed to be the earliest written account of American birds (in 1613 or 1614). This writer presumably had not visited America but may have talked with someone who had been there and must have seen specimens which had been brought back. Still more recently, Mrs. Allen has described some paintings (*Auk*, 53:17-21) made about 1585, which included a Tropic Bird, Brown Pelican, Booby, Flamingo, Noddy Tern, and Flicker.

It is a simple matter to tabulate from the A. O. U. Check-List the various authors and the dates at which their names were given to the birds, but this yields a number of instances of common birds described later than 1900. In fact, if we list all subspecies, we have a very considerable number of recently discovered birds. This naturally suggests the advisability of limiting the discussion to the larger unit and